

PROJECT MANUAL
INCLUDING CONSTRUCTION SPECIFICATIONS

for

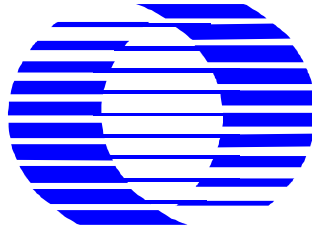
BP-S00195
TERMINAL C, PHASE 1X – AIRSIDE CONCOURSE

CONTRACT DOCUMENTS

Volume 7 OF 7
(Division 27)

ORLANDO INTERNATIONAL AIRPORT

Orlando, Florida 32827



GREATER ORLANDO AVIATION AUTHORITY

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SECTION 27 05 00 - COMMON WORK ELEMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.
- B. Related Specification Sections:
 - 1. 23 09 00 – Instrumentation and Controls for HVAC
 - 2. 26 05 00 – Common Work Results for Electrical
 - 3. 26 05 19 – Building Wire and Cable
 - 4. 26 05 26 – Grounding and Bonding
 - 5. 26 05 29 – Hangers and Supports
 - 6. 26 05 33 – Conduit
 - 7. 26 05 34 – Outlet Boxes
 - 8. 26 05 35 – Pull & Junction Boxes
 - 9. 26 05 53 – Identification for Electrical Systems
 - 10. 26 07 17 – SCADA Monitoring and Control
 - 11. 26 09 24 – Architectural Lighting Controls for Public Spaces
 - 12. 26 27 13 – Electrical Metering and Monitoring System
 - 13. 27 05 00 – Common Work Elements for Communications
 - 14. 27 10 00 – Premise Distribution Systems
 - 15. 27 10 05 – Passive Optical Network
 - 16. 27 10 10 – Voice Over IP Telephone System
 - 17. 27 10 15 – Wireless Local Area Network System
 - 18. 27 10 20 – Visual Docking Guidance System
 - 19. 27 20 00 – Common Use Systems
 - 20. 27 24 00 – Electronic Gate Systems
 - 21. 27 41 33 – IP Master Antenna Television System
 - 22. 27 42 20 – Electronic Dynamic Signage System
 - 23. 27 51 13 – Emergency Communication System
 - 24. 27 53 10 – Distributed Antenna System - Cellular
 - 25. 27 53 20 – Global Positioning System – Public Safety and Facilities Radio
 - 26. 28 05 00 – Common Work Elements for ESS
 - 27. 28 13 00 – Physical Access Control System
 - 28. 28 16 00 – Intrusion Detection System
 - 29. 28 23 00 – Video Surveillance System
 - 30. 28 31 00 – Addressable Fire Detection and Alarm
- C. Reference Symbols:
 - 1. All device symbols are defined by the appropriate symbol schedule on the symbols and abbreviations sheet in the T-series Contract Drawings. Not all device symbols as indicated may be required for the project.

2. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Contractor shall coordinate exact location of all network systems and related components with all related Contract drawings, specifications and affected trades prior to submittal of shop drawings.

D. Abbreviations:

AGC:	Automatic Gain Control
ADA	Americans with Disabilities Act
AHJ:	Authority Having Jurisdiction
AIDB	Airport Integrated Data Broker
APC	Automated Passport Control
APM	Automated People Mover
ASC	Airside Concourse
ASTM	American Society for Testing Materials
ATP:	Acceptance Test Plan
AWS:	Advanced Wireless Service
A/V	Audio Visual Systems – For purposes of this specification section A/V systems shall include all Media Management, Video Broadcasting, Intercommunications (Paging/Public Address, Clock, Auxiliary Sound), Video Intercom, Emergency Communications, Mass Notification, Multi-User Flight Information Displays (MUFIDS), and Internet Protocol Television (IPTV).
BAS	Building Automation System
BDA:	Bi-Direction Amplifier
BIDS	Baggage Information Display System. See also “MUFIDS.”
BICSI	Building Industry Consultant Services International - International organization whose primary objective is to enhance the reputation and skills of companies and individuals employed in the telecommunications and security industries by ensuring that current and developing standards are maintained.
BIDS	Baggage Information Display System
CBP	Customs and Border Protection
CFR	Code of Federal Regulations
CPU	Central Processing Unit
CUPPS	Common Use Passenger Processing
CUSS	Common Use Self Service
CWDM	Coarse Wave Division Multiplexing
dB	Decibel
DAQ	Delivered Audio Quality
DAS	Distributed Antenna System
DDC	Direct Digital Controller / Device Display Controller

DP	Demarcation Point - The point of interface between the Communications Networks, IPTV, any Auxiliary Systems, and the associated Service Providers or Public Utilities. Also see "EF." Shall also serve as the primary termination point for all incoming OSP cabling as well as the primary main grounding busbar for all communications systems. Refer to project documents for exact location and termination requirements.
DSS	(Electronic) Dynamic Signage System
DWDM	Dense Wave Division Multiplexing
ECS	Emergency Communications System
EF	Entrance Facility. See also "DP."
ELFEXT	Equal Level Far End Crosstalk.
EME	Experiential Media Environment
EMI	Electromagnetic interference
EMT	Electrical Metallic Tubing – Also known as thin-wall conduit.
ER	Equipment Room – See also "MDF"
ESMR	Enhanced Specialized Mobile Radio
FAA	Federal Aviation Administration
FAAP	Remote Fire Alarm Annunciator Panel
FACP	Fire Alarm Control Panel
FAS	Fire Alarm System
FCC	Federal Communications Commission
FEXT	Far End Crosstalk
FIDS	Flight Information Display System. See also "MUFIDS."
GFCI	Ground fault circuit interrupter
GIDS	Gate Information Display System. See also "MUFIDS."
GTF	Ground Transportation Facility
GUI	Graphical User Interface – A specialized program employing graphical display maps of a facility and/or site which, also provides a manual user interface for all system functions and operations by utilizing control and annunciation icons from dedicated human machine interface terminals.
HMI	Human/Machine Interface – A Computer-operated, video control terminal complying with FCC Part 15 CFR Title 47, Subparts A and B, and shall utilize multiple dynamic GUI based displays for annunciation and control LCD flat panel computer monitor or display screen as defined by related specification sections.
HTML	Hypertext Markup Language
IAMS	Integrated Airport Management System
IATA	International Air Transport Association - The global trade association for the airline industry
IBC	International Building Code
ICT	Information Communications Technology

IDF	Intermediate Distribution Frame – The room/space that shall serve as the local termination point for all horizontal and backbone cabling. Also shall be known as Equipment Room (ER), Horizontal Cross-Connect (HC) or Floor Distributor (FD).
IDS	Intrusion Detection System
IEEE	Institute of Electrical and Electronics Engineers
IO	I/O Input/Output
IP	Internet Protocol
IPTV	Internet Protocol Television
IR	Infrared
ISO	International Organization for Standardization
ITF	Intermodal Transportation Facility
Lab	Computer, Science, and/or Education Laboratory.
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
LIU	Light Interface Unit (also known as Fiber Optic Patch Panel)
LMR	Land Mobile Radio
LST	Landside Terminal
LTE	Long Term Evolution (Commonly known as “4G”)
LV	Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
Mbps	Megabits per second.
MCO	Orlando International Airport (IATA Code)
MDF	Main Distribution Frame – The room/space that shall serve as the primary termination point for all backbone cabling to each IDF locations and horizontal connection point for local communication drops. May also serve as a local IDF location as well as the cross-connection and interconnection of all entrance cables from the DP for all PSTN and WAN connections. Also shall be known as Main Cross Connect (MC), Telecommunications Room (TR) and/or Campus Distributor (CD)
M-JPEG	Motion – Joint Photographic Experts Group
MPEG	Moving picture experts group.
MTBF	Mean Time Between Failures
MUFIDS	Multi-User Flight Information Display System
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NEXT	Near End Crosstalk
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratory
NTSC	National Television System Committee.
NVR	Network Video Recorder
NVW	Network Video Workstation
OAR	Owner’s Authorized Representative
OFE	Owner-Furnished Equipment

OLT	Optical Line Terminal
ONT	Optical Network Terminal
OSP	Outside Plant Cabling
OTDR	Optical Time Domain Reflectometer
PA	Public Address System
PACS	Physical Access Control System
PDS	Premise Distribution System
PCS	Personal Communications System
POL	Passive Optical Local Area Network
PON	Passive Optical Network
POS	Passive Optical Splitter
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
RCDD	BICSI-accredited Registered Communications Distribution Designer
PSN	Public Safety Network
RFI	Radio-frequency interference / Request for Information
RGS	Rigid Galvanized Steel conduit: Galvanized steel tubing, with a tubing wall that is thick enough to allow it to be threaded.
RoF	Radio-over-Fiber
RoHS:	Restriction of Hazardous Substances
RSL	Received Signal Level
RSSI	Received Signal Strength Indication
RSRP	Reference Signal Receive Power
RS-232	An ANSI/TIA standard for asynchronous serial data communications protocol between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.
RS-485	An ANSI/TIA multipoint communications protocol standard.
SCADA	Supervisory Control and Data Acquisition
SLA	Service Level Agreement
SMR	Specialized Mobile Radio
SMS	Security Management System / Short Message Service
SNIR	Signal-to-Noise Interference Ratio
SNMP	Simple Network Management Protocol
SOW	Statement of Work
STC	South Terminal Complex
TCP/IP	A standard protocol stack on which the Internet and data communications networks operate
TGB	Telecommunications Grounding Busbar – Located in each
IDF	Intermediate Distribution Frame – See also “TR”
TIA	Telecommunications Industry Association
TMGB	Telecommunications Main Grounding Busbar
TP	Transition Point – A location in the horizontal cabling where flat under carpet cable transitions to a horizontal cabling consolidation point (CP).
TR	Telecommunications Room -- See also “IDF”

TPM	Technical Project Manager – A sub-contractor to the CMAR that shall assume responsibility for oversight of all Division 27 and 28 scopes of work and all related Divisions 23 and 26 scopes of work. The TPM shall serve as a single point-of-contact between the Authority/Owner's Authorized Representative (OAR) and all Division 27 and 28 sub-contractors.
TSA	Transportation Security Administration
TSB	Technical Service Bulletin
TVSS	Transient Voltage Surge Suppressor
UHD	Ultra High Definition
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VDGS	Visual Docking Guidance System
VLAN	Virtual Local Area Network
VoIP	Voice Over IP telephone Network
VPN	Virtual Private Network– A technique made possible by switching technologies that permits the logical grouping of any number of network devices into one or more sub-networks.
VSS	Video Surveillance System
VSWR	Voltage Standing Wave Ratio
WAN	Wide Area Network
WAP	Wireless Access Point
WLAN	Wireless Local Area Network
WSP	Wireless Service Provider
10BASE2	10 Mbps data throughput over coaxial cable.
10BASE-T	10 Mbps data throughput over twisted pair cable.
10BASE-FL	10 Mbps data throughput over fiber.
100BASE-T	100 Mbps data throughput over twisted pair cable.
100BASE-TX	100 Mbps data throughput over Category 5 twisted pair or greater.
100BASE-FL	100 Mbps data throughput over fiber.
1K-BASE-T	1Gbps data throughput over Category 5 twisted pair or greater.
1K-BASE-LX/LH	1Gbps data throughput over 9-micron single mode fiber.
1K-BASE-ZX:	1Gbps data throughput over 8-micron single mode fiber.
10GBASE-T	10Gbps data throughput over Category 6A/6e twisted pair or greater.

E. Definitions:

1. Contract Documents: The documents consisting of the Form of Agreement between Authority and Contractor, Conditions of the Contract, (General, Supplementary, and other Conditions), Drawings, Specifications and all Addenda issued prior to the execution of the Contract.
2. Contract Drawings: The drawings that form a part of the Contract Documents that provides the graphical representation of the project requirements intended design and/or performance criteria to be delivered by the Contractor.

3. Reference Drawings: A drawing and/or set of drawings produced by a proprietary supplier, manufacturer, subcontractor, or fabricator included in the Contract Documents for informational purposes, providing specific information related to the installation of related appurtenances, components, devices, hardware, products, and/or systems. Reference Drawings shall also include any Contract Drawings from prior bid packages that may have pertinent information or require coordination of trades related to this contract.
4. Shop Drawings: A drawing and/or set of drawings produced by the contractor, supplier, manufacturer, subcontractor, or fabricator as a detailed representation of the proper installation of the related, appurtenance, component, device, hardware, product, and/or system to be delivered in conformance to the requirements of the Contract Documents.
5. The Authority: Greater Orlando Aviation Authority (GOAA) (Owner).
6. Authority Vendor (GOAA Vendor): Third party supplier/provider contracted directly by The Authority to provide goods or services as part of this project.
7. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
8. Install: Receive, Unload, verify, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
9. Provide: Furnish and install, complete and ready for the intended use.

1.2 SUMMARY

- A. This Section contains the overall requirements associated with all Division 27 and related Division 28 Specification Sections, and for all network communication cabling and equipment related to the installation of the following systems:
 1. Premise Distribution System
 2. VoIP Telephone System
 3. Passive Optical Network System
 4. Wireless Local Area Network (WLAN) and Bluetooth Wayfinding Beacons
 5. Automated Passport Control
 6. Common Use Systems (Self-Service & Passenger Processing)
 7. Queue Management System
 8. Visual Docking Guidance Systems (VDGS)
 9. Dynamic Signage (Including MUFIDS)
 10. Experiential Media Environment (EME) Multi-Media System
 11. IP Master Antenna Television System
 12. Global Positioning System (GPS)
 13. Public Address / Paging / Emergency Communications System
 14. Physical Access Control System (PACS)
 15. Intrusion Detection System (IDS)
 16. Video Surveillance System (VSS)
 17. Fire Alarm System

- B. In addition to the requirements of Division 1, this section shall address further requirements for submittals, quality assurance, product handling, record documents, project conditions, installation, system performance, demonstrations, testing, and certifications for all scopes of work related to network communication cabling for this project scope of work. Refer to related Division 26, 27 and 28 specification sections and all contract drawings for additional requirements.
- C. The intent of this project is to award as a *Construction Manager At-Risk (CMAR) Project*. The CMAR shall act as the prime contractor for its respective portion of the project
 - 1. The Technical Project Manager (TPM) shall manage and coordinate all technology, multimedia, control and security system aspects of the project for both the ASC and LST scopes of work.
- D. The Contractor shall be responsible for the performance of technology, multimedia, control and security system scopes of work under this project. These include, but are not limited to, systems that are connected to the Passive Optical network (PON), active ethernet network, or other types of communications, control, security, life safety and building management system equipment.
 - 1. The Contractor shall have responsibility for all final installations, equipment and all technical support related to all technology scopes of work and shall ensure full coordination of all work as required to provide fully operational communications infrastructures and systems in accordance with all requirements of the Contract Documents and applicable Codes and Standards.
 - 2. The Contractor shall ensure the technology scope of work including planning, installation, and commissioning of technology and multimedia systems are closely coordinated with Authority and Authority Vendor-Furnished equipment and systems. This planning shall include coordination of device level tracking, delivery time, and location for pick-up and installation of GOAA provided equipment to ensure Authority and Authority-Vendor furnished equipment and components are installed at specific locations.
 - 3. In addition to general CMAR construction meetings, the Contractor shall attend technology, multimedia, and security coordination meetings with TPM, CMAR, Authority and/or Authority Vendors.
 - 4. The Contractor shall be responsible for, at a minimum, the following tasks and activities:
 - a. Project Management
 - b. Schedule Management
 - c. IT System Impact Analysis
 - d. Staff Training
 - e. Performance Management
 - f. Change Management
 - g. Project Closeout
 - h. Estimating
 - i. Scheduling
 - j. Weekly Status Meetings including look-ahead
 - k. Cost Controls
 - l. Status Reporting

- m. Contract Administration
 - n. Document Review
 - o. Contractor Change Order Review
 - p. Trend & Variance Reporting
 - q. Document Controls
 - r. “As Built” Schedule Updates
5. Systems within the Contractor’s scope shall include, but not be limited to:
- a. Common Use Systems
 - b. Electronic Dynamic Signage
 - c. IP Master Antenna Television (IPTV)
 - d. Experiential Media Environment (EME)
 - e. Elevator Status/Control (Liftnet)
 - f. Passive Optical Network (PON) and Local Area Network (LAN)
 - g. Premise Distribution System (PDS)
 - h. Communication Rooms / Spaces (MDFs, IDF, Control Rooms)
 - i. Distributed Antenna System (DAS) – Operations (460MHz), Public Safety (800MHz), Cellular
 - j. Physical Access Control System (PACS)
 - k. Video Surveillance System (VSS)
 - l. Intrusion Detection System (IDS)
 - m. Advanced Visual Docking Guidance System (A-VDGS)
 - n. Wireless Local Area Network (WLAN)
 - o. Bluetooth Indoor Wayfinding
 - p. Building Management System / Building Automation System
 - q. Emergency Communication System (ECS) / Paging
 - r. VoIP Telephone System
 - s. Fire Alarm System
6. All sub-contractors shall meet the minimum technical capabilities, certifications, and licensing requirements as defined by the “Quality Assurance” chapter as specified herein as well as all related specification sections.
- E. It shall be the responsibility of the Contractor to furnish and install all necessary cabling, conduits/raceways, cable terminations, controls, systems, materials, devices, components, electrical power, equipment racks/cabinets and software as well as all appurtenances, programming, commissioning and testing necessary to deliver a complete and fully operational communications network infrastructures and systems as indicated by the contract documents.
- F. The installation, performance, features, functions, software, licenses, and programming criteria as specified herein as well as all related drawings and Division 27 and 28 specification sections have been designed to offer the maximum system efficiency, ease of operation, occupant safety and the protection of equipment as recommended by the Authority and Owner’s Authorized Representative (OAR).
- 1. Any deviations from the specified criteria shall be documented, reviewed, and agreed to in writing by the Authority and OAR prior to submission of bids. Refer to Division 01, and all related Division 27 and 28 Specification Sections for any substitutions and/or project deviation requests.

- a. The required information shall include but not be limited to: reason for deviation, all differences in performance, operation, and function from the herein specified requirements, all benefits, and added features to the Authority and OAR as a result of the deviations and any additional incurred costs to the Authority for maintenance and long term ownership.
 - b. Failure to provide the Authority and OAR with the required information shall result in any shop drawing submissions being returned for non-conformance with the contract requirements.
2. The submission of a bid or proposal for this work shall serve as acknowledgement that the Contractor and all Sub-Contractors have read, understood and accepted all of the General Conditions, Special Requirements, General Requirements, and all related specification sections and in the execution of all work shall be bound by all of the conditions and requirements therein.
- a. Prior to the submission of a Bid or proposal for this work, all anomalies, inaccuracies, discrepancies or inconsistencies noted within these Contract Documents shall be brought to the immediate attention of the Authority and OAR in written form. The submission of a bid or proposal for this work shall serve as acknowledgement that, apart from any such anomalies, inaccuracies, discrepancies or inconsistencies noted, the Contractor and all Sub-Contractors believe the Contract Documents to be complete and sufficient to provide a complete and fully-functional project as intended by the Authority.
 - b. During the execution of all work, the Contractor shall immediately notify, in written form, the Authority and OAR of any and all anomalies, inaccuracies, discrepancies or inconsistencies discovered within the Contract Documents. The Authority shall not be responsible for any additional costs associated with correcting any such anomalies, inaccuracies, discrepancies or inconsistencies incurred as a result of a delay by the Contractor in notifying the Authority and OAR of any such discovery.
 - c. Where ambiguity exists within the Contract Documents, the most stringent requirement and/or that which is superior in system design and performance shall prevail, and shall be delivered by the Contractor at no additional expense to the project.
- G. All device symbols are defined by the appropriate symbol schedules as indicated by the symbol and abbreviation drawing sheets for each discipline. The Contractor shall coordinate exact locations with all architectural, mechanical, electrical, reflected ceiling, furniture drawings and door hardware specifications as well as all affected trades prior to submittal of bids.
1. All symbols are shown on the contract drawings as close as possible to their intended location. Contractor shall coordinate with GOAA and GOAA's Vendor the installation of all equipment, devices, controls, components, cabling conduits/raceways and integration of other systems along with all affected trades and specified system sub-contractors. The contractor shall document all coordination requirements at the time of shop drawing submission.

2. Drawings for this work are diagrammatic and intended to convey the extent, general arrangement, and locations of the work. Because of the scale of the drawings, certain basic items such as access panels, conduits, cabinet sizes, penetration sleeves, pull boxes, back-boxes and junction boxes may or may not be shown on the contract drawings. Include all items where required by code and related specification sections for proper installation of all work.
- H. Project specifications and drawings may not deal individually with every part, control, device, component, or appurtenance which may be required to produce the equipment performance for the specified system and/or as required for compliance with all specified systems integration.
1. Include such items and components, as required, for complete operational systems as defined by the project documents, whether specifically indicated or not. Subject to the responsibility matrices shown on the Contract Drawings, the Contractor shall be responsible for providing conduits/raceways, cable terminations, controls, systems, equipment, materials, devices, components, electrical power, equipment racks/cabinets, software, programming, commissioning, testing and all appurtenances as well as the integration of any ancillary systems or Authority provided equipment/components/systems.
 2. Coordinate with other applicable trades in submittal of shop drawings and the installation of all systems. All shop drawings shall detail space conditions in order to accommodate other concerned trades, all equipment locations are subject to final review by the Authority and OAR.
- I. All Division 27 and 28 scopes of work shall include all necessary labor, coordination and interfacing with other trades and existing systems, software, equipment, materials, devices, cabling, conduits and electrical power as well as the performance of all system programming, testing and commissioning as required to provide fully operational systems in accordance with all requirements of the project documents.
1. Coordinate the installation of all systems, equipment, components, materials, conduits, cabling, devices and all existing system modifications with the Authority and OAR prior to the submission of any shop drawings.
 2. All Division 27 and 28 systems work shall include the labeling of all wire terminations, cabling, patch cords, pathways, enclosures, racks and cabinets in accordance with the Authority labeling standards, requirements and guidelines. All wiring shall terminate on fixed terminal strips, punch blocks, or patch panels in accordance with all requirements of the project drawings and related specifications.
 - a. No splices shall be permitted in underground maintenance holes and non-accessible junction boxes. All junction boxes containing any system splices shall be uniquely identified.
 - b. All mounting heights and accessibility to all equipment requiring access by individuals with disabilities shall comply with ANSI A117.1 requirement.
 - c. All equipment enclosures located outside or in all areas with high moisture or high humidity shall be NEMA 4X enclosures and rated for that application.

- d. All interior devices exposed to the general population shall be installed in secured equipment enclosures and installed in such a manner that resists tampering and/or removal without the use of specialized tools.
 3. All work shall be neat in appearance, free of rough edges, scratches, blemishes, cracks and exposed gaps. All equipment shall be secured to the mounting surface, and fastened with hardware approved by the manufacturer and capable of supporting the rated load. All backbone/permanent cables within enclosures shall be neatly routed and tie wrapped at 6 inches on center. Patch cables shall be secured with hook-and-loop (Velcro) or wire management guides. All wire splices shall be terminated on terminal strips and/or soldered in place. Any splices utilizing wire nuts or crimp/pressure-type connectors shall not be acceptable.
- J. Use of Premises
1. Refer to Specification Section 01 10 00 in addition to the following.
 2. The Contractor shall design, prepare, schedule, and coordinate all scopes of work without disruption of any existing system functions or the daily operation of the existing facility. All cabling and equipment shall be installed in such a manner that all new controls, equipment and/or devices shall be installed, programmed and tested prior to modification, switch over and/or disconnecting of any existing systems.
 - a. Include all costs related to any phased construction methodologies having to do with the scope of work defined herein, including, but not limited to, all necessary temporary equipment, devices, components or systems as well as any labor costs associated with any installation, commissioning, testing demolition of any technology systems required to be performed outside of normal business hours of the facility, Contractor or Sub-Contractors.
 - b. Prior to the disabling, modifications, switchover and/or demolition of any existing system components and/or cabling, all new system components, equipment, conduits, cabling, shall be in place, tested and fully operational.
 - c. The contractor shall coordinate all installation activities so as not to disrupt the daily operations of the airport and shall include any costs related to a phased construction methodology where applicable. Installation activity and costs shall include but are not limited to all necessary temporary equipment, devices, components or systems as well as any labor costs associated with any installation, commissioning, testing demolition of any systems required to be performed outside of normal business hours of the facility, Contractor or Sub-Contractors.
 - d. Contractor shall submit a Utility Outage Notice (UON) following GOAA UON protocol prior to any system disruptions.
 3. Contractor shall plan, schedule and install all scopes of work in accordance with all requirements of the project construction schedule. Refer to related specification sections for additional information related to project scheduling and facility access.
 - a. The contractor shall coordinate all installation and demolition activities so as not to disrupt the daily routine of the existing facility or negatively impact the integrity of the facility's security and life safety measures.

K. Coordination

1. The Contractor shall coordinate with all other affected trades in the submittal of comprehensive shop drawings and the installation of all equipment, devices, and systems. All shop drawings shall detail space conditions in order to accommodate all impacted trades, all equipment and device locations are subject to final review by the Authority and OAR.
 - a. If installation of equipment, enclosures, raceways, cable trays and/or conduits is performed prior to submission and/or approval of shop drawings, the Contractor shall make any adjustments or corrections as indicated in the shop drawing review at no additional cost to the Authority.
 - b. If installation of equipment, raceways, cable trays, and/or conduit is performed prior to coordination with all other trades, which interferes with work of other trades or the performance of the system, the contractor shall make necessary changes to correct the condition at no additional cost to the Authority.
 - c. The premise distribution infrastructure shall provide for the support and connectivity of the Building Automation System (BAS). The Contractor shall coordinate with the work specified in Division 23 and Division 28 as required for the connectivity and proper integration of the BAS, all life safety and security system requirements in accordance with the Contract Documents.
 - d. Provide all cabling, conduits, terminations, and programming to properly interface the BAS, fire alarm, emergency communications system (ECS) and access control systems with all related mechanical, elevator fire and security systems in accordance with all applicable life safety codes and/or in accordance with all requirements of the project drawings and related specifications.
 - e. Coordinate with all affected systems providers to ensure the proper integration and performance requirements of all Division 28 systems as required by Code, Contract Documents, and the AHJ.
2. Where applicable, contractor shall coordinate all service, rework, and relocation of existing utilities. Bid shall include all work required for any connections/interfaces with existing systems and/or utilities.
 - a. Contractor shall coordinate all work with vendors for rework, relocation, and addition of equipment and devices, including any modification to existing system infrastructure.
3. Coordinate all work involving tenant leased areas or equipment for rework, relocation, and addition of equipment and devices, including any modification to existing system infrastructures with the Authority and OAR.
4. Communication rooms including, but not limited to, MDF, IDF and control room spaces require activation in advance of other portions of the project to facilitate installation and commissioning of Authority-furnished and Authority Vendor-furnished equipment, Division 23 building automation / building management systems, and selected other systems. The Contractor shall schedule all work impacting communications room spaces to ensure completion adheres to the Project Schedule.
5. Refer to 3.1 Coordination for additional information.

1.3 SCOPE OF WORK

- A. Refer to individual Specification Sections for further system requirements.
- B. Refer to drawing sheet T0.00.01, TA0.00.01, and TS0.00.01 for work responsibility matrix and for any work provided by the Authority and/or Authority Vendors.
- C. Authority-Furnished Equipment (Owner-Furnished Equipment (OFE))
 - 1. Refer to the Technology Responsibility Matrices in the Contract Drawings for additional information.
 - 2. The Contractor shall coordinate with the Authority and OAR for all Authority Vendor and OFE.
 - 3. The Contractor shall coordinate with the Authority and OAR for pick-up of all OFE to be installed by the Contractor. The Contractor shall coordinate with the Authority in advance for specific pick-up location of OFE and to obtain access to such locations. The Authority shall not be responsible for delivery of OFE to be installed under this contract to the construction site. The hand-off of OFE between the Authority and the Contractor may occur multiple times throughout the project to permit configuration by either party after delivery and prior to installation.
 - 4. Immediately inspect all OFE upon pick-up for damage and/or defects. Notify the Authority and OAR in writing of any damage or defects immediately upon discovery. The contractor shall assume full responsibility for any unreported damage and/or defects to OFE.
 - 5. The Contractor shall provide all vehicles, hand trucks, carts and other means of transporting OFE within the project site. The Contractor shall transport OFE from the point of delivery to the point of installation.
 - 6. Refer to Part 1 Delivery, Storage and Handling requirements of this specification section and all related Division 27 and 28 specification sections for additional requirements.
 - 7. Refer to Part 3 Protection requirements of this specification section and all related Division 27 and 28 specification sections for additional requirements.
- D. Authority and Authority Vendor-Furnished Equipment and Services
 - 1. Portions of this project shall be furnished and installed by the Authority and/or Authority Vendors. The contractor shall identify elements of the project provided by Authority and/or Authority Vendors that impact the contractor's scope of work and coordinate all work with such parties. Schedule work to permit authority vendors' access to required work areas with sufficient time to complete tasks in accordance with the Project Schedule. Refer to related specification sections for additional information.
 - 2. The Authority Vendor shall actively attend meetings to coordinate work and construction with the Contractor.
 - 3. The Authority Vendor shall provide all equipment, tools, and services to complete work as described in the Contract Documents.
- E. Where listed on the drawing responsibility matrix, the following components shall be defined as follows:

1. Network Components: GOAA will furnish and install all required network switches and other active elements for network connectivity. The network includes layer 2 access and distribution or layer 3 core and router switches to connect a system to the GOAA Passive Optical Lan and Local Area Network. Contractor shall coordinate patching into the network with GOAA. Passive Optical LAN components are specified in Section 27 10 05 for ASC and LST work and include Optical Line Terminals (OLTs) and Optical Network Terminals (ONTs). Refer to related specification sections for additional information.
- F. The Contractor shall coordinate with the OAR for work related to any GOAA furnished, GOAA installed, and GOAA vendor work.

1.4 REFERENCES

- A. References to industry and trade association standards as well as all building codes are minimum installation requirements. The codes, standards and agencies listed below shall form a part of all related specification sections and all work shall comply with the latest adopted standards.
- B. Authority Having Jurisdiction: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.
- C. Local Adoption and Amendments: Follow the locally adopted version of all codes and standards. Where local jurisdictions or governments include amendments to codes including the National Electrical Codes, national health & safety codes, radio frequency regulations, or other building codes, the Contractor shall follow the locally amended versions and amendments.
- D. Publication Dates: Comply with published standards in effect as of date of the Contract Documents unless otherwise indicated.
 1. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity.
 2. Copies of applicable standards are not bound with the Contract Documents.
 3. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
- E. Where the contract drawings and specifications mandate a greater requirement or performance than those specified by any of the below referenced codes and standards, the Contract Documents shall then be the governing requirements for this project. The minimum codes and standards to be applied for this project shall be the following;
 1. National Fire Protection Association (NFPA):
 - a. NFPA-70: National Electrical Code (NEC)
 - b. NFPA-72: National Fire Alarm and Signaling Code
 - c. NFPA-75: Standard for the Protection of Information Technology Equipment
 - d. NFPA 76: Standard for the Fire Protection of Telecommunications Facilities
 - e. NFPA-101: Life Safety Code

- f. NFPA 1221: Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems
- g. NFPA 780: Standard for the Installation of Lighting Protection Systems
2. American National Standards Institute (ANSI) / Telecommunications Industry Association (TIA):
 - a. ANSI/TIA-455-61 FOTP-61: Measurement of Fiber or Cable Attenuation Using an OTDR
 - b. ANSI/TIA-455-78 FOTP-78 / IEC 60793 Optical Fibers Part 1-40: Measurement Methods and Test Procedures, Attenuation
 - c. ANSI/TIA 526-7-A: Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement.
 - d. ANSI/TIA-526-14-C: Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant
 - e. ANSI/TIA-568-D.0 : Generic Telecommunications Cabling for Customer Premises, and Annex E from ANSI/TIA-568-C.0: Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling
 - f. ANSI/TIA-568-D.1: Commercial Building Telecommunication Standard
 - g. ANSI/TIA-568-D.2: Balanced Twisted-Pair Telecommunication Cabling and Components Standard
 - h. ANSI/TIA-568-D.3: Optical Fiber Cabling Components
 - i. ANSI/TIA-569-D: Telecommunications Pathways and Spaces
 - j. ANSI/TIA-606-B: Administration Standard for Telecommunications Infrastructure
 - k. ANSI/TIA-607-C: Commercial Building Grounding and Bonding Requirements for Telecommunications
 - l. ANSI/TIA-758-B: Customer Owned Outside-Plant Telecommunications Infrastructure Standard
 - m. ANSI/TIA IS-811: Telephone Terminal Equipment, Performance and Interoperability for VoIP Feature Telephones.
 - n. ANSI/TIA-854: Full Duplex Ethernet Specification for 1000Mbps Operating Over Category 6 Balanced Twisted Pair Cabling
 - o. ANSI/TIA-862-A: Building Automation Systems Cabling
 - p. ANSI/TIA-1005-A: Telecommunications Infrastructure Standard for Industrial Premises
 - q. ANSI/TIA-1152: Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
 - r. ANSI/TIA-1183: Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems
3. International Telecommunication Union
 - a. ITU-T G.984: Gigabit Passive Optical Networks (GPON)
 - b. ITU-T G.987: 10-Gigabit Capable Passive Optical Network (XG-PON)
4. Motorola
 - a. R56 Standards and Guidelines for Communication Sites
5. Americans With Disabilities Act (ADA) 2014 ADAAG.
6. Underwriters Laboratories, Inc.:

- a. UL 486A: Wire connectors and soldering lugs for use with copper conductors
- b. UL 1449: Transient Voltage Surge Suppressors
- c. UL 1581: Standard for Electrical Wires, Cables, and Flexible Cords
- d. UL 1666: Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
- e. UL 478: Standard for Electronic Data-Processing Units and Systems
- f. UL 83: Thermoplastic-Insulated Wires and Cables
- g. UL 910: Test Method for Fire and Smoke Characteristics of Cables Used in Air-Handling Spaces." Provide products which are UL-listed and labeled.
- h. UL 969: Standard for Marketing and Labeling.
- i. UL Certified: UL's LAN Cable Certification Program
7. International Code Council
 - a. Florida Building Code 5th Edition (2014) Accessibility
 - b. Florida Building Code 5th Edition (2014) Building
 - c. Florida Building Code 5th Edition (2014) Energy Conservation
 - d. Florida Building Code 5th Edition (2014) Mechanical
 - e. Florida Building Code 5th Edition (2014) Plumbing
8. Florida Fire Prevention Code, 5th Edition (2014)
9. Institute of Electrical and Electronic Engineers (IEEE)
 - a. IEEE 802.1, Bridging and Management
 - b. IEEE 802.3, Standard for Ethernet (2012 with published amendments)
 - c. IEEE 802.11 Wireless LANs
10. NEMA/ICEA Compliance:
 - a. WC-5 - "Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy,"
 - b. WC30 - "Color Coding of Wires and Cables," pertaining to control and signal transmission media.
11. Internet Networking Standards: Network hardware and software shall be able to communicate with the Internet and provide for the creation of IP based networks for the Authority. All supplied hardware shall comply with the following minimum standards and RFC's as appropriate.
 - a. RFC 950 - Internet Standard Sub-Netting Procedure
 - b. RFC 1140 - Official Protocol Standards
 - c. RFC 1156 - MIB Base for IP Networks
 - d. RFC-1213 - MIB-II
 - e. RFC-1757 - Remote Monitoring (RMON)
 - f. RFC 1157 - Simple Network Management Protocol
 - g. RFC 1720 - TCP/IP, OSI Compliant
 - h. RFC 1918 - Address Allocation for Private Subnets
 - i. RFC 1583 - OSPF, Version II
 - j. RFC 1723 - RIP -II
12. ASTM Compliance: Comply with applicable requirements of D-2219 and D-2220. ASTM Compliance: Comply with applicable requirements of D-2219 and D-2220.
13. Building Industry Consulting Service International (BICSI)
 - a. ANSI/BICSI-002, Data Center Design Standard and Recommended Practices

- b. Electronic Safety and Security Design Reference Manual (ESSDRM)
 - c. Information Technology Systems Installation Manual (ITSIMM)
 - d. Outside Plant Design Reference Manual (OSPDRM)
 - e. Telecommunications Distribution Methods Manual (TDMM)
14. Safety Code for Elevators and Escalators – American Society of Mechanical Engineers (ASME 17.1).
15. Federal Communications Commission:
- a. FCC Regulations Part 15 Title 47.
 - b. FCC: Federal Communication Commission Part 68 as modified by Wiring Docket 88-57.
- F. Refer to the Responsibility Matrices in the Contract Drawings for additional information regarding the scope of work under this contract, and for information regarding items to be furnished by the Authority, which shall be designated as “Owner Furnished Equipment (OFE)”.
1. Where listed on the responsibility matrix, the following line items shall be defined as follows:
- a. Headend And Software: Includes any servers, management/administrative software, software licenses, and components which serve the purpose of performing system-wide coordination, monitoring, data processing, control and other global functions. Refer to related specification sections for additional information.
 - b. Integration to Existing System: Includes all hardware, software, wiring, cabling, programming, protocol converters, interface devices and appurtenances as required to extend the physical or logical scope of an existing system, or to incorporate a new or disparate system into an existing system. Refer to related specification sections for additional information.
 - c. Interfaces: Includes all hardware, software, wiring, cabling, programming, interface devices and appurtenances as required for communication between systems, or between a given system and an operator to provide the specified functionality. Refer to related specification sections for additional information.
 - d. Network Switch: Includes layer 2 (access / distribution) or layer 3 (core / router) network switches to connect a system to the GOAA Passive Optical Lan (POL) / Local Area Network (LAN). Refer to related specification sections for additional information. Where noted as “PON”, this line item shall include Passive Optical LAN active components including Optical Line Terminals (OLTs) and Optical Network Terminals (ONTs).
 - e. Backbone Cable: The segment of the premises distribution system that provides connection between telecommunications spaces. Refer to specification section 27 10 00 for additional information.
 - f. Horizontal Cable: The segment of the premises distribution system that provides connectivity from communications rooms to field devices. Refer to specification section 27 10 00 for additional information.

- g. Field Devices: Components of a system which are served by the system headend and are the network endpoint or “edge” device. Refer to individual specification sections for additional information.
- G. Additional System specific requirements may be included in the Sections referenced in 1.1. The Contractor shall meet the requirements in this Section in addition to those specific requirements for each System. Where common work results within this Section conflict with Sections listed in 1.1, the more stringent shall apply.

1.5 SYSTEMS DESCRIPTIONS

- A. Refer to individual specification sections for systems descriptions.

1.6 SUBMITTALS

- A. In addition to all submittal requirements as stipulated by Division 01 and any related specifications sections, the Contractor shall provide all submittals in accordance with the following:
 - 1. The Authority and OAR approvals shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.
 - 2. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Authority and OAR to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
 - 3. Prior to any submission the contractor shall be responsible for performing the following quality control items to ensure compliance with all project requirements:
 - a. Review all Shop Drawings and Product Data
 - b. Review all field measurement criteria.
 - c. Review all field construction criteria and methodologies.
 - d. Review all catalog numbers and similar data.
 - e. Review all coordination requirements of affected trades.
 - f. Review conformance to all appropriate specification sections.
 - 4. The Contractor shall have a registered RCDD professional review and seal shop drawings related to network installations, testing, certifications, and structured cabling layouts for communications systems confirming that the proposed network infrastructure is in conformance with all stipulated standards and requirements as herein specified. Failure to provide RCDD sealed shop drawings shall result in all shop drawings being returned for resubmission without any reviews taking place.
 - 5. Submit all system testing, commissioning and startup procedures to be employed. Include all estimated times for performance of all tests, all test equipment and manpower necessary for testing.
 - 6. Submit all sub-contractor qualifications and certifications in accordance with the requirements as specified elsewhere in this specification section.

- B. In addition to items to be furnished and installed under this Contract, this project includes of items to be furnished and/or installed by the Authority and Authority Vendors, known as Owner-Furnished Equipment (OFE). In order to provide for comprehensive review of all system designs by the Authority and OAR, the contractor shall obtain all items and related information required as part of standard submittals from the Authority and or Authority Vendor(s) for Authority- or Authority-Vendor furnished equipment and submit them as part of the Contractor's submittal packages for each system. Examples of submittal items where OFE shall be incorporated include, but are not limited to:
1. Heat load calculations
 2. Power load calculations
 3. Rack space requirements
 4. Rack elevation drawings
 5. Floor plan drawings
 6. Mounting details
 7. Mock-ups as specified
- C. The Contractor shall schedule submittals to maintain the project schedule. For coordination requirements refer to Division 01 Specification Section, which outline basic submittal requirements and coordination. All Division 01 and related Specification Sections requirements shall be used in conjunction with all requirements as herein specified.
1. Submittals shall be provided as a complete submission; no partial submissions will be accepted. Failure to provide a complete submission shall result in all submittals being returned for resubmission.
 2. No substituted equipment shall be reviewed without prior approval in accordance with the requirements of "substitutions" under Division 1 Specification Section.
 3. Mark the submittals, "SUBMITTED UNDER SECTION__."
 - a. Submittals shall be marked to show specification reference including the section and paragraph numbers.
- D. All shop drawings shall be prepared using latest version of AutoCAD or REVIT, drawn accurately, and in accordance with the Authority's Standards and the requirements of Specification Section 01 33 23. Failure to provide a complete set of "Contractor prepared" installation drawings at the time of submittal shall result in all submittals being returned for resubmission.
1. Submission Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
 - a. Electronic Copy Submission: One complete set of electronic equipment data sheets and drawings submitted in PDF format and collated in two distinct files:
 - 1) Equipment Data Sheets, equipment schedules, alarm matrixes cable termination spread sheets, and all related pertinent information.
 - 2) Drawings including all site plans, floor plans, risers, point to point wiring, grounding, installation details, rack/cabinet and mounting elevations.

- b. Hard Copy Submission: Submit hardcopies of all shop drawings and product datasheets in accordance with the requirements the of Division 01 Specifications
- E. Compliance Matrix
 - 1. The Contractor shall submit a compliance matrix that summarizes compliance or non-compliance with each specification component.
- F. Software
 - 1. The Contractor shall provide software submittals including manufacturer's/developer's documentation for each type of software used in the project. Documentation shall include, at a minimum:
 - a. Complete description of software features, proposed options and functionality.
 - b. Software version and revision identification.
 - c. Software manufacturer's contact information for technical support, including address, telephone numbers, fax numbers and e-mail/web URLs
 - d. Well-commented source code and an executable version for all custom and special purpose software. Source code shall be delivered in both hard copy and machine readable formats on a media acceptable to the Authority and OAR. All compilers, case tools, utilities, etc. that are needed to create the executable code shall be included.
- G. Re-submittals
 - 1. Submitted items, found unsuitable, rejected or returned for revision by the Authority and OAR, shall be reworked by the Contractor and resubmitted.
 - 2. Review of Contractor's submittals by the Owner's Representative will be limited to examination of an initial submittal and one (1) resubmittal. The Authority and/or OAR reserves the right to obtain reimbursement from the Contractor for amounts paid to the Owner's Authorized Representative for evaluation of any additional resubmittals due to incomplete information or non-compliance to the project documents on the part of the Contractor. An incomplete submittal (whether an initial submittal or a resubmittal) shall count as a submittal.
- H. Shop Drawings
 - 1. Provide all shop drawings shall include sufficient information, clearly presented, to determine full compliance with all project drawings and specifications. At the minimum include the following information as applicable for review. Failure to provide all information listed below shall result in all shop drawing submittals being returned for resubmission:
 - a. All Building Floor and Site Plans.
 - b. All equipment, devices and components with manufacturer's name(s), model numbers,
 - c. All equipment, device and component electrical ratings and power requirements
 - d. All equipment, device, and component performance ratings.
 - e. All equipment /device battery calculations,
 - f. All equipment /device cable voltage drop calculations,

- g. All dB losses for all fiber optic devices and cabling,
 - h. All dB losses for all coaxial cabling taps and devices
 - i. All Speaker taps, voltages and zoning
 - j. All equipment rack/cabinet layouts and rack/cabinet sizes.
 - k. All device-mounting elevations.
 - l. All device wiring details.
 - m. All grounding and bonding connections.
 - n. Complete point-to-point-wiring diagrams for all systems. Include all equipment and wiring termination schedules and/or matrices.
 - o. Equipment, devices, cabling, and work related to Authority and Authority-Vendor furnished and/or installed work.
2. Provide a complete set of “contractor prepared” installation drawings. Drawings at the minimum shall consist of all floor plans indicating all passive and active electronic component locations, field devices, device identifications, distribution racks, patch panels, control panels, auxiliary control panels, power supplies, conduits, cable trays, and cabling distribution, as well as all 120-volt electrical circuit locations and designations.
- a. Drawings shall be made at 1/8" = 1'-0" scale. Drawings shall include at the minimum the following:
 - 1) Detailed equipment layouts for all communications rooms. Coordinate all room layouts with affected trades.
 - 2) Floor plan drawings showing locations of all equipment, devices, equipment cabinets and/or rack locations. Identify type and sizes of all equipment cabinets and/or racks.
 - 3) All cable tray layouts, including methods of support, and conduit routing of all conduits 2 inches in diameter or greater.
 - 4) All equipment rack layouts showing locations of all rack mounted equipment items.
 - 5) System riser diagrams and single line drawings, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codings (point-to-point wiring diagrams). System performance measurements shall be documented as specified.
 - 6) Equipment wattage for each location and rack/cabinet and estimated BTU production.
 - 7) Detailed equipment layouts for all equipment consoles. Indicate all equipment locations, power connections, data connections and installation details.
 - 8) All equipment mounting hardware/brackets and installation details, identify type size, load capacities of all mounting hardware/brackets; include all mounting and installation details, all space requirements, any special architectural modifications required.
 - 9) Outline drawings of all equipment cabinets/racks showing the relative position of all major components, all-wiring and grounding terminations. Include all panel, cabinet and/or rack dimensions.

- 10) Point-to-point wiring diagrams for all cabling. Include all cable drop identification at edge device and at termination equipment. Include complete wiring termination schedules.
 - 11) All grounding and bonding termination points
 - 12) All electrical circuit numbers and distribution panel locations.
 - 13) Equipment, devices, cabling, and work related to Authority and Authority-Vendor furnished and/or installed work.
3. Provide a complete termination schedule of all communications device drop/outlet locations. Indicate on the installation drawings all device drops/outlet locations, termination room locations, unique identifications, cable types, cable distances and all pertinent data to properly evaluate the performance and capabilities of each cable run.
 4. All drawings shall be prepared using an AutoCAD- or REVIT-based program; hand drawn mark-ups of the original Contract Drawings shall not be acceptable. Failure to provide a complete set of “contractor-prepared” shop drawings at the time of submittal shall result in all submittals being returned for resubmission.
 5. Provide a sleeve layout for all penetrations through post tensioned concrete structures. Coordinate with Structural, Mechanical, Plumbing, Electrical, and Fire Protection Contractors. Submit sleeve layout no later than eight weeks prior to forming the post tensioned concrete.
 6. All shop drawings shall include input from related trades for coordination. Related trades include, but are not limited to architectural, structural, mechanical, electrical, plumbing, fire protection, interiors, FFE, signage, wayfinding, and similar elements.
 7. Contractor shall include Owner-Furnished Equipment in system block diagrams and MDF/IDF rack and cabinet elevations and details for coordination of power and overall space planning purposes.
 8. The Contractor shall be responsible for reconciling rack and cabinet elevations submitted by various sub-contractors into a comprehensive rack and cabinet elevation drawing for each telecommunications space. Comprehensive rack/cabinet elevations shall include all rack/cabinet mounted equipment provided and/or installed by the Contractor or sub-contractors in a single drawing for each telecommunications space.
- I. Equipment Submittals:
1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
 - a. Include all equipment data sheets pertinent to equipment provided. All data sheets shall be highlighted and annotated indicating specific equipment and options supplied. Failure to provide the proper annotation of all equipment shall result in submittals being returned for resubmission.
 2. Submit complete technical data necessary to evaluate the material and equipment. Include a complete technical specification for the submitted equipment, noting differences and adherence to this Section. Failure to provide the required data will result in all submittals being returned for resubmission.

3. Submit performance data, equipment ratings, cable requirements, control sequences, GUI based control panels, programming matrices, logic diagrams and all other descriptive data necessary to describe the installation and operations of the system being provided. Failure to provide the required data will result in all submittals being returned for resubmission.
 4. Parts list, which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price, and availability of each part.
 5. Installation Instructions: indicate application conditions and limitations of use stipulated by the applicable NRTL. Include instructions for storage, handling, protection, examination, preparation and installation.
 6. Equipment, devices, cabling, and work related to Authority and Authority-Vendor furnished and/or installed work.
- J. Maintenance and Operation Manuals: Submit in accordance with all requirements of Division 01 Specification Section and as herein specified.
1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
 2. Inscribe the following identification on the cover: the words "Maintenance and Operations Manual", include the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
 3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
 4. Furnish (1) copy of all Maintenance and Operation Manuals in PDF format on DVD media or flash drive.
 5. The manuals shall include:
 - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - b. A control sequence describing start-up, operation, and shutdown.
 - c. Description of the function of each principal item of equipment.
 - d. Installation and maintenance instructions.
 - e. Safety precautions.
 - f. Diagrams and illustrations.
 - g. Testing methods.
 - h. Performance data.
 - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
 - j. Contractor contact information.

- k. Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
6. Approvals will be based on complete submission of manuals together with shop drawings.

1.7 QUALITY ASSURANCE

- A. Quality Assurance services as described below shall be provided by the Contractor. The Authority will only provide Quality Assurance inspection.
 1. Quality Assurance services described in this section are a portion of the quality assurance activities which may be necessary to achieve full compliance with the Contract Documents and are not intended to limit the activities of the contractor.
 2. These provisions do not relieve the contractor of providing quality control services or other inspections to the Authority or authorities having jurisdiction over this project.
 3. A quality assurance supervisor whose responsibility it is to ensure compliance with the contract documents shall be included in the quality assurance program. This person shall be assisted by other quality assistance staff as warranted by the specific construction activities and workload.
 4. The Contractor shall submit signed Quality Assurance Summary reports to the Authority and OAR. These reports shall address both project progress and project quality control activity.
- B. Quality Assurance Program
 1. The Contractor shall establish a Quality Assurance Program to perform inspection and tests of all items of work. This Program shall insure conformance to applicable specifications and drawings with respect to the materials, codes, workmanship, construction, finish, functional performance, and identification. This Program shall be established for all system rollout and phasing plan work performed under this Contract. The Contractor's Quality Assurance Program shall specifically include surveillance and tests required in the technical provisions of the specifications.
 2. The Contractor shall describe its Quality Assurance Program in detail. Descriptions shall be given for at least the following:
 - a. Organization
 - b. Inspection
 - c. Testing
 - d. Documentation
 - e. Administration
 - f. Quality Awareness and Training
 - g. Forms
 - h. Schedules
 - i. Submittals

3. Before the Contractor's Quality Assurance Program description is submitted, the Contractor shall meet with the Authority and OAR and discuss the Contractor's Quality Control Plan. The meeting shall develop a mutual understanding of the details of the plan, including the forms to be used for recording the quality assurance operations, inspections, administration of the plan for both on-site and off-site work, and the interrelationship of the Contractor and the Authority inspection. The Contractor shall prepare meeting minutes which shall be incorporated in the Contractor's Quality Assurance plan.
- C. Contractor qualifications: Each contractor or sub-contractor shall be an accredited and authorized distributor of the appropriate equipment manufacturer and shall be fully certified in the installation, testing and programming of all equipment being provided. These qualifications shall be submitted and approved by the Authority and Owner's Authorized Representative (OAR) for all persons performing work on the system.
1. The Contractor shall submit documented successful work experience of at least three (3) facilities of equivalent size and technical requirements utilizing the proposed equipment being provided. The contractor shall have on staff a minimum of one full time individual that holds a current RCDD registration in good standing.
 - a. Experience shall be defined as the completion of the specific system being provided, with that system being successfully operated for its intended purpose for at least three (3) years.
 - b. In addition to the above "Experience" shall also be defined as the completion of modifications and renovations to any associated system being provided in any existing occupied facility of this size and magnitude.
 - c. For each facility submit the following:
 - 1) Name and location of facility
 - 2) Date of Occupancy or beneficial use by Owner
 - 3) Owner's representative to contact and telephone number
 - 4) Construction Manager or General Contractor
 - 5) Project Architect or Engineer
 - 6) Provide information on the installed locations with operational equipment
 - 7) Registration number and expiration date of RCDD professional
 - 8) Registration number and expiration date of Level II installer.
 2. All information technology system work shall be certified in writing to the Authority and OAR by the contractor's on-staff RCDD professional asserting that all communications network system shop drawings and structured cabling is in conformance with all appropriate NEC requirements, ANSI/TIA standards, and all related specification sections.
 3. Submit a technical resume of experience for the Contractor's Project Manager and on-site installation foreman who will be assigned to this project.
- D. Cable Installer Qualifications: The cable installation contractor shall demonstrate not less than five (5) years' experience in the installation of structured cabling systems.

1. The installing contractor shall have on staff a minimum of one full time member that holds a current BICSI level II installer credential in good standing that has been active for a minimum of two (2) years and that has been employed by the Contractor for a minimum of one (1) year..
2. NOTE: The installation of all communications cabling shall be under the direct supervision of a current BICSI level II installer who shall be knowledgeable in the following technical applications:
 - a. The Routing and installation of inside and outside plant shielded, unshielded, twisted pair, coaxial and fiber optic cables.
 - b. Bonding and grounding of cable tray and equipment racks.
 - c. Fusion splicing of fiber optic cabling.
 - d. Testing copper conductors for electrical continuity.
 - e. Testing and Certifying of UTP structured cabling for attenuation and worst case near end cross talk.
 - f. Testing and Certifying of ALL fiber optic cabling employing an Optical Time Domain Reflectometer (OTDR) in accordance with TIA/EIA protocols.
 - g. Testing and Certifying of coaxial cable networks for RF leakage
 - h. Termination, connection, and testing of shielded and un- shielded twisted pair cable, coaxial cabling, and fiber optic cabling on all specified connectors, electrical protection blocks, termination blocks, and patch panels.
 - i. Generally accepted industry standards, as well as manufacturers written installation instructions, will be used for in-process quality control and final acceptance of the work installation.
3. Installing Contractor shall be currently licensed as a Certified Electrical Contractor or Certified Limited Energy System Specialty Contractor (ES 069).
4. The Installing Contractor shall maintain an office within fifty (50) miles of the project with a permanent, local staff of specialists, including a Superintendent, for planning, installation and service and the capability to provide emergency service 24 hours per day, 7 days per week.

E. Technology Master Contractor

1. The Contractor shall demonstrate not less than three (3) years of experience in management of airport systems. These qualifications shall be submitted and approved by the Authority, Contractor and Owner's Authorized Representative (OAR) for all persons performing work on the system.
2. Experience shall be based on the individuals and not the company proposed and defined as the completion of the specific system being provided, with that system being successfully operated for its intended purpose for at least three (3) years.
3. In addition to the above "Experience" shall also be defined as the completion of modifications and renovations to any associated system being provided in any existing occupied facility of this size and magnitude.
4. For each facility submit the following:
 - a. Name and location of facility
 - b. Date of Occupancy or beneficial use by Owner
 - c. Owner's representative to contact and telephone number

- d. Construction Manager or General Contractor
 - e. Project Architect or Engineer
 - f. Provide information on the installed systems
- F. Service Qualifications: All sub-contractors shall be a permanent service organization maintained and/or trained by the product manufacturer on the products being provided for this project.
1. The sub-contractors shall be (where required) properly licensed by the governing municipality to provide the services and work for the specific system being installed. In addition, all sub-contractors shall be capable of providing full service for the entire warranty period within an 4-hour response time 24 hours per day, 7 days per week upon notification of a service emergency.
- G. Manufacturer's Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and materials specified for this project, and shall have manufactured the items for at least five (5) years.
- H. Non-Compliance
1. The Authority may notify the Contractor of any non-compliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Any notice, when delivered to the Contractor or its representative at the site of the work, shall be considered sufficient notice.
 2. If the Contractor fails or refuses to comply promptly, the Authority may issue an order stopping all or part of the work until satisfactory corrective action has been taken. It is understood and agreed to the following:
 - a. Time lost due to any such stop order is the responsibility of the Contractor.
 - b. Costs to repair, replace or otherwise remedy the defective work are the responsibility of the Contractor.
 - c. Costs incurred by the Authority to correct defective work shall be deducted from the total amount due the Contractor. An amount may be withheld from the payment due the Contractor to recoup expenses incurred by the Authority due to non-compliance.
 3. Failure of the Authority to notify the Contractor of non-compliance does not relieve the Contractor of the responsibility to comply fully with the requirements of the Contract Documents and does not preclude the Authority from taking the corrective action specified in this paragraph.
 4. In cases where implementation of the Quality Assurance Program does not comply with either the Contractor's Quality Assurance Plan or the Contract Provisions, or where the Contractor fails to properly operate and maintain an effective Quality Assurance Program, the Authority may:
 - a. Order the Contractor to replace ineffective or unqualified quality control personnel.

- b. Assign the Authority or contracted outside professional staff to carry out the functions and operations of the Contractor's approved Quality Assurance Plan. Costs incurred by the Authority to operate a Quality Assurance Program or to otherwise remedy the Contractor's non-compliance with quality-related provisions of the contract shall be deducted from the total amount due the Contractor.

1.8 DELIVERY, STORAGE AND HANDLING

- A. In addition to the requirements below, refer to specific related specification sections for additional requirements.
 1. Contractor shall store all equipment and materials in a climate controlled environment. Storage environment shall, at a minimum, comply with the following:
 - a. Temperature not to exceed: -20° C to +70° C (-4° F to + 158° F)
 - b. Relative humidity of 5% to 95%, non-condensing.
 2. Where manufacturer's storage requirements are more restrictive than those listed above, store such equipment and/or materials in compliance with all manufacturer's requirements.
 3. Do not store equipment or materials in areas where fire or explosion hazards exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers. Do not store equipment or materials in areas subject to corrosive agents, liquids or gasses.
 4. Do not store equipment or materials in areas that contain potential water hazards (including, but not limited to, restrooms, kitchens, or mechanical spaces), or adjacent to liquid-carrying pipes.
- B. Contactor shall store materials only in areas designated by the Authority and OAR.
- C. The Contractor shall coordinate and participate in product delivery and movement to installation locations with the Authority and OAR within both on- and off-hour periods as required to minimize impact to the Airport operations.
- D. The Contractor shall be responsible for product shipment, delivery and storage/staging/testing location onsite. The Contractor shall coordinate with the Authority and OAR regarding site readiness and refer to architectural drawings regarding placement.
- E. The Contractor shall provide a security plan for approval by the Authority and OAR describing the methods, areas, and access for equipment. The plan shall include how equipment will be securely stored and accessed by the Contractor, GOAA, and OAR within communications rooms, MDFs, IDFs, control rooms, and similar spaces throughout construction.

1.9 RECORD DOCUMENTS (AS-BUILT DOCUMENTS)

- A. In addition to all general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections include the following project requirements;
- B. Project Record Documents

1. Provide record documentation to the Authority and OAR at the completion of each phased installation and at Contract Closeout. To ensure that this submittal reflects proper record keeping during the Work, maintain on-site one (1) set of the Contract Drawings, specifications, addenda, change orders and other modifications to the Contract, and reviewed shop drawings and product data.
2. Legibly mark and record at each specification section a description of actual products installed, including the manufacturer's name and product model number, product substitutions or alternates approved and utilized, and changes made by Addenda and Modifications.
3. Legibly mark Record Documents and shop drawings to record actual installation including communication conduit, cabling and pathways used, field changes of dimensions and detail, changes in details from those indicated on drawings, details not on original Contract Drawings, and provide make and model of actual product installed.
4. Mark whichever drawing is most appropriate to showing "field" conditions fully and accurately. If necessary, provide scaled drawings of modifications and give attention to concealed work, which would be difficult to measure and record later. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, and print suitable titles, dates, name of installing company, name and signature of job superintendent, and other identification on the cover of each set.

C. As-Built Documentation

1. Provide complete set of finalized copies of record documents prior to final acceptance of the project by the Authority and OAR in accordance with all requirements of Division 01 specification sections. At the minimum the as-built documents shall contain all information, data, and drawings as described in the "Submittals" paragraph of this specification section as well as all shop drawing requirements of related specification sections.
 - a. As-built documents shall be submitted in both paper and electronic media formats in the quantities as specified by Division 01 specification requirements.
 - 1) All electronic record drawings shall be prepared and submitted utilizing an AutoCAD- or REVIT-based program as manufactured by Autodesk. Where electronic documents are prepared using other than an AutoCAD or REVIT program manufactured by Autodesk, the contractor shall provide to The Authority and OAR the necessary software to electronically view the submitted documents.
 - 2) All electronic data sheets, control sequences, programming matrices and other descriptive data shall be provided in PDF formatted documents.
 - 3) Copies of all current system programming and associated software shall be provided on downloadable media formatted for the use in restoration all system operations and functionality in the event of a catastrophic failure.

2. As-Built documentation shall include finalized equipment locations, cable and conduit routing pathways, and installation details. The As-Built documentation shall not be redlined copies, but be finalized AutoCAD or REVIT drawings. The As-Built documentation shall build on the initial design details and further develop these based on specific installation details.
3. As-Built documentation shall be capable of being inserted into the Authority GIS system.
4. The level of detail defined in these As-Built documents shall be suitable to allow any third party to support system maintenance as well as support future integration and expansion of installed systems at the Airport.
5. All junction boxes containing any system splices shall be uniquely identified in the field and indicated on the as-built drawings with corresponding schedule identifying all related splices at the specific junction box locations.

1.10 OPERATION AND MAINTENANCE

- A. Refer to specific related specification sections for requirements in addition to the following.
- B. Provide complete set of operating and maintenance manuals in accordance with all requirements of Division 1 and related Division 27 and 28 specification sections. The manuals shall include all operational programming and maintenance information for the system being provided. Edit all manuals specific to the installation of the provided system; manufacturer's documentation alone shall not be acceptable. Include all, manufacturer's technical data sheets, programming matrixes and graphic screen representations.
- C. Operations Manuals
 1. Provide a clear and concise sequence of operation that gives, in detail, the information required to properly operate all equipment and systems. Include detailed programming matrixes, indicating at the minimum all manual and automatic functions for all system, components and devices comprising the system being provided.
- D. Maintenance Manuals
 1. Include maintenance instructions and other descriptive material as received from the manufacturer to enable designated personnel to maintain and test equipment.
 2. Include descriptions, specifications, layout drawings (showing component types and positions), and back-panel and assembly wiring diagrams.
 3. Provide instructions for preventative maintenance procedures that include examinations, tests, adjustments and periodic cleaning.
 4. Provide guidelines for isolating the causes of hardware malfunctions and for localizing faults.

1.11 SOFTWARE AGREEMENT

- A. The Authority shall retain the ownership and access rights of the source code for all custom system programs and software specifically developed and/or modified as part of this project. Additionally, the Authority shall retain ownership of all software licenses for "off the shelf" software furnished and installed as part of this project.

1. The Contractor shall provide to the Authority and OAR complete copies of all current software programming and software licenses related to the operation of each system prior to final acceptance of the related Contract scopes of work.
 - a. All programming shall include but not be limited to all device identifications, device descriptions, Programming Logic Matrices, all program access level passwords as well as all function and sub-function routines.
 2. Programming and software copies shall be provided to the Authority and OAR on DVD digital formatted media or flash drive. In addition, the contractor shall provide a complete hard copy printout of all system programming and shall be included as part of closeout documentation for review by the Authority and OAR.
- B. Software and firmware upgrade provisions shall be included as part of this specification requirement and shall include the automatic upgrades as required to maintain all software and firmware to the manufacturers most current revision on all system components installed and or modified as part of this project for duration of the warranty period. This upgrade policy shall require the contractor to install, test, and certify all software and firmware upgrades that become available from manufacturer for a period of one year from date of final acceptance to the expiration of the warranty.
1. Upgrading of software shall include all revised/new software, labor, testing certification as well as all licenses, software and all programming copies as described in the Record Documents paragraph of this section associated with the installation of all revised software.
 2. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations/maintenance and software documentation manuals.
 - a. One (1) scheduled final update shall be provided near the end of the warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software and firmware for all systems installed and/or modified for this project.
 - b. All software changes shall be recorded in a log maintained in the unit control. An electronic copy of the most current software update shall be maintained within the log.
 - 1) At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "Software Change Log."
 3. Provide not less than thirty days' notice to the Authority and OAR to allow scheduling and access to system and to allow the Authority and OAR to upgrade computer equipment if necessary.

1.12 SPARE MATERIAL

- A. In addition to all general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections refer to related Specification Sections "Extra Material" for specific requirements.

- B. All spare materials shall be provided at the time of final acceptance of the project and a signed packing list shall be obtained at the time of delivery. At no time is the contractor to use the spare materials provided for this project to replace malfunctioning or damaged equipment and or components.

1.13 ENVIRONMENTAL CONDITIONS

- A. Systems, components, devices materials, and equipment shall be capable of withstanding the environmental conditions of the space without mechanical or electrical damage or degradation of operating capabilities or performance.
- B. All devices, components, or equipment installed on the exterior of the facility shall be provided in accordance with all manufacturers' requirements to ensure the proper operation when exposed to the environmental conditions and/or average annual highest and lowest temperature that can be anticipated for the geographic region of the facility, as well as anticipated temperatures within a sealed enclosure exposed to direct sunlight.
 1. Interior, Controlled Environment: System components, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 2 to 50 °C (36 to 122 °F) dry bulb and 20 to 90 percent relative humidity, non-condensing and shall utilize NEMA 250, Type 1 enclosures.
 2. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 °C (0 to 122 °F) dry bulb and 20 to 90 percent relative humidity, non-condensing and shall be installed in NEMA 250, Type 4X enclosures.
 3. Exterior Environment: System components, conduits and back-boxes installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 °C (-30 to 122 °F) dry bulb and 20 to 90 percent relative humidity, condensing. Rated for continuous operation where exposed to rain as specified in NEMA 250, winds up to 240 km/h (149 mph) shall utilize NEMA 250, Type 4X enclosures.
 4. Hazardous Environment: System components, conduits and back- boxes located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
 5. Corrosive Environment: System components, conduits, and back- boxes subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, shall utilize NEMA 250, Type 4X enclosures.
 6. Submersible Environment: System components, conduits and back-boxes subjected to prolonged submersion in water, shall utilize NEMA 250, Type 6P enclosures.
 7. Areas where equipment and devices may be subject to damage by the general population shall be installed in vandal resistant enclosures; all fire alarm system and related devices shall be provided with wire guards.
 8. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 °C (60 to 85 °F) and a relative humidity of 20 to 80 percent.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, that meet and/or exceed the specified performance and features of the equipment and/or systems and for which replacement parts shall be readily available to the contractor and/or using agency. The equipment specified is based on the acceptable manufacturers listed. Where "or equal" is stated, equipment shall be equivalent in every way to that of the equipment specified, and subject to approval.
1. When more than one unit, device, or component of the same class of equipment is required, such units, devices, or components shall be the product of a single manufacturer.
 2. Acceptable manufacturers for each system shall be as specified and shall be provided in full compliance with the requirements of this and all related specification sections and contract drawings.
 - a. Manufacturers listed as acceptable shall not negate the contractors' responsibility for providing all equipment, devices, components, and/or systems, in accordance with all functions and performance requirements of the Contract Documents.
 - b. Where manufacturer and/or manufacturer model numbers reference specific system components in the related specification sections, it is to establish the performance requirements and quality of the systems and components only.
 - 1) It is in no way an inference that the referenced model numbers are the manufacturer's current product and are the only acceptable components for this project unless specifically referenced as "no substitutions."
 - c. Equivalent UL- listed equipment may be substituted for the approved manufacturers unless stipulated by other Specification Sections as "No Substitutions." All substitutions shall be submitted for approval by the Authority and OAR in accordance with all requirements of Division 01 Specification Sections and "Submittals" chapter of this Specification Section.
 - 1) Where systems and/or components are referenced as "no substitutions" the specific system and/or components shall be provided.
 - 2) All substitutions shall comply with all requirements as specified above and all system performance standards shall be maintained.
 - 3) The contractor shall stipulate the following information impacted by such a substitution.
 - a) Any and all extensions in time impacted by the substitution.
 - b) Any changes to the architectural or structural elements to the project
 - c) Differences in operation and/or performance from intended system criteria. Note all deviations from the requirements of the Contract Documents on the Compliance Matrix. Provide sufficient detail to enable thorough review of how the proposed equipment or solution differs from the requirements of the Contract Documents.

- 4) Failure to provide the required substitution information shall result in “without consideration” the immediate rejection of the substituted equipment and/or systems.
 3. Due to the rapid advancement and antiquation of hardware technology, the supplied hardware shall be the “contemporary technical and operational equivalent” of the specified hardware. The following requirements shall be met:
 - a. Contemporary technical and operational equivalent shall be based on a comparison of technology at the time of publication to the technology at the time of ordering the equipment.
 - b. Hardware shall be ordered as close to the actual installation date for a given phase as reasonable (i.e., latest responsible date). Final hardware approval and scheduled order date are at the sole discretion of the Authority and OAR.
 - c. Hardware equivalence shall be based on both technical equivalence and operational equivalence.
 - d. Contemporary technical equivalence shall be based on device performance and class specifications.
 - e. Contemporary operational equivalence shall be based on industry standards, maintainability and functions.
 4. The Manufacturer's product or product line/series shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years. The Authority and OAR reserves the right to require the Contractor to submit a list of installations where the products have been in operation for the specified period of time prior to approval of shop drawings.
 - a. The manufacturers shall submit the appropriate documentation certifying that the installing sub-contractor is a qualified service provider of all manufacturers' products being provided for this project.
 - b. The Manufacturer shall certify that the submitted product will continue to be fully supported for a minimum of (5) years after acceptance by the Authority and OAR.
- B. Equipment Assemblies and Components:
 1. Components of an assembled unit need not be products of the same manufacturer.
 - a. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 - b. Components shall be compatible with each other and with the total assembly for the intended service.
 - c. Constituent parts which are similar shall be the product of a single manufacturer.
 - d. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- C. Electrical Components, Devices and Accessories
 1. Shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Compatibility and Interoperability of System Components and Devices
1. Where multiple components, devices, and/or systems are intended to be interconnected and components of a complete system in accordance with any related specification sections, it shall be the Contractor's responsibility to verify interoperability and compatibility of said components, devices, and/or systems in full conformance to the specified performance criteria prior to the submission of shop drawings.
 2. Where specified devices are found to be incompatible or incapable of performing as specified in a seamless manner, the contractor shall notify the Authority and OAR in writing prior to submission of shop drawings. Failure to properly identify such functional discrepancies shall not relieve the contractor from providing a complete and fully functional system in accordance with the requirements of all related specification sections.
- E. Where Factory or Off-Premises Testing of any equipment, product or assembly is recommended by the product manufacturer or where specified as part of this section and/or any related specification section:
1. The Authority and OAR, shall have the option of witnessing all factory tests. The Contractor shall notify the Authority and OAR at a minimum of thirty (30) working days prior to the performance of any factory or off-premises tests.
 - a. Where the factory or assembly point for all off-premises testing is not within two (2) hours driving time from the project location, the contractor shall include as part of this project all per diem costs (travel, meals and lodging) for two representatives from the Authority and OAR to witness all testing. Any travel overseas shall include business-class airfare. Lodging shall consist of 3-star or better accommodations.
 2. Provide four (4) copies of certified test reports containing all preliminary test data and testing procedures shall be furnished to the Authority and OAR prior to any final testing and not more than ninety (90) days after completion of any tests.
 3. When equipment, product, or assembly fails to meet any factory or off-premises tests, retesting of equipment, product, or assembly shall be mandated, the manufacturer/contractor shall be liable for all additional expenses, including all expenses incurred by the Authority and OAR for witnessing the retesting of any equipment, product, or assembly.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate with all trades at the time of shop drawing submission detailing all space and/or room conditions. The contractor shall coordinate with the appropriate trade all conditions impacting the installation of any system including but not limited to all equipment locations, ceilings, lighting fixtures, fire protection piping, and ductwork layouts to the satisfaction of all concerned trades, subject to final review by the Authority and OAR.
1. Coordinate exact location of all desktop/counter mounted equipment with the Authority and OAR, as well as all affected trades and tenants prior to the installation of any equipment and/or cabling.

2. Coordinate exact location(s) of all ceiling mounted cable, conduits, cable tray, equipment, and/or devices with all architectural plans, reflected ceiling plans and affected trades prior to installation.
 3. For equipment installations requiring coordination with other trades, the contractor shall provide all supplemental framing, bracing, templates, backboxes and equipment anchor bolts for mounting or flush mounting preparation, (e.g. pedestals or other devices requiring mounting on walls, concrete pads or other materials). Coordinate delivery of templates and equipment anchor bolts to preclude any delay in the construction schedule or the work of the affected trade.
 4. If installation of equipment, raceways, cable trays, J-hooks and/or conduit is performed prior to coordination with other trades, which interferes with work of other trades or operation and maintenance of the facility, make necessary changes to correct the condition at no additional cost to the Authority.
 5. Contractor to provide all component MAC addresses to GOAA IT in device labeled floor plans and spreadsheet form for GOAA IT network configuration.
- B. Prior to final programming of all systems review with the Authority and OAR all system features, functions, system operations and related operational programming for all systems provided.
- C. Provide coordination with all system sub-contractors and trades for the proper installation of all equipment, components, and all integration requirements in order to provide fully operational systems in accordance with all applicable specification sections.
- D. Each Contractor shall maintain a complete set of current and up to date shop drawings and equipment submissions at the job site at all times. Shop drawings and all other submissions shall be made available to the Authority and OAR upon request.
- E. Coordinate the work of this contract with the work of the Authority and all Authority Vendors. Schedule all work to ensure that the work of the Authority and all Authority Vendors can proceed in accordance with the Project Schedule.
1. All communications room spaces including, but not limited to IDF, MDF and control rooms spaces shall be constructed and complete six (6) months ahead of project substantial completion in order to allow the Authority and Authority Vendors to complete additional work within these spaces. Refer to Section 01 01 00 for early completion requirements. Completion shall, at a minimum, include the following elements:
 - a. The room shall be secured in accordance with the approved Security Plan described in 1.8 Delivery, Storage and Handling.
 - b. The following work items relating specifically to these spaces shall be completed as part of this requirement:
 - 1) Architectural finishes
 - 2) Secure doors
 - 3) Electrical Power
 - 4) Grounding and Bonding
 - 5) Mechanical Systems
 - 6) Fire Suppression

- 7) Equipment Racks and Cabinets including, but not limited to complete installation, bonding and labeling. All work within equipment racks and cabinets shall be complete including, but not limited to installation and labeling of patch panels, patch cables, wire management, surge protectors, and similar work.
 - 8) Premise Distribution System Backbone Cabling including, but not limited to complete installation, termination, testing, labeling, and programming of any PDS cabling and pathways within, terminating, or routing through the space. Work shall also include all terminations, cross-connects, securing, and fiber channeling for a complete and operational backbone system. Backbone PDS shall be entered in the GOAA PDS Administration Database.
 - 9) Final Cleaning
- c. Notify the Authority and OAR upon completion of each communications room space to obtain written acceptance. Rooms shall not be considered complete until final written acceptance is issued by the Authority and OAR. Acceptance for the purposes of this section does not constitute turnover of the space to the Authority. The contractor shall still be responsible for the space and any additional work required to complete the project.

3.2 EQUIPMENT PROTECTION

- A. Protect all materials, equipment, devices, or components permanently installed and/or stored on the job site. Protect all materials, equipment, cabling, devices, or components during construction and after installation. Provide appropriate protection of all materials, equipment, components, and/or devices until time of substantial completion. All materials, equipment, components and/or devices shall be protected during shipment and storage against any physical damage, dirt, moisture, extreme temperatures, precipitation, theft and/or vandalism:
1. During installation, enclosures, racks/cabinets, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of any foreign matter; and shall be vacuum cleaned both inside and outside before testing and operating and repainting if required.
 2. Any materials, equipment, components and/or devices, stored on site, which have been deemed by the Authority and OAR to exhibit any indications of damage or exposure dust or moisture shall not be installed and shall returned to the source of supply for immediate replacement.
 - a. The use of spare parts or the return of defective equipment for repair to mitigate the damage of defective materials, equipment, components, and/or devices shall not be acceptable. All materials, equipment, components, and/or devices shall be new and unused until final acceptance by the Authority and OAR.
 3. Provide and apply protective material immediately upon receiving the products and maintain throughout the construction process.
 - a. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
 - b. Any damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired area is not obvious or detectable.

4. Failure to properly protect all materials, equipment, components and/or devices prior to final acceptance shall constitute sufficient cause for rejection of materials, equipment, components and/or devices should any defects, damage or degradation in performance is observed.
- B. Seismic Performance: The Contractor shall furnish and install all equipment bracing, and anchoring rated for the seismic zone of the geographical area in which the project resides, and shall withstand the effects of earthquake motion and wind forces in accordance with the current editions of the IBC and ASCE/SEI 7. Refer to Refer to Division 01 and Division 26 – Hangers and Supports for additional seismic information and requirements.
 1. Equipment shall include, but not be limited to, racks/cabinets, video monitors, TV's, cable trays, conduits, junction boxes, and all associated appurtenances.
- C. Immediately replace all malfunctioning materials, equipment, components, and/or devices with new unused products up until the time the Authority and OAR issues final acceptance of the system. The returning of any malfunctioning equipment, devices, and/or components to the manufacturer for repair and then reinstallation at the project site shall not be acceptable.
 1. All replacement materials, equipment, components, and/or devices shall be factory new and not obtained from the Project's spare parts inventory or use factory recycled products unless expressly identified by contractor prior to replacement and approved beforehand by the Authority and OAR.

3.3 WORK PERFORMANCE

- A. Receipt, storage, transport, handling, installation, final termination, testing, start-up and commissioning of all systems, system components and cabling infrastructures shall be under the direct supervision of the appropriate system sub-contractor. The sub-contractor shall be an accredited and authorized distributor of the appropriate equipment manufacturer and shall be fully certified in the installation, testing, commissioning, and programming of all equipment, devices, components, and/or systems being provided as part of this project.
- B. Job site safety and worker safety is the responsibility of the Contractor. Ensure that safe access and egress from all work areas is maintained during movement and installation of materials. Clean up all debris generated by installation activities. Keep all communications equipment rooms free of debris at all times. Communications rooms are not to be used for the storage of tools or project materials at any time during the project.
- C. Pre-installation Conferences: Include provisions to attend all Preconstruction/Preinstallation conferences at Project site in compliance with all requirements in Division 01 Specification Section and as herein specified. Review methods and procedures related to installation and operations of all communications systems, including, but not limited to, the following:
 1. Inspect and discuss electrical and equipment roughing-in related to all communications systems as well as other preparatory work required to be performed by other trades.

2. Review and discuss all work, equipment deliveries, installation procedures, and related scopes as required to conform to the phased construction schedule.
 3. Review sequence of operations for each type of system, control, cabling and/or integration to any systems and/or equipment provided by other trades.
 4. Review and finalize construction schedule and verify availability of materials, installation personnel, equipment, and any preparatory work by other trades needed to make progress and avoid delays.
 5. Review required start-up, testing, commissioning, and certifying procedures to be employed for each system and any impacts to other trades.
- D. For work on existing facilities, arrange, phase, and perform work to assure the operation of all communications systems for other buildings and contiguous spaces at all times. Refer to Division 01 Specification Section for additional requirements.
- E. All new work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Division 01 Specification Section.
- F. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been completed unless designated for storage.
- G. Coordinate the installation of all cabling, conduits/raceways and cable trays and equipment with applicable trades to ensure proper operation and function of all integrated systems in accordance with all related specification sections. Refer to Division 01 Specification Section for additional project coordination requirements.
- a. Prior to the final programming of any systems review with The Authority all system features, functions, system operations, network mapping, system integrated responses and all related programming as required for the proper operation of the respective communications systems.
- H. The Contractor shall prepare the necessary documents required for installing, testing, and bringing each system online. Such documents include but are not limited to:
1. Project management and quality assurance plans
 2. Testing plans
 3. Component and system submittal documents
 4. Installation plans
 5. Component design plans
 6. System user documentation
 7. As-built drawings and documentation
 8. Authority-required documentation including, but not limited to Cable Management Reports and Device Schedules.
- I. The Contractor shall coordinate with the Authority and OAR to ensure each system meets the project requirements. The Contractor shall meet all ADA requirements.

3.4 EQUIPMENT INSTALLATION

A. General

1. The Contractor shall provide all tools and test equipment required to install, verify, and test the installation and to determine that it meets the specifications. The Contractor shall furnish all necessary materials required to implement and to achieve the required work performance.
2. The Contractor shall install products detailed in the specifications, system requirements, drawings and Contractor designs including those purchased by the Contractor and those provided by other parties.
3. All equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specification shall be subject to the control and approval of the Authority and OAR.
4. All system equipment installations shall be in accordance with good engineering practices, NEC, local building codes, industry standards and all manufacturer's requirements. Cable terminations at all equipment locations shall comply with all state and local electrical codes and industry standards. All wiring shall test free from all grounds, shorts, stray voltages, and EMI.
5. Follow manufacturers' instructions for installing, components and adjusting all equipment and cabling. Submit two (2) copies of such instructions to the Authority and OAR a minimum of fourteen (14) days before installing any equipment related to the submitted instructions. Provide an additional copy of such instructions at the equipment during any work on the equipment. Where no instructions are included with the equipment, follow accepted industry practices and workmanlike installation standards.
6. Equipment location shall be as close as practical to locations as indicated on the contract drawings.
 - a. Provide all equipment clearances in accordance with NEC requirements and industry standards. Arrange equipment to facilitate unrestricted access for maintenance and service around all equipment, components, and/or cable terminations.
7. Where the Authority and OAR determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the project.
 - a. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
8. System/Hardware and mounting must comply with IBC Seismic Requirements.
9. Comply with manufacturer's published rated load for all fasteners, brackets, enclosures, racks, cabinets, cable trays and supports for system components.
10. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of not less than three feet and ensure that the cable is long enough to allow full extension of drawer or slide.

11. The Contractor's quality assurance Inspector shall conduct a visual inspection of all installations to verify that the installations are in accordance with the project's and manufacturer's specifications. Records of the inspections signed and dated by the Quality Assurance Inspector shall be provided to the Authority and OAR. Prior to any scheduled inspections the Authority and OAR representative shall be notified by the Contractor of any inspection(s) so they may witness.
- B. Software Installation
1. The Contractor shall test all custom and packaged "off-the-shelf" software in development, test, stage and production environments, and have successfully passed factory acceptance testing, prior to installation on-site.
 2. Contractor shall install and configure all software in accordance with the software manufacturer's installation instructions. Apply the latest patches and security updates, unless otherwise noted.
- C. Hardware Installation
1. Final hardware selected and installation of hardware shall be coordinated with the Technical Project Manager. Additionally, the Contractor shall ensure the ventilation requirements for the all hardware components are met.
 2. The Contractor shall install and inspect all hardware required in this specification in accordance with the manufacturer's installation instructions. Final placement of hardware is subject to the Authority and OAR approval.
 3. The Contractor shall be responsible for any and all loss or damage in the shipment and delivery of all material until transfer of title to the Authority.
 4. The Contractor shall obtain written permission from the Authority and OAR before proceeding with any work which requires cutting into or through any part of the building structures such as, but not limited to, girders, beams, concrete, carpeted or tiled floors, partitions or ceilings. The Contractor shall obtain written permission from the Authority and OAR before cutting into or through any part of the building structures where fireproofing or moisture proofing could be impaired. In any such case the Contractor shall be responsible for restoring the affected area to "like-new" condition or to a condition to match the existing conditions.
 5. The Contractor shall take all steps necessary to ensure that all public areas remain clear or are properly marked during installation or maintenance.
 6. The Contractor shall coordinate installation with the Authority and OAR, to minimize disruption of existing business functions at the airport.
 7. The Contractor shall place materials only in those locations that have been previously approved. Any other locations shall be approved, in writing, by the Authority and OAR.
 8. The Contractor shall label all cabling and patch cords in accordance with the Authority approved labeling plan. Coordination with the Authority and OAR shall be performed, and all labeling shall be approved, prior to implementation.
- D. System Startup
1. Subject to the responsibility matrix on the Contract Drawings, the Contractor shall not apply power to the system until after:
 - a. System and components have been installed and inspected in accordance with the manufacturer's installation instructions.

- b. A visual inspection of the system components has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
- c. System wiring has been tested and verified as correctly connected as indicated.
- d. All system grounding and transient protection systems have been verified as properly installed and connected, as indicated.
- e. Power supplies to be connected to the system and equipment have been verified as the correct voltage, phasing, and frequency as indicated.
- f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage due to Contractor work/equipment.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. All wiring and cables shall be properly dressed and/or bundled with hook-and-loop (Velcro) straps or cable ties. Twisted wire, tape, rope, twine, phone wire and similar bits of debris usually available on site are not acceptable substitutes for proper securing hardware. All inter-rack cables and wiring must be properly routed, and where available, in cable trays. Overhead cables must be easily removed or reworked within the cable trays. Proper care must be taken to ensure that new cables added to the trays are not stressed or intertwined with existing cables. Cables shall not be broken out of their outer jackets except within enclosures designed to support and protect cable break-outs. Overhead cables may not cross perpendiculars or be suspended in mid-air without supports.
 1. Cables exiting conduits at a height exceeding 18" above cable tray shall be supported by conduit waterfall fittings. Cables shall not exit conduits at a height exceeding 3 feet above the supporting cable tray.
- B. Cabling shall be sized to support the appropriate communication system. All communications cable installations shall be in accordance with good engineering practices as established by the ANSI/TIA, IEEE and the NEC and all referenced standards. All cabling shall meet all state and local electrical codes. All cabling shall test free from all grounds, shorts, and EMI.
 1. Contractors shall have the option to combine all cable home runs and conductors of same type and voltage "class" in accordance with NEC requirements unless specified elsewhere. Size all conduits and cable trays to meet the required fill ratios and install all conductors in accordance with NEC requirements, referenced standards and manufacturers recommendations.
 - a. All communications cabling located above accessible suspended ceilings shall be installed in conduit.
 - b. Cabling installed above hard ceiling spaces shall be installed in dedicated conduits.
 - c. No exposed cabling will be acceptable in finished or occupied spaces of the facility without approval by the Authority and OAR.
 - d. Any communications system cabling installed exterior to the building and/or all cabling being routed from the facility to any remote location external to the project location shall utilize OSP rated fiber optic cable installed in conduit system.

2. Do not install bruised, kinked, scored, deformed, abraded, or otherwise damaged cable. Do not splice cable between indicated terminations, taps, or junction points. Remove and discard cable where damaged during installation and replace it with new cable.
3. Ensure that all communications cabling supports (conduits, support grips, cable trays, and cable termination panels) are fully installed before proceeding with cable installation.
4. At no time shall any cables be installed and left unsupported, nor shall cables be tie-wrapped to any other supporting structure in lieu of specified cable supports. Do not tie-wrap or permanently affix cable bundles to approved cable supports.
 - a. NOTE: Cable bundles shall not be cinched too tightly; all cable ties shall be hook-and-loop ("Velcro") strips only.
5. The Contractor shall not permit any communications cabling to lie unprotected on the floor at any time. If cables must be left on any floor, protect the cables so that they may not be walked on or have any material or equipment placed or rolled on top. Replace all damaged cables from demarcation to termination point; no splicing of damaged cables shall be permitted.
6. Maintain manufacturers recommended minimum bend radiuses of all cabling. Where referenced standards stipulate a larger bend radius than that specified by the manufacturer, comply with the larger requirement. Do not stretch, stress, tightly coil, bend, or crimp cables. The Contractor shall keep all cabling out of the way of other trades during staging of any work. The contractor at the contractor's expense will replace all severely stressed or damaged cables, equipment, and materials as determined by the Authority and OAR.
7. Do not exceed the manufacturer's maximum specified pull tension during installation. Where the manufacturer does not specify a maximum pull tension, follow those specified in the applicable referenced standard(s). Contractor shall utilize a winch with tension control or a "break-away" link designed to break away at or below the recommended maximum pulling tension.
8. Special care shall be taken to avoid damage to the cable. While under pulling tension, the cable shall not be bent into a curve with a radius of less than twenty (20) times the cable diameter, or no less than manufacturers minimum.
9. Use methods and lubricating compounds on cables and wires to prevent damage to material and products during roughing-in. Provide compounds that are not injurious to the cable and wire jackets that do not harden or become adhesive.
10. No media, fiber or copper, shall be installed in lengths surpassing Standards based length requirements.
11. Wire and cable routing shown on the Contract Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project conditions.
12. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required. Record actual routing on as-built for all conduit larger than one inch.
13. Cables shall not be broken out of their jackets except within enclosures designed to support and protect cable breakouts, splices, and/or terminations.
14. Installation of all cabling shall be in accordance with all guidelines established by the product manufacturer and all referenced industry standards.

- C. Unshielded Twisted Pair (UTP) and Shielded Twisted Pair (STP) Cable
1. All TCP/IP-based copper network cabling shall be Category 6 or Category 6a rated as noted and installed in conduit except within dedicated communications rooms. All communications raceway shall not contain any AC carrying conductors or non-associated communications network cables.
 2. Refer to related specification sections for additional requirements related to Category 6 or 6a cabling types, and testing requirements.
 - a. All network cabling located above accessible suspended shall be installed in dedicated conduits, exposed cabling supported by the use of “J” hooks shall not be accepted.
 - b. All horizontal data drops shall be terminated on Category-6 or 6a patch panels installed on the 19” equipment racks\cabinets.
 - c. All data drops and backbone cabling installed above inaccessible ceiling spaces or areas containing no ceiling shall be installed in dedicated conduits. In no case shall cable be supported on ceiling tiles, T-bars, or tie- wrapped to any conduit or pipes.
 - a) Category-6 or 6A cables shall not be cinched too tightly; all cable bundles at patch panel locations and in the field shall be VELCRO type strips only. Plastic wire ties shall not be accepted on any Category-6 or 6a cabling.
 - b) Each horizontal cabling drop shall be a dedicated Category-6 or 6a cable and shall not exceed a maximum cable length of 295 feet (including slack and service loops)..
 - c) Communications drops installed inside walls shall be installed in dedicated conduit terminating in a junction box at the jack location.
 - d) Cable and wiring shall not lay loose on ceiling tiles or grids. Cable must be supported in all areas. Bridle rings or tie-wrapped supporting methods are not acceptable. Conduit stub-ups shall extend to the cable tray.
 - e) Install all cabling parallel and perpendicular to building lines and follow building structure. Use cable support equipment/hardware recommended by the manufacturer and/or as herein specified.
 - f) Provide all terminations, cross-connects, wire management, surge protectors, etc. for a complete and operational system.
 - g) Any data communications system cabling installed exterior to the building and/or being routed from the facility to any remote location external to the project location shall be rated for the environment in which it is being installed.
 - d. Ensure that all communications systems cabling supports (conduits, support grips, cable trays, and termination patch panels) are fully installed before proceeding with cable installation.
- D. Fiber Optic Cabling

1. All fiber optic cabling shall be provided to meet the communications requirements for all network communications systems, at the minimum all fiber optic cabling shall be sized in accordance with the project documents. All fiber optic cabling shall be a minimum of 8.3/125µm OS2 type cabling. Multi-mode fiber optic cabling shall be unacceptable, unless for specific uses explicitly defined in the contract documents.
 - a. All fiber optic cabling shall be a continuous segment from demarcation to termination point and shall be installed above accessible ceilings wherever possible. All fiber optic cabling shall be installed in dedicated conduits.
 2. All exterior fiber optic cabling shall be rated for exterior outside plant (OSP) applications and installed in dedicated multi-cell fabric (“Maxcell”) inner-duct conduit system, and routed in the exterior conduit ducts in accordance with the requirements of the contract documents. Outside plant cable shall not extend more than fifty (50) feet into a building interior before terminating and transitioning to standard indoor fiber optic cable.
 3. Fiber optic cabling shall be provided as the primary media for any exterior network components installed remote to building, as well as all network communications links for all backbone communications.
 - a. The contractor shall be responsible for the determination of actual segment lengths. Actual quantities will be calculated by the routing as indicated on the contract drawings and/or in the field based on existing conditions.
 4. All splices shall be fusion type. Mechanical splices shall not be acceptable.
 5. Refer to related specification sections for additional requirements related to fiber optic cabling types, sizes and testing requirements.
- E. Hybrid (Conductive) Fiber Optic Cable
1. Provide fiber optic cable with integrated copper conductors for electrical power distribution where indicated on the Contract Drawings. Fiber optic cabling shall meet all of the requirements listed under “Fiber Optic Cabling” above.
- F. Analog Cable Terminations
1. Splice, Taps and Terminations of all analog cabling: Use numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures. Tighten connections to comply with tightening torques specified in UL Standard 486A.
 2. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque-tightening values for equipment connectors.
 3. Rack and terminal cabinet wiring shall be neatly routed or bundled and routed along rack sides. All splices and connections shall be by plug, solder or screw terminal strips, etc. Splices shall not hang in racks or terminal cabinets.
- G. Conduits/Raceway/Cable Trays
1. Provide conduit and raceway systems for all communications networks as indicated below. Refer to all related specification sections for additional conduit and raceway information.
 - a. Exposed structure: Provide conduit run from each drop to the nearest communication room.

- b. Vertical cabling shall be installed in dedicated conduits and shall be supported between floors in closets or accessible locations; in no case shall any cable risers be unsupported.
 - c. Cables entering all communications equipment rooms shall be supported with Cable tray from entrance to rack/cabinet location as indicated on the contract drawings and/or herein specified.
 - d. Conduits containing horizontal cables shall enter IDF Rooms as close as possible to the furthest distanced ITO in order to minimize cable lengths.
2. All conduits/raceways shall be concealed and shall be installed above accessible finished ceilings and/or in walls. Any conduits/raceways installed in areas requiring installation to be exposed, shall be installed as tight as possible to ceilings and at right angles to walls/building lines and shall not obstruct any access hatches, equipment service panels, lighting or other equipment and/or devices. No exposed conduits/raceways shall be installed without prior approval of the Authority and OAR.
- a. Where conduits cannot be concealed above ceilings or in walls and must be installed in finished or public areas of the building, all conduits shall be finished wire-mold type raceways or approved equal. Finished wire-mold type raceways shall not be installed without prior approval in writing by the Authority and OAR.
 - b. Where any equipment and/or junction boxes are installed above non-accessible finished ceilings, the contractor shall provide access hatches listed for the intended application. Access hatches shall be located so that service access to the equipment and/or junction boxes is unimpeded.
 - 1) Access hatches shall not obstruct any equipment, service panels, lighting equipment, devices, or any architectural elements of the ceiling. At the time of submittals, the contractor shall submit all proposed access hatch locations for review by the Design Professional.
 - c. All conduits/raceways shall be supported in accordance with NEC requirements and referenced standards.
 - d. All conduits/raceways shall be installed in a manner that prevents tampering or removal when installed in areas exposed to the general population.
 - 1) Provide tamper-resistant installation utilizing “torx with peg” security-fastening devices for all conduits/raceways, equipment, devices and appurtenances in all areas accessible to the general population and/or areas subjected to tampering or vandalism.
 - e. Interior raceways shall be a minimum 1 inch unless otherwise noted. Exterior raceways shall be a minimum 1 1/4-inch. Size all raceways and install conductors in accordance with NEC requirements. Fill ratio shall not exceed 40 percent for indoor raceways or exterior raceways.
 - 1) EMT conduit with compression fittings may be utilized in all inaccessible ceiling areas unless otherwise restricted by code.
 - 2) Threaded Rigid metal conduit shall be used on all exterior applications, stub-ups and all interior areas where concealed conduit requirements cannot be met and are exposed to tampering or damage by the general population.

- a) All areas considered being of high risk due to the nature of the occupancy or the need to protect and maintain the integrity of the cabling shall be installed in rigid threaded conduits.
- f. Conduit expansion couplings shall be furnished and installed in all areas where expansion/contraction of structure may occur in order to couple two sections of a conduit runs to support longitudinal movement. The contractor shall refer to architectural drawings for exact locations of all building expansion joints.
 - 1) Conduit expansion couplings shall be consistent with the size the conduit being installed, shall be steel electrogalvanized, and shall meet all environmental and seismic conditions.
 - 2) Expansion couplings shall be weatherproof and approved for use indoors or outdoors without an external bonding jumper.
 - 3) Expansion couplings shall be UL Listed and approved for use in wet locations.
 - 4) Expansion couplings shall comply with UL 514B, CSA 22.2 No. 18 3-12, NEMA FB1.
- g. Exterior raceways: PVC schedule 40 conduit at the minimum shall be utilized in all underground applications unless otherwise specified by related specification sections. The conduit shall be buried at a minimum 36" below grade. Warning flagging tape shall be buried 12" below grade to indicate the conduit routing location. Refer to related specification sections for additional requirements.
 - 1) All exterior conduits larger than 2" in diameter shall be provided with dedicated inner-duct conduit systems, segregated by network type (i.e. security, etc.) and shall include a minimum of one spare empty inner-duct per conduit at the completion of the project.
 - 2) The Contractor shall have the option to utilize the same trench/routing location as other utilities. In no case shall any system conduits or duct banks be combined with other electrical utilities without providing the required separation between conduits as necessary to ensure the minimal transmission or conduction of any RF and/or EMI signals.
- h. Outlet Boxes: shall be 4-11/16 x 4-11/16 x 2-1/8 inches deep with single gang reducer plate where required for all data outlet locations and single gang for wall mounted telephone locations.
 - 1) All outlet boxes shall be provided with single or dual gang device mud-rings flush to finished wall as required based on type and configuration of outlet and type of wall construction.
 - 2) Use deep masonry boxes at masonry construction. T-Bar hangers or other appropriate mounting hardware shall be utilized to support boxes mounted in the ceiling.

3. Cable Tray – Ladder Type: Provide a two-tier cable tray system in all communications rooms and closets for routing horizontal distribution and backbone communications cables as detailed on the Contract Drawings. Refer to Specification Section 27 10 00 for Cable Tray specifications and additional requirements. Cable tray shall be complete with all materials, miscellaneous hardware and all appurtenances required for a complete cable distribution and support system. All cable trays shall be furnished with swept bends/corners within telecommunications room (IDF/MDF) spaces. Provide drop-out/waterfall fittings above racks/cabinets.
 - a. All cable tray widths shall be sized according to the total number of cables to be supported within the various trays plus an additional 100% spare capacity for future expansion capability.
 - b. Install cable tray in a manner ensuring that all cables fully comply with all ANSI/TIA standards.
 - 1) Maintain a minimum clearance of 24" between top of uppermost cable tray and ceiling structure or other equipment or raceway.
 - 2) Maintain a minimum clearance of 12" between bottom of cable tray and top ceiling grid or other equipment or raceway. Maintain 12" of clearance between upper and lower cable tray tiers.
 - 3) Maintain a minimum clearance of 24" from all conduits or cables used for electrical power distribution.
 - 4) Maintain a minimum clearance of 12" between bottom of lower cable tray and top of equipment racks and/or cabinets
 - 5) Maintain a minimum clearance of 24" from fluorescent lighting. All Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.
 - 6) Cable tray supports shall be attached to the structural ceiling or walls with hardware or other installation and support aids specifically designed for the cable tray and designed to support the cable tray's weight and required cable weight and volume.
 - 7) Do not attach cable tray supports to ceiling support system or other mechanical support systems.
 - 8) Cable tray installed adjacent to walls shall be supported from the wall using brackets.
 - 9) Do not support cable trays from cabinets or racks. Connections between cable tray and cabinets or racks shall be for the purposes of stabilization only.
 - 10) Load span criteria: Install tray supports in accordance with the load criteria of L/240, with minimum 5/8" threaded rod for ceiling support within telecommunications spaces.
 - 11) Cable Trays shall be supported in accordance with manufacturers' published recommendations, or at a maximum of 6-foot intervals, whichever is lesser in spacing, and within 2 feet of each end.
 - 12) All Cable trays shall be installed without burrs, sharp edges, or projections, which may damage cable insulation.
 - 13) All lengths or sections of cable tray shall be bonded and grounded in accordance with NEC, ANSI/TIA, IEEE.

- c. Follow manufacturers' instructions for installing, components and adjusting all equipment and cabling. Submit two (2) copies of such instructions to the Architect before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Where no instructions are included with the equipment, follow accepted industry practices and workmanlike installation standards.
 - d. Acceptable Manufacturers: Subject to compliance with these specifications, ladder tray shall be as manufactured by:
 - 1) Chatsworth (CPI)
 - 2) Homaco
 - 3) Eaton B-Line
 - 4) Or approved equal.
4. Cable Tray - Basket Type
- a. Acceptable Manufacturers: subject to compliance with these specifications, wire cable trays and support systems as manufactured by:
 - 1) Chatsworth (CPI)
 - 2) Legrand
 - 3) Eaton
 - 4) B – Line Systems
 - b. General
 - 1) Provide wire cable tray where indicated by the contract documents; the contractor shall include all required types, sizes, necessary connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
 - c. Materials and Finishes specifications for each wire cable tray as follows:
 - 1) Electroplated Zinc: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated zinc in accordance with ASTM B633 SC2.
 - 2) Stainless Steel: Straight sections and accessories shall be made from AISI Type 304 Stainless Steel.
 - 3) Paint: Straight sections shall be painted "Computer White" over Electrodeposited Zinc.
 - 4) Pre-Galvanized Zinc: Wall brackets and other pre-galvanized accessories shall be coated with zinc in accordance with ASTM A653.
 - 5) Electro-Galvanized Zinc: Support accessories and miscellaneous hardware shall be coated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633
 - 6) All straight section longitudinal wires shall be straight (with no bends).

- 7) Wire cable tray shall be made of high strength steel wires and formed into standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along wire cable tray sides (flanges) shall be rounded during manufacturing for safety of cables and installers.
 - 8) Wire cable tray sizes shall conform to the following nominal criteria:
 - a) Straight sections shall be furnished in standard 120-inch lengths.
 - 9) Wire basket shall have at the minimum 4-inch usable loading depth by 16 inches wide.
- d. Cable Tray Support System
- 1) All fittings shall be field formed as needed.
 - 2) All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 Stainless Steel.
 - 3) Wire basket supports shall be center support hangers, trapeze hangers or wall brackets as manufactured by Cooper B-Line, Inc. or Architect approved equal.
 - 4) Trapeze hangers or center support hangers shall be supported by 1/4 inch or 3/8-inch diameter rods.
 - 5) Special accessories shall be furnished as required to protect, support, and install a wire basket support system.
- e. Installation
- 1) Install wire cable tray where indicated on the contract drawings in accordance with manufacturers requirements and recognized industry practices (NEMA VE-2 2000). Ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70 and NECA's "Standards of Installation" pertaining to general Electrical installation practices.
 - 2) Coordinate wire cable tray with other electrical work as necessary to properly interface installation of cable tray with other trades.
 - 3) Provide sufficient space encompassing cable tray to permit access for installing and maintaining cables. Provide a minimum clearance of at least 6" clear AFC and 12" clear above cable tray.
 - 4) Basket type cable tray shall be installed so as to be electrically continuous, but under no circumstances shall cable tray be configured for use as an electrical bonding conductor.

H. Penetrations of Walls and Floors:

1. All wall/floor penetrations are to be sleeved and fire stopped with approved fire stopping material or sealant as applicable for the type of penetration. Coordinate all cable and conduit penetrations of building with all affected trades. Refer to all related specification sections for additional wall/floor penetration requirements.
 - a. All penetrations of rated walls and floors shall be fire stopped in accordance with the ASTM and NFPA standards. Refer to related specification sections for additional requirements.

- b. Floor penetrations shall be sleeved with a minimum sleeve diameter of 4 inches. An additional penetration shall be provided for future use, sleeved, and capped and fire stopped as required.
- c. Coordinate size of wall penetration with conduit size, number of conductors. Comply with all NEC requirements.
- d. The fire rating of all penetrated walls, floors, and ceiling structures shall be strictly maintained. All penetrations shall be fire-stopped and sealed by the Contractor.
- e. Install fire-stopping in open penetrations and in the annular space of penetrations for fire rated barriers.
- f. Installation of fire-stops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
- g. Installation of all fire-stopping shall be in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and shall be installed in a manner acceptable to the authority having jurisdiction.

3.6 ELECTRICAL POWER DISTRIBUTION

- A. Refer to Division 26 specifications in addition to the following:
 - 1. Primary power for all system controls, sub-control panels, processors, and power supplies shall be configured to switch to emergency backup power sources automatically when primary power is interrupted without degradation of any critical system functions.
 - 2. All electrical power shall be hardwired to the panel. System components or panels employing the use of plug-in transformers, extension cords or cheater cords for the connection to electrical power shall not be acceptable.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade (except nonconductive fiber optic cables) which serve as communications, control, or signaling circuits shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection.
 - 1. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator.
 - 2. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be acceptable for surge protection applications. All inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference at the minimum surge suppression test shall meet the following criteria.
 - a. All system power supplies serving exterior system components or devices shall be provided with the appropriate transient surge suppression protection on both the line side as well as the load side.

- 1) A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes shall be the minimum performance requirements. Provide surge suppression in accordance with all manufacturers requirements.
- 2) An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes shall be the minimum performance requirements. Provide surge suppression in accordance with all manufacturers requirements.
- 3) Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equal.
- 4) Operating Temperature and Humidity: -40 to 85 degrees C (-40 to 185 degrees) shall be the minimum performance requirements. Provide surge suppression in accordance with all manufacturers requirements.

3.8 GROUNDING AND BONDING

- A. All electronic equipment, conduits, cable trays, racks/cabinets and cable shields shall be properly grounded and bonded in accordance with all requirements of ANSI/TIA 607-C, NEC 250 and IEEE 1100. Additionally, all communications space, IDF, and MDF room grounding and bonding shall be in accordance with all related specification sections and Motorola R56 Standards and Guidelines for Communications Sites (where Motorola radio equipment is installed).
- B. A Telecommunications Grounding System shall be installed in all communications equipment rooms. Grounding system shall provide equalization of the grounding potentials between the building power system and the telecommunications main grounding bus-bar (TMGB) as well as all telecommunications grounding bus-bars (TGB).
 1. Telecommunications Main Grounding Busbar
 - a. The TMGB shall serve as the dedicated extension of the building grounding electrode system for the telecommunications infrastructure as well as the central attachment point for all TGBs. The TMGB shall be located and provided in the Main Telecommunications Room (MDF) in each building. The TMGB shall be listed by a nationally recognized testing laboratory (NRTL).
 - b. The TMGB shall, at a minimum, meet the following requirements:
 - 1) Material: Copper or copper alloys having a minimum of 95% conductivity when annealed as specified by the International Annealed Copper Standard (IACS).
 - 2) Thickness: minimum 1/4" thick
 - 3) Width: No less than 4"

- 4) Length: The length of the TMGB shall vary based on the installation requirements. The Contractor shall ensure the length of the bar is sufficient to include enough pre-drilled holes for all necessary bonding conductors. The bar shall be no less than 14" long. The minimum number of pre-drilled holes required in the TMGB shall include, but not be limited to the following:
 - a) Two holes for the Telecommunications Bonding Conductor (TBC) termination.
 - b) Two holes for each Telecommunications Bonding Backbone (TBB) termination.
 - c) Two holes for the Alternating Current Equipment Ground (ACEG) termination.
 - d) Two holes for each Telecommunications Equipment Bonding Conductor (TEBC) in the room.
 - e) Two holes for each protector block in the room.
 - f) Two holes for each ladder tray, or independent section thereof in the room. Each independent section of ladder tray must be independently bonded to the TMGB in a manner consistent with referenced standards. Bonding one tray through another that is directly bonded to the TMGB (serial bonding) is prohibited.
 - g) Two holes for each set of conduit sleeves or metallic communications pathways entering the room.
 - h) Two holes for each bonding conductor to structural steel (as required).
 - i) 20% of spare capacity shall be available after all terminations are done and the project is complete.
 - j) If quantity of holes exceeds the maximum available by a manufacturer, multiple bars shall be provided as to match the criteria indicated above.
 - k) Pre-drilled holes: Shall be configured for use with correctly matched listed lugs and hardware. All pre-drilled holes shall have a minimum diameter of 5/16"
 - l) Hole spacing: All pre-drilled holes shall have a minimum spacing of 5/8"
- 5) The TMGB shall be installed on the wall with stand offs and isolators. Isolators shall be rated at 600V.
- 6) Only one lug shall be installed per hole mounting pair on a bonding surface. Lugs shall not overlap or use the same mounting holes on a bonding surface.
- 7) Basis of design: Harger GBI144xTMGB or approved equal.

2. Telecommunications Grounding Busbar

- a. The TGB shall serve as the bonding connection point for the Telecommunications systems and equipment in the area served by a Communications Room (IDF). The TGB shall be located and provided in each Telecommunications Room (except the main telecommunications room) in each building and any other locations indicated on the drawings. The TGB shall be listed by a nationally recognized testing laboratory (NRTL).
- b. The TMGB shall, at a minimum, meet the following requirements:
 - 1) Material: Copper or copper alloys having a minimum of 95% conductivity when annealed as specified by the International Annealed Copper Standard (IACS).
 - 2) Thickness: minimum ¼" thick
 - 3) Width: Minimum 2"
 - 4) Length: The length of the TGB shall vary based on the installation requirements. The Contractor shall ensure the length of the bar is sufficient to include enough pre-drilled holes for all necessary bonding conductors. The bar shall be no less than 12" long. The minimum number of pre-drilled holes required in the TGB shall include, but not be limited to the following:
 - a) Two holes for the Telecommunications Bonding Backbone (TBB) termination.
 - b) Two holes for the Alternating Current Equipment Ground (ACEG) termination.
 - c) Two holes for each Telecommunications Equipment Bonding Conductor (TEBC) in the room.
 - d) Two holes for each protector block in the room.
 - e) Two holes for each ladder tray, or independent section thereof in the room. Each independent section of ladder tray must be independently bonded to the TMGB in a manner consistent with referenced standards. Bonding one tray through another that is directly bonded to the TMGB (serial bonding) is prohibited.
 - f) Two holes for each set of conduit sleeves or metallic communications pathways entering the room.
 - g) Two holes for each bonding conductor to structural steel (as required).
 - h) 20% of spare capacity shall be available after all terminations are done and the project is complete.
 - i) If quantity of holes exceeds the maximum available by a manufacturer, multiple bars shall be provided as to match the criteria indicated above.
 - 5) Pre-drilled holes: Shall be configured for use with correctly matched listed lugs and hardware. All pre-drilled holes shall have a minimum diameter of 5/16"
 - 6) Hole spacing: All pre-drilled holes shall have a minimum spacing of 5/8"
- c. The TGB shall be installed on the wall with stand offs and isolators. Isolators shall be rated at 600V.

- d. Only one lug shall be installed per a two-hole mounting on a bonding surface. Lugs shall not overlap or use the same mounting holes on a bonding surface.
 - e. Basis of Design: Harger GBI142xxTGB or approved equal
3. Telecommunications Bonding Conductors
- a. Telecommunications Bonding Conductors referenced in this section are not intended to be comprehensive. Reference ANSI/TIA-607 for more information on all telecommunications bonding requirements.
 - b. Ferrous metallic conduits containing bonding conductors for telecommunications shall be bonded, at each end of the conduit, directly to the bonding conductor, using a listed exothermic weld, listed irreversible compression-type connectors, or approved equivalent, or to the TMGB/TGB, using a grounding bushing and a minimum 6 AWG bonding conductor. The bonding conductor contained within the ferrous metal conduit shall not be twisted around and passed through the grounding lug on the ground bushing to bond the conduit.
 - c. The minimum included bend angle for all bonding conductors shall be 90°.
 - d. Bends of bonding conductors terminating at the TMGB or TGBs shall have a minimum inside bend radius of 8 inches.
 - e. bends of bonding conductors at all other locations shall be made with the greatest practical inside bend radius. The minimum bend radius of all bonding conductors other than those at the TMGB and TGB shall be 10 times the bonding conductor diameter.
 - f. Telecommunications Bonding Backbone (TBB)
 - 1) The TBB is a conductor that interconnects all TGBs with the TMGB. The intended function of a TBB is to reduce or equalize potential differences. The TBB originates at the TMGB, extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in Telecommunications Rooms.
 - 2) The minimum TBB conductor size shall be a 6 AWG. The TBB shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 750 kcmil. Refer to ANSI/TIA-607 for more information.
 - 3) All TBBs shall:
 - a) Be protected from physical and mechanical damage
 - b) Originate from the TMGB
 - c) Follow the backbone pathways
 - d) Be continuous from the TMGB to the furthest TGB to which it is connected. Daisy-chaining from busbar to busbar is prohibited.
 - e) Minimize to the extent practical the length of the conductor
 - f) Be installed without splices
4. Telecommunications Equipment Bonding Conductor (TEBC)
- a. The TEBC connects the TMGB/TGB to equipment racks/cabinets.
 - b. More than one TEBC may be installed from the TMGB/TGB.

- c. The TEBC shall be a continuous copper conductor that is sized not less than a 6 AWG or as the largest size equipment grounding conductor in the ac branch power circuit(s) serving the racks/cabinet lineup.
 - d. Connections to the TEBC shall be made with listed irreversible compression connectors, suitable for multiple conductors, and with all bends from racks and cabinets routed toward the TMGB/TGB.
 - e. TEBCs shall not be routed within or on top of ladder trays or close to other cables
 - f. Maintain minimum required separation from other cable groups per NEC and referenced standards.
 - g. The TEBC shall be connected to the cabinets/equipment racks, to a Rack Bonding Conductor (RBC) or to a vertical/horizontal Rack Bonding Busbar (RBB). Each cabinet or equipment rack shall have a suitable connection point to which the bonding conductor can be terminated.
5. The TMGB and each TGB shall be provided where indicated on the drawings and shall provide an effective bonding connection to the nearest approved building grounding electrode (e.g., structural steel) as well as to the local power distribution panel grounding system (e.g., ac branch circuit panel board's equipment grounding busbar).
- a. Equipment Grounding: Metallic structures, equipment racks, cabinets and enclosures as well as all raceways, cable trays, junction boxes, outlet boxes, machine frames, and other conductive items shall be bonded and grounded.
 - b. Cabinets, racks, and other enclosures shall not be bonded serially; each shall have their own dedicated bonding conductor to the TMGB/TGB or TEBC.
 - c. Equipment containing metallic parts and patch panels for shielded cabling in cabinets and racks shall be bonded to the telecommunications bonding system in accordance with the manufacturer instructions.
 - 1) Where instructions are not given, all bonding conductors that connect these installed products shall be a minimum sized conductor of 12 AWG.
 - d. Cabinets and racks including an isolated RBB will require a separate minimum 6 AWG bonding conductor, from both the cabinet/rack and the RBB, back to the TMGB/TGB or TEBC.
 - e. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing any voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the grounding bus, to all manhole hardware and ground rods, to the cable shielding grounding provisions for all cable splices, terminations and equipment enclosures.
 - f. Metallic Fences equipped with communications equipment: Fences shall be grounded with a ground rod at each fixed gate post and at each corner post.

- 1) Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a No. 4 AWG copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence.
 - 2) Each gate section shall be bonded to its gatepost by a 3 by 25 mm (1/8 by one inch) flexible braided copper strap and ground post clamps. Clamps shall be of the anti- electrolysis type.
6. All connections of grounding conductors to ground rods, bus bars, rebar, structural members, pipes and fences, as well as splices of any ground conductors, shall be made by exothermic welds except where otherwise noted. All connections to bar lugs shall be exothermic weld or compression type connections. Bolted type connection of ground conductors may only be made where terminal lugs or blocks have been furnished and installed in equipment by the manufacturer.
- a. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per the NEC.
7. Refer to related specification sections for any additional grounding and bonding requirements.

3.9 EQUIPMENT IDENTIFICATION

- A. Identify all system control, component and equipment cabinets and racks using plastic laminate engraved ("lamicoid") labels, or approved equal. Firmly affix to the panel, device, and/or component. Refer to Specification Section 27 10 00, Attachments and all related specification sections for additional requirements.
- B. Permanently label all horizontal and backbone cabling, conduit, pathways, pullboxes, junction boxes and enclosures in accordance with Specification Section 27 10 00 and Attachments.
 1. Warning Tags: At each location where the fiber cable is exposed to human intrusion, it shall be marked with warning tags. These tags shall be yellow or orange in color, and shall contain the warning: "CAUTION FIBER OPTIC CABLE." The text shall be permanent, black, block characters, and at least 3/16" high.
 - a) A warning tag shall be permanently affixed to each exposed cable or bundle of cables, at intervals of not more than five (5) feet. Any section of exposed cable which is less than five (5) feet in length shall have at least one warning tag affixed to it.
 2. Provide typewritten circuit directories installed in 3-ring binders with transparent page protectors in each control and sub control cabinet and/or equipment rack.

3.10 MAINTENANCE & SERVICE

- A. General Requirements

1. The Contractor shall provide all services required and equipment necessary to maintain all contractor-furnished communications systems associated with this project during the Warranty period.
 - a. Provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. Refer to Division 01 specification section for additional requirements.
 - b. The adjustment and repair of the communications systems shall include all software and firmware updates on all computers, servers, CPUs, terminals, devices, communications and data transmission media (DTM), facility interface processors, signal transmission equipment and processors.
 - c. Test, inspect, and service each system on a quarterly basis (three month intervals) during the warranty period from the time of final acceptance. The contractor shall compare quarterly test results with the test results at the time of final acceptance.
 - 1) The contractor shall include as part of the quarterly test the calibration and/or adjustment of any device, component, and/or system that has deviated from the original test results at the time of final acceptance.
 - d. For each quarterly maintenance period, provide written notification to the Authority and OAR of the systems condition before and after service, the exact components that were tested and serviced, and overall status of the system.
- B. Personnel
 1. Service personnel shall be manufacturer certified in the maintenance, testing, and repair of the type of system and equipment provided for the project. Provide the Authority and OAR the name of the designated service representative, and of any change in personnel.
 - a. The Authority and OAR shall be provided copies of system manufacturer certifications for all designated service representatives.
 2. Schedule of all work to be performed during regular working hours, Monday through Friday, excluding federal holidays.
- C. Emergency Service
 1. The Authority shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Authority with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Authority shall have sole authority for determining catastrophic and non-catastrophic system failures.
 - a. For catastrophic system failures, the Contractor shall provide same day eight (8) hour service response with a defect correction time not to exceed sixteen (16) hours from arrival on site. Catastrophic system failures are defined as any system failure that the Authority determines will place the facility(s) at increased risk.
 - b. For non-catastrophic failures, the Contractor within 1 business day with a defect correction time not to exceed 48 hours from time of notification.

D. Records & Logs

1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

E. Work Request

1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion.
2. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

F. System Modifications

1. The Contractor shall make any recommendations for system modification in writing to the Authority and OAR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the Authority. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and all related documentation.

3.11 WARRANTY

- A. Warrant material and workmanship for a period of at least one (1) year. Warranty period shall be longer if specified in related specification sections, or if provided by the furnished product's manufacturer. The warranty period shall commence from the date the Contractor received written notification of final acceptance from the Authority and/or OAR. At the minimum the contractor shall provide warranty provisions:

1. Warrant the replacement of defective components/materials and/or correct defective work when given notice by the Authority and OAR during the warranty period.
 - a. At no time is the contractor to use the extra materials provided under the scope of this project to replace malfunctioning or damaged equipment and or components. The Contractor shall replace all malfunctioning or damaged equipment and or components with new. The repair and then reinstallation of malfunctioning or damaged equipment shall not be acceptable.

- b. During the Warranty period, replace failed equipment per the terms specified in this section. As such, the Authority and OAR shall not be bound to the terms and conditions of the manufacturer's warranty, pertaining to the replacement of failed equipment. In any situation, it is the Vendor's responsibility to keep the system operational during any hardware or software failures. Replacement equipment shall be provided to maintain operations while equipment manufacturer addresses warranty issues.
 - 1) Warranty replacements and repairs shall include any necessary shipping, handling and materials.
 - c. Establish a single point of contact for the Authority and OAR and provide any coordination responsibilities with manufacturers, suppliers, or contractors to resolve warranted issues and on all maintenance and service actions related to items included in the Warranty. Process and procedures for engaging technical support shall be developed and communicated to the Authority, OAR, Authority Vendor.
2. Warranty excludes liability for consequential incidental, or special damages due to vandalism, misuse, or acts of god.
 3. Onsite warranty response time by qualified technician shall be no more than 8 hours upon receipt of request from Authority, unless otherwise noted in related Division 27 and 28 specification sections.
 4. Warranty repairs shall be provided to the Authority at no cost. This shall include but not limited to replacement of all defective components/materials, all labor charges, all travel costs and all vehicle charges.
 5. Response time shall be 7 days a week / 24 hours a day / 365 days a Year.
 6. Provide test, inspection, and service of each system on a semi-annual basis at six month intervals.
 7. Contractor must provide verification that they maintain their principle base of operation along with the personnel that will be responsible for providing service within 3 hours driving time to the project site. This tenet of the warranty shall remain in effect for the life of the warranty.
 8. All TCP/IP-based communications systems cabling and related appurtenances shall be provided with the manufacturer's 25-year extended warranty in addition to all requirements above.
- B. The Contractor shall, as a condition of final payment, execute a written warranty certifying all contract requirements have been completed in accordance with all requirements of the Contract Documents.
1. All system testing, commissioning, demonstration and training shall be performed prior to final system acceptance. All defects or damages due to faulty materials or workmanship shall be replaced without delay, to the satisfaction of the Authority's Representative, at the Contractor's expense.
 - a. The contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty.

- b. The warranty period shall be extended until the last inspection and associated corrective actions are complete. Where any equipment and/or labor covered by Contractor's or manufacturer's warranty, has been replaced, due to failure, the warranty period for any replaced equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work.
 2. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.
- C. The Technical Project Manager, GOAA OAR and GOAA Information Technology Department retain the right to use additional repair personnel as necessary to correct any warranty trouble calls and back charge the Contractor if the Contractor has been considered non-responsive to repair requests by the Owner.

3.12 SERVICES

- A. In addition to all testing requirements as specified by Division 01 specification section and all related Division 27 and 28 Specification Section, testing of all systems, sub-systems and cabling infrastructures shall be provided in accordance with all requirements of this section.
- B. Notify the Authority and OAR in writing, prior to the closing of any ceilings and ten (10) days advance of testing all system cabling to prevent delays in construction schedules.
- C. Test all cabling to confirm that no grounds, shorts, sneak currents, RFI and EMI conditions exist prior to start-up and commissioning of all, components, devices, equipment and/or systems.
- D. Before requesting a final inspection, the contractor shall perform a series of end to end installation performance tests. The contractor shall submit for approval by the Authority and OAR all test procedures to be employed, test result forms, and timetable for testing all fiber optic and UTP structured copper wiring.
- E. Acceptance of the simple test procedures discussed below is predicated on the contractor's use of the specified products including but not limited to, all Division 27 and 28 systems, sub-systems, system components, fiber optic cable, category structured cable, cross-connect blocks, patch panels, and outlet devices as specified by all related specification sections and installed in accordance the Contract documents, manufacturer's recommended practices and all applicable codes, standards and industry practices. Acceptance of the completed installation for each system will be evaluated in the context of each of these factors.
- F. Testing Requirements
 1. Phases of Testing:
 - a. Factory Acceptance Test (FAT) / Manufacturer's Proof of Concept Test (as applicable)
 - b. On-Site Performance Verification Testing
 - c. On-Site Endurance Testing

2. Test Plan/Procedure: The Contractor shall provide six (6) hardcopies and an electronic copy of the test plan/procedures for each testing phase for the review and approval of the Authority and OAR. The test plan for each phase shall detail the objectives of all tests. The tests shall clearly demonstrate that the system and its components fully comply with the requirements specified herein. The test plan shall be provided at least forty-five (45) days prior to the scheduled start of each test. Test plans shall contain at a minimum:
 - a. Functional procedures including use of any test equipment
 - b. Test equipment is to be identified by manufacturer and model
 - c. Interconnection of test equipment and steps of operation shall be defined
 - d. Test records shall include test equipment serial number, calibration date and calibration certification of test equipment
 - e. Expected results required to comply with specifications
 - f. Traceability matrix referencing specification requirements with specific test procedures
 - g. Record of test results with witness initials or signature and date performed
 - h. Pass or fail evaluation with comments.
 - i. The test procedures shall provide conformity to all specification requirements. Satisfactory completion of the test procedure is necessary as a condition of system acceptance.
 - j. The Contractor's Quality Assurance organization shall review all formal test procedures prepared by the Contractor and deliverable under the contract to assure the tests cover all requirements and that there is a conformity between the conducted test, the test results and specification requirements.
 - k. Documentation verification, both interconnects and functionality shall be part of the test. Where documentation is not in accordance with the installed system interconnect and operating procedures, the system shall not be considered accepted until the system and documentation correlate.
 - l. All testing must be witnessed by the Authority and OAR. The Contractor shall cooperate fully in this regard.
3. Test Reports: The Contractor shall prepare, for each test, a test report document that shall certify successful completion of that test. Six (6) hardcopies and one electronic version of the test report shall be submitted to the Authority and OAR for review and acceptance within seven (7) days following each test. The test report shall contain, at a minimum:
 - 1) Commentary on test results.
 - 2) A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution.
 - 3) Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other annotations entered during execution of the test.
 - 4) Signatures of persons who performed and witnessed the test.

4. Test Resolution: Any discrepancies or problems discovered during these tests shall be corrected by the Contractor at no cost to the Authority and OAR. The problems identified in each phase shall be corrected and the percentage of the entire system re-tested determined by the Authority and OAR, before any subsequent testing phase is performed.
- G. Factory Acceptance Testing
1. Test Setup Equipment: Equipment shall be actual products or identical models of products to those designated to be delivered and installed at the site. The following equipment shall be setup and used for conducting pre-delivery test:
 - a. Operator equipment associated with system.
 - b. End devices and displays associated with system.
 - c. Software associated with system.
 - d. Administrative console equipment.
 - e. Sufficient signal transmission media (STM) and associated equipment and accessories to provide a fully integrated system model. Include at least one of each type STM circuit.
 - f. Number of field processors required for system to be installed at site.
 - g. Enough load and data simulators to provide simulation of full load operational conditions as required by design. Loads shall be manually or software generated.
 2. Preparation: Ensure that development of system is complete, required approvals of submittals have been obtained, and sufficient equipment procured to completely demonstrate and test system. Schedule pre-delivery test with Technical Project Manager at least 45 days prior to test:
 3. Time: any equipment to site. Conduct on weekdays during standard business working hours.
 4. Location: Manufacturer's plant or other location approved by the Authority and OAR.
 5. Items to be tested shall be set up and performance verified prior to arrival of the Authority and OAR at test site.
 6. Test: The purpose is to test the complete computer software package and equipment of the system and demonstrate that all specified features and performance criteria are met. All requirements of the specification shall be tested including, but not limited to:
 - a. Functionality including reporting and response.
 - b. System capacity.
 - c. Hardware interaction.
 - d. Hardware and software interaction.
 - e. Demonstrate report generation.
 7. Acceptance: Acceptance of system to perform sufficiently and provide specified functions shall be determined by the Authority and OAR witnessing the factory acceptance test. In addition to the Authority, testing shall be witnessed by up to two (2) additional Owners Authorized Representatives (OAR).
 - a. Acceptance Criteria: Performance of system shall equal or exceed criteria stated in individual specification sections.

- b. If system does not perform satisfactorily, the Contractor shall make corrections and modifications and schedule new test with the Authority and OAR. Compliance is at the sole discretion of the Authority and OAR. If compliance cannot be met, or is insufficient, the Authority and OAR shall have the right to terminate the contract.
 - 8. Completion:
 - a. At successful completion of test, dismantle equipment so as to prevent damage. Replace all defective or worn items.
 - b. Re-pack in original containers all equipment to be delivered to site for installation. Mark on containers that items were used in factory test.
 - 9. Reporting:
 - a. Record all test procedures and results.
 - b. Submit report in accordance with reporting requirements in General Testing Requirements Section.
- H. Performance Verification Testing
 - 1. Complete operational testing of all components and systems shall be witnessed by the Authority and/or OAR.
 - 2. Schedule test with the Authority and OAR. Do not begin testing until:
 - a. All systems have been installed and individually and jointly tested to ensure they are operating properly.
 - b. Written permission from the Authority and OAR has been received.
 - 3. Testing: As part of performance verification, test all components of system. The tests shall demonstrate system features.
 - 4. Verification: Verify correct operation of the required system functionality as defined in these specifications.
 - 5. Adjustment, Correction, and Completion:
 - a. Correct deficiencies and retest affected components.
 - b. Make necessary adjustments and modification to system after obtaining approval of the Authority or authorized representative.
 - c. Completion: Performance verification test shall be complete when testing or retesting of each component has produced a positive result and has been approved in writing by the Authority or authorized representative.
 - 6. Recording:
 - a. Describe actual operational tests performed and equipment used and list personnel performing tests.
 - b. Record in tabular form all test results, deficiencies, and corrective measures.
 - 7. Termination
 - a. Performance verification test shall be terminated by the Authority and OAR when:
 - 1) Individual systems, system components, subsystems, or cabling infrastructure fail to perform as specified.
 - 2) It is determined that a system or sub-system is missing any components or installation is not complete.
 - b. Upon termination, corrective work shall be performed and performance verification test rescheduled with the Authority and OAR.
 - c. Retesting shall be performed by Contractor at no additional expense.

- d. Contractor shall continue to perform corrective actions and retest until system passes all tests to satisfaction of the Authority and OAR.
- I. Endurance Testing
 1. Endurance testing shall verify that all technology hardware can withstand the typical processing load it is expected to endure for a given period. The test shall measure the response of the overall system under conditions that simulate typical-to-heavy daily use for the specific (14) fourteen-day window with all observations recorded during the full period of the test.
 2. The contractor shall develop, document, and submit specific testing procedures for approval prior to initiating the test. The test procedure documentation shall clearly indicate how typical usage load will be simulated and applied to the system, and define the performance metrics to be measured and recorded.
 3. For each device, perform the following steps:
 - a. Access the device's administrative command line, if available, via terminal connection or SSH using the device's management IP address.
 - b. Configure the device to store syslog messages of severity level 0 ("emergency") through 4 ("warning") to a text file on a designated network location. Due to internal buffer storage constraints, syslog files shall not be saved locally on the device itself.
 - c. Once 14 days has elapsed, obtain syslog text files for all connected network devices, compile, and submit for review.
 - d. Obtain, from the device's administrative command line, the current system uptime and output to a text file to verify that the device has been operating continuously for 30 days. Submit text files for review.
 4. Provide personnel to monitor the system operation 24 hours per day, including weekends and holidays during endurance testing.
 5. Start test after:
 - a. Successful completion of performance verification testing.
 - b. Training as specified has been completed.
 - c. Correction of deficiencies has been completed.
 - d. Receipt of written start notification from the Authority and OAR.
 6. Monitor all systems during endurance testing. Coordinate monitoring with the Authority and OAR.
 7. Recording: Record data on approved forms so as to provide a continuous log of systems performance. Include:
 - a. Date and time for all entries.
 - b. Name of individual making entry.
 - c. Environmental conditions.
 - d. Authority activities in process.
 - e. Description of all alarm annunciations, responses, corrective actions, and causes of alarms. Classify as to type of alarm.
 - f. Description of all equipment failures, including software errors.
 - g. Description of all maintenance and adjustment operations performed on system.
 - h. Daily and weekly tabulations.

- i. Daily entries of performance data shall be reviewed by the Authority's representative designated to observe monitoring of system.
 8. The Authority and OAR may terminate testing at any time when any system, sub-system, system component or cabling infrastructure fails to perform as specified. Upon termination of testing, the Contractor shall commence an assessment period.
- J. Adjustment, Correction, and Maintenance
 1. During endurance testing make adjustments and corrections to system only after obtaining written approval of the Authority or authorized representative.
 2. During endurance testing, perform required maintenance on systems including provision of replacement parts.
- K. Final Inspection and Acceptance
 1. After endurance testing is complete, review tabulated records with the Authority and OAR.
 2. The Contractor will not be responsible for failures caused by:
 - a. Outage of main power in excess of backup power capability provided that automatic initiation of all backup sources was accomplished and automatic shutdowns and restarts of systems performed as specified.
 - b. Failure of any Authority furnished power, communications, and control circuits provided failure was not due to Contractor furnished equipment, installation, or software.
 - c. Failure of existing Authority equipment provided failure was not due to Contractor furnished equipment, installation, or software.
 3. When performance of integrated system does not fall within the above rates, determine cause of deficiencies, correct, and retest.
 - a. When requested by the Authority and OAR, extend monitoring period for a time as designated by the Authority or authorized representative.
 - b. Submit final report of endurance testing containing all recorded data.
 4. The Contractor shall submit written certification that:
 - a. The Contract Documents have been reviewed.
 - b. All required as-built documentation has been submitted and approved by the Authority and OAR.
 - c. The Project had been inspected for compliance with the Contract Documents.
 - d. The Work has been completed in accordance with the Contract Documents.
 - e. The equipment and systems have been tested and are shown operational in the presence of the Authority and OAR.
 - f. The Project is completed, and is ready for final inspection.

3.13 TRAINING

A. General

1. By means of training classes augmented by individual instruction as necessary, the Contractor shall fully instruct the Authority's designated staff in the operation, adjustment and maintenance of all products, equipment and systems. The Contractor shall be required to provide all training aids, e.g., notebooks, manuals. The Contractor shall provide an appropriate training area equipped with all required equipment. The location of the training area shall be coordinated with the Authority.
 2. All training shall be completed a minimum of two weeks prior to system cut over. Training schedule shall support the various work shifts of airport and tenant personnel and shall be subject to the Authority and OAR approval.
 3. Training shall be conducted by experienced and factory authorized personnel and supported by training aids. An adequate number and amount of training material shall be provided by the Contractor. The following is considered a minimum.
 - a. Functional flow-charts, overall block diagrams, and descriptive material for all software;
 - b. Schematic drawings for each of the hardware components;
 - c. All procedure manuals, specification manuals, and operating manuals;
 - d. Detailed as-built drawings.
 4. Participants shall receive individual copies of technical manuals and pertinent documentation at the time the course is conducted. The courses shall be scheduled such that Authority personnel can participate in all courses (no overlap).
 5. A final course schedule and syllabus shall be prepared by the Contractor for each course to be conducted for Authority personnel, and submitted for review at least four (4) weeks prior to the scheduled date of the course commencement.
 6. Each course outline shall include, in addition to the subject matter, a short review of the prerequisite subjects (where appropriate); how this course fits into the overall training program; the objective; the standards of evaluation; and any other topics that will enhance the training environment.
 7. Provide detailed video recordings in high quality digitally formatted media of all demonstration and training of all systems and system operations.
 - a. Utilize remote microphones as may be required to ensure high quality audio of the recorded demonstrations.
 - b. Permanently and professionally label all recorded materials and provide self-sealing plastic cases for each training session.
 8. All training requirements identified are minimum requirements.
- B. Types of Training
1. User Training: System users shall be instructed in all aspects of operations of the system, including the business intelligence tool and all reporting functions and shall conform to the following minimum requirements:
 - a. Training classes shall be scheduled not less than 48 hours apart to allow The Authority's User/Operators to familiarize themselves with all system operations.
 - 1) Basic Training: Provide twelve (12) hours of basic user training shall be provided. User training shall be conducted at a location that is coordinated with the Authority.

- 2) Advanced Training: Provide twelve (12) hours of advanced user training shall be provided. User training shall be conducted at a location that is coordinated with the Authority.
 - 3) System Administrator Training: System Administrator Training shall be provided. System Administrator Training shall include both classroom work and field training.
 - 4) Software/Operational Training: Provide twenty-Four (24) hours of software training.
2. The Contractor shall structure each training course to describe all systems, software and applications as well as support programs. This course shall include a functional overview of the complete software and operations of each system. The course material must be presented in depth by a factory authorized instructor and shall covering in detail at the minimum all system functions, features rebooting and maintenance criteria.
 3. Provide operation, parts, and maintenance manuals defining operation and troubleshooting methods of all systems and review with The Authority's User/Operators as part of training demonstrations.
 4. Provide detailed video recordings in high quality digitally formatted media of all demonstration and training of all systems and system operations.
 - a. Utilize remote microphones as may be required to ensure high quality audio of the recorded demonstrations.
 - b. Permanently and professionally label all recorded materials and provide self-sealing plastic cases.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. In addition to all final close requirements as specified by Division 01, Specification Section 270500 Specification Section, the Contractor shall comply with all requirements of this Section.
- B. Final System Acceptance
 1. In addition to the requirements set forth in Division 01, the Contractor shall prepare and issue a Certificate of Project Completion, containing:
 - a. The date of project completion.
 - b. A list of items that have been corrected by the Contractor.
 - c. The time and date the Authority will assume possession of the system (transfer of ownership).
 - d. The date that warranty begins.
 2. The Authority and OAR will perform an inspection after receipt of written certification. The project completion inspection shall include, but not be limited to:
 - a. The project's contracted work and any additional change orders.
 - b. All equipment and systems tested and shown operational in the presence of the Authority and OAR.
 3. After the inspection the Authority and OAR will prepare and submit to the Contractor, a list of items to be completed or corrected, as determined by the inspection, along with the designated timeframe for completion.

4. Should the Authority or OAR consider the work to be incomplete, the Authority or OAR will immediately notify the Contractor, in writing, stating the reasons. Upon receipt of such written notice from the Authority or OAR, the Contractor shall take all steps necessary to complete the work in a timely manner to minimize any impact to operations. Once the incomplete work has been completed, the Contractor shall prepare and issue a Certificate of Project Completion per the requirements set forth in this specification. The Authority and OAR shall then re-inspect the work upon Contractor's request at a scheduled re-inspection time.
 - a. The written notice issued by the Authority and/or OAR will include a maximum compliance period, not to exceed 30 calendar days. The Authority or OAR, at its discretion, may define a compliance period which is shorter based on project needs, project schedule constraints or other extenuating circumstances. If the nature or complexity of the work required to comply with the written notice is such that it cannot be completed within the required compliance period, the Contractor shall immediately notify the Owner and OAR in writing. The notification from the Contractor shall include a detailed, resource-loaded schedule indicating when and how the work will be completed, subject to approval by the Authority or OAR. Until such a schedule is approved by the Authority or OAR, the original compliance period specified will stand.
 - b. If, at any time during the compliance period, the Authority or OAR determines that the Contractor is not progressing satisfactorily with the steps necessary to complete the work in a timely fashion, or if the Contractor fails to complete the work within the compliance period or by the completion date approved by the Authority or OAR, the Authority shall have the right to pursue liquidated damages and/or Contract with a third party in order to complete and/or inspect any work of which Contractor failed to conform with the Contract requirements. All costs associated with the Authority's actions to complete and/or inspect any work not conforming with contract documents shall be borne by the original Contractor responsible for delivering the project.

C. Inspections

1. At the completion of the project and prior to final acceptance of the Work, provide evidence of final inspections and approvals to The Authority, in accordance with all requirements of the Contract Documents as well as required by the authorities having jurisdiction.
2. Authority approval is required prior to final system acceptance and payment.

END OF SECTION 27 05 00

SECTION 27 10 00 – PREMISE DISTRIBUTION SYSTEMS

PART 1 – GENERAL

1.1 STIPULATIONS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Drawings and general provisions of the Contract, including Division 00 and Division 01 Specification sections apply to this Section.
- C. Related Specification Sections:
 - 1. Refer to Specification Section 27 05 00 for a complete list of related specification sections.
- D. The GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document in its entirety. This document is included as an attachment in this section, and it applies for all cables and pathways installed, including but not limited to used conduits, spare conduits, inner-ducts, manholes, and underground duct-bank. Any references made to cable and pathway labeling directives for inside Premise Distribution Systems or Outside Plant installations include all components of this document.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This section includes the requirements for provision and installation of Premise Distribution Systems (PDS) including Outside Plant (OSP) backbone cabling and pathways.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing sheet T0.00.03 for the work responsibility matrix for the scope of work required for the Premise Distribution System.
- C. Where listed on the Premise Distribution System portion of the drawing responsibility matrix, the following components shall be defined as follows:
 - 1. Headend and Software: Contractor shall be responsible for providing information in the GOAA PDS Administration Database Refer to related specification sections for additional information.
 - 2. Integration to Existing System: All wiring, cabling, interface devices and appurtenances as required to extend the physical or logical scope of an existing system, or to incorporate a new or disparate system into an existing system. This shall include fiber channeling – refer to Backbone Cable below for additional information. Refer to related specification sections for additional information.
 - 3. Interfaces: All hardware, software, wiring, cabling, programming, interface devices and appurtenances as required for communication between systems, or between a given system and an operator, to provide the specified functionality. Refer to related specification sections for additional information.
 - 4. Network Switch: Refer to specification section 27 05 00 for additional information. Contractor shall coordinate patching into the network with GOAA

- and GOAA Vendor.
5. **Backbone Cable:** The segment of the premises distribution system that provides inter-building and intra-building connectivity between entrance facilities, equipment rooms and other telecommunications spaces including telecommunications rooms and telecommunications enclosures. Contractor shall furnish and install all backbone cabling, pathways, conduit, termination equipment, communication room fittings, grounding, testing, labeling, and all other work included in this specification section. Contractor shall provide fiber channeling in order to achieve required connectivity to the NTC and all other portions of Airport in support of all telecommunications systems. Fiber Channeling is defined as the required cross connections of fiber circuits through multiple communications spaces, enclosures, IDF and MDF rooms across the campus in order to establish a communications link over fiber between two end points. Channeling also includes additional testing, per Division 27 and related specifications, of the length of fiber channels across all cross connects from end to end, and the documentation of said channel testing per GOAA IT standards. Contractor shall provide fiber channeling by hiring the services of a GOAA Continuing Contractor.
 6. **Horizontal Cable:** The segment of the premises distribution system that provides connectivity from communications spaces to field devices. Contractor shall furnish and install all horizontal cabling, pathways, conduit, termination equipment, communication room fittings, grounding, testing, labeling, and all other work included in this specification section. Furnish all patch cables required for all network-connected systems and to support all spare patch panel connections within communications spaces (IDFs/MDF). Refer to related specifications for information regarding responsibility for installation of patch cables.
 7. **Field Devices:** Components of a system which are served by the system headend and are the network endpoint or “edge” device. Contractor shall furnish and install data outlets, premise distribution system testing, labeling, and all other work included in this specification section.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 for requirements.

1.5 SYSTEM DESCRIPTION

- A. Furnish and install a complete Premise Distribution System (PDS) including Outside Plant (OSP) backbone cabling system, including all necessary tools, materials, equipment, labor, and testing, to create a dynamic multi-product, vendor-agnostic environment including all cable, equipment, materials, and labor as required to provide, install and test a complete system. This system shall enable all GOAA low voltage systems to be fully operational according to design specifications at project completion, complying with these specifications and all regulatory requirements. The system shall include but not be limited to:
 1. **Backbone Cabling:** Fiber and copper cabling including inside and outside plant installations as required. All fiber and copper voice/data/systems cabling necessary for a complete and fully operational Premise Distribution System.
 2. **Backbone Pathway:** Conform to ANSI/TIA-569D – 2015 using conduit, cable tray, backboards, etc. as indicated.

3. Outside Plant backbone cabling. To include buried conduit/duct bank cable and pathways as specified in project. The GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document applies for all cables and pathways installed, including but not limited to used conduits, spare conduits, inner-ducts, manholes, and underground duct-bank.
4. Intra-building pathways shall be installed so Main Communication Rooms are fed to Intermediate Distribution Frame (IDF) Rooms in combination star and ring configuration or dual star configuration connecting IDF Rooms to two Main Communications Rooms to provide redundancy.
5. Horizontal Pathway: Conform to ANSI/TIA-569D – 2015 using conduit, cable tray, backboards, cabinets, etc. as indicated. All cable is to be installed in conduit unless approved otherwise by GOAA in writing as a response to a written request by a member of the Design/Project Team.
6. All references to cable installations within this document include complete installation specifications, including but not limited to: "installed, terminated, tested and administered".
7. All references to testing include complete testing procedures, including but not limited to: "results are to be recorded in the test device, printed and submitted in hardcopy and in electronic format". See details on testing.
8. Horizontal Cabling: Complete from Premise Distribution System Equipment to each outlet using cable (copper or fiber optics) as specified.
9. Outlets: Provide outlets as required. All cabling whether fiber optic or copper installed terminated and tested.
10. Raceways, outlet boxes, cabinets, identification, etc.: Conform to applicable sections in Division 26 and 27 specifications.
11. Cabinets and racks: Conform to applicable sections in these specifications.
 - a. All cabinets shall have internal vertical and horizontal cable management panels.
 - b. All racks shall have cable management components.
 - c. Cabinet and rack installations shall have overhead cable tray installed.
 - d. All cabinets shall have vented front doors, split vented rear doors, and vented side panels for adequate airflow for proposed equipment to be installed.
 - e. All cabinets shall have locking front and rear doors. Locks shall be independently keyed to GOAA PDS cabinet key.
 - f. All cabinets and racks shall be furnished with a vertical rack bonding busbar.
12. Patch panels - Provide and install the required patch panels for fiber optic cables and copper cables. All LIUs (FO) panels to have locking metal framed or metal covers with hasps (front and rear) for a padlock.
13. Surge suppression shall be provided on all cables entering or leaving the footprint of the building or exterior device subject to surge. See below section for additional surge suppression requirements.
14. Fireproofing equivalent to a one-hour rating shall be provided on all communications room penetrations.
15. Systems rooms overhead cable trays: all cable trays shall be mounted per manufacturers specifications complete with all hardware and rubber boots on ends. Corner or T-sections shall be provided with corner bracket sweep or a bend section.

16. All cable trays shall be a minimum of 12 inches from any source of EMI or other sources of electrical interference. The Contractor shall follow industry standards and best practices in maintaining proper separation from EMI and other sources of electrical interference.
 17. All racks or cabinets shall be installed with overhead fiber optic trough system with an open channel design to protect and route fiber optic patch cords. Trough shall have downspouts and drop-outs over each rack side. Refer to drawings for side of ladder rack that fiber optic trough system shall be installed on.
 18. All locations that have Fiber Optic (FO) or copper cabling mounted on Communication Room walls shall have overhead cable ladder rack and overhead fiber optic trough system with an open channel design to protect and route fiber optic patch cords installed from any new racks or cabinets to wall or other existing rack(s) to create cable pathways. In addition, Communications Room walls shall have D-rings and/or other vertical and horizontal cable management to support cabling. Zip ties shall not be used as cable management.
 19. All under floor cable pathways shall be completed as described above providing cable pathways between components, using under-floor system.
 20. Transition pans with dividing fingers shall be furnished and installed on ladder rack above racks and equipment cabinets in quantities and locations as necessary to properly support and route copper cables and patch cords, including patch cords installed by GOAA or GOAA Vendor(s). Transition pans shall match racks (black) in color and be provided by the same manufacturer as the rack.
 21. Backbone cable shall be secured by hook-and-loop (Velcro) cable ties on overhead rack and into LIUs (fiber).
 22. Backbone cables shall not be broken out of the cable jacket except within enclosures designed to protect and support cable breakouts.
 23. All horizontal fiber and copper, and patch cords cable shall be secured by black Velcro wrap as necessary.
 - a. Velcro wrap shall be cut from 1 inch by 10 yard roll (industry standard supply) for cable bundles.
 - b. Individual black Velcro cable ties may be used where appropriate.
 - c. Velcro cable ties shall be solid black without any manufacturers name, logo, or other imprinted on wrap.
- B. Coordinate all work related to equipment provided by the Owner and/or Owner's vendor(s).
1. Where new telephone, network, and other systems equipment provided by Owner (GOAA) is to be installed as a requirement in project, a systems meeting is required with GOAA Information Technology Department no longer than three (3) weeks after Notice To Proceed is issued and thereafter on a monthly basis.
 2. Monthly Systems meetings are required as necessary for successful coordination and completion of Owner provided equipment.
- C. Provide all power, grounding, plywood backboards and complete raceway system. Refer to Division 26 for power and grounding requirements.

- D. Complete Telecommunication Infrastructure element labeling according to ANSI/TIA 606 and GOAA requirements as specified in this document.
 - 1. Labeling format samples and required Telecommunication Infrastructure Record Administration forms are included in this specification document.
 - 2. All Infrastructure Element labeling shall be complete and Telecommunications Infrastructure Administration Records shall be submitted prior to the infrastructure being put into use, at the same time all cable test records are submitted.
- E. Completion of the PDS and OSP cabling system in its entirety is required by Substantial Completion inspection, including submission of system test report documents.
 - 1. If Owner provided or Contractor provided equipment requires the use of systems cabling infrastructure to have any Electronic Systems operational for the project to meet Substantial Completion inspection requirements the cabling infrastructure shall be complete and tested in its entirety according to a previously coordinated schedule providing reasonable and adequate time for Electronic Systems to be installed, tested and made operational.
 - 2. No cabling infrastructure is to be put into use without being complete and fully tested according to these and Project Engineering specifications.
- F. Where any active Electronic Systems are installed by any party requiring installation of fiber or copper patch cords, all patch cords shall be permanently and properly routed in the pathway created for same, and the patch cords shall be labeled on each end with source/destination according to GOAA Labeling Specification. All patch panel or LIU User Identification tables shall be filled out as to use/user.

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Product data shall be submitted on all products used to complete the scope of work of this project, including but not limited to:
 - 1. Catalog cut sheets.
 - 2. Roughing-in diagrams
 - 3. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of cable to be used in installation of the Premise Distribution System. Provide a complete copy of the UL Test report substantiating that the cable meets ANSI/TIA requirements.
 - 4. UL Verification of Category 6 and 6A equipment and material.
 - 5. Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation.
 - 6. Manufacturers Certificate: Certify that products meet or exceed specified requirements.
 - 7. Test results from manufacturer showing product has passed quality control tests at factory (specifically fiber optic cabling, as well as other applicable products.
 - 8. Submit test reports from manufacturers', specifications and any other information necessary to determine compliance with material and equipment specified.

9. Operation and maintenance manuals.
- C. Shop Drawings: Submit plan of building(s) and site showing pathways with all installed cables and pathways noted.
1. Shop Drawings for enclosures shall include plans, elevations, sections, and attachment details indicating sizes of equipment, their relationship, and clear space within the enclosure. The Contractor shall submit cabinet and rack elevation drawings that are coordinated between all Contractors and GOAA Vendors and show all equipment that will be installed by all Contractors and GOAA Vendors.
 2. Detailed floor plan layouts and riser diagrams showing system components and their location, interconnections, wiring/cablings, and interface and connection with other disciplines.
 3. Coordination Drawings in accordance with the requirements of Division 01.
 4. Detailed data as requested by designer/OAR.
 5. Point to point wiring diagrams and block diagrams of system to be installed.
 6. Submit a detailed step by step testing procedure for any active components, component/ system functional checkout and test.
 7. Coordination: Shop drawing plans shall include pathway routing, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - a. Structural members in paths of pathway groups with common supports.
 - b. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- D. Detail drawings of each of the facilities terminal boards/cabinets, and equipment rack elevations for all MDF and IDF locations.
- E. Qualifications: Submit qualifications of system installer including but not limited to:
1. Contractor's license.
 2. A list of a minimum of three (3) recently completed PDS projects of similar type and size with contact names and telephone numbers for each that the Contractor has performed within the last two (2) years.
 3. Documentation of the Contractor's staff member(s) who are BICSI Certified Installation Technicians. The documentation shall be current copies of the certificate issued by BICSI.
 4. A letter certifying the Contractor maintains an office within fifty (50) miles of the project location.
 5. Proof of certification by the manufacturer(s): Documentation that the Contractor is an authorized and designated installer for the equipment manufacturers whose products he intends to install.
 6. Technical resume of the Contractor's Project Manager and Field Supervisor documenting a minimum of five (5) years' experience installing Premise Distribution Systems.
 7. Technical resume for any sub-contractor who will assist the PDS Contractor in performance of this work.
 8. A list of test equipment proposed for use.
 - a. For testing copper or metallic cabling components.
 - b. For testing fiber optic cabling components.

- c. Include test certificate verifying that all test instruments have been calibrated by a factory authorized service agent within 12 calendar months immediately preceding the date of submittal.
- d. All testing equipment/instruments shall be manufactured by a company engaged in the manufacturing of test equipment specifically designed for the purposes specified herein. Test equipment required to satisfy the testing requirements of this project shall have been available for purchase from the submitted manufacturer for at least five consecutive years immediately preceding the submittal date.
- e. All test equipment/instruments submitted and used to satisfy the testing requirements of this project shall be current models manufactured by the submitted manufacturer. The equipment/instruments shall be currently in production at the time of submittal and fully supported by the manufacturer.

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 for requirements..

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. As-Built documents shall include updating and revising contract documents to record actual locations (as-installed) of all equipment, pull boxes, devices, IDF's, raceways, cabling, Telecommunication Outlets, and all Premise Distribution and all Outside Plant cable infrastructure components.
- C. As-Built PDS and OSP riser diagrams shall be submitted.
- D. All drawings required herein shall be in AutoCAD Latest Release or format required by Division 01 specifications.
- E. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA."
- F. Telecommunication Outlet label information sheet: An E size sheet(s) copy of the Electrical, Power or Systems project plan sheet that shows all Telecommunication outlets in office/building spaces with all TO final label information typed in by each TO symbol in each room shall be submitted to GOAA OAR and GOAA Information Technology department. This document shall be submitted by Substantial Completion Inspection or earlier. This sheet is required a minimum of three weeks prior to any need to have any voice/data jacks to be made active for any purpose.

1.10 OPERATION AND MAINTENANCE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. O & M Manuals shall include:
 - 1. A complete as-installed equipment list of active (powered) components, including Owner Furnished Equipment. Equipment shall be listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of

- each item.
2. A complete and correct system schematic, showing detailed connections for all parts of the system, including cable numbers, terminal block numbers and layouts, and other designations and coding's (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.
 3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
 4. Repair parts list for each major equipment item furnished.
 5. A list of spare repair parts provided by the Project with a copy of the Transmittal Sheet showing who took receipt of and where the spare parts are stored.
 6. Service manuals for each major equipment item furnished.
 - a. Manual(s) shall be bound separately and labeled appropriately.
 - b. Include instructions for adjusting, operating, and extending the system
 - c. Manufacturer's warranties and operating instructions for each active equipment item furnished.
 - d. Recommended preventive maintenance procedures.
 7. Test Data: record of results for all copper, metallic, and fiber optic cables installed and tested, or tested.
 - a. Test data shall be formatted according to GOAA Standard and ANSI/TIA 606 Administration Standards.
 - b. Test results shall be submitted in hard copy in three (3) ring binder and in electronic form (CD).
 - c. Include all fiber tests with performance graph from OTDR. Single Mode and Multi-Mode shall be OTDR tested. All fiber utilized for the installation of Project Systems required by the project scope shall be tested whether or not the cable was installed by the Contractor.
 8. Data sheets showing all field labeling used for termination blocks, and cable (outside plant, backbone, riser and horizontal) runs.
 9. Cable Data for all backbone (riser) and horizontal fiber and copper indicating type and use of cable installed by Contractor and to include:
 - a. Manufacturer's specification sheet.
 - b. Manufacturers performance and warranty sheet.
 - c. Date manufactured.
 - d. Part number.
 - e. Serial number.
 - f. Reel number.
 - g. Description.
 - h. Attenuation specifications.
 - i. Bandwidth specifications.
 10. Complete equipment rack/cabinet layouts showing locations of all rack mounted patch panels, and equipment items.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. Refer to Specification Section 27 05 00 for requirements in addition to the following.
- B. Patch Cables – Category 6 Copper: Furnish spare CAT6 patch cables in a quantity equal to the number of terminated CAT6 patch panel ports in communications spaces (MDF/IDFs). Furnish an equal number of each of the following lengths (in meters): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Refer to HORIZONTAL CABLING AND TERMINATION for additional patch cable specifications.
- C. Patch Cables – Singlemode Fiber: Furnish spare fiber patch cables in a quantity equal to the number of terminated fiber patch panel ports in communications spaces (MDF/IDFs). Furnish an equal number of each of the following lengths (in meters): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. Refer to BACKBONE CABLING AND TERMINATION – FIBER OPTIC CABLE for additional patch cable specifications.

1.13 ENVIRONMENTAL CONDITIONS

- A. Refer to Specification Section 27 05 00 for requirements.

1.14 SUBSTANTIAL COMPLETION INSPECTION REQUIREMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. These Substantial Completion requirements are additional to Drawings and general provisions of the Contract, including Division 00 and Division 01 Specification sections apply to this Section.
- C. The Substantial Completion inspection shall cover all locations where PDS components and/or Systems have been installed and/or modified.
- D. The Substantial Completion inspection shall be coordinated by the Technical Project Manager with the Contractor, Project Manager, and GOAA Telecom/IT Representative attending.
- E. A separate PDS and Systems inspection may be requested by GOAA OAR or GOAA Information Technology Department.
- F. All cabling testing and labeling shall be completed by Substantial Completion Inspection, or prior to being put into service, whichever comes first.
- G. All cabling test results' documents shall be submitted to the Technical Project Manager, GOAA OAR, with a copy to GOAA Information Technology Department.
- H. All labeling documents shall be submitted to the Technical Project Manager, GOAA OAR, with a copy to GOAA Information Technology Department.
- I. If Owner provided or Contractor provided equipment requires the use of systems cabling infrastructure to have any Electronic Systems operational for the project to meet Substantial Completion inspection requirements the cabling infrastructure shall be complete and tested in its entirety according to a previously coordinated schedule providing reasonable and adequate time for Electronic Systems to be installed.
- J. Where any active Electronic Systems are installed by any party requiring use of new or existing fiber or copper backbone or horizontal cables, the installation of fiber or copper patch cords shall be complete; all patch cords shall be permanently and properly routed in the pathway created for same, and the patch cords shall be

labeled on each end with source/destination according to GOAA Labeling Specifications. All patch panel or LIU User Identification tables shall be filled out as to use/user. This must be demonstrated as complete by Substantial Completion inspection.

- K. Where new or expansion Systems are installed using new or existing backbone or horizontal fiber strands, and other new or existing fiber strands becomes unused, all strands that became unused shall have their corresponding patch cords removed along the entire fiber cable route. All User ID cards information shall be erased or covered with white adhesive paper to indicate those strands are no longer in use. Marking out fields in User ID cards is prohibited. This shall be demonstrated during Substantial Completion inspection.
- L. Telecommunication Outlet-to-Label space information sheet shall be provided:
 - 1. An E size sheet(s) copy of the Power or Systems project plan sheet that shows all Telecommunication Outlets (TO) in office/building spaces, that has all TO final label information typed in by each TO symbol in each room is to be submitted to GOAA OAR and GOAA Information Technology Department.
 - 2. Two copies shall be submitted to GOAA Information Technology Department.
 - 3. This document shall be submitted by Substantial Completion Inspection or earlier. This sheet is required a minimum of three weeks prior to any need to have any voice/data jacks, dry pairs, or any outlet to be made active for any purpose.

PART 2– PRODUCTS

2.1 GENERAL

- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and a single manufacturer shall provide component assemblies.
- B. Provide all components, equipment, parts, accessories and associated quantities required for complete installations and according to Manufacturers installation specifications. All components may not be specified herein.
- C. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for PDS, OSP and Systems configurations specified in this document.

2.2 PATHWAYS/CONDUIT/RACEWAYS

- A. General:
 - 1. All pathways (conduit, raceways, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within these specifications.
 - 2. All pathways (conduit, raceways, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of ANSI/TIA-569D-2015.
 - 3. Size: All horizontal pathways shall be minimum 1” conduit. Pathways shall be increased in size to properly accommodate number of cables to a maximum of 24 cables. Backbone conduits shall have at least 20% of installed innerduct pathways spare.

4. All conduits shall be sized and installed per NEC and ANSI/TIA specifications for intended use.
 5. Size: All backbone conduit shall be a minimum 2" conduit.
 6. Long Radius (sweep) bends shall be used for all fiber optic cable pathways, sized per NEC and ANSI/TIA specifications for intended use.
 7. No pathway components shall be installed that force cables to exceed manufacturer's recommended bend radius during installation or when pulling of cable is complete.
 8. For all horizontal pathways, there shall be no more than 180-degrees of total bend between any two pull points.
 9. Pull-boxes shall not be used as direction changes but be used to pull straight through.
 10. Where a pull-box is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pull-box.
 11. Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
 - a. Have a length of at least 8 times the trade size diameter of the largest raceway.
 - b. Be individually labeled and installation location marked on As-Builts.
 12. Metal flexible conduit shall not be used for PDS system.
 13. Protective bushings: All backbone and horizontal conduits shall have plastic/nylon insulating bushings installed on all ends to protect cable.
 14. All backbone and horizontal conduits shall have ground bonding bushings with lugs installed on ends that terminate in a communications room and be bonded to the Systems Ground Bus Bar with an insulated #6 AWG wire.
 15. All conduit shall be labeled with source/destination at each end, and each main pull box. See GOAA Cable and Pathways specifications.
 16. Pull Cords/Pull Tape: Install pull cords in all raceway runs including conduit and inner-ducts that are installed without cable (empty). Install a pull string or pull rope in all horizontal and backbone conduits and inner-ducts that have cable installed (used).
 17. Boxes:
 - a. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable sections of these specifications.
 - b. Outlet boxes shall be deep with a minimum size of 4-11/16" by 4-11/6" by 2-1/8" deep with a single gang sheetrock ring.
 - c. Boxes shall be sized as required by ANSI/TIA and NEC for cables, both fiber and copper (metallic), conduit and/or device installed.
- B. Rigid Steel Conduit:
1. Conduit shall be seamless, hot dipped galvanized rigid steel.
 2. Threads shall be cut and ends chamfered prior to galvanizing.
 3. Galvanized to provide zinc coating fused to inside and outside walls of conduit.
 4. Provide an enamel lubricating coating on the inside of the conduit.
 5. Conduit shall conform to ANSI C80.1 and listed and labeled under UL 6.
- C. Rigid Aluminum Conduit:
1. Conduit shall be seamless, 6063 alloy, T-1 temper.
 2. Conduit shall conform to FS WW-C-581d, ANSI C80.1, and UL 6.

3. Pass bending, ductility, and thickness of zinc coating in ANSI C80.1.
- D. Intermediate Metal Conduit:
1. Conduit shall be seamless, hot dipped galvanized rigid steel.
 2. Threads shall be cut and ends chamfered prior to galvanizing.
 3. Galvanizing shall provide zinc coating fused to outside walls of conduit.
 4. Provide an enamel lubricating coating on the inside of the conduit.
 5. Conduit shall be listed and labeled under UL 1242.
- E. Electrical Metallic Tubing (EMT):
1. EMT fittings shall be formed steel compression ring type. Die cast fittings are not allowed.
 2. EMT shall be UL listed and conform to NEC Article 300.22.
 3. Shall be used inside buildings only.
 4. Only manufactured fittings, transition adapters, terminators and fixed bends shall be used.
 5. All transition junction and pull boxes, fittings terminators and adapters shall be a metallic material.
- F. Raintight Sealing Hubs:
1. Two piece type with outer internally-threaded hub to receive conduit, inner locking ring with bonding screw, insulated throat, and V shaped ring or O-ring.
 2. Manufacturers: Thomas & Betts H series or Bridgeport.
- G. Conduit Bodies: Not Permitted.
- H. Conduit Fittings:
1. All fittings shall be compression or threaded.
 2. Fittings shall provide a secure connection for pulling communications cables.
 3. Setscrew fittings are not permitted.
 4. ANSI/NEMA FB 1; material to match conduit.
 5. Couplings for rigid steel conduit and IMC to be single piece threaded, cadmium plated malleable iron.
 6. Couplings for rigid aluminum conduit to be of aluminum construction, 6063 alloy.
 7. Hubs for box connection to be two-piece with outer internally threaded hub to receive conduit and inner locking ring with bonding screw.
 8. Expansion fittings shall allow for a minimum of four inches of movement and shall be similar to O-Z Gedney AX series, complete with bonding jumpers and hardware.
- I. Non-metallic conduits are not permitted in above ground installations. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.
- J. Innerduct:
1. Application: Suitable for an indoor or duct bank installation within a riser system or backbone conduit for the support of telecommunications fiber optic cables.
 2. Material, as specified on drawings for each application:
 - a. Multi-cell flexible fabric.

- b. 3-cell flexible fabric or greater, as indicated on the drawings, for duct bank installation.
 - c. 3-cell flexible fabric, riser rated, for indoor installation.
- K. Pull Cord / Pull Tape:
 - 1. Pre-lubricated, woven polyester, low friction, and high abrasion resistant yarn.
 - 2. Minimum average tensile strength shall be 1250 lbs. for 2 inch and smaller conduits and innerduct.
 - 3. Minimum average tensile strength shall be 1800 lbs. for conduits larger than 2 inches.
- L. Pull Boxes, Junction Boxes, and Gutters:
 - 1. All junction boxes, gutters and pull boxes shall comply with NEC Article 314.
 - 2. All junction boxes, gutters and pull boxes shall meet the following minimum material requirements:
 - a. 16-gauge steel or heavier.
 - b. Seams shall be continuously welded and grounded smooth.
 - c. External screws and clamps.
 - d. External mounting feet (where possible).
 - e. Oil-resistant gasket and adhesive.
 - f. ANSI 61 gray polyester powder coating inside and out over phosphatized surface.
 - g. UL 50 type 12.
 - 3. All junction boxes, gutters and pull boxes shall be provided with bushings for conduits and/or cabling.
 - 4. All junction boxes shall be provided with a hinged cover. Where clearances do not allow full opening of hinged cover, bolt on covers with captive nuts shall be provided.
 - 5. All junction boxes, gutters and pull boxes shall be securely installed.
 - 6. All junction boxes, gutters and pull box configurations and sizes for single and multiple conduit runs shall comply with ANSI/TIA 569.
- M. Metal Wireways and Auxiliary Gutters:
 - 1. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - a. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - b. Comply with TIA-569-B.
 - 2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - 3. Wireway Covers: Hinged type unless otherwise indicated.
 - 4. Finish: Manufacturer's standard enamel finish.
- N. Boxes, Enclosures, and Cabinets:
 - 1. General Requirements for Boxes, Enclosures, and Cabinets:
 - a. Comply with TIA-569-B.

- b. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
 2. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
 3. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
 4. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
 5. Device Box Dimensions: 4-11/16" inches by 4-11/16" inches by 2-1/8 inches deep with mud ring.
 6. Gangable boxes are not allowed.
 7. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
 8. Cabinets:
 - a. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - b. Hinged door in front cover with flush latch and concealed hinge.
 - c. Key latch to match panelboards.
 - d. Metal barriers to separate wiring of different systems and voltage.
 - e. Accessory feet where required for freestanding equipment.
 - f. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- O. Handholes and Maintenance Holes for Exterior Underground Cabling:
 1. General Requirements for Handholes and Maintenance Holes:
 - a. Handholes and maintenance holes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - b. Comply with TIA-569-B.
 2. Polymer-Concrete Handholes and Maintenance Holes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass or a combination of the two.
 - a. Refer to drawings for handhole and maintenance hole sizes.
 - b. Standard: Comply with SCTE 77.
 - c. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
 - d. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and location.
 - e. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - f. Cover Legend: Molded lettering, "Communications".
 - g. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - h. Handholes and maintenance holes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.3 TERMINATION BACKBOARDS

- A. Material: 3/4" A/C grade, Class A Flame Spread plywood, LEED compliant.

- B. Size: 8' high by 4' wide with multiple sections as shown drawings, unless otherwise noted or required in these specifications.
- C. Finish: Paint terminal board with gray paint having a flame spread rating of Class A as a minimum. Do not paint over Class A flame spread information on plywood, this information shall face out.
- D. Install label on backboard with TTB# and Room#.

2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

- A. Ground Bus shall be copper and comply with applicable sections of these specifications.
- B. Install minimum one copper ground bus with qty (12) pre-drilled 1/4" holes on isolating stand-offs of TTB backboard. Holes shall be configured to accept two-hole lugs.
- C. Basis of Design: Chatsworth #10622-012 or approved substitution.

2.5 COMMUNICATION ROOMS AND SIMILAR SPACES

- A. With the exception of cable management devices and rack/cabinet equipment below, devices shall be installed per requirements determined in the field by the Project Engineer and Contractor as required to neatly dress/organize cables in and out of rack/cabinets.
- B. No metallic or fiber cables shall be unsupported, or potential patch cord routes be without a supported pathway.
- C. Fiber optic patch cable pathways shall be routed and specifically constructed for protective fiber cable routing.

2.6 FLOOR MOUNT EQUIPMENT RACKS/CABINETS

- A. Standard open racks (2-post):
 - 1. Universal self-supporting all aluminum rack 84" H. x 19" W. x 3" D.
 - 2. Standard for 19" rack mounted equipment.
 - 3. Standard 3" x 1.25" aluminum upright channels, .125" thick.
 - 4. Have mounting holes both sides (front and rear) of upright channels.
 - 5. Panel Mounting Holes: #12-24 rolled threads in 5/8" - 5/8" x 1/2" hole pattern meeting ANSI/TIA-568 mounting space requirements.
 - 6. Use heavy-duty assembly hardware.
 - 7. Provide isolation pad between rack and floor.
 - 8. Base Angles: 3-1/2" x 6" x 3/8" thick (pair) for bolting to floor with 3/8" expansion anchors.
 - 9. Top Cross-Angles: 1-1/2" x 1-1/2" x 1/4" (pair).
 - 10. Finish: Black.
 - 11. All rack equipment mounting screws to be black clean thread type.
 - 12. Rack Basis of Design: Chatsworth.
 - 13. Acceptable substitutions:
 - a. Homaco.
 - b. Hubbell.
- B. Cabinets:

1. Cabinets shall be sized according to Project design to meet the requirements of active and passive equipment that may be installed inside each cabinet.
 2. Cabinets shall house all active electronics and meet the following minimum requirements:
 - a. All cabinets, if installed in a contiguous fashion, shall have an inter-cabinet pathway installed at the top of cabinets for patch cables following ANSI/TIA guidelines for patch cord cable management.
 - b. All cabinets shall have internal vertical and horizontal cable management panels.
 - c. Cabinet installations shall have overhead cable tray installed.
 - d. All cabinets shall have vented front and rear doors and side panels shall be solid for adequate airflow for proposed equipment to be installed.
 - e. All cabinets shall have locking front and rear covers. Locks shall be independently keyed to GOAA PDS cabinet key.
 - f. Cabinets shall be provided with a full height ground bar. Refer to additional cabinet grounding requirements below.
 - g. Cabinets shall be secured to the floor and bayed together per manufacturer's requirements.
 3. Cabinets shall be full height.
 4. All co-locating cabinets shall have same construction and keying characteristics of full height cabinets.
 5. Cabinet Basis of Design: HP Pallet Intelligent Cabinet 842, 1075mm #BW917A.
 6. Acceptable substitutions:
 - a. Approved substitutions.
- C. Rack and Cabinet Equipment
1. All rack equipment, wire managers, PDUs (power distribution units), etc. shall be black.
 2. All racks/cabinets shall be provided with black equipment mounting screws. Provide (50) fifty cage nuts and (50) fifty rack screws per equipment cabinet and turn over to Owner upon installation of the cabinet.
 3. Provide cable management devices (clamps, guides, supports, etc. as required to neatly dress/organize cables in and out of rack (or enclosure).
 4. Provide horizontal and vertical (full rack height) cable management. Cable management fill rate shall not exceed 50% condition when all provided jacks are in use.
 5. All Rack/Cabinet equipment shall be provided by the same manufacturer as the racks/cabinets with the following exceptions:
 - a. Horizontal wire management.
 - b. PDU.
- D. Horizontal Cable Managers:
1. Horizontal wire managers shall have both front and rear channels with covers.
 2. Horizontal wire manager Basis of Design: Panduit WMPH3, or approved substitution.
- E. Vertical Cable Managers:
1. Racks:

- a. Each rack shall have one full-height double sided vertical cable manager on each side of each rack, 6" wide.
 - b. Racks may share a vertical cable manager mounted between them when co-located.
 - c. Basis of Design for rack vertical cable managers: Chatsworth 11729 series.
2. Cabinets:
 - a. Each cabinet shall have one full-length vertical cable manager installed internally on each side.
 - b. Vertical cable management shall be installed in rear of cabinet and provided by same manufacturer as the cabinet.
- F. Jumper Tray:
1. Each rack shall have a jumper tray installed in the uppermost position.
 2. Each cabinet shall have a jumper tray installed in the uppermost position.
 3. Basis of Design for Jumper Tray: Chatsworth 12183 series.
- G. Power Distribution Unit (PDU):
1. Refer to cabinet elevation drawings for PDU requirements at each equipment cabinet.
 2. Surge protection to comply with UL 1449. For 330/400vac clamping voltage.
 3. Basis of Design for PDU: Dynamic Signage cabinets: HPE P9S15A WITH HPE P9Q66A extension bars; PON system and Public Safety DAS cabinets: APC AP8830, cabinets for other systems: APC 8832. Contractor shall confirm power requirements for each cabinet, including equipment provided by GOAA Vendors, prior to procuring PDUs. Each cabinet shall contain (2) two PDUs.
- H. Ground Bar:
1. Racks:
 - a. Provide full height grounding strip for all rack mounted equipment.
 - b. Racks shall have factory installed studs for crimp on ground lug at top and bottom of vertical rails. Lugs shall be 2-hole with long barrel and inspection window. Crimping tool shall impress the die number into the terminal.
 - c. Connect to communication room TGB with minimum #6 THHN stranded wire; increase size of bonding cable to accommodate cable installations of excessive lengths per ANSI/TIA 607.
 - d. All grounding connections shall utilize non reversible connectors and lugs.
 2. Cabinets:
 - a. Provide full height minus 6" ground bar.
 - b. Mount in rear of cabinet and provide compression 2-hole lug with long barrel and inspection window on top for connection to grounding system. Crimping tool shall impress the die number into the terminal.
 - c. Connect to communication room TGB with minimum #6 THHN stranded wire; increase size of grounding cable to accommodate any ground cable installations of excessive lengths.
 - d. All grounding connections shall utilize non reversible connectors and lugs.

- I. Miscellaneous: Provide all necessary accessories as required to support the placement of non-rack mountable equipment (e.g. termination blocks, fiber optic extenders, audio codecs, etc.) into cabinets.

2.7 LABELS

- A. All Fiber Optic, metallic cable, TTBs (Telecom Spaces), Ground points, racks, cabinets, rack/cabinet-mounted equipment and equipment power cords; and cross-connects shall be identified and labeled per Attachment One: GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document in its entirety, and according to ANSI/TIA 606 Administration Standards for Telecommunication Infrastructure of Commercial Buildings.
 1. All label material shall be suitable for intended usage and environment, meeting the legibility, defacement and general exposure requirements listed in UL 969 for indoor and outdoor use. Where insert labels are used the insert label shall be covered with clear cover and shall be securely held in place under the normal operating conditions and usage to which the labeled infrastructure element is applied.
 2. All items to be identified and labeled as listed above shall be labeled at the time they are installed.
- B. Label printer shall be of the thermal transfer type capable of printing self-laminating labels of various size up to and including 1.5 inch by 1.5 inch printable area with a 4.5 inch self-laminating tail.
- C. Label Printer Basis of Design: Brady BMP61 or approved equal.
- D. In addition to color coding requirements specified in Division 26, Pathways, backbone fiber optic cables, and backbone metallic cable labels shall have a 1.5 inch by 1.5 inch printable area white in color with a 4.5 inch self-laminating clear tail.
 1. Font shall be Arial Alt Mono 7 font size (11 point size).
 2. Label shall have the ability to have 15 characters per line and 8 lines for a total of 120 characters.
 3. Label Basis of Design: Brady P/N PTL-34-427 or approved equal, for inside use. For exterior use label shall follow the same character format, and meet the legibility, defacement, and general exposure requirements listed in UL 969.
 4. GOAA reserves the right to modify the label characters and character layout providing label materials do not change, at no cost.
 5. For all conduit or other pathways that have a diameter too large for the self-laminating label to over-wrap itself and fully laminate the printable area the label shall be changed to an insert type (tie-on is acceptable) and meet the exposure requirements in UL 969 for indoor and outdoor use. The insert label shall be covered with clear cover and shall be securely held in place under the normal operating conditions and usage to which the labeled infrastructure element is applied.
- E. Cables which shall be labeled include, but are not limited to, backbone, horizontal, patch cords, line cords, and jumpers.
- F. Contractor shall install all pathway and cable labels so they are visible and able to be read by a person standing on floor without moving cables, and if

conduit/pathway, labels shall not be obscured by other conduit, or components. Any additional types of labeling materials necessary to keep labels visible shall be provided by the Contractor and installed by the Contractor.

- G. All metallic and fiber patch cords installed by Contractor or at direction of Contractor shall be labeled.
- H. Pathways are defined but not limited to; any conduit, inner-duct, underground duct-bank, cabling troughs, pull boxes, and any materials or systems used to enclose cabling of any type.
 - 1. Any pathways or cables whose label format is not specifically mentioned in the GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document shall still be labeled in a similar format as directed by GOAA OAR/Telecom.
- I. All metallic/fiber horizontal cable and metallic/fiber patch cord labels shall have a 1 inch by 5 inch printable area white in color with a 1 inch self-laminating clear tail, labeled at each end.
 - 1. Font shall be Arial Alt Mono, 7 font size (11 point size).
 - 2. Label shall have the ability to have 15 characters per line and 2 lines for a total of 30 characters.
 - 3. Label Basis of Design is Brady P/N PTL-31-427 or approved equal, for inside use. For exterior use label shall follow the same character format, and meet the legibility, defacement, and general exposure requirements listed in UL 969.
- J. Equipment cabinet / Rack labeling
 - 1. Provide phenolic nameplate fastened to top of racks and cabinets indicating rack / cabinet designation. Min 1" white text on black laminate.

2.8 CABLE TRAY/LADDER RACK

- A. Ladder Rack (inside Communications Rooms):
 - 1. Upper ladder rack shall be populated with horizontal and backbone copper and fiber cables and shall be mounted at 9' A.F.F., unless otherwise noted on communication room enlarged plans.
 - 2. Lower ladder rack shall be populated with copper patch cables only and shall be mounted at 8' A.F.F., unless otherwise noted on communication room enlarged plans. No service loops are permitted inside ladder rack system.
 - 3. Ladder rack shall be spaced off the wall 4" minimum to allow for cabling to pass vertically on wall.
 - 4. Ladder rack width shall be 18" unless otherwise noted, refer to enlarged room plans.
 - 5. 1-1/2" x 0.0625" wall rectangular tubing.
 - 6. Cross members welded at maximum 12" intervals, 1/2" x 1".
 - 7. Side mounted 6" cable guide/cable fence shall be mounted every other cross member, from same manufacturer as ladder rack.
 - 8. Provide all accessories to support ladder rack from above and wall. Ladder rack shall not be supported from racks or cabinets. Supports shall be minimum 5/8" threaded rod.
 - 9. Install ceiling supports as required, eliminating lateral movement.

10. All ladder rack mounted adjacent to walls shall be supported from the wall using brackets.
11. Supports shall be used as specified by the cable tray manufacturer for maximum loading characteristics of cable rack.
12. Provide supports as required by the manufacturer's installation guidelines.
13. Edges, fittings and hardware shall be finished free from burrs and sharp edges. Ends shall have rubber boots.
14. Fittings shall have not less than the load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius unless otherwise indicated.
15. Furnish swept elbows for all direction changes.
16. Bond together to form an electrically continuous path.
17. Provide grounding kit to bond together sections of cable tray.
18. Provide transition pans to be installed where required on cable tray.
19. Transition pans with dividing fingers shall be installed on ladder rack above racks, cabinets and all locations required for routing copper patch cords. Transition pans shall match racking (black) in color and provided by the same manufacturer as the cable rack.
20. Provide all warning labels as required by UL, NEC and NEMA.
21. Finish: Black, including all accessories.
22. Basis of Design: Chatsworth.
23. Approved Substitutions:
 - a. Legrand.
 - b. B-Line.
 - c. Homaco.

2.9 FIBER OPTIC OPEN TROUGH SYSTEM (FIBER GUIDE/FIBER TRAY)

- A. All overhead ladder rack shall have installed an overhead fiber optic trough system with an open channel design to protect and route fiber optic patch cords. Troughs shall have removable top covers. All components shall be yellow in color.
- B. Fiber trough shall be configured to provide a pathway between all 2-post racks, all cabinets, wall mounted equipment, and backboards installed for future equipment in same communications room.
- C. Trough shall have rounded flair downspouts and drop outs over each rack corner and vertical cable manager of sufficient length to enter top rung of vertical cable manager.
- D. Fiber Trough width shall be 6 inch minimum.
- E. Fiber Trough system shall be supported by manufacturer provided support kit of threaded rod/single support arm method, whether supported by ladder rack or unistrut.
- F. Fiber Trough system shall have all end caps and protective bushings.
- G. Fiber Trough systems shall be sized to not exceed manufacturer recommended patch cord fill rate based on area fiber ports.
- H. Fiber Optic Open Trough Basis of Design: Panduit Fiber Runner series.
- I. Acceptable substitutions: None.

2.10 CABLE TESTER

- A. Copper cable tester technology required: basis of design: Fluke DSX-8000, or approved equivalent.
1. Copper cable tester shall be manufactured by a company engaged in the manufacturing of copper cable testing/certification equipment, and such equipment shall have been available for purchase from the chosen manufacturer for at least five consecutive years immediately preceding any test conducted to satisfy the requirements of this project.
 2. Copper cable tester shall be a current model as manufactured by the chosen manufacturer and shall be currently in production, and fully supported by the manufacturer at the time any test is conducted to satisfy the requirements of this project.
 3. Copper cable tester shall be calibrated by a factory authorized service provider within the 12 calendar months immediately preceding any test conducted to satisfy the requirements of this project. A Certificate of Calibration from the factory authorized service provider, identifying the specific unit calibrated, the date it was calibrated and that the specified unit is approved for service, shall be made immediately available to the Owner, OAR or field inspectors upon request. The last calibration date of the testing equipment/instrument used shall be documented in the test results provided to the Owner at any time such results are provided.
 4. Any test results submitted to the Owner, OAR or inspectors that were conducted by a copper cable tester that does not meet the requirements specified herein will be rejected by the Owner. The Contractor will be required to repeat the necessary tests on the impacted cables with an approved tester at no additional cost to the owner and without impacting the project schedule or the Owner's operations.
- B. Fiber cable tester technology required: basis of design: Fluke Versiv, or approved equivalent.
1. Fiber cable tester shall be manufactured by a company engaged in the manufacturing of fiber cable testing/certification equipment, and such equipment shall have been available for purchase from the chosen manufacturer for at least five consecutive years immediately preceding any test conducted to satisfy the requirements of this project.
 2. Fiber cable tester shall be a current model as manufactured by the chosen manufacturer and shall be currently in production, and fully supported by the manufacturer at the time any test is conducted to satisfy the requirements of this project.
 3. Fiber cable tester shall be calibrated by a factory authorized service provider within the 12 calendar months immediately preceding any test conducted to satisfy the requirements of this project. A Certificate of Calibration from the factory authorized service provider, identifying the specific unit calibrated, the date it was calibrated and that the specified unit is approved for service, shall be made immediately available to the Owner, OAR or field inspectors upon request. The last calibration date of the testing equipment/instrument used shall be documented in the test results provided to the Owner at any time such results are provided.

4. Any test results submitted to the Owner, OAR or inspectors that were conducted by a fiber cable tester that does not meet the requirements specified herein will be rejected. The Contractor will be required to repeat the necessary tests on the impacted cables with an approved tester at no additional cost to the owner and without impacting the project schedule or the Owner's operations.

2.11 HORIZONTAL CABLING AND TERMINATION

A. Patch Panels:

1. Category 6 UTP Patch Panel:
 - a. Shall meet or exceed Category 6 rating for all components including but not limited to specifications within this document and as follows:
 - 1) IEEE 802.3AF (POE).
 - 2) IEEE 802.3AT (POE+).
 - 3) IEEE 802.3BT (POE++ 60W).
 - b. Component certified to meet or exceed Category 6 standards.
 - c. Configuration: Modular RJ-45 non-keyed 8-position jack port to 110 printed circuit board, factory pre-wired, Category 6.
 - d. Wire Plan: EIA/TIA T568B.
 - e. Active Pins: 1 through 8.
 - f. Individual patch panel size not to exceed 48 ports.
 - 1) One horizontal wire manager shall be installed for every 24 ports in patch panel configuration, between each patch panel(s).
 - g. Connection Hardware: IDC PCB (printed circuit board) mounted connector for 22-26 AWG.
 - h. Include strain relief bar.
 - i. UL listed and labeled.
 - j. Finish: Black.
 - k. Basis of Design: Optical Cable Corporation.
 - l. Approved Substitution:
 - 1) None.
2. Category 6A STP Patch Panel:
 - a. Shall meet or exceed Category 6A rating for all components including but not limited to specifications within this document and as follows:
 - 1) IEEE 802.3AF (POE).
 - 2) IEEE 802.3AT (POE+).
 - 3) IEEE 802.3BT (POE++ 60W).
 - b. Component certified to meet or exceed Category 6A standards.
 - c. Configuration: Modular Shielded RJ-45 non-keyed 8-position jack port to 110 printed circuit board, factory pre-wired, Category 6A.
 - d. Wire Plan: ANSI/TIA T568B.
 - e. Active Pins: 1 through 8.
 - f. Must be backward compatible in all characteristics to Category 6 specifications.
 - g. Individual patch panel size not to exceed 48 ports.
 - 1) One horizontal wire manager shall be installed for every 24 ports in patch panel configuration, between each patch panel(s).
 - h. Connection Hardware: IDC PCB (printed circuit board) mounted connector for 22-26 AWG.

- i. Include strain relief bar.
 - j. UL listed and labeled.
 - k. Quick Grounding bar design.
 - l. Provide strain relief on all cabling terminated in patch panel.
 - m. Provide shielded panel kit including bonding jumper.
 - n. Finish: Black.
 - o. Basis of Design: Optical Cable Corporation.
 - p. Approved Substitution:
 - 1) None.
3. Category 6A UTP Patch Panel:
- a. Shall meet or exceed Category 6A rating for all components including but not limited to specifications within this document and as follows:
 - 1) IEEE 802.3AF (POE).
 - 2) IEEE 802.3AT (POE+).
 - 3) IEEE 802.2BT (POE++ 60W).
 - b. Component certified to meet or exceed Category 6A standards.
 - c. Configuration: Modular RJ-45 non-keyed 8-position jack port to 110 printed circuit board, factory pre-wired, Category 6A.
 - d. Wire Plan: ANSI/TIA T568B.
 - e. Active Pins: 1 through 8.
 - f. Must be backward compatible in all characteristics to Category 6A specifications.
 - g. Individual patch panel size not to exceed 48 ports.
 - 1) One horizontal wire manager shall be installed for every 24 ports in patch panel configuration, between each patch panel(s).
 - h. Connection Hardware: IDC PCB (printed circuit board) mounted connector for 22-26 AWG.
 - i. UL listed and labeled.
 - j. Quick Grounding bar design.
 - k. Provide strain relief on all cabling terminated in patch panel.
 - l. Provide shielded panel kit including bonding jumper.
 - m. Finish: Black.
 - n. Basis of Design: Optical Cable Corporation.
 - o. Approved Substitution:
 - 1) None.
- B. Telecommunications Outlets:
- 1. Telecommunication Outlet (TO):
 - a. Provide all copper, metallic, and fiber optic cable as designed for Telecommunication Outlets indicated on the drawings.
 - b. Provide Communication Outlet faceplates and jack modules for all type of cable media installed.
 - c. Jacks/ports/faceplates shall be provided from the same manufacturer.
 - d. All jacks installed in TO shall have colored bezel and dust shutter.
 - e. The TO faceplate shall have six port positions and be white or as specified by design to match surrounding area décor.
 - 1) Faceplate shall have a recessed label area covered by a clear plastic lens, at top and bottom covering screws.
 - 2) Exception: when face plate is stainless steel.

- f. Refer to Attachment One in this specification document for GOAA Telecommunication Outlet label, Jack, and wiring configuration. "Data" and "LAN" nomenclature is interchangeable in this reference.
 - g. All Work Areas shall have GOAA Standard Telecommunication Outlets installed.
 - h. Basis of design: Optical Cable Corporation UMJ faceplate #FPSR06xx xx=color.
 - i. Approved substitution:
 - 1) Hubbell.
 - 2) Berk-Tek.
2. Wall Phone Outlet:
- a. Single port wall plates with mounting studs for wall telephone installed as specified and served by one (1) Category 6 cable.
 - b. Basis of design: Optical Cable Corporation.
 - c. Approved Substitution:
 - 1) Hubbell.
 - 2) Berk-Tek.
3. Floor Outlets:
- a. Shall be designed with separate chambers for voice/data/electrical per NEC and ANSI/TIA specifications for dual service use.
 - b. Voice and data jacks and mounting hardware shall meet ANSI/TIA Category 6 requirements for intended use.
 - c. Voice and data jacks shall be recessed to protect cable ends when in use.
 - d. Floor boxes shall have retractable covers to protect debris from entering voice and data jacks. Cover shall be capable of closing while jacks are in use.
 - e. Floor box basis of design: Legrand Evolution Series.
 - f. Approved Substitution:
 - 1) Hubbell.
- C. Telecommunications Modular Jacks:
1. Jacks and faceplates shall be by same manufacturer.
 2. Jacks and modular patch panels shall be by same manufacturer.
 3. Category 6 UTP Jacks:
 - a. Meets ANSI/TIA-568-C.2 Category 6 specifications for all components including but not limited to specifications within this document and as follows:
 - 1) IEEE 802.3AF (POE).
 - 2) IEEE 802.3AT (POE+).
 - 3) IEEE 802.3BT (POE++ 60W).
 - b. Supports IEEE 1000GBASE-T Ethernet.
 - c. Tool-less design allows for simple, consistent, reliable terminations.
 - d. Provide colored bezel for all jacks in accordance with Attachment 1 within this specification section.
 - e. Accommodates 22-24 AWG conductors.
 - f. Modular interface: 750 mating cycles.
 - g. 50μ-inch gold-plated contacts.
 - h. Zinc alloy housing.

- i. 1000 VDC Dielectric withstand.
 - j. 500 MΩ insulation resistance.
 - k. UL 1863 Listed.
 - l. Basis of Design: Optical Cable Corporation UMJ Series.
 - m. Acceptable substitution:
 - 1) Hubbell.
 - 2) Berk-Tek.
4. Category 6A STP Jacks:
- a. Shall meet or exceed Category 6A rating for all components including but not limited to specifications within this document and as follows:
 - 1) IEEE 802.3AF (POE).
 - 2) IEEE 802.3AT (POE+).
 - 3) IEEE 802.3BT (POE++ 60W).
 - b. Meets ANSI/TIA-568-C.2 Category 6A specifications.
 - c. Meets ISO/IEC 11801:2002 AMENDMENT 2 Class EA specifications.
 - d. Supports IEEE 802.3an 10GBASE-T Ethernet.
 - e. Tool-less design allows for simple, consistent, reliable terminations.
 - f. Provide colored bezel for all jacks as follows:
 - 1) Orange for standard Category 6A outlets.
 - g. Shielded housing to ensures superior ANEXT performance.
 - h. Accommodates 22-24 AWG conductors.
 - i. Modular interface: 750 mating cycles.
 - j. 50μ-inch gold-plated contacts.
 - k. Zinc alloy housing.
 - l. 1000 VDC Dielectric withstand.
 - m. 500 MΩ insulation resistance.
 - n. UL 1863 Listed.
 - o. Basis of Design: Optical Cable Corporation UMJ Series.
 - p. Acceptable substitution:
 - 1) Hubbell.
 - 2) Berk-Tek.
5. Fiber Optic Jacks:
- a. Shall be modular style.
 - b. Shall be provided for MM or SM fiber cabling where required.
 - c. Dual LC or SC connector, as required by application.
 - d. Provide colored bezel for all jacks in accordance with Attachment 1 within this specification section.
 - e. Basis of Design: Optical Cable Corporation UMJ Series.
 - f. Acceptable substitution:
 - 1) Hubbell.
 - 2) Berk-Tek.
6. Category 6A UTP Jacks:
- a. Shall meet or exceed Category 6A rating for all components including but not limited to specifications within this document and as follows:
 - 1) IEEE 802.3AF (POE).
 - 2) IEEE 802.3AT (POE+).
 - 3) IEEE 802.3BT (POE++ 60W).
 - b. Meets ANSI/TIA-568-C.2 Category 6A specifications.
 - c. Meets ISO/IEC 11801:2002 AMENDMENT 2 Class EA specifications.

- d. Supports IEEE 802.3an 10GBASE-T Ethernet.
 - e. Tool-less design allows for simple, consistent, reliable terminations.
 - f. Provide colored bezel for all jacks as follows:
 - 1) Orange for standard outlets.
 - g. Shielded housing to ensures superior ANEXT performance.
 - h. Accommodates 22-24 AWG conductors.
 - i. Modular interface: 750 mating cycles.
 - j. 50μ-inch gold-plated contacts.
 - k. Zinc alloy housing.
 - l. 1000 VDC Dielectric withstand.
 - m. 500 MΩ insulation resistance.
 - n. UL 1863 Listed.
 - o. Basis of Design: Optical Cable Corporation UMJ Series.
 - p. Acceptable substitution:
 - 1) Hubbell.
 - 2) Berk-Tek.
- D. Horizontal Cable:
- 1. All cable shall be installed, terminated, and tested by Contractor.
 - 2. All cable jacket and construction shall be applicable for the intended installation environment to maintain full manufacturer's warranty and industry standard expected life cycle, including but not limited to specifications within this document section.
 - 3. All cable shall include additional accessories such as clamps, supports, mounting hardware, straps, anchoring structures, termination hardware, etc. necessary to provide an industry standard installation in all environments. Accessories to include but are not limited to specifications within this document section.
 - 4. Terminate all horizontal cabling on rack mounted patch panels.
 - 5. Horizontal Copper CAT6 UTP Data Cable.
 - a. Cable shall meet the following minimum requirements:
 - 1) Support for Power-over-ethernet including:
 - a) IEEE 802.3AF (POE).
 - b) IEEE 802.3AT (POE+).
 - c) IEEE 802.3BT (POE++ 60W).
 - b. Cable shall be four (4) pair copper unshielded twisted pair cable 23 gauge copper.
 - c. Cable shall exceed Cat 6 performance requirements and have guaranteed performance to 400MHz.
 - d. Certified to UL Category 6.
 - e. Certified to ANSI/TIA Category 6 specifications.
 - f. Shall meet ANSI/TIA-568-C.2–2009+A1:2010, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, and current performance specifications for Category 6 rated cable.
 - g. The cable shall have surface markings: Verified UL Category 6.
 - h. Cable color: Continuous green jacket.
 - i. Plenum rating: Where required cable shall be plenum rated and marked CMP or Plenum (UL) and meet UL-910 standards.

- j. Cable may be non-plenum rated where installed in non-plenum spaces/areas.
 - k. Basis of Design: Superior Essex DataGain, Category 6 4 pair UTP cable.
 - l. Approved Substitution:
 - 1) Mohawk - 6 LAN Plus.
 - 2) Berk-Tek – Lanmark 1000.
6. Horizontal Copper CAT6A STP Data Cable.
- a. Cable shall meet the following minimum requirements:
 - 1) Shall meet or exceed Category 6A rating for all components including but not limited to specifications within this document and as follows:
 - a) IEEE 802.3AF (POE).
 - b) IEEE 802.3AT (POE+).
 - c) IEEE 802.3BT (POE++ 60W).
 - 2) Cable shall be four (4) pair copper shielded twisted pair cable 23 gauge copper.
 - 3) Certified to UL Category 6A.
 - 4) Certified to ANSI/TIA Category 6A specifications.
 - 5) Shall meet ANSI/TIA-568-C.2–2009+A1:2010, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, and current performance specifications for Category 6A rated cable.
 - 6) The cable shall have surface markings: Verified UL Category 6A.
 - 7) Cable color: Continuous orange jacket.
 - 8) Plenum rating: Where required cable shall be plenum rated and marked CMP or Plenum (UL) and meet UL-910 standards.
 - 9) Cable may be non-plenum rated where installed in non-plenum spaces/areas.
 - 10) Basis of Design: Superior Essex 10Gain, Category 6A 4 pair STP cable.
 - 11) Approved Substitution:
 - a) Mohawk – GigaLAN 10.
 - b) Berk-Tek -- LANmark-10G2.
7. Horizontal Fiber Optic Cabling:
- a. Horizontal Fiber Optic Cable shall be Single Mode.
 - b. Refer to drawings for fiber strand count as specified.
 - c. Cables that provide additional fibers to replace defective fibers in the cable shall not be permitted.
 - d. Single-Mode Fiber Optic cable shall:
 - 1) Be single mode 9 micron core diameter/125 micron cladding diameter.
 - 2) Meet all applicable specifications for FDDI physical media.
 - 3) Fiber used in cable shall:
 - a) Support applications using a bandwidth in excess of 1 GHz.
 - b) Meet ANSI/TIA 492 AAAA standard.
 - 4) Interior building cables shall be tight buffered, non-gel-filled design.
 - 5) Cable shall be plenum rated and marked OFNP (UL) and meet UL-910 standards.

- 6) Cable may be non-plenum rated where installed in non-plenum spaces/areas.
 - 7) Cable used for multi-story building risers must be marked OFNR (UL) and meet UL 1666 flame test or be plenum cable as specified above.
 - 8) Underground and exterior cables shall be loose tube, gel-filled design.
 - 9) Loose Tube, gel-filled cables shall be cleaned and terminated according to Cable Manufacturer and specifications within this document.
 - 10) The use of fan-out kits shall be required. The use of splice cases shall include splice trays.
 - 11) Horizontal single-mode cable basis of design: Corning.
 - 12) Acceptable substitution:
 - a) AFL.
 - b) Prysmian.
8. Horizontal Copper CAT6A UTP Data Cable.
- e. Cable shall meet the following minimum requirements:
 - 1) Shall meet or exceed Category 6A rating for all components including but not limited to specifications within this document and as follows:
 - a) IEEE 802.3AF (POE).
 - b) IEEE 802.3AT (POE+).
 - c) IEEE 802.3BT (POE++ 60W).
 - 2) Cable shall be four (4) pair copper unshielded twisted pair cable 23 gauge copper.
 - 3) Certified to UL Category 6A.
 - 4) Certified to ANSI/TIA Category 6A specifications.
 - 5) Shall meet ANSI/TIA-568-C.2–2009+A1:2010, Balanced Twisted-Pair Telecommunications Cabling and Components Standard, and current performance specifications for Category 6A rated cable.
 - 6) The cable shall have surface markings: Verified UL Category 6A.
 - 7) Cable color: Continuous orange jacket.
 - 8) Plenum rating: Where required cable shall be plenum rated and marked CMP or Plenum (UL) and meet UL-910 standards.
 - 9) Cable may be non-plenum rated where installed in non-plenum spaces/areas.
 - 10) Basis of Design: Superior Essex 10Gain, Category 6A 4 pair UTP cable.
 - 11) Approved Substitution:
 - a) Mohawk – GigaLAN 10.
 - b) Berk-Tek.
- E. Lightning / Surge Suppression for Horizontal Copper Cables:
1. Lightning protection assembly shall be comprised of Chassis and Modules and shall be provided for all cabling terminating outside the building envelope or otherwise susceptible to surge.
 2. Chassis shall be installed directly above or below the patch panel being protected.

3. Surge Protection Chassis:
 - a. Shall be high density, min ports per RU shall be 24.
 - b. All modules shall be serviceable from the front.
 - c. Modules shall be individual and field replaceable.
 - d. Chassis Basis of Design: APC #PRM24.
 4. Surge Protection Modules:
 - a. Modules shall be selected based on CATx cable being protected and/or signal type.
 - b. Modules shall be POE compliant and shall match required POE power requirement of cable being protected (30W, 60W or 100W).
 - c. Model Basis of Design: APC #PNETR6.
- F. Patch Cables:
1. Provide factory assembled patch cords sized to routing requirements.
 2. Additional patch cable for specialty systems and equipment shall be provided as required to facilitate a complete and operational system.
 3. Patch cords shall be constructed and provided by the same manufacturer that provided the data patch panels/termination hardware.
 4. Patch cable shall match color and performance specifications of corresponding horizontal cable.

2.12 BACKBONE CABLING AND TERMINATION – FIBER OPTIC CABLE

- A. Termination:
1. No service loops shall be permitted in overhead ladder rack for backbone cable.
 2. Rack Mounted Modular Fiber Optic Patch Panels – Light Interface Unit (LIU):
 - a. LIU shall be stackable, with modular connector bulkhead panels.
 - b. Single Mode bulkhead connectors shall be designed strictly for single mode fiber.
 - c. Multi-mode fiber bulkhead connectors shall be designed strictly for multi-mode fiber use.
 - d. No high density panels will be allowed.
 - e. Other sizes' fiber connector bulkheads shall be designed for specified fiber size and type only.
 - f. Side or rear cable entry.
 - g. Storage area designed internally to neatly store slack cable.
 - h. Hinge out patch/connector panels.
 - i. Each connector to have covers: single-mode shall be yellow, multi-mode shall be black.
 - j. Patch panel to consist of connectors as indicated on the project drawings:
 - 1) LIU bulkhead connectors for work in Parking Garage and trailer complex shall be ST.
 - 2) LIU bulkhead connectors for work in South Terminal facilities including Airside Concourse, Landside Terminal, Ground Transportation Facility, Central Energy Plant, Checkpoint Delta, Emergency Standby Power Generation Plant, and Ground Support Equipment Facility shall be LC-APC type. Vendor

- specific requirements may supersede for Passive Optical Network connections.
- 3) South Terminal 400/800 MHz DAS shall have LC-APC LIU bulkhead connectors in IDF Rooms and fusion splices at MDF Rooms and other locations between IDF Rooms and the 400/800 MHz DAS Headend location.
 - 4) LIUs shall have a metal frame door with pad locking hinged front cover.
 - 5) LIU's shall have metal pad locking rear cover.
- k. Provide a clear separation between horizontal and backbone fiber optic cables. Backbone fiber shall be in separate LIUs than horizontal fiber.
 - l. Provide a clear separation between multi-mode and single-mode fiber optic cables, terminate in grouped connector panels segmented by cable type.
 - m. When splice trays are required for termination of fiber they shall be of same manufacturer as LIU and have brackets / provisions to securely and neatly stack inside the rear compartment of the LIU. Trays shall be installed to allow future work in LIU and serviceability of fiber cable.
 - n. Provide with all required cable management and accessories for a complete installation.
 - o. Terminate all fiber cable with factory terminated pigtail assembly; splices shall be made in splice tray. Refer to additional Splice trays requirements below.
 - p. Basis of Design: Optical Cable Corporation RTC-LM Series.
 - q. Approved Substitution:
 - 1) None.
3. Fiber Splice Trays:
- a. Install fan out kits and splice trays where incoming or outgoing fiber optic cables are loose tube, gel-filled type OSP cables. All loose tube, gel-filled, OSP cables shall be spliced to pigtails prior to connection to patch panel.
 - b. Fiber cable splice trays shall be used for all fiber cable terminations requiring spliced pigtails.
 - c. Splice cases installed without splice trays designed are prohibited.
 - d. Splice trays shall be tray type.
 - e. Splice trays shall be provided by same manufacture as LIU(s) installed.
 - f. All splices in tray shall be fusion type.
- B. Intra-Building Backbone/Riser Fiber Optic Cable:
1. Intra Building cable shall be used where cable is not required to leave the building or be installed below grade.
 2. Intra-Building backbone/riser fiber optic cable shall be Single Mode.
 3. Refer to drawings for fiber strand count as specified.
 4. Cables that provide additional fibers to replace defective fibers in the cable shall not be permitted.
 5. Single Mode Fiber Optic Cable Requirements:
 - a. Single mode 9 micron core diameter/125 micron cladding diameter.
 - b. Meet all applicable specifications for FDDI physical media.
 - c. Fiber used in cable shall:

- 1) Support applications using a bandwidth in excess of 10 Gbps.
 - 2) Meet EIA/TIA 492 AAAA standard.
 - d. Interior building cables shall be tight buffered, non-gel-filled design.
 - e. Cable shall be plenum rated and marked OFNP (UL) and meet UL-910 standards.
 - f. Cable may be non-plenum rated where installed in non-plenum spaces/areas.
 - g. Cable used for multi-story building risers must be marked OFNR (UL) and meet UL 1666 flame test or be plenum cable as specified above.
 - h. Terminate tight buffer cables at connector panels with pre-terminated factory pig tail assemblies. Provide splice tray inside LIU for splice between building cable and pigtail assembly provide service loop in splice tray cable management area for maintenance and service.
 - i. Backbone single mode cable basis of design: Corning.
 - j. Acceptable substitution:
 - 1) AFL.
 - 2) Prysmian.
6. Fire Resistant Single Mode Fiber Optic Cable Requirements:
- a. Single mode 9 micron core diameter/125 micron cladding diameter.
 - b. LSZH Fire Resistive outer jacket.
 - c. Cable shall meet the following standards:
 - 1) Upgraded IEC 60331-25 (1000 °C, 3 hours)
 - 2) UL 1666
 - 3) UL 1685
 - 4) UL 1651
 - d. Cable shall be riser rated and marked OFCR.
 - e. Jacket color shall be red.
 - f. Basis of Design: Draka Lifeline
- C. Inter-Building Backbone/Riser Fiber Optic Cable (OSP):
1. Inter Building cable shall be used where cable is required to leave the building or be installed below grade or in wet location.
 2. Backbone/Riser Inter-Building Fiber Optic Cable shall be Single-mode.
 3. Refer to drawings for fiber strand count as specified.
 4. Cables that provide additional fibers to replace defective fibers in the cable shall not be permitted.
 5. Single-Mode Fiber Optic Cable Requirements:
 - a. Single mode 9 micron core diameter/125 micron cladding diameter.
 - b. Meet all applicable specifications for FDDI physical media.
 - c. Fiber used in cable shall:
 - 1) Support applications using a bandwidth in excess of 10 Gbps.
 - 2) Meet EIA/TIA 492 AAAA standard.
 - d. Underground and exterior cables shall be loose tube, gel-filled design.
 - e. Loose Tube, gel-filled cables shall be Loose Tube, gel-filled cables shall be cleaned and terminated according to Cable Manufacturer and specifications within this document. The use of fan-out kits are required. The use of splice cases shall include splice trays.
 - f. Backbone single mode OSP cable basis of design: Corning.
 - g. Acceptable substitution:

- 1) AFL.
- 2) Prysmian.

D. Patch Cables:

1. Patch cables shall be provided in communications rooms for each LIU panel termination, length shall be as required to reach any LAN switch, active electronic device, and/or cabinet in same communications room.
2. The fiber optic cladding shall be covered by aramid yarn and an OFNR jacket. Specialty use patch cords shall have a jacket suitable for intended use.
3. Provided factory assembled patch cords with SC or LCAPC style connectors, coordinated with LIU connector types, with ceramic ferrules length as required for routing.
4. Provide one (1) duplex patch cord for each Fiber Optic Patch Panel termination pair. Refer to Spare Material for additional information.
5. Patch cords shall be constructed and provided by the same manufacturer that provided the fiber patch panels/termination hardware.
6. Patch cable shall match color and performance specifications of corresponding backbone cable.
7. Patch cables shall be provided by the contractor.

2.13 ZONE ENCLOSURE

- A. Description: Wall-mounted cabinets manufactured from steel sheet. Maximum equipment weight of 100 lb (45.4 kg) when secured to the structural wall with standard anchors.
- B. Equipment Mounting Rails: Two pairs of equipment mounting rails shall provide 6U of rack-mount space.
- C. Front Door: Solid and keyed.
- D. Sides: Louvered near the top for inlet airflow with four 3/4 inch and 1-1/2 inch conduit knockouts for network cable access.
- E. Bottom Panel: Vented for an exhaust fan with two 3/4 inch and 1-1/2 inch conduit knockouts for network cable access.
- F. Top Panel: Solid removable top panel to provide access to internal equipment.
- G. Rear Panel: 4 inches by 6 inches opening located near the bottom center of the cabinet for through-the-wall network cable access.
- H. Electrical Connection: Single-gang 2 inch by 4 inch duplex electrical junction box for a single duplex electrical outlet
- I. Color: Powder coat Black.
- J. Accessories:
 1. Fan Kit: Solid state temperature control variable fan speed with a 115 VAC, 60 Hz to 12 VDC power supply.
 - a. Size: 4U, 65 CFM – 120 CFM (110 CMH – 204 CMH).
 2. Power Outlet: Surge-suppressed duplex receptacle rated for 125 Volt, 15 Amps with two NEMA 5-15R outlets.
 3. Fiber Slack Manager Panel: 19 inches wide rack-mount, 4U high and 2 inches deep in black.

- K. Accessibility: Zone enclosures shall be mounted so as to be accessible for maintenance without requiring the use of a step ladder or lift. Ceiling-mounted zone enclosures shall be unacceptable. Refer to specification section 27 05 00 for additional information regarding accessibility of equipment.
- L. Acceptable Manufacturers
 - 1. Chatsworth (CPI) – Thinline II
 - 2. Middle Atlantic – HDR
 - 3. Hubbell – ReBox
 - 4. Or approved equal.

PART 3– EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 for requirements.

3.4 EQUIPMENT INSTALLATION

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. General Installation Requirements:
 - 1. Provide any necessary screws, anchors, clamps, Velcro ties, raceway, grounding or other support hardware required to facilitate the proper installation of the Premise Distribution System.
 - 2. All cable, terminating hardware, cabinets, racks, and all PDS components shall include additional accessories such as clamps, supports, mounting hardware, straps, anchoring structures, termination hardware, etc. necessary to provide an industry standard installation in intended environments. Accessories include but are not limited to specifications within this document section.
 - 3. Locate, install, and test the Premise Distribution System in accordance with the equipment manufacturer's written instructions; the latest editions of the National Electrical Code; the National Electrical Contractors' Association publication "Standard of Installation," according to Regulatory and Reference Documents section of this document, and all applicable codes and standards referenced in this specification.
 - 4. Furnish any special installation equipment or tools necessary to properly complete the Work. This may include, but not be limited to, testing equipment, communication devices, jack stands, cable winches, etc.
 - a. Furnish to the Owner any specialty hand tools needed to access any covers, access hatches, or other Contractor installed enclosures.
 - b. Provide above hand tools by Substantial Completion Inspection or earlier if deemed necessary by Owner or Project Manager.
 - c. Label all Comm Room outer doors "Communication Room ###" per GOAA door labeling standards for Electrical Rooms.

5. Install equipment, cables, raceways and outlets as required to comply with all applicable requirements within this specification document as minimum installation requirements. Exceed this minimum requirement when called for herein or as required to ensure a fully operational PDS.
6. Install all electrical basic materials per applicable sections of these specifications.
7. Install all rack mountable equipment in equipment rack, except that furnished and installed by GOAA and GOAA Vendors.
8. Install system cabinets/racks in locations shown; arrange to provide adequate cooling, ventilation and access.
9. Properly bond system per applicable sections of these specifications.
10. Support raceways, backboards, and cabinets under the provisions of these specifications and as required by manufacturer's instructions.
11. Install raceways and pathways to conform to applicable sections of these specifications.
12. Install PDS system wiring and raceways away from any surface that may become hot, including and not limited to, hot water piping and heating ducts.
13. Install PDS system wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power or Class 1 circuits, separation may be reduced as described in NEC 800-52 (a) (1). Increase separation if so required to comply with ANSI/TIA referenced standards.
14. Maintain proper separation between PDS system cables and all power and unshielded cables, as required to prevent noise, crosstalk, etc.
15. All horizontal voice and data cables shall be splice-free and homerun to the patch panel in the associated GOAA Telecommunications Room or zone enclosure as shown on the drawings.

3.5 EQUIPMENT RACKS/CABINETS:

- A. Equipment Racks/Cabinets shall be installed where shown on the drawings and in accordance with the manufacturer's instructions.
- B. Whether or not specifically shown on the drawings, all racks and cabinets shall be installed as specified within this document as GOAA Standard Rack/Cabinet configuration.
 1. Each equipment rack shall have one full-length vertical wire manager installed on each side of the equipment rack.
 2. Each row of terminating frames and cable racks shall be bonded to ground with a minimum #6 stranded THHN copper cable with a continuous green jacket.
 3. Remove paint from grounding lug attachment points on each rack. Each grounding lug to be attached to rack via nut and bolt method.
 - a. Bonding cables within Communications Room to be installed separate route from all horizontal and backbone cabling, back to Telecommunications Grounding Busbar.
 - b. This separate pathway shall hang from ladder rack.
 4. When mounting any equipment in enclosure, provide width, height, hardware, etc. as required for complete and coordinated installation.
 5. Horizontal wire managers are to be installed qty (1) for each 24 ports of

- modular copper cable patch panels.
- 6. For the maximum size allowed patch panel (48 ports) one horizontal wire manager to be installed above and one horizontal wire manager to be installed below.
- 7. Furnish and install blank plate covers in all empty equipment cabinet spaces.

3.6 TELECOMMUNICATION OUTLETS (TO)

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Install cable to outlets for PDS where indicated on the drawings.
- C. Install per applicable section of these specifications (i.e., outlet boxes, indoor service poles, floor boxes, wall phones, etc.).
- D. Terminate all voice, data, and fiber optic cable on jacks wired per jack wiring details in Attachment One.
- E. Install face plate on single-gang sheet rock ring. Label face plate per Attachment One.
- F. All required cabling, outlet and faceplate labeling shall be completed at the time of installation.
- G. All cable testing shall be complete before any cabling is put into use.

3.7 PATHWAYS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. General:
 - 1. All raceways shall meet the applicable requirements of all of Divisions 26, 27, 28 Specifications, and all requirements within this specification document.
 - 2. All raceways at terminal boards shall turn 90 degrees down and terminate at a point within 6 inches of termination board with appropriate plastic bushing, and grounding hardware.
 - 3. Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage PDS systems. PDS system cabling may be installed in underground pull boxes with other low-voltage systems provided:
 - a. Installation meets/complies with all applicable codes and standards.
 - b. PDS system cables shall be separated by at least 12 inches from any non-shielded wire/cable.
 - 4. Raceway Bends:
 - a. Bend raceway with minimum inside radius of 6 times the internal diameter.
 - b. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction.
 - c. Pull and splice boxes shall not be used in lieu of a direction change in raceway.
 - d. Install raceways so no more than 180-degrees of total bend are present between any two pull points in any raceway section without pull box.
 - 1) Install additional pull boxes as required to maintain maximum of 180-degrees in total bend between pull boxes and/or termination points.

- 2) Label all raceway at both ends to indicate destination and PDS source room.
 - a) Length of raceway and labeling/identification shall be fully documented in as-built drawings.
 - b) As-built conduit/raceway marking nomenclature shall match exactly Identification Label format according to GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document
 - c) Label PDS Conduits per GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document.
 - 3) Install polyester pull cord/pull tape in each conduit whether used or empty.
 5. Pathways/raceways at terminal board locations shall be racked on a c-channel / strut channel (e.g. Unistrut / Kindorf) type rack secured to wall above and below terminal boards.
- C. Penetrations/Fire Stop:
1. Make no penetration in floors, walls or ceilings without the prior consent of the Authority/OAR. It is the responsibility of the Contractor to firestop all rated walls, penetrations, and conduits affected to code compliant condition.
 2. Where penetrations through acoustical walls or other walls for cable-ways have been provided, such penetrations shall be sealed in compliance with applicable code requirements and the Contract Documents.
 3. Where penetrations through fire-rated walls for cableways have been provided, such penetrations shall be as required by code and the Contract Documents. Submit details of any special systems to be used.
 4. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided and installed.
 5. Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.
 6. Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.
 7. Attach UL Label to wall adjacent to each instance of firestopping.
- D. Sleeves:
1. Install rigid steel conduit sleeves with bushings on both ends at penetration of all walls above ceilings. Stub-out each side of wall a minimum of 8 inches or as per design.
 2. Install firestopping at sleeves and all rated firewall/smoke wall penetrations. Stub-out wall as required for routing. Firestopping assembly must comply with UL for wall routing, material and cable used.
 3. Size sleeves as required by the NEC for cable installed, but in no case shall sleeve be less than 2 inch diameter, nor smaller than that required by "4" below.
 4. Sleeve size shall not be smaller than that required by ANSI/TIA-569, Table 4.1-1, "Conduit Sizing."
- E. Cable Support:
1. Cable shall be supported in raceways according to this specification

document.

- F. Termination Locations:
1. Install vertical wireway to point within six (6) inches of each side of ceiling to facilitate ceiling penetrations.
 2. Size wireway as required for cables and meet percent fill requirements of applicable codes/standards.
 3. Provide bushings on each end of wireway, including grounding hardware, ground.
- G. Telecommunication Outlet (TO) Horizontal Pathway:
1. Minimum size to be 1" C. Increase size of raceway to properly accommodate number of cables.
- H. Backbone Conduit and Pathways (Intra-building or Inter-building):
1. Install raceways as required above under "General."
 2. Minimum size: 2" C.
 3. Increase size of conduit/raceway/pathway called for above if larger size is called for on drawings or larger size is required.
 4. Conduit/raceway/pathway size shall not be smaller than that required by ANSI/TIA-569, Table 5.2-1, "Conduit Fill for Backbone Cable." Conduit size shall be based on type of cable and quantity of cables.
 5. Install per applicable sections of these specifications and all applicable codes/standards.
- I. Pull-boxes, Splice (Junction) Boxes, Outlet Boxes, Termination Enclosures:
1. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.
 2. Where cables can be exposed in pull boxes, label the cables per the GOAA Labeling Plan.
 3. All pull boxes installed to serve more than two 1" conduits shall be labeled and marked on as-built drawings.
 4. All backbone and horizontal pathways (no exception unless in writing from Owner) pull boxes shall be placed in conduit run where:
 - a. The length is over 100 feet.
 - b. Total of all bends exceeds 180 degrees.
 - c. There is a reverse bend.
 - d. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend.
 - 1) Every pull box shall have a hinged cover:
 - a) Install appropriate access panel to allow cover to open.
 - b) No backbone cabling shall rest on hinged cover when cover is closed. All cable shall have its own service loop coil support. No stick-on cable anchors are allowed.
 - 2) The corresponding conduit ends shall be aligned with each other.
 - 3) Conduit fittings shall not be used in place of pull boxes.

- 4) Backbone cable pull-boxes shall have kindorf strut or equivalent secured to inside top to support cables' service loops.
- 5) No cable is to be supported by or strapped to another.

J. Horizontal Conduit and Pathways:

1. Size: Minimum pathway size to be 1" C.
2. Flexible conduit is not allowed.
3. Conduit type for location within Airport Property is per GOAA requirements, Codes, and Regulatory and Reference documents specified within this document.
4. Outlet boxes shall be installed at locations shown on drawings per applicable codes/standards.
5. Where a pull box is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pull box.
6. Where a pull box is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
 - a. For straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway.
 - b. Have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least: six times the trade size diameter of the raceway; or six times the trade size diameter of the larger raceway if they are of different sizes.
 - c. For a raceway entering the wall of a pullbox opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
7. Where a splice box is used with raceway, it shall be sized per ANSI/TIA-569, Table 4.4-2, "Splice Box Sizing".
8. No box shall be smaller than that required by NEC 370-28 (a), (1) and (2).

3.8 TERMINATION BACKBOARDS

A. Terminal Boards:

1. Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.
2. Install termination backboards plumb, and attach securely to building wall at each corner.
3. Finish paint termination backboards with durable gray paint having flame spread rating of Class A prior to installation of any equipment on termination boards.
4. Mark all TTBs with TTB#.

3.9 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. All cable shall include additional accessories such as clamps, supports, mounting hardware, straps, anchoring structures, termination hardware, etc. necessary to provide an industry standard installation in intended environments. Accessories to include but are not limited to specifications within this document.

- C. All cable shall be kept on reels until it is installed. Do not roll or store cable reels without an appropriate underlay and the prior approval of the OAR. Cable on reels shall be handled, loaded, unloaded and transported by approved machinery equipped specifically for these operations.
- D. Replace any cable found to be defective.
- E. Do not install any Premise Distribution System cabling alongside any power circuit or device. Premise Distribution System cabling shall not share the same raceway, channel or sleeve with electrical circuits or devices.
- F. Ensure, during installation, that the maximum pulling tensions and bend radii of the Premise Distribution System cabling (both backbone and horizontal) are not exceeded.
- G. Install cables in accordance with manufacturer's instructions and ANSI/TIA 568.
- H. All cables shall be installed as illustrated on the drawings except where necessary to avoid EMI sources or other obstacles.
 - 1. The Authority/OAR must approve major deviations from the illustrated path in advance.
 - 2. No splices unless specifically noted otherwise.
 - 3. Provide adequate cable size and length for each backbone/riser run.
 - 4. All backbone cable shall be labeled per GOAA Standard Labeling Plan at every location where the cable could be exposed.
 - a. This includes all pull boxes and pull through locations.
 - 5. Provide and install riser/backbone cable that meets performance requirements specified, and links all systems room locations indicated on Contract Documents.
 - 6. Spare Cable (During Installation):
 - a. The following spare cable lengths are to be left at termination ends of conduits after termination is completed:
 - 1) Main Distribution Frame (MDF) Rooms: Fiber and copper cables terminating MDF Rooms shall have enough spare cable length left to be routed to any point in the room from point of entrance to the room.
 - 2) Intermediate Distribution Frame (IDF) Rooms: Fiber and copper cables terminating in the IDF Rooms shall have enough spare cable length left to be routed in industry standard workman like manner, from the point of entry into the systems room, to the farthest equipment rack or backboard, then down to the floor plus three (3) feet.
 - 7. Telecommunications Outlets: At the TO's, cables shall terminate with a minimum of twelve (12) inches of spare cable length for copper and twenty-four (24) inches of spare cable length for fiber.
 - 8. Install all cables no closer than 12" from any cable installed for Premise Distribution System, power system cable/raceway, or fluorescent/ballasted light fixtures.
 - 9. All PDS cable shall be installed in the appropriate raceway.
 - 10. Provide protection for exposed cables where subject to damage.
 - 11. All cables in systems rooms shall be routed in overhead cable ladder racks and dropped into the appropriate racks utilizing transition pans. All cables

- shall be properly secured to the cable tray, racks, or cabinets.
- a. All fiber cable shall be routed in raceway specifically designed for fiber, and separate from copper cables.
12. Cables shall be terminated to preserve wiring order consistently across all termination (jacks, patch panels, connector blocks and patch cords).
- I. Ensure consistency. Corrections shall be made at no additional cost to the Owner.
 - J. Install appropriate cable to match application, i.e., plenum, riser, etc. All cables shall bear CMP and/or appropriate marking for the application in which they are installed.
 - K. Cables/raceways routed through rated walls; floors and assemblies shall be routed via appropriate fireproofing system as approved by UL.
 - L. Label cable per GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document. This labeling/identification shall be fully documented in as-built drawings.
 - M. Horizontal Cables Copper and Fiber:
 1. Provide and install adequate number cables and cable lengths for each horizontal run.
 2. Horizontal cables shall be terminated on patch panels in rack(s) or fiber LIU.
 - a. Install one horizontal wire manager directly above or below every 24 ports of patch panel(s).
 - b. Terminate all cabling in designate system patch panel where applicable. (i.e. WiFi, CCTV, DS, VMS). Refer to specific labeling requirements for dedicated patch panels.
 3. Shall be labeled per GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document.
 4. Horizontal cables shall be installed in a neat and orderly manner.
 5. Horizontal cables shall be dressed in MFD and IDFs without tangle or inter-wrapping.
 6. Termination of all horizontal station copper cables shall be by PDS contractor and shall be according to ANSI/TIA 568B wiring configuration, all fiber cables by termination methods specified within this document.
 - N. Backbone Fiber Optic Cable:
 1. Install fiber optic cable from each IDF to MDF in innerduct within conduit.
 2. Termination in respective fiber optic patch panel shall be via connectors as described in Part 2 and labeled per GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document.
 3. Provide minimum 15FT feet of slack (service loop) on both ends of each fiber optic cable.
 4. Observe all manufacturer's specifications relative to cable bend radius and pulling tension.
 - a. All fiber cables to be installed without splices except at pigtails in LIU or at outlets.
 - O. Provide adequate quantities and supporting hardware to terminate the quantity of cable pairs and fiber strands in the MDF and all IDF's as required to comply with these specifications.

3.10 ELECTRICAL POWER DISTRIBUTION

- A. Refer to Division 26 and Specification Section 27 05 00 for requirements.

3.11 TRANSIENT VOLTAGE SURGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.12 GROUNDING AND BONDING

- A. Refer to Division 26 and Specification Section 27 05 00 in addition to the following. All telecommunications grounding shall comply with Division 27, regardless of the Contractor performing the work.
- B. Provide and install complete bonding system as required to comply with all sections of these specifications and applicable codes and referenced standards.
- C. Connect all rows of racks and cabinets to Telecommunications Ground Bus (TGB) with AWG #6 THHN green jacket.
 - 1. Each row shall have its own ground cable as described above.
- D. Connect all horizontal and backbone metal conduit (via grounding bushing) to TGB.
- E. Connect cable shields to Rack Grounding Busbar (RGB).
- F. Connect surge suppression equipment to TGB.

3.13 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 and Attachments to this section in addition to the following.
- B. Labeling – General:
 - 1. Cables, pathways, significant Junction Boxes, PDS components etc. shall be labeled at each exposed and termination point and as detailed below at the time of installation. All Unique Cable Identifiers (UCI), Unique Pathway Identifiers (UPI), Unique LIU Identifier (ULI), and similar field characters shall be provided by GOAA to the Installer for use in completing label structure field data.
 - 2. All conduit, pathways, innerducts, enclosures, pull boxes and wireways shall be labeled.
 - 3. Provide and install printed labels for all conduit, pathways, cables, patch cords, frames racks, enclosures, pull boxes etc. See Attachment One: GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document.
 - 4. All labeling shall be in accordance with ANSI/TIA-606. UL and NEMA requirements.
 - 5. All physical location and network identifiers shall be derived from MCO standard GIS fields and characters.
 - 6. All PDS components must be easily identifiable for any person that may need to locate telecommunications equipment, facilities, or circuit information.
 - 7. Cable and equipment management shall be performed using PDS Administration Database program that track all telecommunications circuit components. Coordinate requirements for adding cable and equipment management information to the GOAA PDS Administration Database with

GOAA.

8. All copper and fiber test results must be exportable into format to allow importing into Telecommunications PDS Administration Database.
 9. Hand written labels shall not be acceptable.
- C. Patch Panels:
1. Provide Permanente phenolic label on each “dedicated patch panels” located in the upper left hand side indicating patch panel designation, system designation, and warning; see below example:
 - a. PP-01 CCTV ONLY (PP-xx yyyy ONLY) x=patch panel number, y=System type.
- D. Racks / Cabinets:
1. All Racks and cabinets shall have phenolic label mounted to the top of each rack or cabinet.
 2. Labels shall be ¾” MIN letters and White lettering on black label.
- E. Telecommunication Outlets (TOs):
1. All Telecommunication Outlets (TO) are to be labeled (with appropriate designation labels per GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document see Attachment One for details.
- F. Cables and Pathways:
1. Cables that shall be labeled include but are not limited to backbone, horizontal, patch cords, line cords, and jumpers.
 2. Labels shall be installed for all pathway and cable so they are visible and able to be read by a person standing on floor without moving cables, and if conduit/pathway, labels shall not be obscured by other conduit, or components. Any additional types of labeling materials necessary to keep labels visible shall be provided by the Contractor and installed by the Contractor.
 3. All installed metallic and fiber patch cords shall be labeled.
 4. Pathways are defined but not limited to; any conduit, inner-duct, underground duct-bank, wiring troughs, pull boxes, and any wiring systems used to enclose cabling of any type.
 5. Any pathways or cables whose label format is not specifically mentioned in the GOAA Standard Voice and Data Infrastructure Cable and Pathways Labeling Format document shall still be labeled in a similar format as directed by GOAA OAR/Telecom.
 6. Cable and Pathway Labels shall be electronically generated by thermal transfer printer. All labels with all fields shall be delivered to GOAA electronically.
 7. Cable and Pathway Labels shall be printed in ALL CAPITAL LETTERS. All components follow “End One” / “End Two” format and named for Inventory format following MCO standard GIS fields’ structured labels. GOAA has the right to change field data and label structure without additional costs.
 8. Cable and Pathway Labels shall be printed on adhesive tags no less than 2” in height and permanently placed, longitudinally or flagged. ALL LABELS MUST BE VISIBLE WHEN INSTALLED.
 9. Cable and Pathway Labels shall be made of polyester or similar durable

- material with permanent adhesive characteristics typically found in telecommunication labels. Cable labels to be self-laminating. PER-PROJECT PRODUCTS USED ONLY AFTER SUBMITTALS ARE APPROVED BY GOAA.
10. Cable Labeling - Attached for easy access and visibility to the cable within 12" of entering the LIU or terminating at Patch Panel.
 11. Cable Labeling - Attached for easy access and visibility to the cable 12" – 16" before entering conduit or inner-duct pathway.
 12. Cable Labeling - Attached for easy access and visibility to the cable on service loop on TTB for backbone cables.
 13. When printing labels no line break shall fall in a data field. All line breaks to be after nearest field separating character.
 14. Pathway Labeling - Attached for easy access and visibility to conduit (occupied with cable or inner-duct). Shall be visible without movement.
 15. Pathway Labeling - Attached for easy access and visibility to inner-duct (empty or occupied with cable) 12" – 16" before inner-duct enters conduit pathway.
 16. Inner-duct and cables shall be labeled any time the inner-duct or cable is/can be exposed i.e. pull/junction boxes, manholes, and similar conditions.
 17. Inner-ducts and cables shall be labeled in all pull-boxes, manholes, junction boxes. Labels to be minimum 4IN x 2IN, rated for outdoor use and permanently secured by one tie wrap at each end of label or as approved by GOAA.
- G. The labeling scheme is to enable tracing data/circuit information flow between devices without physically tracing each cable, and will be used to identify the following communications infrastructure components and paths:
1. Where any active Electronic Systems are installed by any party requiring use of new or existing fiber or copper backbone or horizontal cables, the installation of fiber or copper patch cords shall be complete; all patch cords shall be permanently and properly routed in the pathway created for same, and the patch cords shall be labeled on each end with source/destination according to GOAA Labeling Specifications. All patch panel or LIU User Identification tables shall be filled out as to use/user. This must be demonstrated as complete by Substantial Completion inspection.
 2. Each active device and its rack location.
 3. Each patch panel, row and the associated active device.
 4. Each active device cable and the device it is attached to at the other end.
 5. Each dormant cable and its other end.
 6. Each systems room cable and the systems room located at the other end.
- H. All horizontal media (cable) shall be labeled at both ends indicating exact origination and destination information, using basis of design labeling method.
- I. Any patch cords installed in MDFs, IDF, or other rooms shall be labeled according to GOAA Format as provided by GOAA Information Technology Department at both ends.
- J. Passenger Boarding Bridge (PBB) Connectivity Infrastructure

1. The Technology Master Contractor shall label all cable provided by the PBB manufacturer as an extension of building premise distribution to technology and security devices located on the passenger boarding bridge in accordance with the Contract Documents. All points of PBB cabling transition and/or interface to building premise distribution shall be labeled per the PBB cable's identification.
- K. Telecommunications Infrastructure Administration Records:
1. Example Telecommunications Infrastructure Administration Records tables shall be provided by GOAA Information Technology Department.
 2. Installing Contractor shall complete all infrastructure element labeling and Telecommunications Infrastructure Administration Records tables/forms.
 3. Above forms shall be submitted filled out by installing Contractor in their entirety prior to Project Substantial Completion, at the same time all cable test records are submitted.
 - a. Tables shall be submitted in Hardcopy and electronic format.
 - 1) Hardcopy to be submitted in 3 ring binder at same time as cable test records.
 - 2) Electronic file to be submitted in Excel most current version using Arial 10 font size using layout in example provided by GOAA.

3.14 MAINTENANCE AND SERVICE

- A. Refer to Specification Section 27 05 00 for requirements.

3.15 WARRANTY

- A. Refer to Specification Section 27 05 00 for requirements.

3.16 FIELD SERVICES

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. No fiber optic or copper cable shall be put into use without being successfully tested and the test results approved as submitted to the Authority and OAR.
1. All telecommunications cable provided by the passenger boarding bridge manufacturer as an extension of building premise distribution to technology and security devices located on the passenger boarding bridge shall be tested and submitted by the Technology Master Contractor.
- C. Perform all testing where necessary or specified to assure a fully functional system. Repair or replace and retest components that fail performance standards.
- D. Test all cables:
1. Provide all cable test results in both hardcopy and CD format.
 2. The CD shall contain test results in tester native format and exported in comma delimited file.
 3. All Test results shall be submitted in 3 ring binder with Project #, title, date, indicated on spine and front in no less than 24 font size Arial font.
 4. All Binder labeling to be machine printed.
 5. Multiple binders shall also be labeled as volume of total volume set, I.E. 1-3, 2-3, 3-3, etc.
 6. Test instrument data fields shall exactly match PDS component labeling, I.E. Telecommunication Outlets, fiber LIUs, etc., provide exact source/destination

- information for all media tested.
7. All copper backbone testing shall be in its own binder.
 - a. A divider shall be placed between each cable's test results.
 8. All backbone fiber test results shall be in its own binder.
 - a. A divider shall be placed between each cable's test results.
 9. All horizontal copper voice and data cable test results shall be together in a binder, with each Telecommunication Outlet's test results pages together and sequential.
 10. Each volume/binder shall have Installing/Testing Contractors company information and warranty phone numbers to call for service.
 11. Test results submittal shall include calibration certification, within twelve months of the test date, for the test equipment used by the Contractor.
- E. Provide system verification and acceptance documentation signed and dated by the installer.
1. This documentation shall include test measurements and system calibrations performed for the entire system.
 2. Sample system operations shall also be performed with actual hardware or using Contractor provided test equipment and documented to verify that the system is operational and ready for acceptance.
 3. This shall also establish the baseline performance of the system.
- F. Fiber Optic Cable Testing:
1. Each fiber in every backbone inter-building and intra-building cable and every horizontal cable run shall undergo testing in accordance with Annex E of ANSI/TIA-568-C, including Tier 1 testing for length, polarity and Optical Return Loss (ORL), using an Optical Loss Test Set (OLTS), and the additional steps required for Tier 2 testing using an Optical Time Domain Reflectometer (OTDR). The test methods and configuration of equipment and test cords for both Tier 1 and Tier 2 tests shall be as detailed in ANSI/TIA-526-7-A.
 2. Test results shall include a record of:
 - a. Wavelength.
 - b. Fiber type.
 - c. Fiber and cable number.
 - d. Measurement direction.
 - e. Test equipment model and serial numbers
 - f. Date.
 - g. Reference setup.
 - h. Operator (crew members).
- G. Copper Category 6 or higher, UTP & STP Cable Testing:
1. Every cable and connector pin for each horizontal cable run from an MDF or IDF to a Telecommunication Outlet (TO) shall be tested up to 250 MHz for Category 6 rated operation:
 - a. Continuity on each pin.
 - b. Correct pin-pair orientation (wiremap).
 - c. Propagation Delay (100 m).
 - d. Skew (100 m).
 - e. Near end crosstalk (NEXT value).
 - f. Power Sum Near End Crosstalk (PSNEXT).

- g. dB loss (attenuation).
- h. Equal Level Far End Crosstalk (ELFEXT).
- i. Power Sum Equal Level Far End Crosstalk (PSELFEXT).
- j. Return loss.
- k. Cable length.
- l. Presence of AC voltage.
- m. The Category 6 cable shall be tested for the conformance to the specifications of ANSI/TIA 568-D Category 6.
- n. Should UTP cable type in project be changed to make use of updated cable technologies, testing of cable shall conform to latest industry standard and manufacturer's testing requirements to ensure cable has been correctly installed and is operating to specification.
- o. STP cabling shall include the following additional test requirements:
 - 1) Cable shield continuity
 - 2) Power Sum Alien Near-End Crosstalk (PSANEXT) test
 - 3) Power Sum Attenuation-to-Alien-Crosstalk Ratio at the Far End (PSAACRF) test
- p. Category 6A rated cable shall include the following additional requirements:
 - 1) Perform all testing required for Category 6 rated cable up to a frequency of 500MHz for all Category 6A rated cable.

3.17 TRAINING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Training and orientation of installed PDS and OSP components and active equipment shall be provided to the Owner.
 - 1. Training instruction shall include any additional active Systems as required by Project.
 - 2. Training shall cover all locations where PDS and/or Systems have been installed and or modified.

3.18 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Upon completion of the aforementioned tests and before system commissioning and final acceptance, actual voice and data testing shall be performed.
- C. The tests may be performed with existing equipment, if in place, or using contractor provided equipment or test equipment.
- D. The tests shall be performed at Owner's discretion and on a sample basis (10% of installed Telecommunication Outlets, copper pairs, and fiber strands) on various portions of the network as determined by the Authority/OAR.
 - 1. The tests shall be witnessed by the Contractor, the Authority/OAR.
- E. Demonstrate system to designated Owner personnel as required by applicable sections of these specifications.
 - 1. Conduct walking tour of project.
 - 2. Briefly describe function, operation, and maintenance of each component.
 - 3. All pull-box covers shall be removed so Owner can inspect for proper

- installation of cable and labels.
- 4. Provide detailed operation and maintenance instruction and training.
- 5. Use submitted operation and maintenance manual as reference during demonstration and training.

3.19 ATTACHMENTS

- A. Attachment 0 – General Guidelines – Labeling Cable and Pathways (1 page)
- B. Attachment 1 – MCO Information Technology Outlets (ITO) Wiring Detail REV 12
- C. Attachment 2 – Labeling Backbone Fiber Optic Cables – Data Field Definitions

END OF SECTION 27 10 00

ATTACHMENT 0 - GENERAL GUIDELINES – LABELING CABLE AND PATHWAYS

The following pages outline general labeling activities for the various pieces of the GOAA Communications Infrastructure at the Orlando International Airport. Cables, pathways, significant Junction Boxes, PDS components etc. shall be labeled at each exposed and termination point and as detailed below *document not all inclusive. All Unique Cable Identifiers (UCI), Unique Pathway Identifiers (UPI), Unique LIU Identifier (ULI), and similar field characters shall be provided by GOAA to the Installer for use in completing label structure field data.

- Printer, labels, font, font size, and attachment details shall be as specified in GOAA Master Design Guidelines Infrastructure Section: Products section pertaining to approved labeling materials and methods. All physical location and network identifiers shall be derived from MCO standard GIS fields and characters.
- Cable and Pathway Labels electronically generated by thermal transfer printer. All labels with all fields shall be delivered to GOAA electronically.
- Cable and Pathway Labels printed in ALL CAPITAL LETTERS. All components follow “End One” / “End Two” format and named for Inventory format following MCO standard GIS fields’ structured labels. GOAA has the right to change field data and label structure without additional costs.
- Cable and Pathway Labels printed on adhesive tags no less than 2” in height and permanently placed, longitudinally or flagged. MUST BE VISIBLE.
- Cable and Pathway Labels made of polyester or similar durable material with permanent adhesive characteristics typically found in telecommunication labels. Cable labels to be self-laminating. PER-PROJECT PRODUCTS USED ONLY AFTER SUBMITTALS ARE APPROVED BY GOAA.
- Cable Labeling - Attached for easy access and visibility to the cable within 12” of entering the LIU or terminating at Patch Panel.
- Cable Labeling - Attached for easy access and visibility to the cable 12” – 16” before entering conduit or inner-duct pathway.
- When printing labels no line break shall fall in a data field. All line breaks to be after nearest field separating character.
- Pathway Labeling - Attached for easy access and visibility to conduit (occupied with cable or inner-duct). Shall be visible without movement.
- Pathway Labeling - Attached for easy access and visibility to inner-duct (empty or occupied with cable) 12” – 16” before inner-duct enters conduit pathway.
- Inner-duct and cables to be labeled any time the inner-duct or cable is/can be exposed i.e. pull/junction boxes, manholes, and similar conditions.

- Inner-ducts and cables to be labeled in all pull-boxes, manholes, junction boxes. Labels to be minimum 4IN x 2IN, rated for outdoor use and permanently secured by one tie wrap at each end of label or as approved by GOAA.

ATTACHMENT 1 – MCO INFORMATION TECHNOLOGY OUTLETS (ITO) WIRING DETAIL. REV12

THIS ATTACHMENT CONTAINS TWO DIAGRAMS;

1. WIRING / JACK DETAILS

2. FACE-PLATE LABELING DETAILS

1. Standard GOAA ITO Requirements: Each Information Technology Outlet (ITO) shall be installed with Category Cat 6 cable and hardware. All Category 6 products shall be Category 6 component compliant unless specifically noted otherwise. Each GOAA Standard Outlet is served by three (3) Cat 6 UTP cables to the local GOAA communications room and where applicable an additional three (3) Cat 6 UTP cables to local tenant communication room.
2. GOAA offices ITO requirements: GOAA office ITO shall be installed with L4, L5 and L6 cables. All cables are installed back to a GOAA Communications Room (CR) and to a rack mounted patch panel. L1, L2 and L3 are blanked. Cables may be added in location(s) per project design. If L1, L2 or L3 are added to a GOAA ITO, the bezels are to be blue.
3. Tenant ITO requirements: Tenant ITO shall be installed with *L1, *L2, *L3, L4, L5 and L6 cables. Tenant ITO shall use L1, L2 and L3 as Tenant only cables and shall be cabled to Tenant space, where typically a Tenant has assigned space within their leased locations to place their private LAN or Point of Sale (POS) network electronics.*Cables L1, L2 and L3 (all with green bezels) may be eliminated if Tenant does not require them. If an ITO is installed without cables L1, L2 or L3, blanks shall be placed in each unused faceplate positions. If Tenant requires higher "L" density, Information Technology Outlet Plus (ITOP) can be used.
4. Non-Tenant, non-GOAA office ITO requirements: such as CUTE, CUPPS, counters, bag make-up floor areas, bag make-up controllers/stations, etc.); shall be installed with L4, L5 and L6 cables. All cables are installed back to a GOAA CR and to a rack mounted patch panel. L1, L2 and L3 are blanked. If increased L densities are required, Information Technology Outlet Plus (ITOP) can be used.
5. All GOAA ITO cables shall be installed unbroken back to a GOAA CR as indicated on the drawings, or as directed by the Owner's Authorized Representative (OAR) and shall be punched down on a GOAA Information Technology patch panel mounted in an open rack. 110 blocks are not to be used for termination. Patch panel locations are to be in accordance with the rack elevations, or as directed by the OAR. All Tenant wiring shall also be installed unbroken end to end.
6. For L1, L2 and L3 jacks / cabling / associated components for Tenant Premise Distribution System (PDS) wiring that has cable staying within Tenant Space and terminated only to Tenant Equipment in Tenant Space; L1, L2 and L3 components specifications are at the Tenants discretion, however it is recommended that GOAA standards be followed.

7. Outlet wire management: all outlet wiring shall have cable management products installed in Work Areas and Communications Rooms; no horizontal wiring shall be self-supporting or supported by tie-wraps to other cables.
8. Cable testing: all cables / jacks installed shall be fully tested in accordance to TIA-568-C.2 and TIA 1152-A requirements by field test devices. Test results SHALL be saved and submitted to Greater Orlando Aviation Authority in a GOAA approved electronic format. GOAA reserves the right to update the electronic format without cost. Testing shall be completed after fiber and copper cabling are in place and secure. Testing shall be submitted to GOAA by Substantial Completion or prior to being put into use, whichever comes first.
9. Information Technology Outlet Plus (ITOP): in some conditions, to increase Tenant LAN jack densities, such as in training rooms, call centers, or similar, (ITOP) may be added to supplement areas served by ITOs. Such applications shall be approved in writing prior to installation. ITOPs shall supplement ITOs, not replace ITOs. Labeling Information Technology Outlet Plus (ITOP) shall follow DIAGRAM TWO in this attachment. Under counter Information Technology Outlets (ITOs) may be side access multi-media outlets in specific designs authorized by Information Technology department.
10. Information Technology Outlet Plus (ITOP): in some conditions the exact configuration of Information Technology Outlets (ITO) fiber and copper connectivity shall vary to accommodate the design intent, such as; Flight Information Displays (FIDs) monitors, Training Centers, multi-purpose kiosks, etc. It's not the intent of this Information Technology Outlet ITO configuration meet all requirements. In SPECIAL CONDITIONS refer to the Contract Documents or consults with the OAR to obtain written authorization to deviate from this ITO configuration.
11. Cables shall be in hard-wall metallic conduit following GOAA construction specifications section Division 27 or per Project written design requirements. Conduit can be trunk/branch system, following TIA / EIA conduit sizing and maximum degree of bends allowed.
12. For GOAA complete copper and fiber infrastructure design requirements and connectivity components performance specifications see GOAA Master Design Guideline sections 27 10 00 Structured Cabling.
13. Any single wall phone height telephone jacks called for shall have type Cat 6 cable and matching components, and a single position wall phone jack.

DIAGRAM ONE: REQUIRED JACK POSITIONS IN FACE PLATE

V1 - LAN Jack 568B

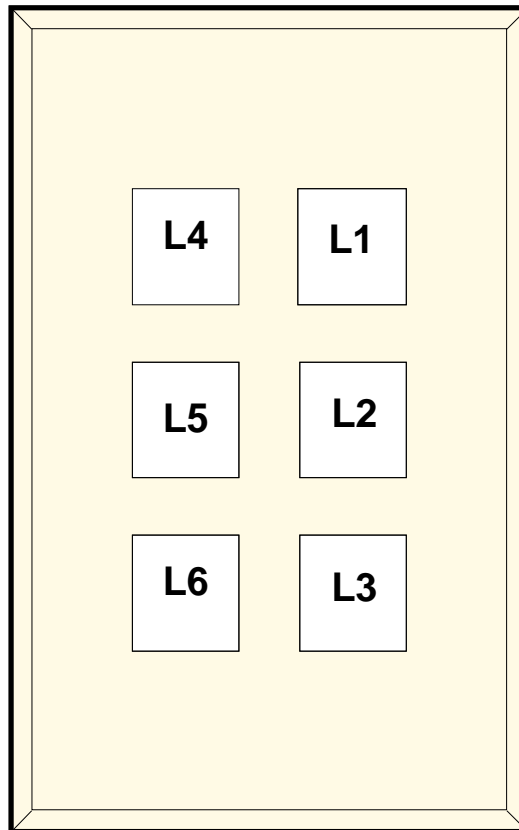
- CATEGORY 6
- RJ45
- BLUE BEZEL

L4 - LAN JACK 568B

- CATEGORY 6
- RJ45
- BLUE BEZEL

L5 - LAN JACK 568B

- CATEGORY 6
- RJ45
- BLUE BEZEL



L1 - LAN JACK 568B

- CATEGORY 6
- RJ45
- GREEN BEZEL

L2 - LAN JACK 568B

- CATEGORY 6
- RJ45
- GREEN BEZEL

L3 - LAN JACK 568B

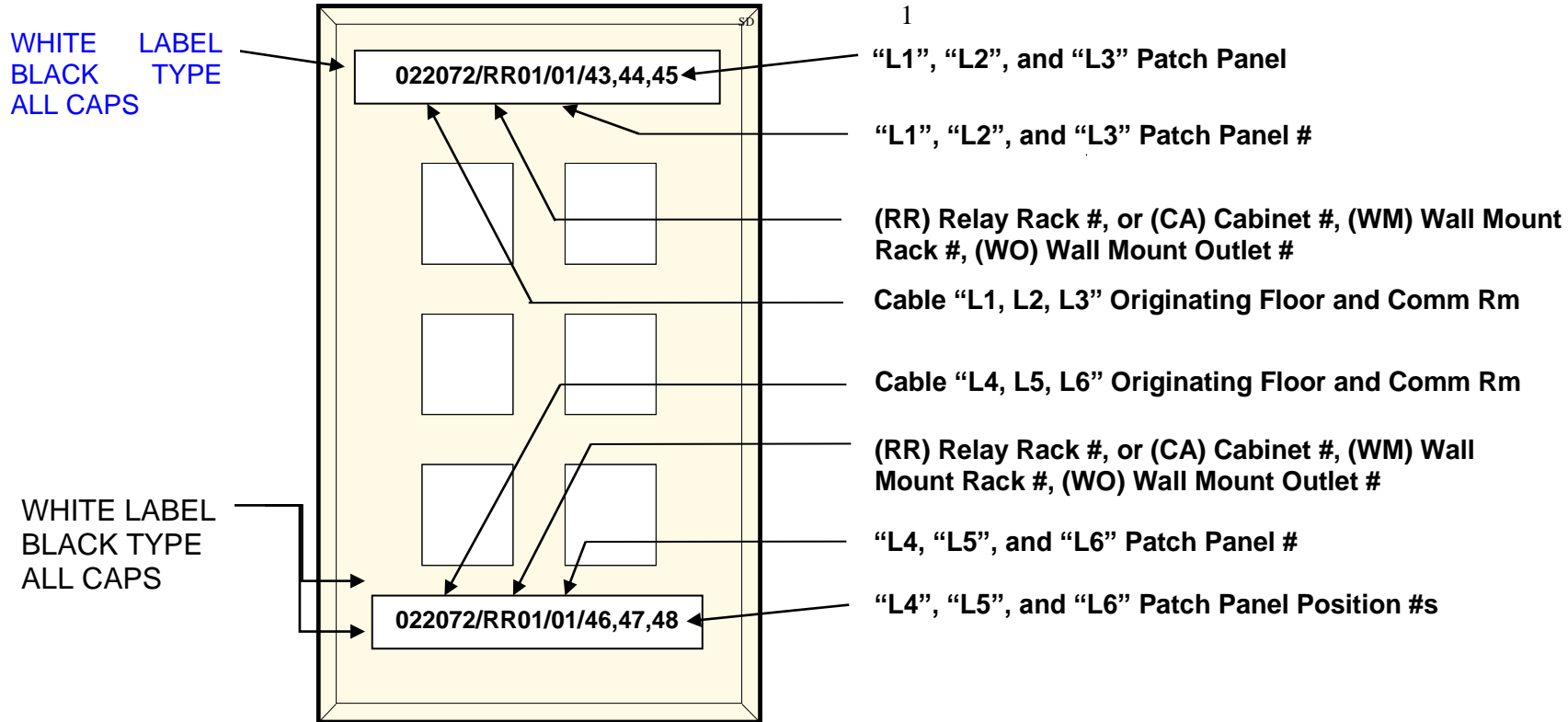
- CATEGORY 6
- RJ45
- GREEN BEZEL

For GOAA-only spaces, L1, L2, L3 shall have blue bezel if positions are required.

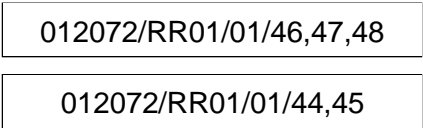
DIAGRAM TWO: LABELING OF FACE PLATE

No handwritten labels are allowed. Do not remove adhesive backing from typical label printers for under lenses' labels. Insert labels under clear lens top and bottom of outlet as shown below. Do remove backing for L1 and L2 label

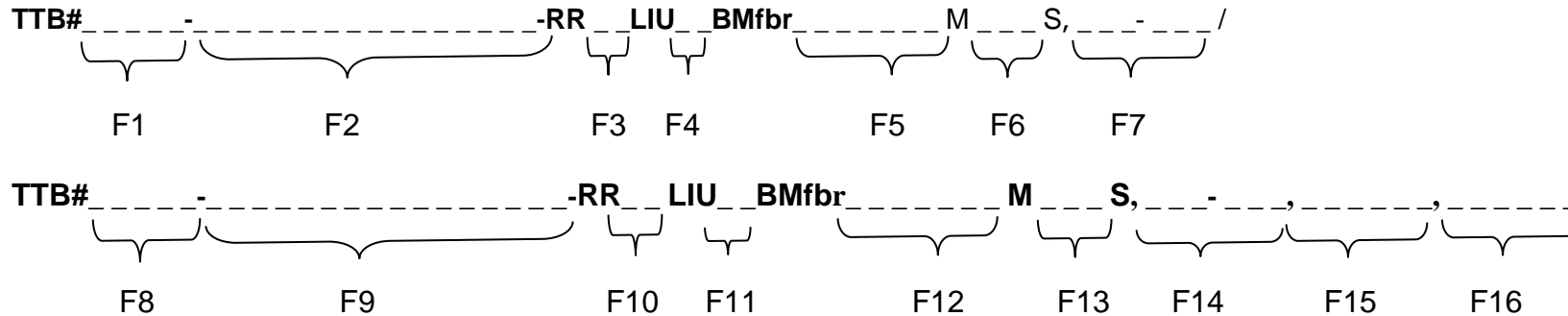
NOTE: All horizontal cables to be labeled behind the patch panel approx 4 inches from the termination fan-out with the room/relay rack/port clearly visible without moving cables.



Duplicates of all three labels with adhesive backing removed to be placed side by side on the suspended ceiling metal support runner ("T bar") above the ITO. If the ceiling is higher than normal office space these labels shall be placed on millwork or other above the (ITO) or (SDO) clearly visible without moving furniture or equipment.



LABELING BACKBONE FIBER OPTIC CABLES – DATA FIELD DEFINITIONS
Physical Layer Administration - Attachment Two R3



1. Enter all characters; commas, dashes, slashes etc. exactly as shown in format and Figure 1. Match line breaks in Figure 1.
2. Where fields are not completely filled left to right, enter zeroes on left of data to fill all field character spaces.
3. Print same label for all placements; do not exchange End 1 and End 2 position in label fields.
4. Complete label as shown here is required at each cable end. Place on cable, exterior to LIU within 12 inches of LIU in clearly viewable location.
5. Duplicate of label shall also be placed on LIU front panel exterior in front of bulkhead positions of cable.
6. One extra copy of each cable label shall be printed and submitted to Telecom as record, used for field QC.
7. Cable shall be tagged with 10 character UCI# in each manhole, junction box, trough, conduit exit location, and similar locations where cable may be exposed.
8. Excel table will be submitted on 3.5IN disk to Contractor for used in gathering cable information. Contractor to return same table on 3.5IN disk or CD filled out in entirety as a record document.

F1: End 1 TTB# provided by Project and/or GOAA Information Technology Department 5 characters

F2: End 1 Building-Area-Room Number (Space Designation) provided by GOAA and/or Project, 16 characters

F3: Relay Rack Number (RR) 2 characters. If a Cabinet is used, (RR) is to be replaced by (CA). If LIU being installed for cable is Wall Mount use (WM).

F4: Light Interface Unit (LIU) 2 characters

F5: Backbone Multi-mode (BMFBR), Single-Mode (BSFBR) or Composite (BCFBR) and Unique Cable Identifier (UCI) 4 characters. UCI provided by GOAA Information Technology Department.

F6: Fiber strand qty of each type under this one jacket. "3 characters M 3 characters S". 096M000S denotes 96MM zero SM. 072M096S denotes a Composite cable.

F7: Bulkhead Position Range 3 characters – 3 characters

F8: End 2 TTB# provided by Project and/or GOAA Information Technology Department 5 characters

F9: End 2 Building-Area -Room Number (Space Designation), provided by GOAA and/or Project, 16 characters

F10: Relay Rack Number (RR) 2 characters. If a Cabinet is used, (RR) is to be replaced by (CA). If LIU being installed for cable is Wall Mount use (WM).

F11: Lightguide Interface Unit (LIU) 2 characters

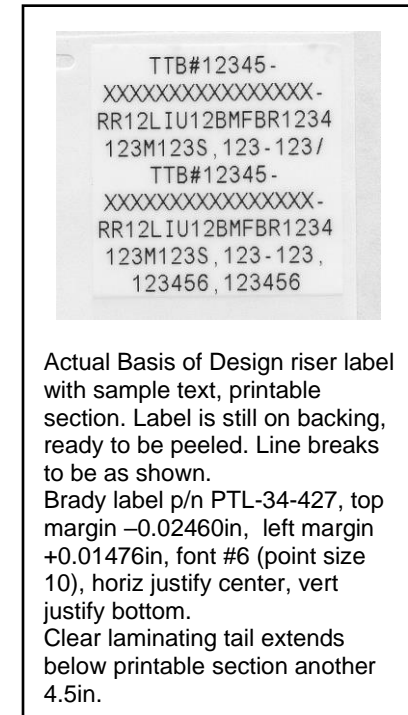
F12: Backbone Multimode or Single-Mode Fiber (**BMFbr**) or (**BSFbr**) Unique Cable Identifier (UCI) 4 characters. This number provided by GOAA Information Technology Department.

F13: Fiber strand qty of each type under this one jacket. 096M000S denotes 96MM zero SM. 072M096S denotes a Composite cable. “3 characters M 3 characters S”.

F14: Bulkhead Position Range 3 characters – 3 characters

F15: Length in feet 6 characters, no commas in number.

F16: Date Installed 6 characters, date format to be month, day, last two digits of year; “012218”.



SECTION 27 10 05 – PASSIVE OPTICAL NETWORK

PART 1 - PART 1 - GENERAL

1.1 STIPULATIONS

A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.

B. Related Specification Sections:

1. 26 05 00 – Common Work Results for Electrical
2. 26 05 19 – Building Wire and Cable
3. 26 05 26 – Grounding and Bonding
4. 26 05 29 – Hangers and Supports
5. 26 05 33 – Conduit
6. 26 05 34 – Outlet Boxes
7. 26 05 35 – Pull & Junction Boxes
8. 26 05 53 – Identification for Electrical Systems
9. 27 05 00 – Common Work Elements for Communications
10. 27 10 00 – Premise Distribution Systems
11. 27 10 10 – Voice Over IP Telephone System
12. 27 10 15 – Wireless Local Area Network System
13. 27 10 20 – Visual Docking Guidance System
14. 27 20 00 – Common Use Systems
15. 27 24 00 – Electronic Gate Systems
16. 27 41 33 – IP Master Antenna Television System
17. 27 42 20 – Electronic Dynamic Signage System
18. 27 51 13 – Emergency Communication System
19. 27 53 10 – Distributed Antenna System – Cellular
20. 27 53 20 – Distributed Antenna System – Public Safety and Facilities Radio
21. 28 05 00 – Common Work Elements for ESS
22. 28 13 00 – Physical Access Control System
23. 28 23 00 – Video Surveillance System

C. Reference Symbols:

1. All device symbols are defined by the appropriate symbol schedule on the symbols and abbreviations sheet in the systems drawing package. Not all device symbols indicated may be required for the project.
2. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Contractor shall coordinate exact locations with all drawings and affected trades prior to submittal of shop drawings.
 - a. The installing Contractor shall coordinate exact locations with all security and telecommunications drawings and site plan drawings as well as all affected trades prior to submittal of any shop drawings.

D. Abbreviations:

1. Refer to Specification Section 27 05 00 for requirements.

E. Definitions:

1. Refer to Specification Section 27 05 00 for requirements.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This is an extension of the existing PON system installed as part of the STC Phase 1 project.
- C. The existing Passive Optical Network (PON) in the South Terminal Complex (STC) shall be extended into the expansion areas of the airside concourse. The system installed shall integrate with the PON headend equipment located in the concourse MDF rooms and support network communications and all connected systems throughout the expansion areas of the STC.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing Sheet T0.00.03 for the work responsibility matrix for the scope of work required for the Passive Optical Network System.
 1. Where listed on the responsibility matrix, the following line items shall be defined as follows:
 - a. Headend and Software: The Authority shall furnish and Authority Vendor shall install all Optical Line Terminal (OLT) cards, connections to core switches and all system management and administrative software, programming and features.
 - b. Integration to Existing System: The Authority shall furnish and install all required hardware, software, programming, protocol converters, interface devices and appurtenances as required to extend the existing STC Passive Optical Network. The contractor shall provide all optical fiber cabling and fiber channeling to achieve this connectivity. Refer to Backbone Cable below for additional information.
 - c. Interfaces: The Authority shall furnish and Authority Vendor shall install all hardware, software, programming, interface devices and appurtenances as required for communication between the PON and other related systems which require network connectivity.
 - d. Network Components: The Authority and Authority Vendor shall furnish and install all Optical Network Terminals (ONTs), network switches, routers and other active elements for network connectivity. The network includes layer 2 access and distribution or layer 3 core and router switches to connect a system to the Authority Passive Optical Lan and Local Area Network.

- e. Backbone Cable: The contractor shall furnish and install all backbone cable. Backbone cable shall include fiber channeling to provide required connectivity to the NTC and existing STC. Contractor shall perform fiber channeling as described in section 27 10 00 and furnish and install all patch cables required for channeling. Contractor shall furnish and install fiber patch cables dressed and routed with the appropriate lengths and labeled per GOAA standards. From each splitter port to each ONT. Provide patch cable labeling and routing plan to the Authority to perform patching onto the splitters and ONTs. Contractor shall also install patch cables onto patch panel and route cable back to OLTs in the MDF with the appropriate lengths, and label per GOAA standards. Provide patch panel port and patch panel labeling information to the Authority to perform patching onto the OLTs. Refer to specification section 27 10 00 for additional information.
- f. Horizontal Cable: The contractor shall furnish and install all horizontal cable. This shall include all cabling to support ONTs. Furnish and install all patch cables for connection of equipment at field ONT locations and in communications spaces (IDFs/MDF). Contractor shall install patch cable onto patch panel and route cable back to ONTs with the appropriate lengths, and label per GOAA standards. Provide patch panel port and patch panel labeling information to the Authority to perform patching onto the ONTs. Refer to specification section 27 10 00 for additional information.
- g. Field Devices: The Contractor shall Furnish and Install all Zone Enclosures, Racks, Cabinets and mounting structures. The Authority shall furnish and Authority Vendor shall install all Optical Network Terminals and Passive Optical Splitters.

1.4 SYSTEMS DESCRIPTIONS

- A. Refer to Specification Section 27 05 00 for requirements.

1.5 SUBMITTALS

- A. Refer to Specification Section 27 05 00 for requirements, in addition to the following.

- B. Mock-Ups

- 1. Prepare mock-ups for each ONT type using Authority-furnished ONTs. Mock-ups shall comply with the following requirements:
 - a. Casework Mount: Install field-mount ONT within a casework mockup and include lengths of cable terminated on the field outlet and patch cords connected to the Authority-furnished ONT to demonstrate cable.
 - b. Display Mount: Install field-mount ONT within a display enclosure and include lengths of cable terminated on the field outlet and patch cords connected to the Authority-furnished ONT to demonstrate cable management within the display enclosure.
 - c. Zone Enclosure Rack Mount: Install rackmount ONT within a zone enclosure and include lengths of cable terminated on the patch panel and patch cords connected to the Authority-furnished ONT to demonstrate cable management within the enclosure.

1.6 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 for requirements.
- 1.7 DELIVERY STORAGE AND HANDLING
 - A. Refer to Specification Section 27 05 00 for requirements.
- 1.8 RECORD DOCUMENTS
 - A. Refer to Specification Section 27 05 00 for requirements.
- 1.9 OPERATIONS AND MAINTENANCE
 - A. Refer to Specification Section 27 05 00 for requirements.
- 1.10 SOFTWARE AGREEMENT
 - A. Refer to Specification Section 27 05 00 for requirements.
- 1.11 SPARE MATERIAL
 - A. All spare active equipment shall be furnished by the Authority.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 in addition to the following:

2.2 HEADEND AND SOFTWARE

A. OPTICAL LINE TERMINAL (OLT)

1. The existing optical line terminals in the existing Airside and Landside phase 1 MDFs shall serve as the core of the Passive Optical Network and shall be equipped with a sufficient quantity of line cards / slots / ports to serve all passive optical splitters and optical network terminals (ONTs) as shown on the contract drawings.
 - a. Additional line cards to match existing shall be added to provide capacity for all network devices.

2.3 FIELD DEVICES

A. PASSIVE OPTICAL SPLITTER

1. The passive optical splitter shall connect multiple ONTs to a single OLT GPON port. Passive optical splitters shall have a fiber connection to both the OLT in the existing Airside MDF and the OLT in the existing Landside MDF. Passive optical splitters shall comply with the following requirements at a minimum:
 - a. LC Angle Polished (LC/APC) type connectors. UPC shall not be acceptable.
 - b. Pre-connectorized (field connectorized splitters shall not be acceptable)
 - c. Mounting: 19" standard ANSI/TIA.

- d. (2) Input Ports for Redundant OLT Connectivity (Connection to each of the two MDF PON OLTs)
 - e. Return Loss: ≥ 55 dB
 - f. Directivity: ≥ 55 dB
 - g. Maximum permissible insertion loss according to number of ports (Input x Output):
 - 1) 2x4: 7.5 dB
 - 2) 2x8: 10.8 dB
 - 3) 2X16: 14.1 dB
 - 4) 2X32: 17.4 dB
 - h. All passive optical splitters shall be planar lightwave circuit (PLC) type. Fused biconical splitter (FBT) type shall not be acceptable.
 - i. All passive optical splitters shall be furnished with cable management provisions.
 - j. All passive optical splitters shall match STC phase 1 splitters.
- B. OPTICAL NETWORK TERMINALS (ONT)
- 1. All ONTs shall meet the following requirements at a minimum:
 - a. 10/100/1000BASE-T Gigabit Ethernet Ports
 - b. Power-Over-Ethernet PoE+
 - c. Link Layer Discovery Protocol (LLDP)
 - d. Media Endpoint Discovery (MED)
 - e. Network Access Control (NAC)
 - f. IEEE 802.1p, 802.1q QoS
 - g. 802.1x Port-Based Authentication
 - h. RADIUS Support
 - i. VLAN Support (25 VLANs per Ethernet port, Tagging/Detagging, Marking/Remarking per Ethernet Port)
 - j. Access Control Lists (ACL) – Layer 2, 3 and 4
 - k. IGMP v2/v3 Snooping
 - l. SC/APC Single-Strand Singlemode fiber connection
 - 2. 4-Port Casework or Display Mount
 - a. Mounting: Shelftop, rack or bracket
 - b. Ports: (4) RJ-45 10/100/1000Base-T Gigabit Ethernet
 - c. Power source: 48VDC or 120VAC
 - d. PoE Capacity: 60W
 - e. Shall be Tellabs ONT205 or approved substitution.
 - 3. 48-Port Rackmount
 - a. Mounting: 19" Standard EIA/TIA
 - b. Ports: (48) RJ-45 Gigabit Ethernet w/POE
 - c. Power source: 120/240VAC
 - d. PoE Capacity: 1000W
 - e. Shall be Tellabs ONT248 or approved substitution.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 in addition to the following.

- B. All active components including Optical Line Terminal Cards and Optical Network Terminals shall be furnished by the Authority and Installed by the Authority Vendor. The Contractor shall fully coordinate all device locations, space and mounting requirements, backbox and enclosure sizing, fiber strand counts, patching, cable terminations, and all other elements as required for a fully functional Passive Optical Network.
- C. Schedule work so as to allow the Authority and Authority Vendor time to complete work in accordance with the Project Schedule.

3.2 EQUIPMENT PROTECTION

- A. Protect all materials, equipment, devices or components permanently installed and/or stored on the job site. Protect all materials, equipment, cabling, devices or components during construction and after installation, provide appropriate protection of all materials, equipment, components and/or devices until time of substantial completion. All materials, equipment, components and/or devices shall be protected during shipment and storage against any physical damage, dirt, moisture, cold, snow or rain:
 - 1. During installation, enclosures, racks\cabinets, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of any foreign matter; and shall be vacuum cleaned both inside and outside before testing and operating and repainting if required.
 - 2. Any materials, equipment, components and/or devices, stored on site which have been deemed by the Authority and OAR to exhibit any indications of damage or exposure dust or moisture shall not be installed and shall be returned to the source of supply for immediate replacement.
 - a. The use of spare parts or the return of defective equipment for repair to mitigate the damage of defective materials, equipment, components and/or devices shall not be acceptable. All materials, equipment, components and/or devices shall be new and unused until final acceptance by the Authority and OAR.
 - 3. Provide and apply protective material immediately upon receiving the products and maintain throughout the construction process.
 - a. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
 - b. Any damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas is not obvious or detectable.
 - 4. Failure to properly protect all materials, equipment, components and/or devices prior to final acceptance shall constitute sufficient cause for rejection of materials, equipment, components and/or devices should any defects, damage or degradation in performance is observed.
- B. Immediately replace all malfunctioning materials, equipment, components and/or devices with new unused products up until the time the Authority and OAR issues final acceptance of the system. The returning of any malfunctioning equipment, devices and/or components to the manufacturer for repair and then reinstallation at the project site shall not be acceptable.

1. All replacement materials, equipment, components and/or devices shall be factory new and not scavenged from the Project's spare parts inventory or factory recycled products unless expressly identified by contractor prior to replacement and approved beforehand by the Authority.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 for requirements.

3.4 EQUIPMENT INSTALLATION

- A. All system equipment installations shall be in accordance with good engineering practices, NEC, local building codes, referenced standards and all manufacturer's requirements. Cable terminations at all equipment locations shall comply with all state and local electrical codes and referenced standards. All wiring shall test free from all grounds, shorts, stray voltages and EMI.
- B. Follow manufacturers' instructions for installing components and adjusting all equipment and cabling. Submit two (2) copies of such instructions to the Authority and OAR before installing any equipment. Provide an additional copy of such instructions at the equipment during any work on the equipment. Where no instructions are included with the equipment, follow accepted industry practices and workmanlike installation standards.
- C. Equipment location shall be as close as practical to locations as indicated on the contract drawings.
 1. Provide all equipment clearances in accordance with NEC and ANSI/TIA requirements. Arrange equipment to facilitate unrestricted access for maintenance and service around all equipment, components and/or cable terminations.
- D. Inaccessible Equipment:
 1. Where the Authority and OAR determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the project.
 - a. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

3.5 INSTALLATION REQUIREMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. General
 1. System/Hardware and mounting must comply with IBC Seismic Requirements.
 2. Where undefined by codes and standards, Contractor shall apply a safety factor of at least 2 times the rated load to all fastenings and supports of system components.

3. The Contractor shall install all system components including furnished equipment in accordance with the manufacturer's instructions, NFPA 70, ANSI-C2 and shall furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
4. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
5. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of not less than three feet and ensure that the cable is long enough to allow full extension of drawer or slide.
6. The Contractor's quality assurance Inspector shall conduct a visual inspection of all installations to verify that the installations are in accordance with the project's and manufacturer's specifications. Records of the inspections signed and dated by the Quality Assurance Inspector shall be provided to the Authority and OAR. Prior to any scheduled inspections the Authority and OAR representative shall be notified by the Contractor of any inspection(s) so they may witness.

C. Hardware Installation

1. Contractor shall ensure the ventilation requirements for the all hardware components are met.
2. The Contractor shall install and inspect all hardware required in this specification in accordance with the manufacturer's installation instructions. Final placement of hardware is subject to the Authority and OAR approval.
3. The Contractor shall be responsible for any and all loss or damage in the shipment and delivery of all material until transfer of title to the Authority.
4. The Contractor shall obtain written permission from the Authority and OAR before proceeding with any work which requires cutting into or through any part of the building structures such as, but not limited to, girders, beams, concrete, carpeted or tiled floors, partitions or ceilings. The Contractor shall obtain written permission from the Authority and OAR before cutting into or through any part of the building structures where fireproofing or moisture proofing could be impaired. In any such case the Contractor shall be responsible for restoring the affected area to "like-new" condition or to a condition to match the existing conditions.
5. The Contractor shall take all steps necessary to ensure that all public areas remain clear or are properly marked during installation or maintenance.
6. The Contractor shall coordinate installation with the Authority and OAR, to minimize disruption of existing business functions at the airport.
7. The Contractor shall place materials only in those locations that have been previously approved. Any other locations shall be approved, in writing, by the Authority and OAR.
8. The Contractor shall label all cabling and patch cords upon installation in accordance with the Authority approved labeling plan. Coordination with the Authority and OAR shall be performed, and all labeling shall be approved, prior to implementation.

D. System Startup

1. The Contractor shall not apply power to the system until after:
 - a. System and components have been installed and inspected in accordance with the manufacturer's installation instructions.
 - b. A visual inspection of the system components has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

- c. System wiring has been tested and verified as correctly connected as indicated.
- d. All system grounding and transient protection systems have been verified as properly installed and connected, as indicated.
- e. Power supplies to be connected to the system and equipment have been verified as the correct voltage, phasing, and frequency as indicated.
- f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.6 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 ELECTRICAL POWER DISTRIBUTION

- A. All 120/208VAC emergency electrical power shall be provided by this Contractor from the nearest emergency distribution panel as required for the proper operation of all communications systems, devices and/or components. Refer to Division 26 and coordinate with the Authority and OAR prior to connections and/or modifications to the electrical distribution panels. Additional locations requiring electrical power by the specific products and/or Contractor-selected equipment shall be the responsibility of this Contractor to include as part of this project to provide a complete functional system.

3.8 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.9 GROUNDING AND BONDING

- A. Refer to Division 26 and Specification Section 27 05 00 for requirements.

3.10 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.11 MAINTENANCE & SERVICE

- A. Refer to Specification Section 27 05 00 for requirements.

3.12 WARRANTY

- A. Refer to Specification Section 27 05 00 for requirements.

3.13 FIELD SERVICES

- A. Refer to Specification Section 27 05 00 for requirements.

3.14 TRAINING

- A. Refer to Specification Section 27 05 00 for requirements.

3.15 PROJECT CLOSEOUT REQUIREMENTS

A. Refer to Specification Section 27 05 00 for requirements.
END OF SECTION 27 10 05

SECTION 27 10 10 - VOICE OVER IP TELEPHONE SYSTEM

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Refer to Specification Section 27 05 00 for requirements.
- B. Abbreviations:
 - 1. Refer to Specification Section 27 05 00 for requirements.
- C. Definitions:
 - 1. Refer to Specification Section 27 05 00 for requirements.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This section includes the requirements for provisions and installation of work and shall be a contractual obligation with the GOAA, the contractor, and GOAAs Vendor inherent responsibility for applying this specification. This specification as well as contract details and drawings define the technical requirements. This section shall apply to the following project components:
 - 1. Airside Concourse Building
- C. The intent of this specification is to establish a standard of quality, functions, and features for the extension of a TCP/IP- based VoIP System into the South Terminal Complex and locations identified in section 1.2-B and as indicated on the contract drawings and/or herein specified.
- D. Telephones, and 3rd party equipment procured as referred to in Section 2.4 Hardware Requirements and Section 2.4-B Accessories and Add-on Components of this document shall be compatible with the existing Avaya VoIP System. The new telephone(s) and 3rd party equipment will be supported by an existing IP PBX system located in the North Terminal Complex. Telephones that require an analog signal shall route through a gateway to convert analog signal to a VoIP signal. Areas throughout the South Terminal shall have dedicated telephones as identified on drawings.
- E. GOAAs Vendor scope of work shall include all necessary modifications, software upgrades and programming as required to seamlessly extend functions and features from the existing system at the north terminal complex to the south terminal complex. GOAAs Vendor shall extend the VoIP PBX system and shall include all work, materials, infrastructure, equipment, software, licensing, programming, coordination with GOAA and contractor as required to provide a fully integrated and operational system as herein specified.
 - 1. The installation, performance, features, functions, software and programming modifications as specified herein as well as all related specification sections have been designed to offer the maximum system efficiency for ease of operation, occupant safety and the protection of equipment as recommended by the Authority and OAR.

2. Prior to the submission of the Bid, any discrepancies or inconsistencies noted within these specifications and/or project drawings shall be brought to the immediate attention of the Authority and Owner's Authorized Representative (OAR).
 - a. Any deviations from the specified criteria shall be documented, reviewed and agreed to in writing by the Authority and Owner's Authorized Representative (OAR) prior to submission of bids. Refer to Division 01, and 27 05 00 Specification Section and 27 10 00 Specification Section for product substitutions.
 - 1) The required information shall include but not limited to: reason for deviation, all differences in performance, operation, and function from the herein specified requirements, all benefits, and added features to owner as a result of the deviations and any additional incurred costs to owner for maintenance and long term ownership. The information shall adhere to the requirements found in Div. 01 and 27 05 00 specifications sections.
 - 2) Failure to provide the Authority and OAR with the required information shall result in all shop drawing submissions being returned for non-conformance with the contract requirements.
 3. It shall be the responsibility of the contractor and GOAAs vendor to coordinate active and passive network electronics, electrical power, UPS units, and ensure that 3rd party equipment installed meets or exceeds every standard set forth in these specifications. GOAA Vendor shall be responsible for providing a complete and functional VoIP enterprise-based system, including all necessary components, devices, servers, active and passive network electronics, electrical power, UPS units, software, programming, commissioning, testing and all appurtenances as well as the integration to all ancillary systems as necessary to provide a complete and fully operational system whether specifically included in this section or not.
 - a. The system shall consist of, but not be limited to, all equipment, devices, servers, administrative workstations, network servers, telephone instruments, network communications equipment, power supplies, conduits, cabling, software, programming and all appurtenances as well as the integration of the facility's Emergency Communications, Paging Systems, airport databases, and all related systems necessary to provide a complete operating TCP/IP based networked system in accordance with the contract documents.
 - 1) The Contractor shall have a registered RCDD professional review and seal all system shop drawings demonstrating industry standard design, installations and certifications of all structured cabling networks related to the installation and operation of the Voice over IP Telephone System and all related TCP/IP based electronic security systems.
 - 2) Refer to Specification Sections 27 05 00 and 27 10 00 for all TCP/IP based cabling requirements.
- F. GOAAs Vendor shall assume total system responsibility for providing all connections and cross-connections to:
1. The Incumbent Local Exchange Carrier, Competitive Local Exchange Carrier, Session Initiation Protocol providers (SIP), Internet Service Providers (ISP), SIP trunks, PRI circuits, inter-office ring, Central Office Lines (CO), or remote off

premises communications by the Authority All Authority provided common carrier network equipment, integration of any Authority provided systems, equipment including but not limited to paging system, tenant equipment, audible loud ringers, external visual indicators, and/or databases as it relates to the operation of the existing IP PBX system.

2. GOAAs Vendor shall coordinate with GOAA and Contractor for incoming services which may be implemented, added, or purchased prior to installation.
- G. The Contract drawings and specifications may not deal individually with every part, control, device, software, or programming, which may be required to produce the equipment and/or system performance specified or as necessary for the installation and integration of all requirements of the Contract Documents.
- H. All references to industry and trade association standards as well as all building codes are minimum installation requirements for this system. The codes, standards and agencies listed in Specification Section 27 05 00 shall form a part of this Specification Section and all work shall comply with the latest adopted standards.
1. The publications listed in Specification Section 27 05 00 (including all amendments, addenda, revisions, supplement, and errata) shall form a part of this Specification Section to the extent referenced. The publications are referenced in the aforementioned Specification Section by the basic designation only.
- I. The Contractor shall coordinate with GOAAs Vendor and GOAA for GOAA purchased devices for initial deployment of the VoIP components which shall consist of, but not be limited to, the following:
1. The Contractor shall furnish and install all phones and accessories not furnished by GOAA and GOAAs vendor.
 2. GOAA vendor shall coordinate with GOAA for computer generated labels that will be applied to the phone identifying its extension and computer-generated labels on telephone soft key buttons. GOAAs Vendor shall furnish printed labels.
 3. Furnish and install all telephone audible and visible enhancement equipment and connectivity that will reside with or on telephones. Refer to spec section Hardware Requirements for furnishing responsibility.
 4. The Division 27 contractor shall install telephones to ADA requirements.
- J. The Contractor shall be responsible for providing all equipment, devices, system components, final cable terminations, programming, commissioning, and testing of all VoIP Telephone components in accordance with all related Division 27 Specification Sections not identified as GOAA Vendor responsibility.

1.3 SCOPE OF WORK

- A. All references to industry and trade association standards as well as all building codes are minimum requirements. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to contract drawing sheet T0.00.03 for the work responsibility matrix for the scope of work required for the VoIP Telephone system and devices.
- C. Where listed on the contract drawing responsibility matrix, the following components shall be defined as follows:

1. Headend and Software: GOAAs Vendor will be responsible for furnishing and installing the Avaya Pod FX headend cabinet, servers, management/administrative software, software licenses, and components which serve the purpose of performing system-wide coordination, monitoring, data processing, control and other global functions.
2. Integration to Existing System: GOAA and GOAAs Vendor will be responsible for furnishing and installing all hardware, software, wiring, cabling, programming, protocol converters, interface devices and appurtenances as required to extend the existing Avaya VoIP telephone system.
3. Interfaces: GOAA and GOAAs Vendor will be responsible for furnishing and installing all hardware, software, wiring, cross connection cabling, programming, interface devices and appurtenances as required for incorporation of analog and IP telephones.
4. Network Switch: Refer to Specification Section 27 05 00 for more information.
5. Backbone Cable: Refer to Specification Section 27 10 00 for more information.
6. Horizontal Cable: Refer to Specification Section 27 10 00 for more information.
7. Field Devices: GOAA will be responsible for furnishing, Avaya telephone instruments. The Contractor shall furnish and install 3rd party visual/audible “ringer” notification appliances. The contractor shall be responsible for distributing and installing all telephone devices and 3rd party equipment not under GOAAs and GOAA vendor contract. Contractor shall provide patch cords.
8. Code Blue phones exterior to the airside concourse shall be furnished and installed by the contractor. Contractor shall refer to section 2.4 Hardware Requirements and related Appendix A for airside Code Blue phone type.

1.4 REFERENCES

- A. Publications and standards listed in Specification Section 27 05 00, 28 05 00 and/or authored by the organizations listed below (including amendments, addenda, revisions, supplement, and errata) shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. All references to industry and trade association standards as well as all building codes are minimum installation requirements for this system. The codes, standards and agencies listed in Specification Section 27 05 00 shall form a part of this Specification Section and all work shall comply with the latest adopted standards.
 1. Where the Contract Documents mandate a greater requirement or performance than those specified by the aforementioned referenced codes and standards, the greater requirement shall be the governing design application for this project.

1.5 SYSTEMS DESCRIPTIONS

- A. Existing VoIP Systems shall serve the telephones shown on plans at the Terminal C PH 1X Complex.

1.6 SUBMITTALS

- A. In addition to all requirements as specified by Division 01 and Specification Section 27 05 00, the Telephone Equipment and components shall also be provided in accordance with the following requirements:
 1. Shop drawings shall detail space conditions to accommodate other concerned trades.

2. Provide a complete signal flow diagram with connectivity component and connectivity identified.
3. Any new integration protocols, communications connectivity and interface components to the facility's VoIP PBX system.

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 for requirements.
 1. The south terminal network infrastructure shall run at a minimum 10Gb/s up/down between the Avaya VoIP Pod FX A and Pod FX B to function correctly.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Refer to Specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

1.10 OPERATIONS AND MAINTENANCE

- A. Refer to Specification Section 27 05 00 for requirements.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. All spare material shall be furnished by the Authority unless otherwise noted. Refer to section 2.4.B for additional information.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 for requirements:

2.2 SYSTEM CONFIGURATION REQUIREMENTS

- A. GOAAs Vendor shall coordinate with GOAA VoIP System configuration which shall include, but not limited to, the following:
 1. The VoIP system shall have priority within a converge network for life safety.
 2. Trunk programming shall be an extension of the NTC existing configuration to the STC. The trunk programming shall be configured to mirror the North Terminal Complex in relation to auto attendant mapping, call routing, zone areas, and voicemail integration.
 3. Shared Tenant Services shall be implemented, whereas GOAA programs, manages, and maintains all voice services for airlines, vendors, agencies (CBP, TSA), and satellite buildings.
 4. The PBX programming between GOAA and tenant services shall not overlap or configured to allow bypass, or interact across operational platforms. Each tenant VoIP partition shall operate as virtual standalone VoIP PBX systems.

5. Administration controls will be managed through GOAA I.T. department.
6. Voice Recording Services shall follow the GOAA current standards.
7. All FDOT 511 calls and customer calls shall be routed to the MPS500 IVR system.
8. Courtesy phones shall only allow local call and shall block any calls to pay services numbers.
9. Code Blue phones located in Terminal C PH 1X Airside Concourse shall be configured to call as follows:
 - a. Emergency Button shall call 911 direct.
 - b. Info Button shall call the help desk.
10. Programming of all telephone system auto attendant, call routing, extensions, grouping, hunt group, forwarding, ring forward, voicemail, DSS buttons, schedules (holiday, after hours, etc.), falls under the Avaya Operations Service's (AOS) agreement and will be programmed, maintained and monitored by Avaya.

2.3 SYSTEM AND SOFTWARE REQUIREMENTS

- A. The Contractor shall furnish and install Code Blue control software ToolVox licensing and service maintenance agreement. ToolVox licensing shall be upgraded or purchased to include emergency phones located in the Terminal C PH 1X Airside Concourse. Contractor shall coordinate with GOAA and GOAAs Vendor for programming and implementation of the software and configuration.

2.4 HARDWARE REQUIREMENTS

- A. Telephones shall integrate with the existing Avaya headend and shall meet or exceed the following models and features. The contractor, GOAAs Vendor, and GOAA shall coordinate and schedule deployment of hardware.
 1. Avaya model J179 shall be implemented for GOAA office and personnel, furnished by GOAA and installed by the Contractor.
 2. Avaya model J159 dedicated for tenant services and operations, furnished by GOAA and installed by the Contractor.
 3. Avaya model J-129 dedicated for tenant services and operations, furnished by GOAA and installed by the Contractor.
 - a. Wall mount kit installed on every phone.
 4. Code Blue exterior application interfaces for the airside concourse shall be CB4-s with IP5000 FP-2 telephone interface. Contractor furnished and installed, refer to Appendix A.
 5. Elevator phone
 - a. Furnished and installed by elevator contractor.
 - b. Division 27 integrator shall coordinate with the elevator contractor for connectivity and final location.
 - c. Division 27 integrator shall furnish and install patch cords from the Low Voltage Demarcation Box in the Elevator Control Room to each elevator controller.
 - d. Division 27 integrator shall furnish and install patch cords to the local gateway in the nearest IDF or Zone Enclosure that feeds the Elevator Control Room's Low Voltage Demarcation Box.
 6. AudioCodes MP114 and MP118 Gateway shall be GOAA furnished and Contractor installed in the nearest Zone Enclosure or IDF for the elevator control rooms:

- a. The Contractor shall identify the quantity of elevators managed/controlled by each control room.
 7. AudioCodes MP114 and MP118 Gateway shall be GOAA furnished and Contractor installed for analog courtesy phones in the nearest Zone Enclosures or IDF.
- B. Accessories and Add-on Components
1. Algo 8028 Door Station. Contractor shall furnish a total of (15) units to GOAA IT department. Contractor shall obtain a signed letter proof of delivery.
 - a. Contractors shall include the Door phone Kit
 2. Algo 8180 SIP Audio Alerter:
 - a. Contractor shall furnish and install a total of (15) units. GOAA and contractor shall coordinate exact installation location. Contractor shall furnish (5) spare units to GOAA IT department. Contractor shall obtain a signed letter of delivery.
 3. SNOM PA1 Outdoor Rated Paging Horn. Contractor shall furnish and install a total of (15) units. Contractor and GOAA shall coordinate exact installation locations. Contractor shall furnish (5) spare units to GOAA IT department. Contractor shall obtain a signed letter of delivery.
 4. Arktel 1185 exterior horn. Contractor shall furnish and install a total of (15) units. Contractor and GOAA shall coordinate exact installation locations. Contractor shall furnish (5) spare units to GOAA IT department. Contractor shall obtain a signed letter of delivery.
 5. Avaya J100 expansion module 24 shall be GOAA furnished GOAA Vendor installed. Expansion module shall have:
 - a. 24 Button
 - b. Ethernet Connection
 - c. Programmable
 - d. Expandable
 - e. GOAA shall furnish a total of (5) units to GOAA IT department. Contractor shall obtain a signed letter of delivery.
 6. Polycom IP5000 GOAA shall furnish (20) units and GOAAs Vendor shall install.

PART 3 – EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 in addition to the following:
 1. Refer to related Specification Sections for additional project coordination requirements. In addition to the requirements defined in this Specification Section, the contractor shall coordinate and meet all requirements addressed in Division 26, Division 27 and Division 28 Specification Section.
 2. The GOAAs Vendor and contractor shall supply all software and hardware necessary for the systems(s) to function as specified.
 3. System Cabling Refer to specifications section 27 10 00 and section 27 10 05.

4. The Contractor shall prepare the necessary documents required for installing, testing, and bringing the VoIP online. Such documents include but are not limited to:
 - a. Project management and quality assurance plans
 - b. Testing plans
 - c. Component and system submittal documents
 - d. Installation plans
 - e. Component design plans
 - f. System user documentation
 - g. As-built drawings and documentation
5. The Contractor and GOAAs vendor shall coordinate with the Authority and OAR to ensure the system meets the requirements. The Contractor shall meet all ADA requirements.
6. The Voice over IP Telephone System (VoIP) shall support the entire airport terminal. The system shall integrate with the existing system and existing hardware.

3.3 EQUIPMENT INSTALLATION

- A. All system equipment installations shall be in accordance with good engineering practices, NEC, local building codes, and all manufacturer's requirements. Cable terminations at all equipment locations shall comply with all state and local electrical codes. All wiring shall test free from all grounds, shorts, stray voltages and EMI.
- B. Follow manufacturers' instructions for installing components and adjusting all equipment and cabling. Submit two (2) copies of such instructions to the Authority and OAR before installing any equipment. Provide an additional copy of such instructions at the equipment during any work on the equipment. Where no instructions are included with the equipment, follow accepted industry practices and workmanlike installation standards.
- C. Equipment location shall be as close as practical to locations as indicated on the contract drawings.
 1. Provide all equipment clearances in accordance with NEC requirements. Arrange equipment to facilitate unrestricted access for maintenance and service around all equipment, components and/or cable terminations.
- D. Inaccessible Equipment:
 1. Where the Authority and OAR determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the project.
 - a. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

3.4 INSTALLATION REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

A. Refer to Specification Section 27 05 00 for requirements.

3.6 ELECTRICAL POWER DISTRIBUTION

A. Refer to Specification Section 27 05 00 for requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

A. Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE & SERVICE

A. Refer to Specification Section 27 05 00 for requirements.

3.11 WARRANTY

A. Refer to Specification Section 27 05 00 for requirements.

3.12 FIELD SERVICES

A. Refer to Specification Section 27 05 00 for requirements.

3.13 TRAINING

A. Refer to Specification Section 27 05 00 for requirements.

3.14 PROJECT CLOSEOUT REQUIREMENTS

A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 10 10

APPENDIX A



Code Blue

CB 4-s

DEALER INFORMATION

Unit Order Form

Dealer:	City: Orlando	State: FL	PO:	Date: 1/30/2021
End User (required for valid order):	City: Orlando	State: FL	Type: Airport	

STANDARD FEATURES



Basic Unit Configuration	Part #	Price	Add
<input checked="" type="checkbox"/> Code Blue 4-standard (CB 4-s), wall or pole mount enclosure		\$295	\$ 295
Color and Graphics Options <input checked="" type="checkbox"/> STANDARD (choose below)		0	\$ 0
Finish Color (choose one)			
Standard Color: <input type="checkbox"/> Safety Blue		\$0	\$ 0
Optional Colors: <input type="checkbox"/> Safety Yellow <input checked="" type="checkbox"/> Safety Red <input type="checkbox"/> Gloss White <input type="checkbox"/> Bright Silver <input type="checkbox"/> Tiger Orange <input type="checkbox"/> Midnight Blue <input type="checkbox"/> Gloss Black <input type="checkbox"/> Dark Bronze <input type="checkbox"/> Cardinal Red <input type="checkbox"/> Medium Bronze <input type="checkbox"/> British Racing Green <input type="checkbox"/> Architectural Gray <input type="checkbox"/> Oak Buff		\$50	\$ 50
<input type="checkbox"/> Custom Color*		\$100	\$ 0
*A physical color sample must be sent to Code Blue for matching. It must be printed or professionally printed and be at least 2x2" in size.			
Clear Coat enclosure (for additional protection - recommended for high iron and saltwater regions)			
<input checked="" type="checkbox"/> CB 4-s	20029	\$100	\$ 100
<input type="checkbox"/> CB 4-s with Dual Faceplates	20093	\$150	\$ 0
Graphics Text (choose one) (2-sided only)			
<input checked="" type="checkbox"/> Emergency <input type="checkbox"/> Assistance <input type="checkbox"/> Help Point <input type="checkbox"/> Police <input type="checkbox"/> Courtesy <input type="checkbox"/> Security <input type="checkbox"/> Information <input type="checkbox"/> [None]...		\$0	\$ 0
Graphics Color (choose one)			
<input checked="" type="checkbox"/> Reflective White <input type="checkbox"/> Reflective Black <input type="checkbox"/> Reflective Blue <input type="checkbox"/> Reflective Red <input type="checkbox"/> Reflective Green <input type="checkbox"/> Reflective Yellow <input type="checkbox"/> Reflective Orange <input type="checkbox"/> [None]		\$0	\$ 0

OPTIONAL FEATURES

Faceplate Opening Options

First Opening (Bottom)	Part #	Price	Add
Speakerphone - IA4100 (analog) <input type="checkbox"/> 1 Button (+\$985) <input type="checkbox"/> 2 Button (+\$1065) <input type="checkbox"/> 2 Button with Keypad (+\$1115)		\$ 0	\$ 0
Speakerphone - IP5000 (IP) <input type="checkbox"/> 1 Button (+\$1460) <input checked="" type="checkbox"/> 2 Button (+\$1595) <input type="checkbox"/> 2 Button with Keypad (+\$1645)		\$ 1,595	\$ 1,595
<input type="checkbox"/> No Phone - blank Lexan plate (units ordered w/o phone will not contain surge suppression)		\$0	\$ 0
<input type="checkbox"/> IP5000 Battery Back-Up	40008	\$95	\$ 0
<input checked="" type="checkbox"/> Clear Coat faceplate (for additional protection - recommended for high iron and saltwater regions)	41460	\$120	\$ 120
<input type="checkbox"/> Custom Silkscreen		\$250	\$ 0

Main Bezel

<input type="checkbox"/> PUSH FOR HELP (+\$0) (standard) <input checked="" type="checkbox"/> EMERGENCY (raised letters w/ Braille) (+\$100)	100	\$ 100	
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Second Opening (Top) (+\$300)

<input type="checkbox"/> Blank Stainless Steel Plate (+\$0) <input type="checkbox"/> Directory (+\$90) <input type="checkbox"/> Custom Camera Cut-Out (call)		\$0	\$ 0
<input type="checkbox"/> Clear Coat 2nd faceplate (for additional protection - recommended for high iron and saltwater regions)	41460	\$120	\$ 0

Remote Mounted Light Option

<input type="checkbox"/> Combination LED blue beacon/strobe kit, low voltage	40525	\$700	\$ 0
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Communication Connection Options

Cellular	Part #	Price	Add
<input type="checkbox"/> 4G/LTE Cellular (+\$1495)	SLNP0020	\$ 1,495	\$ 0
<input checked="" type="checkbox"/> Managed Cloud			
<input type="checkbox"/> VoIP Extension Activation Fee	SLNH0028	\$25	\$ 0
<input type="checkbox"/> VoIP Call Routing Annual Renewal	SLNH0033	\$288	\$ 0
<input type="checkbox"/> VoIP SIM Card for VPN Router	SLNH0040	\$3	\$ 0
<input type="checkbox"/> VoIP Annual Renewal for SLNH0040	SLNH0040-AR	\$264	\$ 0

Note: For Private Cloud, email solutions@codeblue.com. For more information, see SLN-122.

Power (standard 24V)

<input checked="" type="checkbox"/> Power over Ethernet (PoE) Extractor		\$195	\$ 195
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SEE PAGE 2 FOR TOTAL

RESET FORM

Product details: www.codeblue.com/4-series



CB 4-s

OPTIONAL FEATURES - CONT.

Unit Order Form

Mounting Options	Part #	Price	Add
<input checked="" type="checkbox"/> Wall Mount (standard).....		\$0	\$0
<input type="checkbox"/> Pole Mount Hardware Kit (see Parts Order Form, part no. 40027).....	40027	\$195	\$0
<i>NOTE: Banding tool sold separately. See Third Party Products Order Form, part no. 41441</i>			
<input type="checkbox"/> Single Curb Mount Stand (gloss black)	41462	\$615	\$0
<input type="checkbox"/> Single Curb Mount Stand with Clear Coat (gloss black) (recommended for high iron and saltwater regions)		\$715	\$0
<input type="checkbox"/> Dual Curb Mount Stand (gloss black)	40777	\$840	\$0
<input type="checkbox"/> Dual Curb Mount Stand with Clear Coat (gloss black) (recommended for high iron and saltwater regions)	40789	\$940	\$0

RESET FORM

Prices and specifications subject to change without notice. Please contact Customer Service to confirm final pricing at customerservice@codeblue.com.

QUANTITY & TOTAL

Unit Price: **\$ 2,260.00 + \$195 (POE)** X Quantity: **1** = Total Price: **\$ 2,260.00 + \$195 (POE) = \$2455**
(U.S. Dollars - excludes S&H)

SECTION 27 10 15 – WIRELESS LOCAL AREA NETWORK SYSTEM

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.
- B. Related Specification Sections:
 - 1. Refer to Specification Section 27 05 00 for a complete list of related specification sections.
- C. Reference Symbols:
 - 1. All device symbols are defined by the appropriate symbol schedule on the symbols and abbreviations sheet in the systems drawing package. Not all device symbols indicated may be required for the project.
 - 2. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Contractor shall coordinate exact locations with all drawings and affected trades prior to submittal of shop drawings.
 - a. The installing Contractor shall coordinate exact locations with all security and telecommunications drawings and site plan drawings as well as all affected trades prior to submittal of any shop drawings.
- D. Abbreviations:
 - 1. Refer to Specification Section 27 05 00 for requirements.
- E. Definitions:
 - 1. Refer to Specification Section 27 05 00 for requirements.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The intent of this specification is to establish a standard of quality, functionality, and features for the extension of the existing Authority Wireless Local Area Network System (WLAN) throughout the airside concourse expansion of the South Terminal Complex. The WLAN shall be an extension of the Authority's existing Aruba / HP Enterprise (Authority Vendor) system as indicated on the Contract Drawings, unless directed otherwise by the Authority. The WLAN shall provide wireless network connectivity to passengers, Authority staff and personnel, tenants, and other stakeholders as well as specified building systems in areas of the South Terminal Complex identified in the Contract Documents.
- C. The WLAN shall also include a segregated portion of the system dedicated to exclusive use by Customs and Border Protection (CBP) officers and staff. Wireless Access Points furnished for CBP use shall not be available for use by GOAA or the public.

- D. WLAN “coverage” is defined as a minimum received signal strength indication (RSSI) of -67 dBm or greater and a minimum available throughput of 4Mbps to each connected device. Areas of the airside concourse expansion which shall receive WLAN coverage include, but are not limited to:
1. Airside Concourse – Gate Holdrooms
 2. Airside Concourse – International Arrivals Corridor (Sterile Area and FIS)
 3. Ramp Area – All gates, complete tail-forward aircraft coverage
 4. All public circulation areas in every portion of the airside concourse.
- E. The WLAN system shall incorporate a Bluetooth Beacon system to provide indoor wayfinding capabilities as part of the Authority’s mobile device application (“mobile app”). Coordinate with the GOAA IT to integrate the airside concourse expansion Bluetooth wayfinding system with the existing Authority system. This integration shall result in a seamless wayfinding experience between the NTC and STC and STC airside concourse expansion.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing Sheet T0.00.03 for the work responsibility matrix for the scope of work required for the Wireless Local Area Network System.
1. Where listed on the responsibility matrix, the following line items shall be defined as follows:
 - a. Headend and Software: The authority shall furnish and install all required master and slave wireless access point controllers, all connections to core switches and optical line terminals, patch cords and all system management and administrative software, programming and features. The Contractor shall coordinate communications room (MDF / IDF) space requirements and availability.
 - b. Integration to Existing System: The Authority shall furnish and install all required hardware, software, programming, protocol converters, interface devices and appurtenances as required to extend the existing Aruba WLAN and Bluetooth Wayfinding (Beacons) system from the existing system. The Contractor shall coordinate such activities to comply with the Project Schedule.
 - c. Interfaces: The Authority shall furnish and Authority Vendor shall install all hardware, software, programming, interface devices and appurtenances as required for communication between the WLAN and other related systems which require WLAN connectivity.
 - d. Network Switch: The Authority shall furnish and install all required network switches and other active elements for network connectivity. The network includes layer 2 access and distribution or layer 3 core and router switches to connect a system to the Authority Passive Optical Lan and Local Area Network. Contractor shall coordinate patching into the network with the Authority and provide all patch cables as required. Passive Optical LAN components are specified in Section 27 10 05 for ASC and LST work and include Optical Line Terminals (OLTs) and Optical Network Terminals (ONTs). Refer to related specification sections for additional information.

- e. Backbone Cable: The Contractor shall furnish and install all backbone cable. Work shall also include all fiber channeling for a complete and operational system. Contractor shall perform fiber channeling as described in section 27 10 00 and furnish and install all patch cables required for channeling. Refer to specification section 27 10 00 for additional information.
 - f. Horizontal Cable: The Contractor shall furnish and install all horizontal cable. Furnish and install all patch cables for connection of equipment at WAP locations and in communications spaces (IDFs/MDF). Contractor shall install patch cable onto patch panel and route cable back to ONTs with the appropriate lengths, and label per GOAA standards. Provide patch panel port and patch panel labeling information to the Authority to perform patching onto the ONTs. Refer to specification section 27 10 00 for additional information.
 - g. Field Devices: The Authority will furnish and Contractor shall install Wireless Access Points (WAPs), antennas and Bluetooth Wayfinding Beacons. The Contractor shall furnish and install housings, and mounting brackets. Contractor shall furnish patch cords and coordinate unique device identifiers with the Authority and OAR and label WAPs accordingly.
- C. The Authority shall provide all necessary modifications, software upgrades and programming as required to seamlessly integrate the expansion WLAN with the existing HP / Aruba Networks system located at the North Terminal Complex. The WLAN shall be an extension of the existing system and shall include all, equipment, software, and programming as required to provide a fully integrated and operational system as herein specified. The Contractor is responsible for all Fiber Channeling to achieve the required connectivity to the North Terminal Complex.
- D. The Authority shall be responsible for integration of the expansion WLAN with the South Terminal Complex Local Area Network (LAN) / Passive Optical Network (PON), existing Authority network(s), and connected tele/data systems.
- E. The Contractor shall be responsible for providing all cabling, cable terminations, conduits/raceways, racks, cabinets, commissioning, and testing of all network communications cabling and equipment in accordance with all related Division 27 Specification Sections.
- a. The Contractor shall have a registered RCDD professional review and seal all system shop drawings demonstrating industry standard design, installations and certifications of all structured cabling networks related to the installation and operation of the Wireless Local Area Network System.
 - b. Refer to Specification Sections 27 05 00 and 27 10 00 and for all TCP/IP based system cabling requirements
- F. The Contractor shall install all Authority-furnished Wireless Access Points and Bluetooth Wayfinding Beacons in the locations shown on the Contract Drawings. Perform pick-up of all Authority-Furnished equipment in accordance with Specification Section 27 05 00.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 for requirements.

1.5 SYSTEMS DESCRIPTIONS

- A. Refer to Specification Section 27 05 00 for requirements.

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 for requirements in addition to the following.
- B. The Contract Drawings detail typical mounting conditions and do not necessarily reflect all possible mounting configurations. The Contractor shall submit all WAP mounting details as part of Shop Drawings.
- C. Mock-Ups
 - 1. Prepare mockups for each wireless access point mounting type using approved mounting brackets and Authority-furnished wireless access points. Mock-ups shall comply with the following requirements:
 - a. Demonstrate means of securing the WAP and bracket/housing to the structure.
 - b. Demonstrate the appearance and finish of the installed products.
 - 2. Mock-Ups shall encompass the following:
 - a. Wall Mount: Construct a 2'x2' section of wall to match the actual mounting surface.
 - b. Ceiling Mount: For each mock-up, include a 2'x2' section of the ceiling finish to which WAP will be mounted. If the ceiling consists of prefabricated panels or tiles, utilize a tile or panel for the mock-up. If the WAP is to be mounted to a supporting grid or system, demonstrate attachment to the grid in the mock-up.
 - 3. Specialized Mounts: For all other mounting conditions, construct a mock-up that demonstrates the structural and aesthetic features specified.

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 for requirements.

1.8 DELIVERY STORAGE AND HANDLING

- A. Refer to Specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following:
 - 1. Provide floor plans indicating the location of each WAP and unique identification number associated with MAC address and serial number of each device.

1.10 OPERATIONS AND MAINTENANCE

- A. Refer to Specification Section 27 05 00 for requirements.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 for requirements.

2.2 SYSTEM REQUIREMENTS

- A. WLAN system configuration shall include, but not be limited to, the following:
 - 1. All network configuration tasks including, but not limited to, assignment of IP addresses or configuration of DHCP as directed by the Authority and OAR.
 - 2. Setup of system administrative features such as traffic monitoring, security/firewall settings, and other functions as directed by the Authority and OAR.
 - 3. Configuration of public WLAN such that users encounter a seamless experience between the NTC and STC. The BSSID for public use in the STC shall match that currently implemented in the NTC.
 - 4. Configuration of additional BSSIDs for various tenant users and stakeholders as directed by the Authority and OAR. BSSIDs shall match those in the NTC as applicable and as directed by the Authority and OAR.
 - 5. Adjustment of WAP and Bluetooth beacon locations, antenna orientation and configurations to achieve the desired signal coverage, throughput, and wayfinding functionality in areas of the terminal as specified in the contract documents.
 - a. The Contractor shall continue to provide adjustments until performance is achieved to the satisfaction of the Authority and the OAR at no additional cost to the Authority.
- B. Contractor shall coordinate with the Authority to ensure proper placement, configuration and performance of the WLAN in accordance with the manufacturer's published system and device documentation and all requirements of the Contract Documents.

2.3 SOFTWARE REQUIREMENTS

- A. The Authority shall provide all WLAN software requirements.

2.4 HARDWARE REQUIREMENTS

- A. Wireless Access Points (WAPs)
 - 1. Indoor Omnidirectional WAPs shall, at a minimum, meet the following feature requirements:
 - a. Wireless Standards: 802.11ax, 802.11ac Wave2, 802.11n, 802.11g, 802.11a and 802.11b
 - b. Dual radios, 2.4GHz and 5GHz frequency bands
 - c. Multi-User, Multi-Input Multi-Output (MU-MIMO) with up-link and down-link
 - d. (4) spatial streams

- e. 4x4 MIMO
 - f. Maximum concurrent bandwidth: 4.8Gbps (5GHz), 575Mbps (2.4GHz)
 - g. Maximum connected devices per radio: 256
 - h. Maximum number of BSSIDs: 16
 - i. Maximum aggregate transmit power: +24dBm (2.4GHz), +24dBm (5GHz)
 - j. Integrated Bluetooth Low Energy (BLE) radio
 - k. Indoor Omnidirectional WAPs shall be Aruba AP-535 or most current version, no approved substitution.
2. Outdoor Omnidirectional WAPs shall, at a minimum, meet the following feature requirements in addition to those listed under Indoor Omnidirectional WAPs above:
 - a. Operating Temperature: Temperature: -40° C to +70° C (-40° F to +158°F)
 - b. IP67 and NEMA 4X rated included housing
 - c. Outdoor Omnidirectional WAPs shall be Aruba AP-575 or most current version, no approved substitution.
 3. Outdoor Directional WAPs shall, at a minimum, meet the following feature requirements in addition to those listed under Outdoor Omnidirectional WAPs above:
 - a. Integrated directional antenna gain:
 - 1) 6.3 dBi @ 2.4 GHz (90° Vertical x 90° Horizontal)
 - 2) 6.5 dBi @ 5.x GHz (90° Vertical x 100° Horizontal)
 - b. Outdoor Omnidirectional WAPs shall be Aruba AP-577 or most current version, no approved substitution.
- B. WLAN Controllers
1. WLAN Controllers shall provide the overall administration and management functionality for the WLAN. Controllers shall be designated as “master” and “slave” controllers depending on the logical and physical location of the controller within the system. At a minimum, controllers shall comply with the following requirements:
 - a. Physical Form Factor & Connectivity
 - 1) 1RU rack mount enclosure
 - 2) (4) 10GBase-X SFP+ Ports
 - 3) (1) USB 2.0
 - 4) (1) RJ-45 Console Port
 - 5) Operating environment: 0 to 40 deg. Celsius, 5 to 95% relative humidity (non-condensing)
 - b. Functionality
 - 1) Maximum connected WAPs: 2,048
 - 2) Maximum concurrent connected devices: 32,768
 - 3) Maximum supported VLANs: 4,094
 - 4) Maximum concurrent GRE tunnels (BSSIDs): 32,768
 - 5) Maximum concurrent tunneled ports: 16,384
 - 6) Maximum concurrent active firewall sessions: 2,015,091
 - 7) Wired throughput (large packets): 40Gbps
 2. Provide all SFP+ modules and accessories as required to connect the WLAN controller to the STC network.
 3. WLAN controller shall be Aruba 7240 or most current version, no approved substitution.

C. Bluetooth Wayfinding Beacons

1. Bluetooth Wayfinding Beacons shall perform their intended location services functions without requiring any pairing operation with mobile devices.
2. Bluetooth beacons shall be Bluetooth LE 4.0 compatible, or most current supported Bluetooth version.
3. Bluetooth beacons shall be Aruba LS-BT20 or most current version, no approved substitution.
4. Furnish and manufacturer's mounting bracket for all Bluetooth Wayfinding Beacons, indoor or outdoor rated according to beacon location.
5. Beacon locations shown on the Contract Drawings are approximate. Coordinate with the Authority, OAR and Authority Vendor for final beacon placement.

D. WAP Housings

1. Contractor shall furnish and install housings as specified below.
 - a. Right-angle Wall Mount Housing
 - 1) Wedge-shaped housing capable of mounting WAP on a wall in a horizontal orientation
 - 2) Direct mounting over standard data outlet/back box
 - 3) 18-Gauge steel, white powder coat
 - 4) Locking, hinged cover for access to rear of access point and data outlet
 - 5) Support for current Aruba series WAPs
 - 6) Oberon model 1012-00 or approved substitution.
 - b. Suspended Tile Ceiling Housing
 - 1) 2'x2' lay-in ceiling tile form factor
 - 2) Extra deep backbox with single-gang electrical knock-out for electrical box mounting above ceiling
 - 3) White ABS plastic dome
 - 4) 25lb load capacity
 - 5) Compatibility with current Aruba series WAPs
 - 6) Oberon model 1077-WA-T or approved substitution.
 - c. Hard Ceiling Locations
 - 1) Backbox mud ring shall be installed flush to ceiling surface. Mounting bracket shall be installed to backbox mud ring.
 - 2) Aruba AP-MNT-MP10-A
 - d. Outdoor Locations
 - 1) AP's mounted outdoors shall be manufactured with outdoor rated housings.
 - 2) Mounting bracket shall be by the same manufacturer as the AP.
 - 3) Aruba AP-270-MNT-H3 or approved substitution.
 - e. Other housing form factors as required to protect the WAP from the surrounding environment, restrict access to authorized personnel, and to match the surrounding architectural features. Housings shall be as manufactured by Oberon or approved substitution.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 in addition to the following:
 - 1. Refer to related specification sections for additional project coordination requirements. In addition to the requirements defined in this specification section, the Contractor shall coordinate and meet all requirements addressed in Division 26, Division 27 and Division 28 specification sections.
 - 2. The Contractor shall supply all end-user cabling and connectivity components for interconnection of system equipment. This shall consist of, but not be limited to:
 - a. The installation of fiber optic/copper cabling from communications rooms (IDFs/MDFs) to all ONTs supporting WAPs.
 - b. The installation of Category 6 UTP patch cords for interconnection from ONTs to WAPs
 - c. The installation of single mode fiber optic and Category 6 UTP patch cords in communications rooms to connect equipment associated with the WLAN.

3.4 INSTALLATION REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements in addition to the following:
 - 1. The Contractor shall assign a unique device identifier associated with each device's MAC address and manufacturer serial number.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

3.6 ELECTRICAL POWER DISTRIBUTION

- A. Refer to Specification Section 27 05 00 for requirements

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE & SERVICE

- A. Refer to Specification Section 27 05 00 for requirements.

3.11 WARRANTY

- A. Refer to Specification Section 27 05 00 for requirements.

3.12 FIELD SERVICES

- A. Refer to Specification Section 27 05 00 for requirements.

3.13 TRAINING

- A. All training shall be provided by the Authority and Authority Vendor.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 10 15

SECTION 27 10 20 - VISUAL DOCKING GUIDANCE SYSTEM

PART 1 - PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.
- B. Related Specification Sections:
 - 1. Refer to Specification Section 27 05 00 in addition to the following.
 - 2. 34 77 13 – Passenger Boarding Bridges
- C. Reference Symbols:
 - 1. All device symbols are defined by the appropriate symbol schedule on the symbols and abbreviations sheet in the systems drawing package. Not all device symbols indicated may be required for the project.
 - 2. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Contractor shall coordinate exact locations with all drawings and affected trades prior to submittal of shop drawings.
 - a. The installing Contractor shall coordinate exact locations with all security and telecommunications drawings and site plan drawings as well as all affected trades prior to submittal of any shop drawings.
- D. Abbreviations:
 - 1. Refer to Specification Section 27 05 00 for requirements.
- E. Definitions:
 - 1. Refer to Specification Section 27 05 00 for requirements.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The existing Automated Visual Docking Guidance System (A-VDGS) in the South Terminal Complex (STC) by ADB Safegate. The ADB Safegate A-VDGS shall be extended into the expansion areas of the airside concourse. The new locations shall integrate into the existing system. The existing system shall be modified as required to support the new locations throughout the expansion areas of the airside concourse.
- C. The Contractor shall furnish and install a network of A-VDGS to serve each aircraft gate centerline as shown on the Contract Drawings. Each A-VDGS unit shall provide visual guidance to assist pilots in safely docking the aircraft at the proper position and with the proper alignment to the gate.

- D. A-VDGS administrative and monitoring capabilities shall be IP-based, allowing all units to be configured and monitored from networked computer workstations. The Contractor shall be responsible for all integration with the Local Area Network (LAN)/Passive Optical Network (PON); the Authority's Airport Integrated Data Broker (AIDB) and/or Gentrack/Veovo Airport 20/20 Resource Management System (RMS); and necessary configuration to provide the functionality described within this document. Refer to section 2.4 for additional requirements. Any configuration shall be performed in coordination with and approval by the Authority and Owner's Authorized Representative (OAR).
- E. The A-VDGS shall provide ancillary functionality as a Ramp Information Display System (RIDS). Configure A-VDGS units to accept information from the Multiuser Flight Information Display System (MUFIDS) and/or the Authority's existing Gentrack/Veovo RMS and/or the AIDB over the LAN / PON and display it on the main system unit's LED screen when there are no active docking activities. Refer to Specification Section 27 42 20 for additional requirements.
- F. It shall be the responsibility of the contractor to ensure that the installed systems meet or exceed every standard set forth in these specifications. The contractor shall be responsible for providing complete and functional A-VDGS units at each aircraft gate, including all necessary components, devices, equipment racks and/or cabinets, cable terminations, connection to electrical power on generator and UPS-supported circuits, software, programming, commissioning, testing, training, warranties and all appurtenances as well as the integration to all ancillary systems as necessary to provide a complete and fully operational system whether specifically included in this section or not.
1. The system shall primarily consist of, but not be limited to, main A-VDGS units, local operator panels, passenger boarding bridge (PBB) interfaces, RMS interface, network servers, administrative workstations, cabling, power supplies, software, programming, and all appurtenances necessary to provide a complete operating system in accordance with the contract documents.
 2. Refer to Specification Sections 27 05 00 and 27 10 00 for all TCP/IP, PON and network cabling requirements
 3. In addition to the items specified above, the contractor shall also provide the following as part of a complete A-VDGS solution:
 - a. System training as specified in section 3.14 herein
 - b. System warranty as specified in section 3.12 herein.
 - c. System testing and acceptance plans as specified herein.
- G. The Contractor shall provide all equipment, devices, system components, final cable terminations, programming, calibration, commissioning, and testing of all network communications cabling in accordance with all related Division 27 Specification Sections.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing sheet T0.00.03 for work responsibility matrix and for any work provided by the Authority.

1. Where listed on the drawing responsibility matrix, the following components shall be defined as follows:
 - a. Headend and Software: The Contractor shall provide the Gate Control System (GCS) software, servers, and workstations. Refer to PART 2 – HEADEND, SOFTWARE & INTERFACES in this specification section for additional information.
 - b. Integration to Existing System: The Contractor shall furnish and install all required hardware, software, programming, protocol, interfaces, devices and appurtenances as required to extend the existing STC A-VDGS system into the airside concourse expansion areas. The Contractor shall provide all programming, configuration and physical connectivity required to exchange data with other airport systems. Refer to PART 2 – HEADEND, SOFTWARE & INTERFACES in this specification section for additional information.
 - c. Network Components: The Authority will furnish and install all required network switches and other active elements for network connectivity. The network includes layer 2 access and distribution or layer 3 core and router switches to connect a system to the Authority's Passive Optical LAN and Local Area Network. Contractor shall coordinate patching into the network with the Authority and provide all patch cables as required. Passive Optical LAN components are specified in Section 27 10 05 and include Optical Line Terminals (OLTs) and Optical Network Terminals (ONTs). Refer to related specification sections listed in section 1.1.B for additional information.
 - d. Backbone Cable: The contractor shall furnish and install all backbone cable and associated raceways, pathways, boxes, fittings and appurtenances. Contractor shall perform fiber channeling as described in section 27 10 00 and furnish and install all patch cables required for channeling. Refer to specification section 27 10 00 for additional information.
 - e. Horizontal Cable: The contractor shall furnish and install all horizontal cable and associated raceways, pathways, boxes, fittings and appurtenances. This shall include passive optical splitters, hybrid copper/fiber cabling to support ONTs, and all patch cables. Refer to specification section 27 10 00 for additional information.
 - f. Field Devices: Contractor shall provide all A-VDGS units, workstations, and other accessories required for the extension of the existing system. Refer to PART 2 – FIELD DEVICES for more information.
- C. Authority and Authority Vendor-Furnished Equipment and Services
 1. Portions of the project scope shall be furnished and installed by the Authority and/or Authority Vendors. The contractor shall identify elements of the project provided by Authority and/or Authority Vendors that impact the contractor's scope of work and coordinate all work with such parties. Schedule work to permit authority vendors' access to required work areas with sufficient time to complete tasks in accordance with the Project Schedule. Refer to related specification sections for additional information.
- D. The Contractor shall coordinate with the OAR for work related to any Authority furnished, Authority installed, and Authority vendor work.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00, section 1.4, for requirements.

1.5 SYSTEM DESCRIPTION

- A. Each A-VDGS unit shall provide visual guidance to assist pilots in safely docking the aircraft at the proper position and with the proper alignment to the gate. The units shall incorporate collision avoidance guidance. Visual guidance shall be provided by means of an LED or LCD display mounted within the pilot's line of sight of the aircraft intended to be served by each gate and centerline. Each A-VDGS shall contain sensors that ascertain an aircraft's position with respect to the centerline and final, docked position regardless of weather conditions. A-VDGS units at each gate shall be networked to provide administrative monitoring and configuration capabilities from remote workstations.

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 in addition to the following:
 - 1. Contractor shall draft a detailed interfacing narrative and data flow chart/diagram describing the method used to interface the A-VDGS with each airport system. This description shall include, at a minimum:
 - a. Applicable data exchange protocols used
 - b. Specific types of data exchanged
 - c. Functionalities provided by the interface
 - d. Programming languages used, if applicable
 - e. Interfacing hardware used, if applicable, and accompanying point-to-point wiring diagrams
 - f. Any other items contractor deems relevant to this project.
- B. Submit two (2) copies of such manufacturer's installation instructions to the Authority and OAR before installing any equipment. Provide an additional copy of such instructions at the equipment during any work on the equipment. Where no instructions are included with the equipment, follow accepted industry practices and workmanlike installation standards.

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 in addition to the following:
 - 1. Manufacturer's Qualifications: Provide a minimum of ten (10) reference projects at international airports evidencing systems with similar aircraft tracking technique that are in operation. Provide evidence that a minimum of five hundred (500) units with similar technique have been in successful operation for a minimum of five (5) years. References must include the following:
 - a. Project location
 - b. Description of project scope
 - c. Description of proposer's role
 - d. Proposer's key personnel involved
 - e. Start and end dates
 - f. Contact information including project owner's name, address, contact person's current email address and phone number. Contact person shall be familiar with the proposer and key personnel's role on the project.
 - 2. Reference checks will be conducted on those projects disclosed.

1.8 DELIVERY STORAGE AND HANDLING

- A. Refer to Specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

1.10 OPERATIONS AND MAINTENANCE

- A. Provided by the Owner at the conclusion of the warranty period.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. Submit a list of required spare parts and furnish recommended quantities in order to maintain the installed base of VDGS units. At a minimum, spare parts shall include:
 - 1. Aircraft Sensing Elements
 - 2. Video Camera
 - 3. LED/LCD Displays
 - 4. System mainboard/motherboards
 - 5. Required mounting bolts/hardware
 - 6. Cleaning supplies

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 in addition to the following:
 - 1. The A-VDGS shall conform with the following published guidelines:
 - a. ICAO Annex 14 6th Ed., Volume I, Paragraphs 5.3.25 and 5.3.26
 - b. EASA Certification Specifications and Guidance Material for Aerodromes Design (CS-ADR-DSN) Section M.760

2.2 FIELD DEVICES

- A. A-VDGS Main Unit shall comply with the following requirements:
 - 1. Stop position range: 8 – 50m (approx. 26 – 164ft)
 - 2. Stop position accuracy within +/- 0.1m (4 in.)
 - 3. Azimuth guidance accuracy within +/- 0.1m (4 in.)
 - 4. Operating Temperature -25°C to +50°C
 - 5. Main Unit Enclosure: IP54 Rated
 - 6. Operator's Panel: IP65 Rated
 - 7. Main Unit shall include an integrated video camera for recording of every docking and ramp surveillance. Video streams shall be available for viewing by system operators.
 - 8. Main Unit shall be provided with Battery Backup in case of power failure.

9. Basis of Design: ADB Safegate T2 Main Unit. No approved substitutions. Extension of existing system.
- B. GCS System Servers and Workstations
1. The Contractor shall provide any additional servers and workstations required to expand the A-VDGS system for inclusion of additional docking stations in the airside concourse expansion.
 2. Where the Contractor determines the need for additional servers or workstations, due to changes in technology, the Contractor shall submit a question during bidding to the Authority requesting specific and most current server and workstation specification standards prior to providing product data submittals for approval of ordering equipment.
 3. Current Authority standards for servers and administrative workstation equipment. Coordinate with GOAA IT on ordering to ensure the supplied hardware will be added to the GOAA Microsoft EA agreement for licensing.
 - a. Servers.
 - 1) Dual Processors (with memory split appropriately between the 2 processors.)
 - 2) Redundant Power Supplies.
 - 3) Raid 1 for OS drives.
 - a) (2) 600 GB minimum
 - 4) Raid 5 for data drives.
 - a) (3) 600 GB minimum
 - 5) Minimum of 2 NICs for teaming and redundancy.
 - 6) Minimum Windows 2019 Server Standard.
 - 7) 5 year 24x7x4 hour response with Data Center/Complete Care Support.
 - 8) Manufacturer: HP or approved Substitution
 - b. Workstation
 - 1) HP Z2 Small Form Factor G8 RCTO BU
 - 2) HP Z2 G8 SFF 90 450W Chassis
 - 3) Core i7 11700 8C 2.50G 65W
 - 4) OS Localization
 - 5) Windows 10 Pro 64
 - 6) 16GB (1x16GB) DDR4 3200 UDIMM NECC
 - 7) NVIDA Quadro P400 2GB (3) mDP Graphics
 - 8) 512GB M.2 2280 PCIe NVMe TLC SSD
 - 9) HP USB 320K Keyboard
 - 10) HP WRD 320M Mouse
 - 11) HP ZCentral Remote Boost 2020 SW for Z
 - 12) 3/3/3 Warranty
 - 13) Single Unit SFF HP WKS Packaging
 - 14) HP Z2 G8 SFF CKIT
 - 15) HP 5yr Next Business Day Response Onsite Workstation Hardware Support.
 - 16) Audio: High Definition Stereo, 192 kHz
 - 17) Includes 24" Full HD (1080p) monitor, Keyboard and Mouse, and all required interface cabling.
 - 18) Networking: Intel I219-LM, Ethernet, Fast Ethernet, Gigabit Ethernet capable, SNMP2, ACPI Support, Auto-uplink (auto MDI/MDI-X), PXE2.1 support, Wake on LAN

- 19) Interfaces: (1) Audio line-out, (1) headphone/microphone (CTIA headset support), (1) LAN (Gigabit Ethernet), (1) USB-C 3.2 Gen 2, (1) VGA, (1) DisplayPort, (1) HDMI, (2) USB 2.0, (4) USB 3.2 Gen 1 (one fast charging), (4) USB 3.2 Gen 2.
- 20) Color: Black
- 21) Manufacturer: HP or approved substitution

2.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. The display portion of the main A-VDGS unit shall be capable of displaying alphanumeric and directional arrows, characters and symbols on a highly visible and legible LED-based display, oriented in such a manner so as to permit clear line of sight to pilots and co-pilots of aircraft approaching the gate.
 1. Displayed information shall be visible in direct sunlight and shall not be overly bright at night. Brightness adjustment shall be accomplished automatically in response to ambient lighting conditions. The display shall be equipped with a sun visor/cover to enhance visibility in direct sunlight.
 2. The display portion of the main A-VDGS unit shall, at a minimum, be capable of displaying the following types of information listed below.
 - a. Aircraft identification (type and series)
 - b. Azimuth centerline guidance to pilot and co-pilot
 - c. Aircraft actual position with reference to centerline
 - d. Closing rate indicator for the last 15 meters
 - e. Digital countdown configurable for the last 30 meters
 - f. Stop information
 - g. Correctly parked information
 - h. Excessive speed information
 - i. Too Far information
 - j. Automatic error indication
 - k. Free text (when operating in RIDS mode)
 3. The system shall display azimuth guidance indicator(s) that show the actual position of the aircraft in relation to the centerline of the aircraft stand and shall indicate the direction to steer. The azimuth guidance indicators shall provide unambiguous left/right guidance to enable the pilots to acquire and maintain the lead-in line without over-controlling. Azimuth guidance shall be provided based on actual position of the aircraft and not based on pilot's position.
 4. When the aircraft reaches its designated stop position, 'STOP' shall be displayed in red color, as per ICAO Annex 14 recommendation
 5. A Reduce Speed warning message shall be displayed as "SLOW" when the speed of the approaching aircraft is found to exceed the configured maximum speed.
 6. The A-VDGS shall be capable of interlocking with the passenger loading bridge to disable the start of aircraft docking, if the passenger loading bridge is not in its park position.
 7. The A-VDGS shall be capable of interfacing with any stand equipment for interexchange of information with the IAMS/RMS regarding the incoming aircraft type and the final stop position after the aircraft is docked.
- B. The A-VDGS scanning unit shall be capable of tracking both the lateral and longitudinal position of the approaching aircraft and comparing the results against the stored database profile for the type of aircraft selected by the operator.

1. The measuring technique shall not require any sensor embedded in the apron.
 2. The scanning unit shall operate safely and reliably in all weather, visibility conditions, ambient lighting and pavement conditions in accordance with ICAO Annex 14. The performance of the system shall not depend upon apron flood light operation or any other artificial sources of illumination and the A-VDGS shall function properly regardless of the ramp lighting level.
- C. The A-VDGS shall include a local Operator Panel to permit local control of the A-VDGS. The Operator Panel shall provide the following capabilities and features:
1. Manually start docking
 2. Emergency stop which activates corresponding visual “STOP” indication on docking unit display
 3. Alphanumeric LCD display indicating mode of operation and diagnostic/error information
 4. Numeric password/pin protection to prevent unauthorized operation
 5. Computer connection port for maintenance and configuration
- D. The A-VDGS shall incorporate, at a minimum, the following safety features and functions:
1. Capability to verify type of aircraft approaching the gate and compare to the type of aircraft selected by the operator or provided automatically to the A-VDGS by the Gentrack/Veovo Airport 20/20 Resource Management System (RMS) schedule. If the approaching aircraft does not match the type previously indicated in the system, the system shall automatically direct the pilot to stop the aircraft at least 50 feet before the normal stop position.
 2. Automatic system error detection and visual indication under the following conditions:
 - a. Display/control unit communication loss
 - b. Failure of scanning unit to track aircraft
 - c. Software error detected
 - d. Scanning unit malfunction

2.4 HEADEND, SOFTWARE & INTERFACES

- A. The Contractor shall provide all required software, hardware, programming and appurtenances in order to expand and/or modify the existing A-VDGS administrative software platform, referred to as the Gate Control System (GCS) which provides a means for monitoring and administering the Terminal’s A-VDGS units over the Authority’s LAN / PON, for the additional A-VDGS docking stations that will be installed in the airside concourse expansion.
1. The GCS acts as both a service provider for the A-VDGS units and as a gateway to other external systems for exchange of data provided by the A-VDGS, or for used by the A-VDGS.
 2. The GCS shall operate in redundant, dual-server configuration. The failure of the primary server will cause the system to automatically switch to a back-up server to ensure uninterrupted operation (hot standby).
 3. The GCS shall support an unlimited number of administrative workstations. The connection of additional workstations to the GCS shall not negatively impact the performance of the software platform.
 4. The GCS shall provide the following capabilities:

- a. Graphical user interface (GUI) at each workstation that provides the user overall activity across all installed A-VDGS units or a desired subset of those units, as well as access to video from A-VDGS unit cameras.
 - b. Remote operation/activation of each A-VDGS.
 - c. Event and error logging.
 - d. Time synchronization across all A-VDGS units.
 - e. Incorporation of ramp gate restrictions to avoid wing tip incursions while certain aircraft sizes are parked.
5. The GCS shall be interfaced with the Authority's Airport Integrated Data Broker (AIDB). The GCS shall be able to send and accept specially-formatted data describing events, requests and replies to and from the AIDB via its service-oriented architecture (SOA) web service definition language (WSDL) based on business process execution language (BPEL).
6. The GCS shall support the following information exchange formats in order to interface with the Authority's resource management system (Gentrack/Veovo RMS):
- a. REST (Representational State Transfer) web services
 - b. Application Programming Interface (API)
 - c. The latest Extensible Markup Language (XML) standards over a Message Oriented Middleware (MOM)
 - d. Open Database Connectivity (ODBC) drivers
 - e. Connectors for Major Enterprise Application Integration (EAI) platforms
 - f. IATA/ACI-NA AIDX XML standard method of sending and receiving airline information
 - g. Other techniques as approved by the Authority and OAR including, but not limited to Java Database Connector (JDBC) or Java Messaging Service (JMS)
7. The GCS shall be configured to accept, at a minimum, the following information from the AIDB and/or Gentrack/Veovo RMS:
- a. Estimated Time of Arrival or Departure (ETA/ETD)
 - b. Scheduled Time of Arrival or Departure (STA/STD)
 - c. Gate or Stand Number
 - d. Aircraft Type (including series)
 - e. Flight ID (Airline Code plus flight number)
 - f. Airport of arrival or departure
8. The GCS shall be configured to provide, at a minimum, Block On / Block Off time information to the AIDB and/or Gentrack/Veovo RMS and/or Virtual Ramp Control tower (VRC).
- B. The A-VDGS display unit shall provide Ramp Information Display System (RIDS) functionality. Coordinate exact screen layout with the Authority and OAR. The system shall obtain RIDS information from the Authority's AIDB, and/or Electronic Dynamic Signage system as required to display the following types of information:
1. Upon Aircraft Arrival:
 - a. ETA/STA
 - b. Flight ID (Airline code plus flight number)
 - c. "Arriving From" Airport
 - d. Baggage Carousel for Current Aircraft's Baggage
 2. Prior to Aircraft Departure:
 - a. ETD/STD
 - b. Flight ID (Airline code plus flight number)

- c. "Departing To" Airport
 - d. Number of bags checked in
 - e. Amount of fuel in aircraft
 - f. Countdown to departure
- C. The GCS shall be interfaced with ramp stand equipment as follows:
- 1. Ground Power (400 Hz) System functions:
 - a. Log turn-on and turn-off times for ground power supply
 - b. Display alarm message if ground power has not been turned on within 60 seconds of completed aircraft docking
 - 2. Preconditioned air (PC Air)
 - a. Log turn-on and turn-off times for PC Air
 - b. Display supervisory message if PC air has not been turned on within 60 seconds of completed aircraft docking
 - 3. Passenger Boarding Bridge (PBB)
 - a. Log the times for connection and retraction of PBB

PART 3 - EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00, section 3.1 for requirements.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. Protect all materials, equipment, devices or components permanently installed and/or stored on the job site. Protect all materials, equipment, cabling, devices or components during construction and after installation, provide appropriate protection of all materials, equipment, components and/or devices until time of substantial completion. All materials, equipment, components and/or devices shall be protected during shipment and storage against any physical damage, dirt, moisture, cold, snow or rain:
- 1. During installation, enclosures, racks\cabinets, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of any foreign matter; and shall be vacuum cleaned both inside and outside before testing and operating and repainting if required.
 - 2. Any materials, equipment, components and/or devices, stored on site which have been deemed by the Authority and OAR to exhibit any indications of damage or exposure dust or moisture shall not be installed and shall be returned to the source of supply for immediate replacement.
 - a. The use of spare parts or the return of defective equipment for repair to mitigate the damage of defective materials, equipment, components and/or devices shall not be acceptable. All materials, equipment, components and/or devices shall be new and unused until final acceptance by the Authority and OAR.
 - 3. Provide and apply protective material immediately upon receiving the products and maintain throughout the construction process.
 - a. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

- b. Any damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious or detectable.
 4. Failure to properly protect all materials, equipment, components and/or devices prior to final acceptance shall constitute sufficient cause for rejection of materials, equipment, components and/or devices should any defects, damage or degradation in performance is observed.
- C. Immediately replace all malfunctioning materials, equipment, components and/or devices with new unused products up until the time the Authority and OAR issues final acceptance of the system. The returning of any malfunctioning equipment, devices and/or components to the manufacturer for repair and then reinstallation at the project site shall not be acceptable.
 1. All replacement materials, equipment, components and/or devices shall be factory new and not scavenged from the Project's spare parts inventory or factory recycled products unless expressly identified by contractor prior to replacement and approved beforehand by the Authority.

3.3 WORK PERFORMANCE

1. Refer to Specification Section 27 05 00 in addition to the following:
2. Refer to related specification sections as identified in section 1.1.B herein for additional project coordination requirements. In addition to the requirements defined in this Specification Section, the contractor shall coordinate and meet all requirements addressed in Division 26, Division 27 and Division 28 Specification Sections.
3. The Contractor shall supply all software and hardware necessary for the systems(s) to function as specified. In addition, the Contractor shall provide all end-user cabling and connectivity components for interconnection of system equipment. This shall consist of, but not be limited to:
 - a. The installation of Category 6 UTP patch cords for interconnection from data jacks or Optical Network Terminals (ONTs) to end devices, and from patch panels to switch ports.
 - b. The installation of Singlemode Fiber Optic cabling and connectivity as a distribution backbone.
 - c. The installation of Singlemode Fiber Optic jumpers for interconnection from panel to interface.
4. The Contractor shall prepare the necessary documents required for installing, testing, and bringing the A-VDGS online. Such documents include but are not limited to:
 - a. Project management and quality assurance plans
 - b. Testing plans
 - c. Component and system submittal documents
 - d. Installation plans
 - e. Component design plans
 - f. System user documentation
 - g. As-built drawings and documentation consistent with Specification Section 27 05 00 Shop Drawing requirements
 - h. Administration documentation
5. The Contractor shall coordinate with the Authority and OAR to ensure the system meets the requirements. The Contractor shall meet all ADA requirements.

6. The A-VDGS shall support all gates across the entire airport terminal. The Contractor shall adjust and calibrate all A-VDGS scanning units to manufacturer standards and to the satisfaction of the Authority and OAR. Adjustments shall continue until such performance has been achieved at no additional cost to the project.

3.4 EQUIPMENT INSTALLATION

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. All system equipment installations shall be in accordance with good engineering practices, NEC, local building codes, and all manufacturer's requirements. Cable terminations at all equipment locations shall comply with all state and local electrical codes. All wiring shall test free from all grounds, shorts, stray voltages and EMI.
- C. Follow manufacturers' instructions for installing, components and adjusting all equipment and cabling.
- D. Equipment location shall be as close as practical to locations as indicated on the contract drawings.
 1. Coordinate with the work of Specification Section 34 77 14 for placement of local operator panels within the Passenger Boarding Bridges.
 2. Provide all equipment clearances in accordance with NEC requirements. Arrange equipment to facilitate unrestricted access for maintenance and service around all equipment, components and/or cable terminations.

3.5 INSTALLATION REQUIREMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. General
 1. System/Hardware and mounting must comply with IBC Seismic Requirements.
 2. All fastenings and supports of system components shall be rated for the load to be supported and approved by the equipment manufacturer.
 3. Miscellaneous hardware, structural components, mounting brackets and posts shall comply with ASTM A36 or greater, and shall be hot-dipped galvanized unless otherwise approved by the Authority and OAR. All field assembly points and welds shall be galvanized to the satisfaction of the Authority and OAR.
 4. The Contractor shall install all system components including furnished equipment in accordance with the manufacturer's instructions, NFPA 70, ANSI-C2 and shall furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
 5. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
 6. For equipment mounted in drawers or on slides, provide the interconnecting cables with a service loop of not less than three feet and ensure that the cable is long enough to allow full extension of drawer or slide.

7. The Contractor's quality assurance Inspector shall conduct a visual inspection of all installations to verify that the installations are in accordance with the project's and manufacturer's specifications. Records of the inspections signed and dated by the Quality Assurance Inspector shall be provided to the Authority and OAR. Prior to any scheduled inspections the Authority and OAR representative shall be notified by the Contractor of any inspection(s) so they may witness.
- C. Software Installation
1. The Contractor shall test all custom and packaged software in development and production environments, and have successfully passed factory acceptance testing, prior to installation on-site.
- D. Hardware Installation
1. The Contractor shall ensure the ventilation requirements for the all hardware components are met.
 2. The Contractor shall install and inspect all hardware required in this specification in accordance with the manufacturer's installation instructions. Final placement of hardware is subject to the Authority and OAR approval.
 3. The Contractor shall be responsible for any and all loss or damage in the shipment and delivery of all material until transfer of title to the Authority.
 4. The Contractor shall obtain written permission from the Authority and OAR before proceeding with any work which requires cutting into or through any part of the building structures such as, but not limited to, girders, beams, concrete, carpeted or tiled floors, partitions or ceilings. The Contractor shall obtain written permission from the Authority and OAR before cutting into or through any part of the building structures where fireproofing or moisture proofing could be impaired. In any such case the Contractor shall be responsible for restoring the affected area to "like-new" condition or to a condition to match the existing conditions.
 5. The Contractor shall take all steps necessary to ensure that all public areas remain clear or are properly marked during installation or maintenance.
 6. The Contractor shall coordinate installation with the Authority and OAR, to minimize disruption of existing business functions at the airport.
 7. The Contractor shall place materials only in those locations that have been previously approved. Any other locations shall be approved, in writing, by the Authority and OAR.
 8. The Contractor shall label all cabling and patch cords in accordance with the Authority approved labeling plan. Coordination with the Authority and OAR shall be performed, and all labeling shall be approved, prior to implementation. Refer to specification Section 27 10 00, Attachment 0 for labeling requirements.
- E. System Startup
1. The Contractor shall not apply power to the system until after:
 - a. System and components have been installed and inspected in accordance with the manufacturer's installation instructions.
 - b. A visual inspection of the system components has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
 - c. System wiring has been tested and verified as correctly connected as indicated.
 - d. All system grounding and transient protection systems have been verified as properly installed and connected, as indicated.

- e. Power supplies to be connected to the system and equipment have been verified as the correct voltage, phasing, and frequency as indicated.
- f. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.6 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 ELECTRICAL POWER DISTRIBUTION

- A. Coordinate with Division 26 Contractor for all required power connections. Refer to Division 26 specifications for additional requirements.

3.8 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.9 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.11 MAINTENANCE & SERVICE

- A. Provided by the Owner at the end of the warranty period.

3.12 WARRANTY

- A. Refer to Specification Section 27 05 00 for requirements.

3.13 FIELD SERVICES

- A. Refer to Specification Section 27 05 00 for requirements.

3.14 TRAINING

- A. Refer to Specification Section 27 05 00 for requirements.

3.15 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 10 20

SECTION 27 20 00 – COMMON USE SYSTEMS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all. General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 specification sections.
- B. Related Specification Sections:
 - 1. Refer to Specification Section 270500 for a complete list of related specification sections.
- C. Reference Symbols
 - 1. Refer to Specification Section 27 05 00 for requirements.
- D. Abbreviations
 - 1. Refer to Specification Section 27 05 00 in addition to the following:
 - a. AODB Airport Operational Database
 - b. CUPPS Common Use Passenger Processing System
 - c. CUSS Common Use Self-Service
 - d. GIS Geographic Information System
 - e. HTML5 HyperText Markup Language Version 5
 - f. ICD Interface Control Document
 - g. NTC North Terminal Complex
 - h. OEM Original Equipment Manufacturer
 - i. PMP Project Management Plan
 - j. TIL Technology Integration Lab
 - k. UL Underwriters Laboratories
 - l. URL Uniform Resource Locator
- E. Definitions
 - 1. Refer to Specification Section 27 05 00 in addition to the following:
 - a. Interface: Bridge between two (2) or more separate software products where data is maintained in more than one (1) location.
 - b. Integration: Two (2) or more software products where functionality is combined into one (1) product and data is maintained in one (1) location.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Common Use System shall be extensions of the existing enterprise-based systems.
- C. The intent of this specification is to establish a standard of quality, functions, and features for the installation of components to support a fully operative integrated Airport system, herein referred to as the Common Use System.

- D. The installation of the Common Use System in the South Terminal Complex (STC) airside concourse expansion shall include, but not be limited to, raceway, cabling, mounting systems and support, network and video infrastructure cabling, housings, labor, training, labeling, clean up, and coordination and oversight of all Contractor, Authority Vendor, and Authority Furnished Equipment (Owner-Furnished Equipment (OFE)).
- E. The Contractor shall notify the Authority and Owner's Authorized Representative (OAR) in writing of any items not in compliance with the requirements described in this section.
- F. The Common Use System shall include all system components as required to meet all, functional, operational, performance, and redundancy requirements necessary to deliver fully integrated and operational systems in accordance with the Contract Documents and as herein specified.
 - 1. Refer to Specification Section 27 05 00 and 27 10 00 for all TCP/IP based cabling requirements for additional information regarding the intended connectivity of these systems.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing Sheet T0.00.03 for the work responsibility matrix for the scope of work required for the Common Use System.
 - 1. Where listed on the responsibility matrix, the following line components shall be defined as follows:
 - a. Headend and Software: The Authority will furnish all required headend equipment and software including, but not limited to management servers and all associated system software.
 - b. Integration to Existing Systems: The Contractor shall provide fiber channeling with all materials required to connect the STC airside concourse expansion to the existing NTC and STC systems. The Contractor shall coordinate with the Authority and the Authority Vendor to ensure fiber channeling completion complies with the project schedule. Refer to Backbone Cable below for additional information.
 - c. Interfaces: The Authority Vendor shall provide all system interfaces including, but not limited to all hardware, software, programming, interface devices and appurtenances as required for communication between the Common Use System and other related systems including, but not limited to, the Authority Passive Optical Network (PON), Integrated Airport Management System (IAMS), Multi-User Flight Information Display System (MUFIDS), Voice Over IP (VOIP), Baggage Handling Systems (BHS), Dynamic Signage System and Premise Distribution System (PDS).
 - d. Network Components: Refer to specification section 27 10 05 for requirements. The Authority will furnish and Contractor shall install all Passive Optical Network components required to support the Common Use System.

- e. Backbone Cable: The Contractor shall provide all backbone cabling and associated raceways/pathways, boxes, fittings and appurtenances. The Contractor shall provide fiber channeling to achieve required connectivity with the NTC and STC Phase 1. Contractor shall perform fiber channeling as described in section 27 10 00 and furnish and install all patch cables required for channeling. Coordinate with the Authority and the Authority Vendor to ensure fiber channeling completion complies with the project schedule. Refer to specification section 27 10 00 for requirements.
 - f. Horizontal Cable: The Contractor shall furnish and install all horizontal cabling and associated raceways/pathways, boxes, fittings and appurtenances. Includes passive optical splitters, fiber optic cabling and copper cabling to support ONTs. Contractor shall install patch cable onto patch panel and route cable back to ONTs with the appropriate lengths, and label per GOAA standards. Provide patch panel port and patch panel labeling information to the Authority to perform patching onto the ONTs. Refer to specification section 27 10 00 for additional information.
 - g. Field Devices: The Authority shall furnish workstation displays and computer workstations. The Authority Vendor shall furnish and install all kiosks, ticket and bag tag printers, and other peripheral devices. The Contractor shall furnish all monitor arms and keyboard stands and mount (install) all monitors. The Contractor shall provide all field patch cables with the appropriate lengths required for field device connection to field outlets or ONTs.
- C. The services provided by the Contractor shall include the following:
- 1. The Contractor shall provide comprehensive project management services for the coordination of its team members during the term of the project.
 - 2. The Contractor shall be responsible for coordinating casework and installation requirements with all affected trades, the Authority and Authority Vendor(s).

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. If conflicts exist between referenced requirements, the Contractor shall comply with requirements in the following order:
 - 1. Requirements contained within this section
 - 2. Specifications Section 27 05 00
 - 3. Contract documents.
- C. Reference Documents:
 - 1. ISO Standards on Quality Management and Quality Assurance (ISO 9001:2015, ISO 9002:2015, ISO 9004:2015)

1.5 SYSTEM DESCRIPTION

- A. The Common Use System shall be an enterprise-based solution consisting of components that are an extension of the existing North Terminal Complex (NTC) and South Terminal C platforms, along with new components required for the STC airside concourse expansion.
- B. The Common Use System shall consist of all computing hardware and software, peripheral devices, active electronics, and all other items required for a fully functioning system, including the interface of multiple peripherals into ticketing and gate counter casework.
- C. The Common Use System includes the following systems and subsystems:
 1. Common Use Passenger Processing System (CUPPS) – allows multiple airlines, service providers, or other agents to share check-in and gate hardware. The CUPPS will be located at check-in counters, gates, recheck and remote locations throughout the facility.
 - a. The CUPPS includes a Management Application which provides management functions like reporting usage data and peripheral status (e.g. heartbeat, paper outage) for common use positions.
 2. Common Use Self-Service Boarding Control System – allows self-service boarding functionality for the passenger. Self-Service Boarding Control Systems (BCS) shall be located at the gates, in the hold room areas to assist the passenger with aircraft boarding.
 3. Local Departure Control System (LDCS) – allows airlines without a dedicated reservation system, to perform the necessary functions for providing boarding passes and baggage tags. The LDCS will be located at check-in counters, gates and recheck locations throughout the facility.
 4. The Common Use System includes interfaces with the Authority’s other systems.
 - a. Multi-User Flight Information Display System (MUFIDS) – provides flight, baggage and gate information.
 - b. Integrated Airport Management System (IAMS) – provides CUPPS log in control, check-in counter and gate assignments, and automated flight information.
 - c. Voice over Internet Protocol (VoIP) telephone system – allows communication over a single platform and dynamic allocation of phones based on airline assignments.
 - d. Dynamic Signage System – provides standard and rich content displays which correspond to airline counter and gate assignments.
 - e. Baggage Handling System (BHS) - handles the processing and transportation of passenger's baggage to and from locations across the airport property.
 - f. Premise Distribution System (PDS)- Enables all GOAA low voltage systems to be fully operational according to design specifications at project completion.
 - g. Passive Optical Network (PON)- Supports network communication and all connected systems throughout the South Terminal Complex (STC).

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. In addition to items to be furnished and installed under this Contract, this project consists of items to be furnished and/or installed by the Authority and Authority Vendors. In order to provide for comprehensive review of all system designs by the Authority and OAR, the contractor shall obtain all items required as part of standard submittals specified above from the Authority and or Authority Vendor(s) for Authority- or Authority-Vendor furnished equipment and submit them as part of the Contractor's submittal packages.
- C. The Contractor shall provide a system rollout and phasing plan documents and include, at a minimum:
 - 1. Schedule of Events
 - 2. Include calibration plan
 - 3. Warranty Plan
 - 4. Service & Maintenance Logged Events
 - 5. Detailed schedule including time to allow Authority and Authority Vendors to perform work items related to the Common Use System. Coordinate with Authority and Authority Vendors, obtain length of time required for Authority and Authority Vendors to perform required tasks, and incorporate these time requirements into the system rollout and phasing plan.
- D. The Contractor shall provide project management documents and include, at a minimum:
 - 1. Project Management Plan.
 - 2. Change Management Process.
 - 3. Monthly Communication Plan.
 - 4. List of Special Tools, Test Equipment and Outside Inventory needed for the project.

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Authority Vendor shall be responsible for the testing of all hardware, software, and certification.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall coordinate delivery and testing requirements with the Authority and OAR for component testing in the Authority's Technology Integration Lab (TIL).
- C. The Authority Vendor shall coordinate reacceptance of equipment that is held in storage greater than 90 days.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Project Record Documents

1. Provide record documentation to the Authority and OAR at the completion of each phased installation and at Contract Closeout. To ensure that this submittal reflects proper record keeping during the Work, maintain on-site one (1) set of the Contract Drawings, specifications, addenda, change orders and other modifications to the Contract, and reviewed shop drawings and product data.
2. Legibly mark and record at each specification section a description of actual products installed, including the manufacturer's name and product model number, product substitutions or alternates approved and utilized, and changes made by Addenda and Modifications.
3. Legibly mark Record Documents and shop drawings to record actual installation including communication conduit, cabling and pathways used, field changes of dimensions and detail, changes in details from those indicated on drawings, details not on original Contract Drawings, and provide make and model of actual product installed.
4. Mark whichever drawing is most appropriate to showing "field" conditions fully and accurately. If necessary, provide scaled drawings of modifications and give attention to concealed work, which would be difficult to measure and record later. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, and print suitable titles, dates, name of installing company, name and signature of job superintendent, and other identification on the cover of each set.

C. As-Built Documentation

1. As-Built documentation shall include finalized equipment locations, cable and conduit routing pathways, and installation details. The As-Built documentation shall not be redlined copies but be finalized AutoCAD or REVIT drawings. The As-Built documentation shall build on the initial design details and further develop these based on specific installation details.
2. As-Built documentation shall be capable of being inserted into the Authority GIS system.
3. The level of detail defined in these As-Built documents shall be suitable to allow any third party to support the Common Use System maintenance as well as support future integration and expansion of the Common Use System at the Airport.
4. Acceptance of As-Built documentation shall be part of final system acceptance process and subject to a ten percent (10%) cost retainage.

1.10 OPERATIONS AND MAINTENANCE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Authority Vendor shall provide Operations and Maintenance Manuals for Authority Vendor provided equipment.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIALS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Provide a list of required spare parts inventory and shall furnish each inventory of spare parts (type, model number, and quantity) during the warranty period. Furnish a bill of materials, catalog numbers, unit prices, and a list of local distribution sources for all replacement parts. Required spares shall be on-site at the time of final system acceptance.
- C. Spare parts are to be inventoried at the beginning of the project and accounted for at the end of the warranty and service period. Any spare parts unused at the end of the warranty and service period shall become the property of the Authority.
- D. As a minimum, the following spare parts shall be provided on site:
 - 1. A quantity of five (5) of each type of commercial off-the-shelf or custom fabricated display mount.
- E. Manage all required spare parts, including logistics and performing/coordinating repair activities. On-site storage and maintenance of spare parts shall be in sufficient quantity to maintain each system at the level of six (6) months.

1.13 ENVIRONMENTAL CONDITIONS

- A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 for requirements.

2.2 SYSTEM REQUIREMENTS

- A. Network and Connectivity
 - 1. Coordinate with the Authority and Authority Vendor for the installation of all network components required for the Common Use System.
 - 2. Provide the design and all integrations with the PON/LAN and necessary configuration to provide the functionality described within this document. All configurations shall be performed in coordination with and approval by the Authority and OAR.
 - 3. The Common Use System shall be able to connect to the existing head end servers in the NTC via Passive Optical Network (PON).

2.3 HARDWARE REQUIREMENTS

- A. Supporting Infrastructure
 - 1. Hardware Structures:
 - a. Provide all hardware and casework required for final installation.
 - b. Perform the appropriate coordination with the Authority, OAR, and Authority Vendor to ensure all Common Use System equipment (display devices, workstations, etc.) will be accommodated by casework, mounting brackets and/or housings.

- c. Create and submit shop drawing component drawings detailing the exact mounting requirements for each component and device as well as the detail information for the casework that is to be installed to support the Common Use System devices.
 - d. All casework, mounting brackets and mounting hardware shall be adjustable to permit future replacement of Common Use System displays with displays differing in overall horizontal and/or vertical dimensions by up to one (1) inch. Mounting provisions which do not allow horizontal, vertical, and front-to-back adjustment shall not be acceptable.
 2. Equipment racks:
 - a. Supply and install any additional equipment racks that may be required for equipment installation with the telecommunication rooms. Obtain rack space requirements from the Authority and Authority Vendor(s).
 - b. Coordinate with the Authority and OAR to determine installation location for all equipment that is to be placed with the telecommunication rooms.
 - c. Refer to Specification Sections 27 05 00, 27 10 00 and 27 10 05 for additional information.
- B. End Devices
 1. The contractor shall coordinate all mounting hardware and provisions with Authority and Authority Vendor-furnished and/or installed displays and devices.
 2. The basis of design for the Common Use System equipment are as follows.
 - a. Gate Counters will include configurations of the following:
 - 1) CUPPS Standard Workstation- Model: HP 800 G4 Mini (PC)
 - 2) Standard Keyboard & Mouse- Model: HP Standard Wired
 - 3) Display Device- Viewsonic 22 Inches
 - 4) Boarding Pass Printer- Model: Custom TK180-metal
 - 5) RFID Baggage Tag Printer- Model: Custom Tk180- metal RFID
 - 6) Magnetic Stripe Reader and Optical Character Reader- Model: Access-IS MSR/OCR315e
 - 7) Printer- Model: HP M506
 - b. Gate Podiums will include configurations of the following:
 - 1) CUPPS Standard Workstation - Model: HP 800 G4 Mini (PC)
 - 2) Standard Keyboard & Mouse- HP Standard Wired
 - 3) Display Device- Viewsonic 22 Inches
 - 4) Boarding Gate Reader- Model: Access-IS BGR 750 Flat bed
 - 5) Boarding Pass Printer- Model: Custom TK180-metal
 - 6) RFID Baggage Tag Printer- Model: Custom Tk180- metal RFID
 - 7) Magnetic Stripe Reader and Optical Character Reader- Model: Access-IS MSR/OCR315e
 - 8) 4 Port USB to Serial RS232 Adapter
 - 9) RJ45 Modular Adapter

PART 3 - EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Common Use System consists of hardware, software, installation, and appurtenances provided by the Authority and Authority Vendor in addition to items provided under this Contract. The Contractor shall be responsible for overall coordination of the installation of all system components, equipment and all appurtenances to ensure all activities adhere to the Project Schedule, whether performed under this Contract or not.
 - 1. The Common Use System shall require extensive software programming by the Authority Vendor to incorporate data from other systems including IAMS, Electronic Dynamic Signage, MUFIDS, PON, PDS, BHS and VoIP. Contractor shall coordinate with the Authority Vendor to allow sufficient time for such programming to be completed prior to project completion in accordance with the Project Schedule.
- C. Project Management
 - 1. The contractor shall provide comprehensive project management services for the coordination of its team members and coordination of team members with the Authority and all Authority Vendors during the term of the project. Within thirty (30) calendar days after receipt of the Notice to Proceed, develop and submit a detailed draft Project Management Plan addressing the means and methods for implementing the Common Use System, including the preparation of schedules and plans.
 - 2. The contractor shall submit a project schedule that defines the completion milestones, review periods, approvals, and related items. Produce a project schedule using Primavera 6.
 - 3. The Contractor shall coordinate with the Authority, OAR and Authority Vendors to finalize the Project Management Plan and all associated documents and schedules.
 - 4. The Contractor shall provide regular progress and problem resolution reporting.
- D. Site Preparation
 - 1. The Contractor shall obtain the latest Common Use (CUS) Equipment product data cutsheets from the Vendor during product data and shop drawing submission. Confirm locations of and all dimensions of CUS devices being deployed with the Vendor and note their locations on and within the millwork in shop drawing submission. Coordinate cabling pathways for network, power and peripheral cabling throughout the millwork with the Vendor, the millwork Contractor, the OAR and EOR. Include labor and appurtenances required for any drilling post millwork production required for proper cable routing. Work with the Vendor and Millwork Contractor to present a detailed field mockup for approval to the OAR of each millwork type showing component placement, power, data and fiber outlet placement, cable routing, cable management and access points prior to proceeding with the complete installation in all areas.

2. Any work performed onsite regarding conduit and cable installation, floor penetrations, etc. related to the Common Use deployment performed before the shop drawing and field mockup approval will be at the sole risk of the Contractor.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 for requirements.

3.4 EQUIPMENT INSTALLATION

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Provide all tools and test equipment required to install, verify, and test the installation and to determine that it meets the specifications. Furnish all necessary materials required to implement and to achieve the required work performance.
- C. Install products detailed in the specifications, system requirements, and drawings including those purchased by the Contractor and those provided by other parties.
- D. Contractor shall be responsible for all work to be neat in appearance and completely installed per means and methods of this type of equipment installation. Contractor shall ensure that all equipment is plumb, level and square and securely attached to the structures. Structures shall be rated to hold the rated equipment.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

3.6 EQUIPMENT POWER DISTRIBUTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE AND SERVICE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. General Requirements
 1. Maintenance and Service as defined in the following sections shall be included as a part of the Warranty Plan at no additional cost to the Authority.
 2. Special Equipment

- a. Identify and provide special tools, test equipment, and outside inventory required for this project.
 3. In the event of a failure of the systems, platforms or equipment under the direct control of the Contractor, whether the failure falls below service targets or not, the Contractor shall take measures to correct the problem in a responsive and professional manner.
- C. Resolution of Conflict
 1. Due to the nature of multiple products, suppliers, contractors, installers, software, etc. that is involved in the Common Use System solution, there may be conflicts that could occur between the various sources, the Authority and OAR, Authority Vendor, and/or the airlines. The following steps shall be followed for conflict resolution with escalation to the next step should resolution not be achieved.
 - a. The best effort shall be made to resolve all conflicts without involving the Authority and OAR, Authority Vendor, or airlines
 - b. Coordinate and arrange appropriate meetings with only necessary representatives of involved outside parties to achieve conflict resolution. Representatives shall be expected to have all required documentation describing their input to the conflict and potential resolution. Have a recommended solution prepared prior to the meeting. The Authority and OAR shall provide final approval on recommendation.
 - c. Should resolution not be achieved as described above, the Authority and OAR shall provide final decision based on modifications to the provided recommendation or a request that other recommendations be researched and presented to the Authority and OAR.

3.11 WARRANTY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Authority Vendor shall be responsible for the removal of OFE for the purposes of warranty repairs and for subsequent reinstallation and/or replacement of OFE.
- C. The Contractor shall be responsible for warranty of contractor supplied equipment and infrastructure.

3.12 FIELD SERVICE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Post-Delivery / Pre-Installation Staging
 1. Pre-Installation Staging shall verify through a basic mounting mock-up process that each device and display ready to be installed will properly attach to all mounting brackets and housings. The Pre-Installation Staging shall verify proper fit and finish.
 2. Equipment shall be the actual products or identical models of products used for Factory Acceptance Testing.

3. Ensure that the development of the Common Use System is complete, required approval of submittals have been obtained, and sufficient equipment procured to perform the Pre-Installation Staging.
4. Pre-Installation Staging shall be scheduled on weekdays during standard business working hours, unless otherwise noted and approved in writing by the Authority and OAR.
5. Items to be tested shall be set up and performance verified prior to the arrival of the Authority and OAR at the test site.
6. The Vendor, Contractor, the Authority, OAR, and Authority Vendor shall have the opportunity to inspect Pre-Installation Staging mock-ups.
 - a. All costs associated with required retesting due to failures or delays beyond the test schedule shall be incurred by the party conducting the test. All retests shall require acceptance and approval by the Authority and OAR prior to formal Delivery Integration Testing with the Authority and OAR and the airlines.

C. Final Inspection and Acceptance

1. Pre-Installation Staging is complete, submit and review the final report of Pre-Installation Staging containing all recorded data with the Authority and OAR.
2. Update the test plans with attachments created and presented during all test phases and deliver as one (1) document to the Authority and OAR upon Final Inspection and Acceptance.

3.13 TRAINING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Authority Vendor shall provide training at the Airport per stakeholder group for the participating Airlines and Authority Staff. Training schedules shall be coordinated with the Authority and OAR.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 20 20

SECTION 27 24 00 – ELECTRONIC GATE SYSTEMS

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.
- B. Related Specification Sections:
 - 1. Refer to Specification Section 27 05 00 for a complete list of related specification sections.
- C. Reference Symbols:
 - 1. Refer to Specification Section 27 05 00 for requirements.
- D. Abbreviations:
 - 1. Refer to Specification Section 27 05 00 in addition to the following:
 - a. ICAO International Civil Aviation Organization
 - b. ICD Interface Control Document
 - c. MRZ Machine Readable Zone
 - d. NTC North Terminal Complex
 - e. OFE Owner-Furnished Equipment
 - f. TIL Technology Integration Lab
 - g. TPM Technical Project Manager
 - h. UL Underwriters Laboratories
- E. Definitions:
 - 1. Refer to Specification Section 27 05 00 in addition to the following:
 - a. Interface: Bridge between two (2) or more separate software products where data is maintained in more than one (1) location.
 - b. Integration: Two (2) or more software products where functionality is combined into one (1) product and data is maintained in one (1) location.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The current Electronic Gate System deployed at the South Terminal C airside concourse is the Gunnebo Mk3, deployed by SITA. The Electronic Gate Systems scope for the airside concourse expansion will be the extension of this existing system, deploying additional electronic gates throughout the expansion areas.
- C. The intent of this specification is to establish a standard of quality, functions, and features for the installation of components to support a fully operative integrated Airport system, herein referred to as Electronic Gate System.
- D. The Electronic Gate System installed shall meet the requirements presented in this specification as an extension of the existing Electronic Gate System currently serving both the North Terminal Complex (NTC) and South Terminal C.

- E. The installation of the Electronic Gate System in the South Terminal Complex (STC) airside expansion shall include, but not be limited to, raceway, cabling, network infrastructure cabling, housings, labor, training, labeling, clean up, coordination and oversight of all Contractor, Authority Vendor, and Authority Furnished Equipment (Owner-Furnished Equipment (OFE)).
- F. The Contractor shall notify the Authority and Owner's Authorized Representative (OAR) in writing of any items not in compliance with the requirements described in this section.
- G. The Electronic Gate System shall include all system components as required to meet the functional, operational, performance, and redundancy requirements necessary to deliver a fully integrated and operational system in accordance with the Contract Documents and as herein specified.
 - 1. Refer to Specification Section 27 05 00 and 27 10 00 for all TCP/IP based cabling requirements for additional information regarding the intended connectivity of these systems.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing sheet T0.00.03 for the work responsibility matrix for the scope of work required for the Electronic Gate System.
 - 1. Where listed on the drawing responsibility matrix, the following components shall be defined as follows:
 - a. Headend and Software: The Authority shall furnish and configure the site server. The Authority Vendor shall install the site server, furnish and install the management software, unit firmware and software, configurations, interfaces and upgrades.
 - b. Integration to Existing System: The Contractor shall provide fiber channeling with all materials required to connect the STC airside concourse expansion to the existing NTC and STC systems. The Contractor shall coordinate with the Authority and the Authority Vendor to ensure fiber channeling completion complies with the project schedule.
 - c. Interfaces: The Authority Vendor shall provide all system interfaces including, but not limited to all hardware, software, programming, interface devices and appurtenances as required for communication between the E-Gate and other related systems.

- d. Network Components: The Authority will furnish and configure all network-related equipment including servers and routers. The network includes layer 2 access and distribution or layer 3 core and router switches to connect a system to the Authority Passive Optical Lan and Local Area Network. Contractor shall coordinate patching into the network with the Authority and provide all patch cables as required. Passive Optical LAN components are specified in Section 27 10 05 for ASC and LST work and include Optical Line Terminals (OLTs) and Optical Network Terminals (ONTs). Refer to related specification sections for additional information. The Contractor shall also complete the integration to a dedicated Local Area Network (LAN), which is not part of the PON or Authority network, to provide the functionality described within this document.
 - e. Backbone Cable: The Contractor shall provide all backbone cabling and associated raceways/pathways, boxes, fittings and appurtenances. Work shall also include all fiber channeling for a complete and operational system. Contractor shall perform fiber channeling as described in section 27 10 00 and furnish and install all patch cables required for channeling. Refer to specification section 27 10 00 for requirements.
 - f. Horizontal Cable: The Contractor shall provide all horizontal cabling and associated raceways/pathways, boxes, fittings and appurtenances. Contractor shall install patch cable onto patch panel and route cable back to ONTs with the appropriate lengths, and label per GOAA standards. Provide patch panel port and patch panel labeling information to the Authority to perform patching onto the ONTs.
 - g. Field Devices: The Authority will furnish and configure all Electronic Gates and will provide test space. The Authority Vendor shall install the Electronic Gate Systems associated management software including firmware and software, configurations, interfaces and upgrades. The Contractor shall coordinate with the Authority Vendor for the exact location and install the Electronic Gate System equipment. The Contractor shall provide all field patch cables with the appropriate lengths required for field device connection to field outlets or ONTs.
- C. The Contractor shall provide the following services:
- 1. Contractor shall provide comprehensive project management services for the coordination of its team members during the term of the project.
 - 2. The Contractor shall provide Quality Assurance services to ensure that the installed system meets or exceeds every standard set forth in these specifications, in coordination with the Authority and Authority Vendor.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. If conflicts exist between referenced requirements, the Contractor shall comply with requirements in the following order: 1) requirements contained within this section, 2) Specifications Section 27 05 00, and 3) Contract documents.
- C. Reference Documents:

1. ISO Standards on Quality Management and Quality Assurance (ISO 9000:2015, ISO 9001:2015, ISO 9004:2015)
2. UL 60950-1: Information Technology Equipment Safety
3. U.S. CBP Biometric Air Exit program

1.5 SYSTEM DESCRIPTION

- A. The E-Gate in the South Terminal Complex (STC) is made up of self-service electronic gates and biometric cameras, connected to common use workstations.
- B. The E-Gate functions shall include, at a minimum:
 1. Biometric capture of passenger or scan of boarding pass at E-Gate
 2. Transmission of data to airline DCS to generate UID
 3. Airline DCS sends APIS to CBP to CBP Traveler Verification System through SecureFlight router
 4. Passenger information is filtered through the applicable databases (Passport DB, Visa DB, Arrivals) and matched with existing information
 5. Ability for SmartPath hub server to receive data and transmit results
 6. Go or No-Go confirmation is sent to the E-Gate
- C. The E-Gate management functions include, at a minimum:
 1. Reporting capabilities

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall provide a system rollout and phasing plan documents and include, at a minimum:
 1. Schedule of Events
 2. Warranty Plan
 3. Service & Maintenance Logged Events
 4. Detailed schedule including time to allow Authority and Authority Vendors to perform work items related to the E-Gate. Coordinate with Authority and Authority Vendors to obtain length of time required for Authority and Authority Vendors to perform required tasks and incorporate these time requirements into the system rollout and phasing plan.
 5. Need for special equipment to transport and install
- C. The Contractor shall provide project management documents and include, at a minimum:
 1. Project Management Plan
 2. Change Management Process
 3. Monthly Communication Plan
 4. List of Special Tools, Test Equipment and Outside Inventory needed for the project

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 in addition to the following.

- B. The Authority Vendor shall be responsible for the testing of all hardware, software, and certification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall coordinate delivery and testing requirements with the Authority and OAR for component testing in the Authority's Technology Integration Lab (TIL).
- C. The Authority Vendor shall coordinate reacceptance of equipment that is held in storage greater than 90 days.
- D. The need for special equipment to transport and install the E-Gate.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 for requirements.
- B. Project Record Documents
 1. Provide record documentation to the Authority and OAR at the completion of each phased installation and at Contract Closeout. To ensure that this submittal reflects proper record keeping during the Work, maintain on-site one (1) set of the Contract Drawings, specifications, addenda, change orders and other modifications to the Contract, and reviewed shop drawings and product data.
 2. Legibly mark and record at each specification section a description of actual products installed, including the manufacturer's name and product model number, product substitutions or alternates approved and utilized, and changes made by Addenda and Modifications.
 3. Legibly mark Record Documents and shop drawings to record actual installation including communication conduit, cabling and pathways used, field changes of dimensions and detail, changes in details from those indicated on drawings, details not on original Contract Drawings, and provide make and model of actual product installed.
 4. Mark whichever drawing is most appropriate to showing "field" conditions fully and accurately. If necessary, provide scaled drawings of modifications and give attention to concealed work, which would be difficult to measure and record later. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, and print suitable titles, dates, name of installing company, name and signature of job superintendent, and other identification on the cover of each set.
- C. As-Built Documentation
 1. As-Built documentation shall include finalized equipment locations, cable and conduit routing pathways, and installation details. The As-Built documentation shall not be redlined copies, but be finalized AutoCAD or REVIT drawings. The As-Built documentation shall build on the initial design details and further develop these based on specific installation details.
 2. As-Built documentation shall be capable of being inserted into the Authority GIS system.

3. The level of detail defined in these As-Built documents shall be suitable to allow any third party to support the DSS maintenance as well as support future integration and expansion of the DSS at the Airport.
4. Acceptance of As-Built documentation shall be part of final system acceptance process and subject to a ten percent (10%) cost retainage.

1.10 OPERATIONS AND MAINTENANCE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Authority Vendor shall provide Operations and Maintenance Manuals for Authority Vendor provided equipment.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Authority Vendor shall provide site licenses. If site licenses are not available, provide user licenses for each type of software used in the E-Gate.

1.12 SPARE MATERIALS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Provide a list of required spare parts inventory and shall furnish each inventory of spare parts (type, model number, and quantity) during the warranty period. Furnish a bill of materials, catalog numbers, unit prices, and a list of local distribution sources for all replacement parts. Required spares shall be on-site at the time of final system acceptance.
- C. Spare parts are to be inventoried at the beginning of the project and accounted for at the end of the warranty and service period. Any spare parts unused at the end of the warranty and service period shall become the property of the Authority.
- D. At a minimum, ten (10%) spare parts inventory shall be maintained on site for end devices.
- E. Manage all required spare parts, including logistics and performing/coordinating repair activities. On-site storage and maintenance of spare parts shall be in sufficient quantity to maintain each system at the level of six (6) months.

1.13 ENVIRONMENTAL CONDITIONS

- A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to specification Section 27 05 00 for additional information.

2.2 MANUFACTURERS

- A. Electronic Gate System
 1. Gunnebo
 2. SITA
 3. No Approved Substitution. Extension of existing system.
- B. The installed E-Gate shall be UL listed.

2.3 SYSTEM REQUIREMENTS

A. Network and Connectivity

1. Coordinate with the Authority and Authority Vendor for the installation of all network components required for the E-Gate.
2. The Authority Vendor shall provide the design and all integrations with the LAN and necessary configuration to provide the functionality described within this document. All configuration shall be performed in coordination with and approval by the Authority and OAR.
3. The Contractor shall connect the E-Gate directly to the workstation at the gate

B. Fire Alarm System Interface

1. The Contractor shall provide (1) one addressable Fire Alarm Relay per electronic gate lane (typical of (2) two lanes per gate). The Contractor shall coordinate Fire Alarm cabling installation in E-Gate with the E-Gate Vendor installing contractor and shall provide all wiring, terminations, testing and labor to complete the Fire Alarm scope of the E-Gate installation.
2. Refer to Division 28 31 00 specification for additional requirements.

2.4 HARDWARE REQUIREMENTS

A. Type A Passenger Self Boarding Gate

1. E-Gate minimum requirements are as follows:
 - a. LCD screen for passenger instruction
 - b. Device for printing seat assignment changes
 - c. Facial Biometric Camera: capable to capture ICAO-compliant facial photographic images of all kiosk users
 - d. Dynamic LED Illumination System
 - e. Passport Reader: scans the MRZ data to capture embedded traveler information
 - f. Ability to scan industry standard boarding pass barcodes printed by airlines, self-service kiosks, personal printers, smart phones, and wearables
 - g. Lockable Maintenance Access Panel
 - h. Manufacturer: As described in 1.2.C, the equipment shall match the existing NTC equipment.
2. Each unit requires 110V 60Hz single-phase, grounded outlet. Contractor shall coordinate with electrical power trades to ensure correct power provisions to support the E-Gate equipment, including coordination of outlet locations.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 in addition to the following.

- B. The E-Gate consists of hardware, software, installation, and appurtenances provided by the Authority and Authority Vendor in addition to items provided under this Contract. The Contractor shall be responsible for overall coordination of the installation of all system components, equipment and all appurtenances to ensure all activities adhere to the Project Schedule, whether performed under this Contract or not.
- C. Project Management
1. The contractor shall provide comprehensive project management services for the coordination of its team members during the term of the project. Within thirty (30) calendar days after receipt of the Notice to Proceed, the Contractor shall develop and submit a detailed draft Project Management Plan addressing the means and methods for implementing the E-Gate, including the preparation of schedules and plans.
 2. The Contractor shall submit a project schedule that defines the completion milestones, review periods, approvals, and related items. Contractor shall produce the project schedule using Microsoft Project.
 3. The Contractor shall coordinate with the Authority and OAR to finalize the Project Management Plan and all associated documents and schedules.
 4. The Contractor shall provide regular progress and problem resolution reporting.
 5. The Contractor shall coordinate with the Authority Vendor, Authority, OAR and the CBP for site conditions which might impact any aspect of installation, including enabling work, power sources, and unit layout.
- D. Site Preparation
1. The Contractor shall obtain the latest E-Gate product Engineering Drawings from the Vendor during shop drawing submission. Confirm all dimensions of E-Gate assembly including floor penetration locations and sizes. Note that floor penetrations shall be core drilled after slab on metal deck has cured and reached compressive strength. Work with the Vendor to create a template for floor penetration locations prior to core drilling. Contractor's shop drawing submittal shall include the following:
 - a. Vendor's current engineering shop drawing of E-Gate being deployed including all dimensions.
 - b. Scaled floor plans of gate areas showing the correctly dimensioned E-Gate in its final position and noting floor penetration location and size.
 - c. Conduit pathways from floor penetration interconnecting between E-Gates and millwork for connections to ONTs and Common Use Workstations.
 - d. Fire Alarm interface wiring diagrams.
 - e. Building power connections.
 - f. Network diagrams.
 2. Any work performed onsite regarding conduit and cable installation, floor penetrations, etc. related to the E-Gate deployment performed before the shop drawing approval will be at the sole risk of the Contractor.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 for requirements.

3.4 EQUIPMENT INSTALLATION

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall provide all tools and test equipment required to install, verify, and test the installation and to determine that it meets the specifications. The Contractor shall furnish all necessary materials required to implement and to achieve the required work performance.
- C. The Contractor shall be responsible for all work to be neat in appearance and completely installed per means and methods of this type of equipment installation. Contractor shall ensure that all equipment is plumb, level and square and securely attached to the structures. Structures shall be rated to hold the rated equipment.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

3.6 EQUIPMENT POWER DISTRIBUTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE AND SERVICE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. General Requirements
 1. Maintenance and Service as defined in the following sections shall be included as a part of the Warranty Plan at no additional cost to the Authority for Contractor provided equipment.
 2. Special Equipment
 - a. Contractor shall identify and provide special tools, test equipment, and outside inventory required for this project.
 3. In the event of a failure of the systems, platforms or equipment under the direct control of the Contractor, whether the failure falls below service targets or not, the Contractor shall take measures to correct the problem in a responsive and professional manner.
- C. Resolution of Conflict
 1. The following steps shall be followed for conflict resolution with escalation to the next step should resolution not be achieved.

- a. Contractor shall make its best effort to resolve all conflicts without involving the Authority and OAR, Airlines or CBP.
- b. Contractor shall coordinate and arrange appropriate meetings with only necessary representatives of involved outside parties to achieve conflict resolution. Representatives shall be expected to have all required documentation describing their input to the conflict and potential resolution. Contractor shall have prepared a recommended solution prior to the meeting. The Authority and OAR shall provide final approval on recommendation.
- c. Should resolution not be achieved as described above, the Authority and OAR shall provide final decision based on modifications to the Contractor provided recommendation or a request that other recommendations be researched and presented by the Contractor to the Authority and OAR.

3.11 WARRANTY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall be responsible for warranty of contractor supplied equipment and infrastructure.
- C. The Authority Vendor shall be responsible for the removal of OFE for the purposes of warranty repairs and for subsequent reinstallation and/or replacement of OFE.

3.12 FIELD SERVICE

- A. Refer to Specification Section 27 05 00 for requirements.

3.13 TRAINING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Authority Vendor shall provide training at the Airport per stakeholder group for the CBP and Authority Staff. Training schedules shall be coordinated with the Authority and OAR.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 24 00

SECTION 27 41 33 - IP MASTER ANTENNA TELEVISION SYSTEM

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.
- B. Related Sections:
 - 1. Refer to Specification Section 27 05 00 for a complete list of related specification sections.
- C. Reference Symbols:
 - 1. Refer to Specification Section 27 05 00 for requirements.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The IPTV System shall be an extension of the existing South Terminal C IPTV System.
- C. The intent of this specification is to establish a standard of quality, functionality, and features for the installation of an IP-based Master Antenna Television (IPTV) system throughout the STC airside concourse expansion as indicated on the Contract Drawings and specified herein. The IPTV system shall distribute and display broadcast television content obtained from the Authority's service provider, Summit Broadband, on video display monitors throughout the terminal.
- D. It is the responsibility of the contractor to ensure that the installed system meets or exceeds every standard set forth in these specifications. The contractor shall provide all fiber/copper outlets, conduits, fiber optic cabling and category 6 cabling as necessary to provide a complete and fully operational IP Master Antenna Broadcast Television (IPTV) distribution system.
 - 1. Refer to Specification Sections 27 05 00 and 27 10 00 and for all TCP/IP based system cabling requirements.
- E. The Contractor shall be responsible for providing all cabling, cable terminations, conduits/raceways, racks, cabinets, programming, commissioning, and testing of all network communications cabling in accordance with all related Division 27 Specification Sections.
- F. Definitions
 - 1. Refer to Specification Section 27 05 00 for requirements.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing Sheet TA0.00.03 for the work responsibility matrix for the scope of work required for the IPTV System.

1. Where listed on the responsibility matrix, the following line items shall be defined as follows:
 - a. **Headend and Software:** The IPTV system requires connectivity to the public internet in order to obtain the required video data. The Authority and Authority Vendor shall furnish and install all required active network equipment. The Contractor shall coordinate with the Authority and Authority Vendor to furnish end-to-end cabling connectivity to service IPTV outlets. The Contractor shall also furnish and install all head end audio/visual equipment including fiber optic extender transmitters, networks a/v media players, A/V control system equipment, A/V matrix switchers, and A/V distribution amplifiers.
 - b. **Integration to Existing System:** The Authority will perform all required tasks in order to document and manage the IPTV in the North and South Terminals as a single system. The Contractor shall provide fiber channeling with all materials required to connect the STC airside concourse expansion to the existing NTC and STC systems. The Contractor shall coordinate with the Authority and the Authority Vendor to ensure fiber channeling completion complies with the project schedule. Refer to Backbone Cable below for additional information.
 - c. **Interfaces:** The Authority shall furnish and Authority Vendor shall install all hardware, software, programming, interface devices and appurtenances as required for communication between the IPTV and the Authority Passive Optical LAN (POL) / Local Area Network (LAN) and all terminal systems which require connectivity.
 - d. **Network Components:** Refer to specification section 27 10 05 for requirements. The Authority shall furnish and Authority Vendor shall install all Passive Optical Network components required to support the IPTV system except for passive optical splitters. Refer to Horizontal Cable below.
 - e. **Backbone Cable:** The contractor shall furnish and install all backbone cable, including fiber channeling to achieve the required connectivity to the NTC and STC Phase 1. Contractor shall perform fiber channeling as described in section 27 10 00 and furnish and install all patch cables required for channeling. Coordinate with the Authority and the Authority Vendor to ensure fiber channeling completion complies with the project schedule. Refer to specification section 27 10 00 for additional information.
 - f. **Horizontal Cable:** The contractor shall furnish and install all horizontal cabling and associated raceways/pathways, boxes, fittings and appurtenances. Furnish patch cables for connection of all IPTV set-top boxes at display locations and in communications spaces (IDFs/MDF). Install patch cables at each set-top box location. Includes fiber optic cabling and copper cabling to support ONTs. Contractor shall install patch cable onto patch panel and route cable back to ONTs with the appropriate lengths, and label per GOAA standards. Provide patch panel port and patch panel labeling information to the Authority to perform patching onto the ONTs. Refer to specification section 27 10 00 for additional information.

- g. Field Devices: The Authority will furnish and Contractor shall install Set-Top Boxes and Flat Panel Displays. The Contractor shall furnish and install standard off-the-shelf mounts, A/V touchscreen controllers, A/V control cables, audio amplifiers, audio speakers, A/V media panels, fiber optic extender receivers, A/V cables and connectors and all appurtenances. The Contractor shall provide all field patch cables with the appropriate lengths required for field device connection to field outlets

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 for requirements.

1.5 SYSTEM DESCRIPTION

- A. The IPTV system shall provide the display of broadcast/cable television channel feeds on selected flat panel display monitors in the South Terminal Complex airside concourse expansion. The system shall consist of IPTV tuner modules (“set top boxes”) located at each IPTV display. Set top box make and model shall be as required by the Authority’s service provider. Set top boxes shall obtain television content through the Local Area Network / Passive Optical Network from the content provider’s utility connection.
- B. The South Terminal Local Area Network / Passive Optical Network shall be configured to provide the appropriate routing and switching paths from the existing network service provider public wide area network (WAN) connection in the NTC to the set top boxes to be installed in the STC airside concourse expansion.
- C. The IPTV system shall receive an initiation signal from the Fire Alarm System (FAS) through the ECS and playback a preset message on the IPTV displays. Refer to Division 27 51 13 and 28 31 00 for more information in addition to the requirements listed below.
 - 1. The Contractor shall coordinate the interface with the FAS through the ECS to provide the functionality.
 - 2. The Contractor shall coordinate with GOAA and create images for multiple emergency announcements. Those may include Weather Event 1, 2, X, evacuation, and similar.

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 in addition to the following:
 - 1. Submit a channel plan listing channel numbers and corresponding broadcast network or content.

1.7 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 for requirements.

1.8 DELIVERY STORAGE AND HANDLING

- A. Refer to Specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

1.10 OPERATIONS AND MAINTENANCE

- A. Refer to Specification Section 27 05 00 for requirements.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. Refer to Specification Section 27 05 00 for requirements.

1.13 ENVIRONMENTAL CONDITIONS

- A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 for requirements.

2.2 SYSTEM REQUIREMENTS

- A. The IPTV system shall support all channels made available by the service provider as part of the Authority's subscription, with the capability to support additional channels in the future (minimum of 64 channels).
- B. The IPTV system shall meet the following audio/visual formatting requirements
 - 1. Support a minimum of 1920x1080-pixel full HD resolution at 60Hz refresh rate, as well as other standard resolutions including 480i, 480p, 720p, and 1080i.
 - 2. Support for standard compression formats including, but not limited to MPEG-1, MPEG-2, MPEG-4 Part 10 (AVC/H.264), and others as specified by the service provider.
- C. Images and audio shall be free from pixilation, artifacts, noise and other undesirable audible and visual aberrations.
- D. All system components shall be fully interoperable and permit future upgrades via software or firmware update.

2.3 FIELD DEVICES

- A. Flat Panel Displays
 - 1. Authority shall furnish and Contractor shall install LED-backlit LCD flat displays as shown on the contract documents. Displays shall be commercial/professional-grade, rated for 24/7 use and meet the following requirements:
 - a. Panel Size: 55" Class Diagonal – 16:9 widescreen aspect ratio.
 - b. Bezel: 0.9mm or less
 - c. Panel Technology: In-Plane Switching (IPS)
 - d. Native Resolution: 1920 x 1080 pixels (Full HD)
 - e. Brightness: 700 cd/m²
 - f. Contrast Ratio: 1400:1
 - g. Dynamic Contrast Ratio: 500,000:1
 - h. Viewing Angle (Degrees): 178H x 178V
 - i. Color Depth: 1.06 Billion colors
 - j. Response Time (Gray-To-Gray, Black & White): 8ms
 - k. Duty Cycle: 24-7 Continuous Use

- l. Orientation: Portrait or Landscape
 - m. Inputs: HDMI, DisplayPort, DVI-D, OPS, Analog RGB, RS-232C, RJ-45, USB3.0/2.0
 - n. HDTV Formats: 720p, 1080i, 1080p
 - o. Outputs: DisplayPort (1.2a/HDCP 1.3), audio, RS-232C, RJ-45
 - p. Integrated Network/USB Media Player
 - q. Remote Monitoring and Control GUI
 2. Owner Furnished Display is the NEC P555.
- B. Set-Top Boxes
 1. Authority shall furnish and Contractor shall install an IPTV set-top box tuner for each LCD television monitor. IPTV tuners shall meet the following requirements:
 - a. AES 128/256 decryption capable.
 - b. Support of network video-on-demand.
 - c. Support for MPEG-1/2/4, H.264 and HD IPTV streams.
 - d. IR remote control.
 - e. Serial RS-232 control.
 - f. HDMI video output.
 - g. All service provider / carrier requirements.
 2. Contractor shall coordinate with the Authority and OAR for exact mounting locations of all LCD television monitors. Furnish and install mounts listed for the application and with sufficient load-bearing capacity to support the selected television monitors. Refer to the Contract Drawings for additional information.
 3. Contractor shall provide mounting brackets, hardware and fasteners required to securely mount the set-top box within the monitor mount/housing.
- C. Standard Mounts
 1. Mounts shall meet the following requirements at a minimum:
 - a. Support 40" – 65" displays
 - b. Back-to-back mounting for (2) displays
 - c. Concealed mounting area for media player / set-top box equipment
 - d. Maximum Capacity: 300lb / 136kg
 - e. Mount shall be Peerless-AV model #DST965 or approved equal.
- D. Hold Room IPTV Sound Bar
 1. At each hold room display used to transmit IPTV provide UL listed Sound Bar connected to display and Fiber Optic Extender – Receiver with all required cabling, power, mounting hardware and all other required appurtenances to complete the installation per the contract documents. Audio level of sound bar shall be adjusted and tested by Contractor to 10dB above ambient noise level for the application.
 - a. Basis of Design: EXTRON Sound Bar Model #SB 33A 46-55 or approved substitution.
 - b. Physical Characteristics
 - 1) Adjustable Dimensions: 6"H x 40"W x 3.9"D to 6"H x 49"W x 3.9"D
 - 2) Weight: 13.1 lbs
 - 3) Enclosure type: Black metal and plastic

- 4) Mounting: Mount to display with VESA compliant Sound Bar Mounting Kit, Basis of Design is SMK V SB 33. Spacers shall be used as required to provide clearance off of pole/pedestal.
 - 5) Provide with cover p/n SAK BCG SB 33
 - c. Integrated Audio Amplifier
 - 1) Class D
 - 2) Stereo channel separation: >60dB @1kHz
 - 3) Common Mode Rejection Ratio (CMMR): 74dB @ 1 kHz
 - 4) Signal to noise ratio: >90 dB
 - d. Audio Input Connections
 - 1) (1) 3.5 mm captive screw connector, 5 pole (main input)
 - 2) (1) 3.5 mm mini audio jack (tip, ring, sleeve)
 - 3) 1 pair female RCA
 - e. Control Input Connections
 - 1) (1) 3.5 mm captive screw connector, 3 pole
 - a) +10 VDC, Volume/mute, GND
 - 2) Power Supply
 - a) Input 100-240 VAC, 50-60 Hz, 4.2A
- E. Fiber Optic Extender - Transmitter
- 1. The fiber optic extender with metal enclosure shall receive an input video signal and extend it over fiber optic cabling to a receiver. The extender shall be High-bandwidth Digital Content Protection (HDCP) compliant using DVI and HDMI standards. Video signals shall achieve pixel for pixel performance. It shall also extend stereo audio signals either via HDMI, or audio embedding and HDMI de-embedding. It shall transmit bidirectional RS-232 control signals. The unit shall manage EDID communication between connected devices.
 - a. Fanless, convection cooled
 - b. Video Processing
 - 1) Maximum data rate: 4.25 Gbps
 - c. Resolution range: 640x480 to 1920x1200, 480p, 576p, 1080i, 1080p at 60 Hz, 2048x1080 at 60 Hz (undersampled)
 - d. EDID and DDC: Supports Extended Display Identification Data (EDID) and Display Data Channel (DDC) data using DVI and HDMI standards with user selectable factory or custom EDID tables
 - e. Standards: DVI 1.0, HDMI 1.4, HDCP 1.4
 - f. Audio:
 - 1) 18 bits per channel sampled at 48 Hz
 - 2) Distortion: <0.1% THD at 1kHz, >80dB S/N from 20 Hz to 20kHz
 - 3) Response: +1 dB/-3dB 80 Hz to 20 kHz at 1W
 - g. Inputs
 - 1) Audio Video: (1) female Type A HDMI
 - 2) Audio:
 - a) Signal: (1) unbalanced stereo or (2) unbalanced mono
 - b) Connectors: 3.5mm mini audio jack
 - 3) Control
 - a) Signals: bi-directional serial RS-232
 - b) Connectors: 2.5mm mini stereo jack
 - 4) Control pass through
 - a) Signals: bi-directional serial RS-232

- b) Connectors: 3.5mm 5-pole captive screw
 - h. Outputs: (2) singlemode fiber optic cables with LC connectors
 - i. Mounting: 1 RU, quarter width compatible with EIA 310-D standard, 19-inch wide panel mounting. Include all necessary mounting hardware.
 - j. Power Supply: 100-240 VAC, 50-60 Hz
 - k. Basis of Design: Extron Foxbox Tx HDMI or approved substitution.
- F. Fiber Optic Extender – Receiver
- 1. The fiber optic extender with metal enclosure shall receive an input video signal from a transmitter and convert it to a standard AV signal. The extender shall be High-bandwidth Digital Content Protection (HDCP) compliant using DVI and HDMI standards. Video signals shall achieve pixel for pixel performance. It shall also extend stereo audio signals either via HDMI, or audio embedding and HDMI de-embedding. It shall transmit bidirectional RS-232 control signals. The unit shall manage EDID communication between connected devices.
 - a. Fanless, convection cooled
 - b. Video Processing
 - 1) Maximum data rate: 4.25 Gbps
 - c. Resolution range: 640x480 to 1920x1200, 480p, 576p, 1080i, 1080p at 60 Hz, 2048x1080 at 60 Hz (undersampled)
 - d. EDID and DDC: Supports Extended Display Identification Data (EDID) and Display Data Channel (DDC) data using DVI and HDMI standards with user selectable factory or custom EDID tables
 - e. Standards: DVI 1.0, HDMI 1.4, HDCP 1.4
 - f. Audio:
 - 1) 18 bits per channel sampled at 48 Hz
 - 2) Distortion: <0.1% THD at 1kHz, >80dB S/N from 20 Hz to 20kHz
 - 3) Response: +1 dB/-3dB 80 Hz to 20 kHz at 1W
 - g. Inputs: (2) singlemode fiber optic cables with LC connectors
 - h. Outputs:
 - 1) Audio Video: (1) female Type A HDMI
 - 2) Audio:
 - a) Signal: (1) stereo/mono balanced/unbalanced
 - b) Connectors: 3.5mm mini audio jack
 - 3) Control
 - a) Signals: bi-directional serial RS-232
 - b) Connectors: 3.5mm 3-pole captive screw connector
 - 4) Control pass through
 - a) Signals: bi-directional serial RS-232
 - b) Connectors: 3.5mm 5-pole captive screw
 - i. Mounting: 1 RU, quarter width compatible with EIA 310-D standard, 19-inch wide panel mounting. Include all necessary mounting hardware.
 - j. Power Supply: 100-240 VAC, 50-60 Hz
 - k. Basis of Design: Extron Foxbox Rx HDMI or approved substitution.
- G. Networked AV Media Player
- 1. Provide a commercial network based AV media player to display static images and video on IPTV flat panel displays. The player shall receive updates from the network and retain local files and playback schedule.

2. The media player shall initiate playback based on a signal from the control system with the intent that the FAS will trigger the system through the ECS to display a message on the displays.
 - a. Fanless, convection cooled
 - b. Media Storage and Playback Formats:
 - 1) Video:
 - a) Codecs: MPEG-1, MPEG-2, H.264 MPEG-4 Part 10, H.265
 - b) Containers for FHD content: .ts, .mpg, .vob, .mov, .mP4, .m2ts, .wmv
 - c) Containers for 4K content: .ts, .mov, .mP4, .mkv
 - 2) Images: BMP, JPEG, PNG
 - 3) Audio: MP2, MP3, AAC, FLAC, OGG, WAV
 - 4) HTML5
 - c. Resolution range: 640x480 to 1920x1200, 480p, 576p, 1080i, 1080p at 60 Hz
 - d. Standards: DVI 1.0, HDMI 1.4, HDCP 1.4
 - e. Hardware Interface:
 - 1) Micro SDHC/SDXC slot
 - 2) (2) Type A USB High Speed
 - 3) 12-pin bi-directional phoenix GPIO port
 - 4) 3.5 mm bi-directional serial RS-232
 - f. Network: RJ-45 Gigabit Ethernet
 - g. Outputs:
 - 1) Audio Video: (1) female Type A HDMI
 - 2) Audio:
 - a) Signal: (1) stereo/mono balanced/unbalanced
 - b) Connectors: 3.5mm mini audio jack
 - 3) Control
 - a) Signals: bi-directional serial RS-232
 - b) Connectors: 3.5mm 3-pole captive screw connector
 - 4) Control pass through
 - a) Signals: bi-directional serial RS-232
 - b) Connectors: 3.5mm 5-pole captive screw
 - h. Mounting: 1 RU, quarter width compatible with EIA 310-D standard, 19-inch wide panel mounting. Include all necessary mounting hardware.
 - i. Power Supply: 100-240 VAC, 50-60 Hz
3. Provide fully capable network based software designed to create, publish, and manage media players including. The software shall allow multiple content types to be played in zones on a single display. The software shall include the following.
 - a. WYSIWYG drag and drop capabilities and generate live content previews.
 - b. Publish updates to groups of media players in batches.
 - c. Playlist editor including video, images, audio, HTML5, IP streams, live feeds.
 - d. An intuitive calendar including day parting.
 - e. Publish with update capabilities and dynamic playlists.
 - f. Secure logon with account capability based on user assigned permissions.
 - g. Monitor status of players remotely.

- h. Easily distribute presentations to single players, user defined groups of players, or all players at once.
- i. Remotely host and manage content.
- j. Acceptable Manufacturers:
 - 1) Extron
 - 2) Crestron
 - 3) FSR
 - 4) Or approved substitution.

H. AV Control System

- 1. Control system processor shall be provided with the required COM ports, IR, serial, relays, inputs and outputs to provide for the control and interface of the IPTV flat panel displays, media players, switches, set top boxes, and other equipment indicated on the block diagram. The units shall be a solid state device. The units shall provide the following:
 - a. Interface and programming control of IPTV displays and content selection from the media player from a remote location over the Local Area Network.
 - b. Enable all system components to perform remote control operations, programming functions, and interface functions as detailed throughout this Specification with respect to equipment and operational controls.
 - c. Ethernet and serial ports with the ability for all ports to operate simultaneously. Infrared receivers shall only be utilized as a last resort when required interface cannot be achieved using a network or RS232 interface.
 - d. All required remote power control modules, required relays and I/O ports.
 - e. Software to provide system configuration during installation and operations by end users.
 - f. The controller shall be capable of the following interface types:
 - 1) Ethernet
 - 2) Bidirectional RS-232
 - 3) Bidirectional RS-422
 - 4) Bidirectional RS-485
 - 5) Infrared-serial
 - 6) Voltage Relay
 - 7) Other manufacturer specific protocols for submitted devices
 - g. The AV Controller shall allow the user to manage and maintain the system via a Graphical User Interface. This application shall be able to allow the user to query the available layouts, define new layouts, save the layouts, switch current layouts, preview sources, drag and drop sources, launch applications, and perform other configuration functions.
 - h. Mounting: one RU, compatible with EIA 310-D standard, 19-inch wide panel mounting. Include all necessary mounting hardware.
 - i. Power Supply: 100-240 VAC, 50-60 Hz
 - j. Acceptable Manufacturers:
 - 1) Extron
 - 2) Crestron
 - 3) FSR
 - 4) Or approved substitution.

I. AV Switch

1. Provide an HDCP compliant AV switch to receive, process, and distribute audio video signals. The switch shall include 1 digital authentication key per physical input and output port to minimize HDCP authentication time.
 2. The switcher shall support individual input and output video resolutions up to 4K (4096 x 2160) at 60Hz.
 3. The switcher shall include dedicated audio output using built in audio de-embedders.
 4. The switch shall include AV control capabilities and be compatible with the specified user control interface.
 5. Routing: 2 x 1 switching
 6. Video Processing
 - a. Maximum data rate: 10.2 Gbps (3.4 Gbps per color)
 - b. Digital sampling:
 - 1) 8 bits per color, 4:4:4 color sampling at 4096x2160 at 30 Hz
 - 2) 8 bits per color, 4:2:0 color sampling at 4096x2160 at 60 Hz
 - c. Colors: 16.78 million
 - d. Resolution range: 640x480 to 1920x1200, 480p, 576p, 1080i, 1080p at 60 Hz, 4096x2160 at 30 Hz, 3840x2160 at 30 Hz
 - e. EDID and DDC: Supports Extended Display Identification Data (EDID) and Display Data Channel (DDC) data using DVI and HDMI standards. Factory or custom EDID tables are user selectable.
 - f. Standards: DVI 1.0, HDMI 1.4, HDCP 1.3
 7. Inputs:
 - a. Audio Video: (2) female Type A HDMI
 - b. Audio: Signal: (1) stereo/mono balanced/unbalanced 3.5mm mini audio jack
 8. Outputs:
 - a. Audio Video: (1) female Type A HDMI
 9. Mounting: two RU, compatible with EIA 310-D standard, 19-inch wide panel mounting. Include all necessary mounting hardware.
 10. Power Supply: 100-240 VAC, 50-60 Hz.
 11. Acceptable Manufacturers
 - a. Extron
 - b. Crestron
 - c. FSR
 - d. Or approved substitution.
- J. AV Distribution Amplifier (DA)
1. The video distribution amplifier shall process an input AV signal and rebroadcast an identical signal to multiple outputs. The amplifier shall have a user-selectable HDCP authorization option to allow for automatic source signal encryption management. The unit shall allow the AV system to control AV mute of individual outputs.
 - a. Routing: 1 x 4 distribution
 - b. Video Processing
 - 1) Maximum data rate: 10 Gbps (3.4 Gbps per color)
 - 2) Digital sampling:
 - 3) 8 bits per color, 4:4:4 color sampling at 4096x2160 at 30 Hz
 - 4) 8 bits per color, 4:2:0 color sampling at 4096x2160 at 60 Hz

- 5) Resolution range: 640x480 to 1920x1200, 480p, 576p, 1080i, 1080p at 60 Hz, 4096x2160 at 30 Hz, 3840x2160 at 30 Hz
- 6) EDID and DDC: Supports Extended Display Identification Data (EDID) and Display Data Channel (DDC) data using DVI and HDMI standards. Factory or custom EDID tables are user selectable.
- 7) Standards: DVI 1.0, HDMI 1.4, HDCP 1.4
- c. Inputs:
 - 1) Audio Video: (1) female Type A HDMI
- d. Outputs:
 - 1) Audio Video: (4) female Type A HDMI
- e. Control:
 - 1) Bi-directional serial RS-232
- f. Mounting: one RU one quarter wide, compatible with EIA 310-D standard, 19-inch wide panel mounting. Include all necessary mounting hardware.
- g. Power Supply: 100-240 VAC, 50-60 Hz
2. Acceptable Manufacturers:
 - a. Extron
 - b. Crestron
 - c. FSR
 - d. Or approved substitution.

K. AV Touchscreen Controller

1. 10" color touch screen shall be provided. The units shall offer two-way operation to allow for visual control feedback of system status. The units shall be provided with sufficient internal memory and light and motion sensors to sense activity and illuminate buttons/screen. The screen shall upload and download touch panel pages and graphical objects using supplied control system software. The screen shall include all jacks, adapters and panels required to install and mount the unit and its control interfaces.
2. The design of the color touch panel "pages" and menu system shall be coordinated with and approved by the Employer. The Contractor shall include cost to create unique touch panel pages for each touch screen location. Refer to attachments at the end of this Section for additional Employer requirements. Control functions shall be programmed and stored for simplified operations including, but not limited to:
 - a. System power on/off.
 - b. Video, computer and audio source selection and routing.
 - c. Media Player transport controls (play, stop, fast forward, etc.).
 - d. Flat Panel display controls (on/off, source select, volume control, etc.).
 - e. Multi Window Processor presets
 - f. Video projector controls (on/off, standby, source select, etc.).
 - g. Video blanking/mute
 - h. Projector screen and lift control.
 - i. Audio teleconferencing external RS-232 controller.
 - j. Lighting control functions.
 - k. More detailed controls including direct and breakaway routing switcher controls shall also be made available for technical personnel at the color touch panel.
3. Assembly, installation and setup shall be done according to instructions provided by the manufacturer.

4. All cables, adapters, and converters to connect the touch screen to the AV controller shall be provided as part of this project.
5. Mounting: Freestanding tilting table dock with locking features.
6. Power supply: low voltage cabling routed to power supply located in the AV Cabinet
7. Control: Dock shall utilize manufacturer specific control over Ethernet (RJ45 connector).
8. Finish: matte black.
9. Acceptable Manufacturers:
 - a. Extron
 - b. Crestron
 - c. FSR
 - d. Or approved substitution.

L. Cables and Connectors

1. HDMI Cables
 - a. Provide professional grade HDMI cable with cable equalizer for all HDMI cables routed over 25 feet.
 - b. Maximum data rate: 18.0 Gbps (6.0 Gbps per color)
 - c. Digital sampling:
 - 1) 8 bits per color, 4:4:4 color sampling at 4096x2160 at 60 Hz
 - d. Colors: 16.78 million
 - e. Resolution range: 640x480 to 1920x1200, 480p, 576p, 1080i, 1080p at 60 Hz, 4096x2160 at 30 Hz, 3840x2160 at 30 Hz
 - f. EDID and DDC: Supports Extended Display Identification Data (EDID) and Display Data Channel (DDC) data using DVI and HDMI standards. Factory or custom EDID tables are user selectable.
 - g. Standards: DVI 1.0, HDMI 2.0b, HDCP 2.2
 - h. Skew: <200 ps per 8m for 25' cable construction
 - i. Connectors: pre-manufactured cable with male to male single link HDMI HDCP compliant Type A.
 - j. Attenuation:
 - 1) 2.465-4.125 GHz, <20 dB per 6m
 - 2) 4.125-5.1 GHz, <25 dB per 6m
 - k. Material: gold plated connectors, tinned copper conductors with tinned copper drain wire and overall PVC jacket with aluminum/mylar and tinned copper braid shielding.
 - l. Minimum conductors and drain wire 22 AWG.
 - m. Minimum UL listed CM cable.
 - n. Connectors: 2.46" x 0.80" x 0.60", coordinate all installation locations and pathways prior to construction to ensure sufficient space and pathway sizes to pull the manufacturer terminated cables. Bend radius shall be 4.5".
 - o. Cable Equalizer: Provide equalizer from the cable manufacturer.
 - 1) The equalizer shall ensure full video signal at the distances required by the final installation.
 - 2) The equalizer shall ensure clear, reliable signals by actively equalizing poor or marginal signals, and reducing jitter and skew.
 - 3) Equalizer shall be compact, rack mounted 1 RU tall, 1/8 RU wide.

- 4) Provide all mounting, power, and connectivity required for the equalizer.
2. Audio Signal Cables: Balanced Mono
 - a. Cable shall be used to distribute balanced mono audio signals from field input devices to the audio processing headend.
 - b. Rating: UL 725, Listed for plenum applications
 - c. Conductor: (2) min. #20 AWG, solid tinned copper conductors, overall shield, drain wire, and insulated as required for application.
3. Audio Signal Cables: 70V Mono
 - a. Cable shall be used to distribute amplified audio signals to 70.7 V speakers.
 - b. Rating: UL 725, Listed for plenum applications
 - c. Conductor: (2) min. #18 AWG, solid tinned copper, insulated as required for application.

PART 3 - EXECUTION

3.1 COORDINATION

- A. In addition to the requirements of Specification Section 27 05 00, comply with the following.
- B. Coordinate Work of this Section with the requirements of the Authority's television service provider.
- C. Coordinate the work of this contract with the work of the Authority and all Authority Vendors. Schedule all work to ensure that the work of the Authority and all Authority Vendors can proceed in accordance with the Project Schedule.
- D. Site Preparation
 1. In addition to the Shop Drawing Requirements in section 27 05 00, the Contractor shall present a field mockup for approval to the OAR prior to installing the remaining IPTV locations. The field mockup shall include all power and data outlet locations, cable management and routing, component placement, and display mounting.
 2. Any work performed onsite regarding conduit and cable installation, floor penetrations, display mounting, component placement etc. related to the IPTV display deployment performed before the shop drawing and field mockup approval will be at the sole risk of the Contractor.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 in addition to the following:
 1. Refer to related specification sections for additional project coordination requirements. In addition to the requirements defined in this specification section, the contractor shall coordinate and meet all requirements addressed in Division 26, Division 27 and Division 28 specification sections.
 2. The Contractor shall provide all end-user cabling and connectivity components for interconnection of system equipment. This shall consist of, but not be limited to:

- a. The installation of fiber optic/copper cabling from communications rooms (IDFs/MDFs) to all ONTs supporting IPTV set top boxes.
- b. The installation of Category 6 UTP patch cords for interconnection from ONTs to set top boxes.
- c. The installation of single mode fiber optic and Category 6 UTP patch cords in communications rooms to connect equipment associated with the IPTV system.
- d. The installation of video cables from Set-Top Boxes to Video Displays.
- e. The installation of all AV control cabling.

3.4 EQUIPMENT INSTALLATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

3.6 ELECTRICAL POWER DISTRIBUTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE & SERVICE

- A. Refer to Specification Section 27 05 00 for requirements.

3.11 WARRANTY

- A. Refer to Specification Section 27 05 00 for requirements.

3.12 FIELD SERVICES

- A. Refer to Specification Section 27 05 00 for requirements.

3.13 TRAINING

- A. Refer to Specification Section 27 05 00 for requirements.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 41 33

SECTION 27 42 20 – ELECTRONIC DYNAMIC SIGNAGE SYSTEM

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 specification sections.
- B. Related Specification Sections:
 - 1. Refer to Specification Section 270500 for a list of related specification sections in addition to the following
 - 2. 10 14 00 – Wayfinding Signage
- C. Reference Symbols:
 - 1. Refer to Specification Section 27 05 00 for requirements.
- D. Abbreviations
 - 1. Refer to Specification Section 27 05 00 in addition to the following:
 - 2. AODB Airport Operational Database
 - 3. GIS Geographic Information System
 - 4. HTML5 HyperText Markup Language Version 5
 - 5. ICD Interface Control Document
 - 6. NTC North Terminal Complex
 - 7. OEM Original Equipment Manufacturer
 - 8. PMP Project Management Plan
 - 9. TIL Technology Integration Lab
 - 10. UL Underwriters Laboratories
 - 11. URL Uniform Resource Locator
- E. Definitions
 - 1. Refer to Specification Section 27 05 00 in addition to the following:
 - a. Interface: Bridge between two (2) or more separate software products where data is maintained in more than one (1) location.
 - b. Integration: Two (2) or more software products where functionality is combined into one (1) product and data is maintained in one (1) location.
 - c. Large Sign Array: A display configuration consisting of at least one row and multiple columns of greater than 10 displays in either portrait or landscape configuration.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The DSS shall be extensions of the existing enterprise-based systems.

- C. The DSS in the South Terminal Complex airside concourse expansion shall also be responsible for providing Flight, Gate and Baggage Information Display (FIDS, BIDS, GIDS) functionality.
- D. The intent of this specification is to establish a standard of quality, functions, and features for the installation of components to support a fully operative integrated Airport system, herein referred to as Electronic Dynamic Signage System (DSS).
- E. The installation of the DSS in the South Terminal Complex (STC) airside concourse expansion shall include, but not be limited to, raceway, cabling, mounting systems and support, network and video infrastructure cabling, housings, millwork, labor, training, labeling, clean up, and coordination and oversight of all contractor, Authority Vendor, and Authority Furnished Equipment (Owner-Furnished Equipment (OFE)).
- F. The Contractor shall notify the Authority and Owner's Authorized Representative (OAR) in writing of any items not in compliance with the requirements described in this section.
- G. The DSS shall include all system components as required to meet all, functional, operational, performance, and redundancy requirements necessary to deliver fully integrated and operational systems in accordance with the Contract Documents and as herein specified.
 - 1. Refer to Specification Section 27 05 00 and 27 10 00 for all TCP/IP based cabling requirements for additional information regarding the intended connectivity of these systems.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing Sheet TA0.00.03 for the work responsibility matrix for the scope of work required for the Electronic Dynamic Signage System.
 - 1. Where listed on the responsibility matrix, the following line components shall be defined as follows:
 - a. Headend and Software: The Authority and Authority Vendor shall furnish all required headend equipment and software including, but not limited to video content servers, display servers, management servers, video-over-fiber transmitters, and all associated system software.
 - b. Integration to Existing Systems: The Contractor shall provide fiber channeling with all materials required to connect the STC airside concourse expansion to the existing NTC and STC Phase 1 systems – refer to Backbone Cable below for additional information. The Contractor shall coordinate with the Authority and the Authority Vendor to ensure fiber channeling completion complies with the project schedule.

- c. Interfaces: The Authority Vendor shall provide all system interfaces including, but not limited to all hardware, software, programming, interface devices and appurtenances as required for communication between the DSS and other related systems including, but not limited to, Fire Alarm Interface, the ECS, the GOAA Passive Optical LAN (POL) / Local Area Network (LAN), Airport Integrated Data Broker (AIDB), Multi-User Flight Information Display System (MUFIDS). The Contractor shall coordinate with the Authority for VLAN provisioning and IP addressing.
- d. Network Components: Refer to specification section 27 10 05 for requirements. The Authority shall furnish and Authority Vendor shall install all Passive Optical Network components required to support the Electronic Dynamic Signage system except for passive optical splitters. Refer to Horizontal Cable below.
- e. Backbone Cable: The Contractor shall provide all backbone cabling and associated raceways/pathways, boxes, fittings and appurtenances. Contractor shall provide fiber channeling in order to achieve required connectivity to the NTC and STC Phase 1 in support of all network systems. Contractor shall perform fiber channeling as described in section 27 10 00 and furnish and install all patch cables required for channeling. Refer to specification section 27 10 00 for requirements.
- f. Horizontal Cable: The Contractor shall furnish and install all horizontal cabling and associated raceways/pathways, boxes, fittings and appurtenances. Includes fiber optic cabling and copper cabling to support ONTs. In the Vendor IDF room, the Contractor shall furnish and install the following:
 - 1) Field fiber patch panels in GOAA Signage Vendor Cabinets.
 - 2) LC-APC to LC-UPC duplex Fiber Patch Cables from field fiber patch panels shall be dressed and routed with the appropriate lengths to Vendor supplied HDMI over fiber transmitters, labeled per GOAA standards.
 - 3) LC-APC to LC-APC simplex Fiber Patch Cables from field fiber patch panels shall be dressed and routed with the appropriate lengths to the rack mounted GOAA-Vendor fiber tie cable LIU for connection to the adjacent GOAA IDF room, labeled per GOAA standards. These patch cables will provide the connectivity to support the field ONTs.
 - 4) CAT6 patch cables from the GOAA-Vendor copper tie cable patch panel shall be dressed and routed with the appropriate lengths to Vendor supplied video playback servers and HDMI over fiber transmitters for connection to the adjacent GOAA IDF room, labeled per GOAA standards. These patch cables will provide connectivity from the GOAA IDF ONTs to the Vendor supplied video playback servers and HDMI over fiber transmitters.In the GOAA IDF room, the Contractor shall furnish and install the following:

- 1) LC-APC to LC-APC simplex Fiber Patch Cables shall be dressed and routed with the appropriate lengths from the GOAA-Vendor fiber tie cable LIU to the GOAA PON cabinet for connection to the vendor supplied passive optical splitter. These patch cables will provide the connectivity to support the field ONTs.
- 2) CAT6 patch cables from the GOAA-Vendor copper tie cable patch panel shall be dressed and routed with the appropriate lengths to the GOAA PON cabinet for connection to the GOAA IDF ONTs. These patch cables will provide connectivity from the GOAA IDF ONTs to the Vendor supplied video playback servers and HDMI over fiber transmitters.

Coordinate and work with the GOAA PON Vendor and GOAA Signage Vendor to provide a comprehensive patch panel port and patch panel labeling guide corresponding to field display and ONT outlet ports including routing of cables in ladder rack and fiber runner, patch cable distances, and termination end points to the Authority vendors to perform the patching onto the signage equipment, the ONTs and passive optical splitters. Refer to specification section 27 10 00 for additional information.

- g. Field Devices: The Authority shall furnish video-over-fiber receivers and flat panel displays. The Authority Vendor shall install video-over-fiber receivers, and configure, program and calibrate the displays, and update the firmware. The Contractor shall mount the flat panel displays and outdoor LED displays. The Contractor shall furnish and install all copper/fiber patch cables and HDMI video patch cables required for the complete installation of all flat panel displays, outdoor LED displays and field ONTs.
- h. Specialized Housings: The Contractor shall provide all display housings, brackets and mounts.

C. The Contractor shall provide the following services:

1. The Contractor shall provide comprehensive project management services for the coordination of its team members, the Authority and the Authority Vendor during the term of the project.
2. The Contractor shall be responsible for coordinating millwork and installation requirements with all affected trades, the Authority and Authority Vendor(s).
3. The Contractor shall provide Quality Assurance to ensure that the installed system meets or exceeds every standard set forth in these specifications, in coordination with the Authority and Authority Vendor.
4. The Contractor shall be responsible for pick-up, inspection, transport and delivery of Owner-Furnished Equipment as specified in Section 27 05 00.
5. Where prescribed for large sign arrays, the Contractor shall procure the services of the existing Authority Vendor, RP Visual Solutions, to furnish and install the display mounts and install the Owner furnished displays.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 in addition to the following.

- B. If conflicts exist between referenced requirements, the Contractor shall comply with requirements in the following order: 1) requirements contained within this section, 2) Specifications Section 27 05 00, and 3) Contract documents.
- C. Reference Documents:
 - 1. ISO Standards on Quality Management and Quality Assurance (ISO 9001:2015, ISO 9002:2015, ISO 9004:2015)

1.5 SYSTEM DESCRIPTION

- A. The DSS shall be an enterprise-based solution consisting of components that are an extension of the existing North Terminal Complex (NTC) and STC Phase 1 digital signage platforms, along with new components, currently not a part of the NTC or STC Phase 1 platforms.
- B. The DSS shall consist of all cabinetry, millwork, computing hardware and software, peripheral devices, active electronics, and all other items required for a fully functioning system.
- C. DSS displays shall include:
 - 1. Flight Information Displays – for displaying flight information
 - 2. Gate Information Display – backwall counters and ceiling mounted for use by Airlines
 - 3. Holdroom Signage – for displaying Airline flight and boarding information, as well as other related content, e.g. weather.
 - 4. Wayfinding Signage – for displaying directional content for navigation through the Airport

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall collect all items normally required as part of submittals for all Authority and Authority Vendor-furnished equipment and submit it as part of the Contractor's submittal package as though those items were being furnished by the Contractor in order to show the interaction between various system components and facilitate comprehensive review by the Authority. These items include, but shall not be limited to:
 - 1. Authority-furnished flat panel displays
 - 2. Authority-furnished HDMI-over-fiber transceivers
- C. The Contractor shall submit for approval fabrication and mounting details for all commercial off-the-shelf and custom-fabricated display mounts, brackets, housings and millwork. Obtain display hardware and ancillary hardware specifications and dimensions from the Authority and/or Authority Vendor to ensure mounting hardware, housings and millwork will accommodate the physical dimensions and load of all equipment to be mounted.

1. Fabrication and mounting details shall indicate the type and gauge/thickness of materials used, fastener types and quantities, methods for attaching to the surrounding structure, weight of the elements being mounted, methods for attaching the mounted devices, and provisions for data, video and power cable routing.
 2. These details shall be stamped by a structural engineer who is licensed in the state of Florida.
- D. The Contractor shall provide system rollout and phasing plan documents and include, at a minimum:
1. Schedule of Events
 2. Include calibration plan
 3. Warranty Plan
 4. Service & Maintenance Logged Events
 5. Detailed schedule including time to allow Authority and Authority Vendors to perform work items related to the DSS. Coordinate with Authority and Authority Vendors, obtain length of time required for Authority and Authority Vendors to perform required tasks, and incorporate these time requirements into the system rollout and phasing plan.
- E. The Contractor shall provide project management documents and include, at a minimum:
1. Project Management Plan.
 2. Change Management Process.
 3. Monthly Communication Plan.
 4. List of Special Tools, Test Equipment and Outside Inventory needed for the project.
- 1.7 QUALITY ASSURANCE
- A. Refer to Specification Section 27 05 00 for requirements.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall provide carts to transport OFE displays and related equipment. All carts shall become the property of the Authority at project completion.
- 1.9 RECORD DOCUMENTS
- A. In addition to all requirements in the Specifications Section 27 05 00 and all requirements by related specification sections, the work shall also conform to all requirements of this section.
- B. Project Record Documents

1. Provide record documentation to the Authority and OAR at the completion of each phased installation and at Contract Closeout. To ensure that this submittal reflects proper record keeping during the Work, maintain on-site one (1) set of the Contract Drawings, specifications, addenda, change orders and other modifications to the Contract, and reviewed shop drawings and product data.
2. Legibly mark and record at each specification section a description of actual products installed, including the manufacturer's name and product model number, product substitutions or alternates approved and utilized, and changes made by Addenda and Modifications.
3. Legibly mark Record Documents and shop drawings to record actual installation including communication conduit, cabling and pathways used, field changes of dimensions and detail, changes in details from those indicated on drawings, details not on original Contract Drawings, and provide make and model of actual product installed.
4. Mark whichever drawing is most appropriate to showing "field" conditions fully and accurately. If necessary, provide scaled drawings of modifications and give attention to concealed work, which would be difficult to measure and record later. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, and print suitable titles, dates, name of installing company, name and signature of job superintendent, and other identification on the cover of each set.

C. As-Built Documentation

1. As-Built documentation shall include finalized equipment locations, cable and conduit routing pathways, and installation details. The As-Built documentation shall not be redlined copies, but be finalized AutoCAD or REVIT drawings. The As-Built documentation shall build on the initial design details and further develop these based on specific installation details.
2. As-Built documentation shall be capable of being inserted into the Authority GIS system.
3. The level of detail defined in these As-Built documents shall be suitable to allow any third party to support the DSS maintenance as well as support future integration and expansion of the DSS at the Airport.
4. Acceptance of As-Built documentation shall be part of final system acceptance process and subject to a ten percent (10%) cost retainage.

1.10 OPERATIONS AND MAINTENANCE

- A. In addition to all requirements in the Specifications Section 27 05 00 and all requirements by related specification sections, the work shall also conform to all requirements of this section.
- B. The Authority Vendor shall provide Operations and Maintenance Manuals for Authority Vendor provided equipment.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIALS

- A. In addition to all requirements in the Specifications Section 27 05 00 and all requirements by related specification sections, the work shall also conform to all requirements of this section.
- B. The Contractor shall provide a list of required spare parts inventory and shall furnish each inventory of spare parts (type, model number, and quantity) during the warranty period. Furnish a bill of materials, catalog numbers, unit prices, and a list of local distribution sources for all replacement parts. Required spares shall be on-site at the time of final system acceptance.
- C. Spare parts are to be inventoried at the beginning of the project and accounted for at the end of the warranty and service period. Any spare parts unused at the end of the warranty and service period shall become the property of the Authority.
- D. As a minimum, the Contractor shall furnish the following spare parts on site:
 - 1. A minimum quantity of (5) of each type of commercial off-the-shelf or custom fabricated display mounting bracket.
 - 2. A minimum quantity of (5) sections of universal mounting rail for Wayfinding type signage mounts.
 - 3. Outdoor LED – One (1) spare
- E. The Contractor shall manage all required spare parts, including logistics and performing/coordinating repair activities. On-site storage and maintenance of spare parts shall be in sufficient quantity to maintain each system at the level of six (6) months.

1.13 ENVIRONMENTAL CONDITIONS

- A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 for requirements.

2.2 SYSTEM REQUIREMENTS

- A. The Authority Vendor shall configure the DSS to receive and display emergency messaging from the Fire Alarm system and the Emergency Communication System (ECS).
 - 1. The system shall support a minimum of eight (8) unique emergency messages each from both the Fire Alarm System and ECS.
- B. Network and Connectivity Requirements
 - 1. Coordinate with the Authority and Authority Vendor for the installation of all network components required for the DSS.
 - 2. Provide the design and all integrations with the PON/LAN and necessary configuration to provide the functionality described within this document. All configuration shall be performed in coordination with and approval by the Authority and Owner's Authorized Representative (OAR).

3. The DSS shall be able to connect to the existing head end servers in the NTC and STC Phase 1 via Passive Optical Network (PON).
 - a. Connectivity to the NTC and STC Phase 1 is required to distribute content files from the primary head-end servers to content servers throughout the STC airside concourse expansion.

2.3 HARDWARE REQUIREMENTS

A. Supporting Infrastructure

1. Hardware Structures:
 - a. Provide all hardware required for final installation.
 - b. Perform the appropriate coordination with the Authority, OAR, and Authority Vendor to ensure all DSS equipment (display devices, workstations, etc.) will be accommodated by casework, mounting brackets and/or housings.
 - c. Create and submit shop drawing component drawings detailing the exact mounting requirements for each component and device as well as the detail information for the casework that is to be installed to support the DSS devices.
 - d. All casework, mounting brackets and mounting hardware shall be adjustable to permit future replacement of DSS displays with displays differing in overall horizontal and/or vertical dimensions by up to one (1) inch. Mounting provisions which do not allow horizontal, vertical, and front-to-back adjustment shall not be acceptable.
2. Equipment racks:
 - a. Coordinate with the Authority and OAR to determine installation location for all equipment that is to be placed with the telecommunication rooms.
 - b. Refer to Specification Sections 27 05 00, 27 10 00 and 27 10 05 for additional information.

B. Displays

The contractor shall coordinate all mounting hardware and provisions with Authority and Authority Vendor-furnished and/or installed displays and devices. The basis of design for dynamic signage system displays are as follows.

- a. LED 55" Flat Panel Display
 - 1) Manufacturer: NEC
 - 2) Model: UN552S
 - 3) Screen Size: 55" class (54.64" diagonal)
 - 4) Weight (Unpacked): 56.9 lbs.
 - 5) Overall Dimensions: 47.7" X 26.8" X 3.9"
- b. Pier Interlock LED Video Wall Panel
 - 1) Manufacturer: Gable or Approved Substitution
 - 2) 2.5mm high impact resistant, GOB, hot swappable LED panel assembly.
 - 3) Weight (Unpacked): 48 lbs.
 - 4) Dimensions: 13.5"H x 96" W x 2.38" D
 - 5) Provided with Gable Z-Clip LED Cabinet Bracket for mounting.

- c. Outdoor Commercial Grade 55" Signage
 - 1) Manufacturer: SunBrite or Approved Substitution
 - 2) Model: SB-S2-55-4K
 - 3) Screen Size: 55" class
 - 4) Weight (Unpacked): 65 lbs.
 - 5) Overall Dimensions: 49.38" X 28.72" X 3.66"

C. Mounting Brackets

- 1. Ceiling-Mounted Signage – 2 or more displays per side: brackets shall, at a minimum, meet the following requirements:
 - a. Expandable track-based system which allows installation of additional displays after initial installation without drilling, welding, or custom fabrication.
 - b. "Pop-Out" or "scissor" type VESA-compliant display brackets to allow display to be pulled out horizontally from its normal position to facilitate ease of installation and access to rear of display for maintenance.
 - c. Weight Capacity: Up to 68kg / 150lb per display
 - d. Display Size: 39" to 70"
 - e. Tilt: +4.0°, -2.5°
 - f. Ceiling or floor-to-ceiling pendant supports to be submitted and approved by the Authority during the shop drawing phase
 - g. Alignment and adjustment features
 - 1) Height: ±1" on each interface
 - 2) Tilt adjustment at single pivot point
 - 3) Depth: 4" to 7.4" from wall for setting of "home" position
 - 4) 3 levels of lateral adjustment
 - a) Mount left/right along rail
 - b) Interface left/right along mount
 - c) Lock in lateral guide for fine tune adjustment utilizing turn knobs.
 - h. Cord release system for maintenance and serviceability
 - 1) Remote release and pop out of any individual screen, extension up to 13.4"
 - 2) Cord length and storage to be approved by the Authority during shop drawing phase
 - i. Orientation: Landscape, Portrait
 - j. Mounting system shall be ConnexSys LVS manufactured by Chief or approved substitution.
- 2. Ceiling-Mounted Signage: 1 display per side: brackets shall, at a minimum, meet the following requirements:
 - a. Ceiling pendant mount
 - b. Weight Capacity: 136kg / 300lb total
 - c. Display size: 40" to 65"
 - d. Tilt: Up to 20°
 - e. Integrated Media Player/Device Shelf
 - f. Decorative Side Panels

1. The Contractor shall provide comprehensive project management services for the coordination of its team members and coordination of team members with the Authority and all Authority Vendors during the term of the project. Within thirty (30) calendar days after receipt of the Notice to Proceed, develop and submit a detailed draft Project Management Plan addressing the means and methods for implementing the DSS, including the preparation of schedules and plans.
2. The contractor shall submit a project schedule that defines the completion milestones, review periods, approvals, and related items. Produce a project schedule using Primavera 6.
3. Coordinate with the Authority, OAR and Authority Vendors to finalize the Project Management Plan and all associated documents and schedules.
4. Contractor to provide regular progress and problem resolution reporting.

D. Site Preparation

1. In addition to the Shop Drawing Requirements in section 27 05 00, the Contractor shall present a field mockup of each sign type for approval to the OAR prior to installing the remaining sign locations. The field mockup shall include all power and data outlet locations, cable management and routing, component placement, and display mounting.
2. Any work performed onsite regarding conduit and cable installation, floor penetrations, display mounting, component placement etc. related to the dynamic signage deployment performed before the shop drawing and field mockup approval will be at the sole risk of the Contractor.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 for requirements.

3.4 EQUIPMENT INSTALLATION

- A. In addition to all requirements in the Specifications Section 27 05 00 and all requirements by related specification sections, the work shall also conform to all requirements of this section.
- B. Provide all specialized tools required to install specialized display mounts.
- C. Install products detailed in the specifications, system requirements, and drawings including those purchased by the Contractor and those provided by other parties.
- D. Authority Vendor shall be responsible for display calibration.
- E. Contractor shall be responsible for all work to be neat in appearance and completely installed per means and methods of this type of equipment installation. Contractor shall ensure that all equipment is plumb, level and square and securely attached to the structures. Structures shall be rated to hold the rated equipment.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

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3.6 EQUIPMENT POWER DISTRIBUTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE AND SERVICE

- A. In addition to all requirements in the Specifications Section 27 05 00 and all requirements by related specification sections, the work shall also conform to all requirements of this section.
- B. General Requirements
 1. Maintenance and Service as defined in the following sections shall be included as a part of the Warranty Plan at no additional cost to the Authority for Contractor provided equipment.
 2. Special Equipment
 - a. Identify and provide special tools, test equipment, and outside inventory required for this project.
 3. In the event of a failure of the systems, platforms or equipment whether the failure falls below service targets or not, the Contractor shall notify the Authority and OAR problem in a responsive and professional manner and coordinate corrective activities to be performed by the Authority Vendor(s).
- C. Resolution of Conflict
 1. Due to the nature of multiple products, suppliers, contractors, installers, software, etc. that is involved in the DSS solution, there may be conflicts that could occur between the various sources, the Authority and OAR, Authority Vendor, and/or the airlines. The following steps shall be followed for conflict resolution with escalation to the next step should resolution not be achieved.
 - a. The best effort shall be made to resolve all conflicts without involving the Authority and OAR, Authority Vendor, or airlines.
 - b. Coordinate and arrange appropriate meetings with only necessary representatives of involved outside parties to achieve conflict resolution. Representatives shall be expected to have all required documentation describing their input to the conflict and potential resolution. Have a recommended solution prepared prior to the meeting. The Authority and OAR shall provide final approval on recommendation.
 - c. Should resolution not be achieved as described above, the Authority and OAR shall provide final decision based on modifications to the provided recommendation or a request that other recommendations be researched and presented to the Authority and OAR.

3.11 WARRANTY

- A. Refer to Specification Section 27 05 00 for requirements.
- B. The Authority Vendor shall be responsible for the removal of OFE for the purposes of warranty repairs and for subsequent reinstallation and/or replacement of OFE.
- C. The Contractor shall be responsible for warranty of contractor supplied equipment and infrastructure.

3.12 FIELD SERVICE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Post-Delivery / Pre-Installation Staging
 - 1. Pre-Installation Staging shall verify through a basic mounting mock-up process that each device and display ready to be installed will properly attach to all mounting brackets and housings. The Pre-Installation Staging shall verify proper fit and finish.
 - 2. Equipment shall be the actual products or identical models of products used for Factory Acceptance Testing.
 - 3. Ensure that the development of the DSS is complete, required approval of submittals have been obtained, and sufficient equipment procured to perform the Pre-Installation Staging.
 - 4. Pre-Installation Staging shall be scheduled on weekdays during standard business working hours, unless otherwise noted and approved in writing by the Authority and OAR.
 - 5. Items to be tested shall be set up and performance verified prior to the arrival of the Authority and OAR at the test site.
 - 6. The Vendor, Contractor, the Authority, OAR, and Authority Vendor shall have the opportunity to inspect Pre-Installation Staging mock-ups.
 - a. All costs associated with required retesting due to failures or delays beyond the test schedule shall be incurred by the party conducting the test. All retests shall require acceptance and approval by the Authority and OAR prior to formal Delivery Integration Testing with the Authority and OAR and the airlines.
- C. Final Inspection and Acceptance
 - 1. Pre-Installation Staging is complete, submit and review the final report of Pre-Installation Staging containing all recorded data with the Authority and OAR.
 - 2. Update the test plans with attachments created and presented during all test phases and deliver as one (1) document to the Authority and OAR upon Final Inspection and Acceptance.

3.13 TRAINING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall provide Authority Vendor training on the mounting systems for the installation/removal of displays.

1. Training shall include an instructional video depicting detailed steps for proper installation of each type of display on each type of mount provided as part of this project. Submit instructional video as part of Operational and Maintenance submittals in DVD format.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 42 20

SECTION 27 51 13 – EMERGENCY COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. General provisions of the Contract, including Contractual Conditions and Division 0 and Division 01 specifications sections apply to this section.
- B. Related Specification Sections:
 - 1. Refer to Specification Section 27 05 00 for requirements

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This section includes the requirements for provision and installation of the extension of existing emergency communications/paging system (ECS).
- C. The Emergency Communications System (ECS) shall provide code compliant emergency voice evacuation and airport operational public address functions. The headend and amplifiers shall be capable of performing voice evacuation announcements as required by NFPA 72. Programming and installation of speaker circuits and related circuit monitoring equipment shall be provided as required by NFPA 72. The ECS shall interface to the South Terminal Complex Fire Alarm System to provide code compliant voice evacuation. Refer to Section 28 31 00, Addressable Fire Detection and Alarm for additional requirements.
- D. The ECS shall be installed in compliance with FBC 907
- E. Provide a complete and operational system throughout project area in accordance with current codes, standards, manufacturer's recommendations and available guidelines.
- F. Work will included updates and expansion to the existing STC System, NTC Comm Center head end, and associated ECS LAN to provide connectivity between new system and existing Head-End.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Refer to drawing sheet TA0.00.03 for the work responsibility matrix for the scope of work required for the system and for any work provided by the Authority.
- C. Where listed on the drawing responsibility matrix, the following components shall be defined as follows.

1. **Headend and Software:** Contractor shall furnish, install, and program all required headend equipment and software including, but not limited to licensing, system expansion, redundancy, workstation licenses, operating software license or any other software required to expand the existing system to support all new elements added under this contract. Contractor shall be required to coordinate requirements as well as scheduling license installation. Headend and software include any amplifiers, cabinets, management/administrative software, software licenses, programming, and components which serve the purpose of performing system-wide coordination, monitoring, data processing, control and other global functions.
2. **Integration to Existing System:** Contractor shall provide all hardware, software, programming, licenses, wiring, cabling, protocol converters, interface devices and appurtenances as required to extend the physical or logical scope of the existing system.
3. **Interfaces:** Contractor shall provide all system interfaces including, but not limited to all hardware, software, wiring, cabling, programming, devices and appurtenances as required for communication between systems, or between a given system and an operator, to provide the specified functionality.
4. **Network Switches:** Refer to specification section 27 05 00 for requirements. Coordinate network programming requirements with GOAA IT for ECS operation on the GOAA network. Contractor shall coordinate patching into the network with GOAA.
5. **Backbone Cable:** Refer to specification section 27 10 00 for requirements. Coordinate system backbone requirements with backbone cable Contractor.
6. **Horizontal Cable:** Contractor shall provide dedicated PAS signal cabling as described in this section.
7. **Field Devices:** Contractor shall provide all field devices including, but not limited to power supplies, microphones, speakers, mounting hardware, and similar equipment or appliances.

1.4 DESCRIPTION

- A. Contractor to rework the existing paging system to facilitate additional devices and modifications to the existing system to increase functionality as shown on drawings and included in these specifications. Contractor shall submit to GOAA for approval for all modifications to the existing system. These items shall include but not be limited to:
 1. Updating of existing GUI to indicate additional zones and areas
 2. Updating of existing messages as required for new areas being served
 3. Rework and/or update of NTC/STC system programming and firmware
 4. Providing and scheduling new area specific messages.
- B. The ECS is an extension of the existing IED GlobalCommACS system utilizing Cobranet network audio protocol which is located thru-out the South Terminal Complex main communications room and communicates with the North Terminal Complex (NTC) Comm. Center. All devices, equipment, and software shall be compatible with this existing system.

- C. All control and supervision of the ECS system shall be from Comm Center in NTC. Rework NTC interface to support additional devices and areas.
- D. The ECS shall be interfaced with the EME control system to reproduce dedicated audio channels in areas around multimedia displays. This audio will be overridden during an airport paging of emergency message. The system shall provide a warning trigger prior to airport page to the EME controller to soft mute (fade out) the audio prior to paging message.
- E. Contractor shall include in his bid all required components and labor to support the extension of the existing STC/NTC ECS system. This shall include but not be limited to:
 - 1. Head end equipment
 - 2. Power Amplifiers
 - 3. Ambient Sensing Microphones
 - 4. Paging Microphone Stations
 - 5. All Wire and Cable
 - 6. Programming / Firmware / Software / Licenses
 - 7. GUI
 - 8. Speakers and Speaker mounting hardware
 - 9. Terminal cabinets
 - 10. Labeling
 - 11. Testing and Tuning of system
 - 12. Interface with third party systems
 - 13. Interface with Fire Alarm system to perform Emergency Voice Messaging
 - 14. Visual Paging Interface for all way finding monitors.
- F. Parking Garage: Match existing NTC /STC parking garage configuration and messaging for ECS system and include all additional requirements indicated in these drawing and specifications.
- G. LST/ASC/GTF: Match existing NTC / STC messaging for ECS system and include all additional requirements indicated in these drawing and specifications.
 - 1. Configure system to page by ZONE as indicated in ECS zone plans, with the additional capability to create on demand paging zones which may include ADS areas as well as ECS ZONES.
- H. Contractor shall provide an ECS paging workstation and local desktop paging station in the Fire Command Room for local override and control of the ecs system in the event of an emergency. This shall be provided at each building (ASC and LST)
- I. Provide interface with existing FIDS database to incorporate Automated Announcements with flight information. Use FAS and T-CAS to provide this functionality, coordinate with GOAA and provide messaging required. Upgrade existing STC APM ACS as required to provide this capability between existing and new building ACS's.

- J. Contractor shall interface with owners Weather alert / lighting warning system vendor to provide interface for activation of dedicated weather alert visual notification devices and warning speakers at ASC.
- K. System shall provide a “MUTE” trigger to IPTV controllers where indicated on drawings and be configured to provide audio / video mute to selected local TV’s during an airport page or emergency notification.

1.5 REFERENCES AND REGULATORY REQUIREMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following.
 - 1. All requirements of Federal Communications Commission.
 - 2. UL 6 Rigid Metal Conduit
 - 3. UL 797 Safety Electrical Metallic Tubing
 - 4. EIA-219: Audio Facilities for Radio Broadcast Standards
 - 5. EIA-310-D: Cabinets, Racks, Panels and associated equipment
 - 6. Supplementary References: The publications listed are listed as they contain design and technical criteria that are pertinent to the project and they shall be used as minimum standards governing work performed on the project.
 - a. System installation and construction practices shall conform to standard industry practices as defined by the National Association of Broadcasters Engineering Handbook (latest edition), Sound System Engineering (Don and Carolyn Davis, Howard W. Sams, publisher).
- B. Contractor shall coordinate with other divisions required for complete functionality of this system these shall be included but not be limited to the following:
 - 1. Fire Alarm Systems
 - 2. PON communications infrastructure
 - 3. EME Multimedia Systems
 - 4. Horizontal Network Cabling System

1.6 SUBMITTALS

- A. Submit in accordance with Section 27 05 00 Common Work Results for Communications Systems and Section 01 33 23 Shop Drawings, Product Data, and Samples.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit in accordance with Section 27 05 00 Common Work Results for Communications Systems and Section 01 78 00 Closeout Submittals .

1.8 O & M MANUALS

- A. Submit in accordance with Section 27 05 00 Common Work Results for Communications Systems and Section 01 78 00 Closeout Submittals .

1.9 QUALITY ASSURANCE

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Work performed as part of this contract shall be in accordance with relative sections of the Electrical Code.
- C. Standards of workmanship shall meet or exceed accepted audio/video systems industry installation practices.
- D. Specific reference in Specifications to codes, rules, regulations, standards, manufacturer's instructions or requirements of regulatory agencies shall mean the latest printed edition of each in effect at date of contract unless the Document is shown dated.
- E. Conflicts
 - 1. Between referenced requirements: Comply with the one establishing the more stringent requirements.
 - 2. Between referenced requirements and contract documents: Comply with the one establishing the more stringent requirements.
- F. Provide documentation for any sub-Contractor who will assist the Contractor in performance of this work shall be required.
- G. Contractor personal shall have been to factory training and received a certificate of completion within 18 months of project start.

1.10 QUALIFICATIONS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Supplier: Authorized distributor of specified manufacturer with five years documented experience.
- D. Quality Assurance: Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of audio and visual systems and have personnel who are adequately trained in the use of such tools and equipment.
 - 1. A resume of qualification shall be submitted with the Contractor's bid indicating the following:
 - a. A list of five completed SPS projects over the past five years of similar type with an audio system scope over \$1,000,000 with contact names and telephone numbers for each. One of the five projects must have included a LAN based networked audio system
 - b. A list of test equipment proposed for use in testing and verifying the systems on this project.

- c. A technical resume of experience for the Contractor's Engineer and on-site installation foreman who will be assigned to this project.
- E. Installer: Authorized installer of specified manufacturer with five years documented experience and service facilities within 50 miles of Project.

1.11 EQUIPMENT WARRANTY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. Warrant all equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by Owner, repair or replace any equipment found to be defective.
 - 1. No charges shall be made by the installer for any labor, equipment or transportation during this period to maintain functions.
 - 2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

1.12 SPARE MATERIAL

- A. Contractor shall provide the following spare equipment and turn over to GOAA electronics shop:
 - 1. (10) of each style AMP Card used
 - 2. (5) AMP Mainframes
 - 3. (5) Multifunction IO
 - 4. (5) Ambient Sensor Collectors
 - 5. (5) of each style Mic stations
 - 6. Ceiling Speakers
 - a. (20) Type 00
 - b. (15) Type 01
 - c. (5) Type 02
 - 7. Wall Speakers
 - a. (20) Type 01
 - b. (2) Type 05
 - c. (2) Type 06

1.13 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

- A. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes, and in particular the ADA requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant ECS system. Said additional devices shall be shown on shop drawings submitted by Contractor.

- B. In addition to the above-mentioned devices, Contractor shall include in his bid price the cost of installing 20 additional audible notification devices wall mount Type 01 (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior substantial completion date. At least two weeks prior to substantial completion system shall be fully operational. After system is operational GOAA OAR, EOR and the system installer shall review the placement of and coverage provided by audible signals throughout the facility for compliance with all codes and in particular, the ADA requirements and NFPA 72. System installer shall provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion.
- C. After the project has had its first annual safety inspection, the system installer shall install within one week notice any additional audible signals that have been determined to be required during said inspection from the balance of the additional devices noted above. There shall be no cost for these added devices provided the total does not exceed the balance remaining of the devices noted above. The final balance of the additional devices included in bid price shall be turned over to the Owner as spare material after any ECS issues identified during the first annual safety inspection are resolved.

1.14 TRAINING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. System orientation: Contractor shall conduct a walking tour for the Owner, tenants, and host organizations (separate from the systems testing) of the system to demonstrate the scope of the work and the completeness of the systems.

1.15 REFERENCES AND REGULATORY REQUIREMENTS

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. The equipment and installation shall comply with, but not be limited to the current or applicable provisions of the following:
 - 1. National Electric Code, Article 760.
 - 2. National Fire Protection Association Standards:
 - a. NFPA 70 - National Electrical Code.
 - b. NFPA 72 - Application, performance, installation and maintenance of fire alarm systems and their components.
 - 1) NFPA 72: Chapter 24 Emergency Communications System
 - 2) NFPA 72: Chapter 24.3.3 Required Emergency Communications Systems
 - 3) NFPA 72: Chapter 24.3.5.2 Loudspeakers for ECS
 - c. NFPA 101 - Life Safety Code.

3. Underwriters Laboratories Inc. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
 - a. UL 1480: Speakers.
 - b. UL 1424: Cables.
 - c. UL 1711: Amplifiers for Fire Protective Signaling Systems.
 4. Florida Building Code: Latest adopted edition.
 5. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.
 6. State of Florida: Division of State Fire Marshal.
- C. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
- D. All Control Equipment shall be listed under UL category UOJZ.
- E. The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.
- F. IEEE: The fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in Table 1, Location Category a High Exposure of ANSI/IEEE Standard C62.41-1980 (formerly IEEE Standard 587).

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all components, equipment, parts, accessories and associated quantities required for complete extension of existing system. All components may not be specified herein.
- B. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for Sound/Paging system specified in this section.

2.2 PATHWAYS

- A. All pathways (conduit, raceways, and wireways, pullboxes, and outlet boxes) shall comply with applicable requirements of Division 27.

2.3 ECS EQUIPMENT PDU

- A. Provide (2) PDU's minimum at each ECS cabinet location and connect to Life Safety branch UPS power. Provide additional PDU's where required due to power consumption.
- B. Basis of Design: APC# AP9626

2.4 SOFTWARE

- A. Update existing Globalcom ACS software and licenses
- B. Update existing GCK – Advanced notification software
- C. Update existing FAS - Automated Announcement System
 - 1. T-CAS – Text-to-speech Announcement System (Client and Server) Include Text to speech engine and language pack
- D. Coordinate with GOAA for configurations required for software setup and installation.

2.5 ANNOUNCEMENT CONTROL SYSTEM

- A. IED GLOBALCOM.IP ACS (ANNOUNCEMENT CONTROL SYSTEM)
 - 1. The ACS shall be provided at each Head end (LST/ASC/GTF) and shall have a parallel secondary ACS configured for backup if the primary ACS fails.
 - 2. Contractor shall provide additional ACS's with backup as required to support total device counts per manufacture recommendation.
 - 3. The ACS shall manage announcements and messages using dynamically routed data on a standard Ethernet Network. It shall include an integral multi-channel message server providing simultaneous record and playback capability for up to 16 play and 16 record channels in multiple languages.
 - 4. The ACS shall manage AtlasIED GLOBALCOM® Series peripherals including Digital Communications Stations, Network Power Amplifier Systems, Input/Output Devices, Zone Controllers and IP End Points.
 - 5. The ACS shall include internal support for (8) logic inputs, (8) relay outputs, and (2) balanced audio inputs.
 - 6. The ACS shall manage dynamic requests for live and delayed announcements, pre-recorded and assembled messages, actions, defined events, and two-way full duplex intercom connections.
 - 7. An integrated visual paging server shall deliver visual messaging to supported visual displays that shall be synchronized to the audio regardless of message length.
 - 8. Announcements and messages shall be initiated by contact closures, microphone paging stations, DIRECTOR® software, open standard IP network commands, and VoIP.
 - a. The ACS shall include an integral interface for VoIP telephones via SIP and PBX trucking as well as standard 3rd party FXO gateways.
 - b. The interface shall support standards G.711, G.722 and RTP protocols.
 - c. Operating modes shall provide for both direct dial zone paging access and well as voice prompted actions for announcements and messages.
 - 9. The ACS shall support CobraNet® and Dante™ Audio-over-Ethernet protocols with VoIP, RTP, and RTCP.
 - 10. The ACS shall supervise all associated end-point devices, report system abnormalities, and log faults to be reported via SMNP, E-mail, and SMS via E-mail notifications.

11. The ACS shall be designed for high reliability with no moving parts including an Intel® 64-bit Quad Core™ low power processor, solid state hard drive, and available hot swap redundant power supply.
12. The ACS shall fit into 1 RU of 19" rack space and weigh 3.0 kg.
13. The ACS shall be safety listed to UL Standard 60950.
14. The ACS shall include GLOBALCOM®.IP system configuration and management software and shall include internally hosted web page for configuration and monitoring the System Management Console.
15. Provide additional ACS controllers with backup as required to support number of devices / amplifiers at head end.
16. Basis of Design: IED Globalcom.IP Model - IP116

2.6 INPUT/OUTPUT MODULES

A. Logic Relay Module

1. Provide where indicated on plans and where required for interface with 3rd part equipment
2. 2 electro-mechanical relays
3. 2 optically isolated inputs
4. Communication shall be via RJ-45 LAN connection.
5. Power shall be via PoE from LAN
6. DIN rail mounted. Provide rack mounted DIN rail for installation of modules in ECS cabinets.
7. Basis of Design: IED 1516LI

B. Input Module

1. Provide where indicated on plans and where required for interface with 3rd part equipment
2. 16 optically isolated inputs (expandable to 32 using expansion module)
3. Communication shall be via RJ-45 LAN connection.
4. Power shall be via PoE from LAN
5. DIN rail mounted. Provide rack mounted DIN rail for installation of modules in ECS cabinets.
6. Basis of Design: IED 1516LI

2.7 POWER AMPLIFIERS

A. ECS Amplifier Mainframe (AMP FRAME)

1. General:
 - a. Provide power amp frames in ECS equipment cabinets shown on drawings as required to support all local speaker circuits.
 - b. Provide additional 25% spare capacity in amp mainframe at each IDF room location (for additional amp cards in the future).
 - c. Provide backup amp card in each mainframe sized to match the largest amp card in use in same mainframe

2. The Smart Mainframe Power Amplifier shall house, supply power to, and control up to seven (7) TitanONE Series amplifier cards and a DSP/CPU card. In addition, the Smart Mainframe Power Amplifier shall have a provision to provide digital audio connections via a CobraNET audio distribution.
 3. Local program or BGM (background music) inputs shall connect via (12) analog inputs at the rear panel via provided connectors.
 4. The integrated NIC (Network Interface Card) shall include dual ports for redundant network connections.
 5. The Smart Mainframe Power Amplifier shall house six (6) active single or dual channel amplifier cards (150W, 300W or 600W 70.7V/100V load) and a seventh (7th) active spare that is automatically engaged should a failure condition be reported. The system shall detect a failure in any of the primary amplifier cards and replace the effected amplifier without loss of service.
 6. The integrated digital signal processor shall provide up to 12 channels of processing to include level control of individual circuits, up to 8 bands of parametric equalization, high pass filter, signal delay, compression (on analog inputs) and ambient analysis control.
 7. All setup, monitoring, configuration, testing and control shall be under software control.
 8. The Smart Mainframe Power Amplifier shall be capable of live or delayed paging, pre-recorded message playback, and muting of individual amplifier channels, zones and zone groups in any combination when used with optional GCK software deployment. Ambient analysis and control shall be accomplished via an adjustment of signal levels via external noise sensing and/or computer commands.
 9. Connections for 24 ambient sensors shall be incorporated via rear panel connections and allow for single or dual sensor control of desired zones. Ambient analysis and control shall be in real time.
 10. The Smart Mainframe Power Amplifier shall include internal audio bus monitoring and provide for visual as well as audio monitoring of the internal signal chain. Testing of the Smart Mainframe Power Amplifier shall be automatic or manually on demand and allow selection of the monitor points in the signal chain internal to the amplifiers and current level to the speaker lines and report with a resolution of 0.5dB.
 11. The Smart Mainframe Power Amplifier shall require 4 rack units of vertical space in a 19 inch rack and all connections shall be in on the rear panel. The front panel shall provide for slide in cards and a visual indicator of amplifier status.
 12. Basis of Design: AtlasIED T112 TitainONE with DSP and Processor
- B. ECS Amplifier Cards
1. General:
 - a. Provide amp card as required per drawings schedules. All power amp cards shall be 1200W 2ch cards unless specifically noted on drawings.
 - b. Contractor may not load any amp card more than 80% rate power handling once final tap values are set.
 2. Line Driver Card

- a. 2-Channed Line Level Driver for long distance audio feeds.
 - b. Utilized to support power line array speakers.
 - c. The 2-channel line driver has two low impedance, balanced, floating, active outputs which are designed to drive very long lines. Its transformer less output design provides wider bandwidth while minimizing distortion at all frequencies.
 - d. Basis of Design: IED T2LD-120V-T1
3. Modular Amp Card (300W)
 - a. 2-Channed amplifier card providing 150W per ch.
 - b. Shall be rated for 70V distribution
 - c. The card shall have LED indicators for power and signal.
 - d. Each card shall be provided with a front accessible power switch
 - e. Basis of Design: IED T302-120V-T1
 4. Modular Amp Card (600W)
 - a. 2-Channed amplifier card providing 300W per ch.
 - b. Shall be rated for 70V distribution
 - c. The card shall have LED indicators for power and signal.
 - d. Each card shall be provided with a front accessible power switch
 - e. Basis of Design: IED T602-120V-T1
 5. Modular Amp Card (1200W)
 - a. 2-Channed amplifier card providing 600W per ch.
 - b. Shall be rated for 70V distribution
 - c. The card shall have LED indicators for power and signal.
 - d. Each card shall be provided with a front accessible power switch
 - e. Basis of Design: IED T1202-120V-T1
- C. POE IP AMP (Elevators)
1. Amp shall have 2 channels, each with 4 watt @ 8 ohms
 2. Provide NEMA enclosure and DIN mounting rail for installation
 3. Shall integrate with Globalcom via CobraNET Audio.
 4. Basis of Design: IED1542NA-C

2.8 MICROPHONE PAGING STATIONS

- A. Microphone Paging Station (Type 1)
1. Provide where shown on drawings.
 2. Provide rack mounted paging station in ECS cabinet in each IDF room with associated paging equipment.
 3. Provide additional 25 stations and all associated cable, conduit, labor, programing and materials to be located where directed by GOAA. Contractor shall coordinate programing functions and locations with GOAA.
 4. Shall be a network device used for initiating audio/visual announcements, messages, and pages with the IED family of Announcement Control Systems via CobraNET audio.
 5. It is a network appliance with its own unique IP address, which simplifies its installation and configuration.
 6. Shall have fully customizable LCD touch screen interface.

- a. Screen layout and button function Shall be coordinated with GOAA prior to installation
 7. The Digital Communication Station uses a single Ethernet interface for audio and control data. The station is fully compatible with IEEE 802.3af standard for Power Over Ethernet (PoE), allowing the station to be powered directly from any standard off-the-shelf PoE switch.
 8. Provide with back box and all required installation accessories.
 9. For desktop / counter top paging stations, provide handheld microphone with desktop mounting base with rubber feet. Connect to LAN outlet with patch cable.
 10. Where specifically noted on drawings, provide paging station with recessed wall mounted enclosure
 11. Manufacturer:
 - a. LCD Touch Screen Paging Station: IED IED550CS-H Series
- B. Microphone Paging Station (Type 2)
1. Shall be a network device used for initiating audio/visual announcements, messages, and pages with the IED family of Announcement Control Systems.
 - a. It is a network appliance with its own unique IP address, which simplifies its installation and configuration.
A 4 button full function keypad shall be provided for user shortcuts.
 2. Magnetically held replaceable handheld paging microphone.
 3. The Digital Communication Station uses a single Ethernet interface for audio and control data. The station is fully compatible with IEEE 802.3af standard for Power Over Ethernet (PoE), allowing the station to be powered directly from any standard off-the-shelf PoE switch.
 4. Provide with back box and all required installation accessories.
 5. Where noted on drawings provide paging station with recessed wall mounted enclosure
 6. Manufacturer:
 - a. 4 Button Paging Station: IED IEDA524 Series

2.9 AMBIENT SENSING MICROPHONE

- A. Flush Ambient Sensing Microphone
1. Condenser microphone for monitoring of ambient audio levels.
 2. Omnidirectional condenser microphone, preamplifier, and an analog conversion module.
 3. Provide with 2-Gang powder coated mounting plate to match wall color. Coordinate with architect for exact paint color code by location..
 4. Mount in standard flush 4S box
 5. Basis of Design: IED IED0540S

2.10 ECS SPEAKERS: ASC/LST/GTF

1. Ceiling Speaker (Type 0)
 - a. System shall include a high performance 6.5" coaxial loudspeaker, ported bass reflex enclosure and press-fit grille for conventional ceiling installation.

- b. Frequency response for the system shall be 50Hz – 20kHz. Sensitivity shall be 90dB.
 - c. Loudspeaker shall be comprised of a 6.5" cone type driver. Cone shall be constructed of composite cone with polymer coated cloth surround.
 - d. Magnet shall be a minimum of 10 oz (264 g) and the voice coil diameter shall be 1" (25 mm).
 - e. The silk dome tweeter is 20mm and utilizes a Neodymium magnet.
 - f. Transformer shall be a 70.7V / 100V type with 4, 8, 16, and 32 watt primary taps (@70.7V) with a front mounted tap selector switch to include transformer bypass setting for 8Ω direct coupled operation.
 - g. The speaker shall be equipped with a universal line matching transformer for a 70V output line with taps at 2, 4, 8, 16, & 32 watts.
 - h. Mounting: Speaker shall be recessed mounted, and provided with Tile Bridge and all required mounting hardware.
 - i. Color: White
 - j. Where mounted outside building envelope, provide additional Hyfidrophobic™ Treatment from manufacturer to prevent moisture intrusion.
 - 1) Basis of Design: Atlas Sound FAP63T-W or approved substitution
2. Ceiling Speaker (Type 1)
- a. System shall include an 8" coaxial loud speaker, ported bass reflex enclosure and press fit grille.
 - b. Frequency response shall be 60Hz to 15Khz with a sensitivity of 92db average.
 - c. Loud speaker shall be rated at 150W, and be constructed with a polypropylene cone and a 1.25" titanium diaphragm compression driver. Woofer magnet shall be minimum of 25oz.
 - d. Two transducer section shall be coupled thru a built in 2000Hz crossover network.
 - e. Shall include a 70V transformer rated at 1.9, 3.8, 7.5, 15, 30, and 60 watt primary taps with front mounted selector switch.
 - f. Mounting: Speaker shall be recessed mounted, and provided with Tile Bridge and all required mounting hardware.
 - g. Color: White
 - h. Where mounted outside building envelope, provide additional Hyfidrophobic™ Treatment from manufacturer to prevent moisture intrusion.
 - i. Basis of Design: Atlas Sound FAP8CXT or approved substitution
3. Ceiling Speaker (Type 2)
- a. Systems shall include a 250 watt loudspeaker that combines a 12" diameter, low frequency transducer and a 1" exit, true compression driver.
 - b. Frequency response range shall be 58 Hz to 15 kHz, ±3dB. Sensitivity shall be 99dB at 1 watt, 1 meter.
 - c. Voice coil impedance shall be 8 ohms (nominal). Low frequency voice coil diameter shall be 2.5" (63.5mm).
 - d. The maximum depth of the loudspeaker shall not exceed 8" (203mm).

- e. The low frequency reproducer cone shall be a full 12" (305mm) in diameter and the high frequency reproducer diaphragm shall be 2.5" (65mm) in diameter. The woofer shall have a 70 oz. (1984g) ceramic magnet. The tweeter shall have a 20 oz. (567g) ceramic magnet.
 - f. The two reproducer sections shall be coupled through a built-in crossover network. The crossover frequency shall be at 1800 Hz. Conical dispersion shall be 90 degrees at 2kHz.
 - g. System shall be provided with an internal transformer with primary voltage of 70.7V with a frequency response range of 33Hz to 21kHz (± 2 dB) and power taps at 7.5, 15, 30 & 60 watts. Insertion loss shall not exceed 1dB.
 - h. Mounting: Speaker shall be recessed mounted, and provided with a Q series enclosure with a internal volume of 3cu/ft. provide speaker grille cover and mounting channels.
 - i. Color: White
 - j. Where mounted outside building envelope, provide additional Hyfidrophobic™ Treatment from manufacturer to prevent moisture intrusion.
 - 1) Basis of Design: Atlas Sound 12CXT60 or approved substitution
4. Ceiling Speaker (Type 3)
- a. System shall consist of a two-way woofer and tweeter assembly within an pendant mount environmental-resistant housing.
 - b. The 150 Watts system shall have an 8.25" (310 mm) woofer constructed with a polypropylene cone and a 1" (25 mm) titanium diaphragm compression driver.
 - c. Each system shall be complete with a built-in, 60 Watts 70.7/100V transformer with taps of 1.9, 3.8, 7.5, 15, 30, & 60 Watts (70.7V) and a transformer bypass position for 8 Ω direct coupled operation on a 8 position terminal block.
 - d. The frequency response for the system shall be 60 Hz – 15 kHz (± 5 dB). The loudspeaker shall be the Atlas Sound PM8CX.
 - e. Mounting: Speaker shall be pendant mounted from structure above, refer to mounting detail on drawings for additional requirements. Install per manufactures recommendation.
 - f. Color: White
 - g. Where mounted outside building envelope, provide additional Hyfidrophobic™ Treatment from manufacturer to prevent moisture intrusion.
 - 1) Basis of Design: Atlas Sound PM8CX or approved substitution
5. Wall Speaker (Type 1)
- a. Shall consist of a semi recessed horn driver.
 - b. Continuous power rating shall be (15, 8, 4, 2, 1, 1/2, 1/4 watts) at
 - c. 70V.
 - d. Frequency response shall be 600 to 5500 Hz (± 5 dB).
 - e. Sensitivity shall be 96.9dB (at 1 watt, 1 meter).
 - f. Dispersion shall be greater than 190° (-6dB point, 1 and 2 kHz octave bands).

- g. Model shall be water/moisture sealed and constructed of die-cast zinc.
 - h. Unit shall operate within the temperature range of 150°F (66°C) to -30°F (-35°C).
 - i. Mounting: Speaker shall be semi recessed mounted with the Semi-flush adapter plate mounted behind VT Series to cover any recessed 4" SQ x 1 1/2" D (102mm x 38mm) outlet box. CRS wall plate is stamped and painted.
 - j. Color: Shall be Grey
 - l. Basis of Design: Atlas Sound VT-157UC or approved substitution
6. Wall Speaker (Type 4)
- a. Systems shall be self powered steerable vertical line array
 - b. Frequency Range: 80 Hz to 20 kHz
 - c. Max SPL:
 - 1) 102 dB pgm, 105 dB peak @ 100 Ft. (30.5 meters), 105 dB pgm, 108 dB peak when stacked (3-octave bandwidth centered at 2 kHz)
 - d. Coverage:
 - 1) Horizontal: 150° up to 3 kHz; 120° above 3 kHz
 - 2) Vertical: 20°, 25° and 30° (5°, 10°, 15° and 20° when stacked)
 - 3) Aiming Angle: Adjustable from -30° to +30° 66 Ft. (20 m) 132 Ft. (40 m) when stacked Effective down to 800 Hz (400 Hz when stacked)
 - e. Loudspeakers:
 - 1) Five 6.5-inch cone transducers with neodymium magnets Three 1-inch HF titanium nitride compression drivers per module
 - 2) 8 Amp Channels (per module) 48" H x 8" W x 11.3" D (121.5 cm x 20. cm x 28.7 cm) 61 Lbs (27.7 Kg)
 - f. I/O Connectors:
 - 1) Analog Audio Inputs: Looping Phoenix 6-pin (looping 3-in, 3-out)
 - 2) Dual RJ45 connectors
 - 3) AES/EBU: Phoenix connector
 - g. Provide full software suite for remote control and configuration.
 - h. Mounting: Speaker shall be surface mounted utilizing manufacturers provided mounting hardware inside recessed cavity. Refer to architectural specs and drawings for additional mounting information
 - i. Color: White
 - j. Basis of Design: Renkus-Heinz ICL-F-DUAL-RN or approved substitution
7. Wall Speaker (Type 5)
- a. The loudspeaker system shall be a two way, full range column array system with five 3" LF transducers and two 22mm dome tweeter HF transducers.
 - b. The paintable enclosure shall be constructed of extruded aluminum. The back of the enclosure shall incorporate vertical channels that accept an included wall mount and allow the loudspeaker to slide up or down the mount for desired vertical aiming. The mounting system shall provide at least ±10° vertical tilt capability.

- c. The system shall have a frequency response of 137Hz to 20kHz (-5 dB) and a low impedance (8Ω) input capability of 27.4V RMS. The sensitivity at 1W/1m shall be 92dBSPL with a max SPL of 116.8 dBSPL at 1m.
 - d. The loudspeaker system shall have a vertical coverage of 45° (800Hz - 4kHz) and a horizontal coverage of 135° average (800Hz - 4kHz).
 - e. The system shall be equipped with a 60W high performance transformer for use in 70.7V distributed audio systems. In 70V operation, it shall provide 60W, 30W, 15W and 7.5W taps.
 - f. Mounting: Speaker shall be surface mounted utilizing manufacturers provided mounting hardware.
 - g. Color: White
 - h. Where mounted outside building envelope, provide additional Hyfidrophobic™ Treatment from manufacturer to prevent moisture intrusion.
 - 1) Basis of Design: Atlas Sound ALA5T or approved substitution
8. Wall Speaker (Type 6)
- a. The Speaker assemblies shall consist of 2-way, woofer and tweeter, within environment-resistant housings. Enclosure shall be constructed of paintable UV-resistant, talc impregnated, polypropylene, injection molded plastic finished.
 - b. Each unit shall include a stamped, powder coated, aluminum grille and removable C-shaped mounting bracket. All hardware inserts shall be brass and threaded $1/4$ "-20.
 - c. The 100-Watt RMS system shall have a $5\ 1/4$ " (133mm) woofer, constructed of reinforced polypropylene, and a 1" (25mm) Ferrofluid cooled tweeter. The dividing network crossover frequency shall be 5kHz. The dividing network shall include protection circuits for the high-frequency component.
 - d. Each unit shall include an internally mounted 30 Watt 70.7V line matching transformer for use in distributed sound applications wattage taps shall be screwdriver selectable via a sealed switch located near the input section. Wattage taps shall be 0.94, 1.9, 3.7, 7.5, 15, 30 @ 70.7V plus transformer bypass setting for direct coupled 8Ω operation.
 - e. The loudspeaker system shall meet the following performance criteria:
 - 1) Power handling: 100 Watts RMS; Frequency response: 85Hz – 20kHz (± 3 dB); Pressure sensitivity, 90dB SPL at one watt, 100Hz – 10kHz measured at a distance of one meter on axis.
 - f. Input connectors shall include a two-pole barrier strip capable of accepting up to two #16AWG cables.
 - g. A tongue-in-groove cover with rubber wire exit grommet shall be provided to protect the input connectors from corrosion.
 - h. Mounting: Speaker shall be surface mounted in a horizontal configuration utilizing manufacturers provided mounting hardware.
 - i. Color: White

- j. Where mounted outside building envelope, provide additional Hyfidrophobic™ Treatment from manufacturer to prevent moisture intrusion.
- k. Basis of Design: Atlas Sound SM52T or approved substitution
- 9. Surface Speaker (Type S1)
 - a. Speaker Shall be a constant-directivity paging loudspeakers for use in public address or paging applications.
 - b. Speaker shall be rated at 40 watts at 70V.
 - c. Speaker shall be environment-resistant and feature a 60° x 40° (±10°) constant-dispersion pattern across the controlled frequency band of 1.25-10 kHz.
 - d. Mounting shall be via a rotating bell which pivots in precise 15° increments for exact on-site positioning of projection angles. Shall include a triple lock security mounting method.
 - e. The Horn shall be equipped with an internal 25/70.7/100 volt transformer with screw terminal connections made beneath the rear cap. Rear cap shall facilitate armored cable.
 - f. Loudspeaker mounts to die-cast zinc base. Pre-mount the base to a standard 4" sq. E.O. box.
 - g. Basis of Design: Atlas Sound APX40TN or approved substitution
- 10. Surface Speaker (Type S4)
 - a. Shall consist of (2) voice tone compression drivers mounted in opposite direction utilizing a two way ceiling mount.
 - b. Continuous power rating shall be (15, 8, 4, 2, 1, 1/2, 1/4 watts) at
 - c. 70V.
 - d. Frequency response shall be 600 to 5500 Hz (± 5dB).
 - e. Sensitivity shall be 96.9dB (at 1 watt, 1 meter).
 - f. Dispersion shall be greater than 190° (-6dB point, 1 and 2 kHz octave bands).
 - g. Model shall be water/moisture sealed and constructed of die-cast zinc.
 - h. Unit shall operate within the temperature range of 150°F (66°C) to -30°F (-35°C).
 - i. Color: Shall be Grey
 - j. Mounting:
 - 1) Twin housing for bi-directional mounting of two independently powered VT Series models. Unit is recommended for wall or ceiling installation in corridors and walkways.
 - 2) Each unit includes 2 3/4" D (70mm) housing with base and adapter plate for parallel mounting to any 4" SQ or single-gang electrical backbox for distortion-free, bi-directional projection.
 - k. Basis of Design: Atlas Sound VT-158UC or approved substitution

2.11 HIGH POWERED SPEAKER ARRAY (HPSA WEATHER ALERT SYSTEM)

A. HPSA (Speaker)

- 1. Provide where indicated on floor plans with all require mounting hardware and adapters

2. NEMA 3R Rated enclosure
 3. Provide with pole mounting kit
 4. 113db peak output
 5. 250W Power Handling @ 70V
 6. Color: Grey
 7. Basis of Design: EST Hyperpike Series #MN-HSMG25P5N
- B. Visual Device (Strobe)
1. Double Flash Dual Strobe, provide at all HPSA locations with all required mounting hardware and adapters
 2. Color: Amber
 3. Type 4X / IP69K
 4. 120VAC Operation
 5. Basis of Design: Federal Signal #371DST-120A
- C. HPSA-PS (Power Supply)
1. Provide power supply on TTB in each local IDF room supporting a HPSA
 2. Provide Power Controller and low voltage Power Supply boards
 3. Four (4) independently controlled fuse protected outputs. These power outputs can be converted to dry form "C" contacts.
 4. Outputs are activated by an open collector sink or normally open (NO) dry trigger input from an external trigger. Outputs will operate in both Fail-Safe and/or Fail-Secure modes.
 5. Units are designed to be powered by two (2) totally independent power sources, one (1) providing power for board operation and the other for lock / accessory power.
 7. Enclosure shall be as recommended by manufacturer.
 8. Basis of Design: Altronix ACM4CB

2.12 LOCAL VOLUME CONTROL

- A. Local volume control with a 3db per step attenuator.
1. Provide with single gang SS faceplate.
 2. Wattage rating shall be as required based on load supported (10W, 35W, 100W)
 3. Removable terminal strip for all wiring connections
 4. Shall be rated at 70V
 5. Shall be provided with a priority page relay option, relay shall be an SPDT, 24 VDC type securely mounted to the attenuator assembly wired at the factory
 6. Basis of Design: AtlasIED AT##-PA (## = wattage rating)

2.13 WIRES/CABLES

- A. Network Cabling - Refer to Division 27 10 00 for all cabling requirements.
- B. Ambient Sensing Microphones shall be sized to allow no greater than 5 percent loss from source to head end. Lines shall be stranded twisted pair, jacketed with shield and drain wire.

1. Minimum conductor strand count: 2
 2. UM type CMR/CMP as required based on application.
 3. Low capacitance
 4. Manufacturer
 - a. Belden or EQUAL
- C. Loudspeaker signal lines shall be sized to allow no greater than 5 percent loss from source to first speaker. Lines shall be stranded twisted pair, jacketed with no shield.
1. Minimum conductor strand count: 2
 2. Cable size as noted on drawings or as required above. Maximum cable size: 12AWG
 3. UM type CMR/CMP as required based on application.
 4. Low capacitance
 5. Manufacturer
 - a. Belden or EQUAL

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. General
 1. Install equipment and cable/wires in accordance with manufacturer's instructions.
 2. Install equipment, cables, and speakers as required to comply with all applicable requirements of the references and/or regulatory requirements and performance called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.
 3. Install all electrical basic materials per applicable sections of these specifications.
 4. Install system cabinets/racks in locations shown; arrange to provide adequate ventilation and access.
 5. Properly ground system per applicable sections of these specifications.
 6. Support raceways, backboards, and cabinets under the provisions of Division 26, or, if more restrictive as required by manufacturer's instructions.
 7. Install raceways to conform to applicable sections of Division 26.
 8. Install sound/paging system wiring and/or raceways away from any surface that may become hot, including and not limited to, hot water piping and heating ducts.
 9. Install sound/paging system wiring with at least 12 inches of separation from line voltage power wiring on parallel runs. Wiring crossing power circuits shall be at right angles. For metal enclosed electric light or power or Class 1 circuits, separation may be reduced as described in 1990 NEC 800-52 (a) (1). Increase separation if so required to comply with EIA/TIA referenced standards.

10. Raceway for sound/paging system wiring shall not be shared by power or any other electrical wiring that is not part of the low-voltage sound/paging systems.
11. Final connections, balancing, adjustments, testing, etc. Shall be factory trained technicians. When system is complete, it shall be demonstrated to owner's representative who shall be given complete instructions, part, manuals and maintenance information.
12. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.
13. Install input circuits in separate cables and raceways from output circuits.
14. Provide protection for exposed cables where subject to damage.
15. Use suitable cable fittings and connectors.
16. Install equipment racks in location shown; arrange to provide adequate ventilation and access.
17. All cables shall be cut to the length dictated by the run. No splices shall be permitted in any pull boxes. For equipment mounted in drawers or on slides, the interconnecting cables shall be provided with a service loop of appropriate length.

C. Pathway

1. General

- a. All raceways shall meet requirement for raceway per section, in addition to applicable requirement of sections within Division 27 of these Specifications.
- b. Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage Sound/Paging systems. Sound/Paging system wiring may be installed in underground pull boxes with other low-voltage systems provided:
 - 1) Installation meets/complies with all applicable codes and standards.
 - 2) Sound/Paging system cables are separated by at least 12 inches from any non-shielded voice/telephone/PDS wire/cable.
- c. Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.
- d. Install raceways so no more than two 90o bends are in any raceway section without pullbox. Install additional pullboxes as required to maintain maximum of two 90o bends between pullboxes and/or termination points.
- e. Label all raceway at both ends to indicate destination and Sound/Paging source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built drawings.
- f. Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.
- g. Properly support cables/wire not installed in raceways.

- h. Special Raceway Systems: Special raceway systems may be specified for some portions of the Sound/Paging system. Refer to other sections of these specifications to determine where or if such systems are used.
- i. Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.
- j. Fire Stop
- k. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.
 - 1) Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly and/or conduit involved.

D. Grounding

- 1. Equipment grounds: Grounding methods used shall be dependent upon individual equipment interconnection of chassis ground, circuit common, and power supply common within the units. Ground methods shall vary with type as follows:
 - a. Type A: Equipment having a 3-wire power cord with green wire of the power cord connected to chassis and where signal common is not internally connected to chassis. Make no connection from chassis ground to primary systems ground busbar in Equipment Rack.
 - b. Type B: Equipment having a 3-wire power cord with green wire of the power cord connected to chassis and signal common can be connected to chassis ground at the user's option.
 - c. Make no connection from chassis ground to primary system busbar, but do make connection with 14 AWG insulated wire from circuit common to primary system ground busbar in equipment rack. Be sure to separate circuit common from chassis ground.
 - d. Type C: Equipment having a 2-wire power cord, no green wire, neutral is not tied to chassis, and circuit common is tied to chassis. Make connection from chassis to primary system ground busbar using 14 AWG insulated wire.
 - e. Audio cable shields shall be grounded at one point only, without exception. For inter- and intra-rack wiring this requires that the shield be connected at one end only, this shall be at the input to a device. The shield shall be lifted at the device output. For ungrounded portable equipment, such as microphones, the shield shall be connected at both ends but grounded at only one end.
- 2. Contractor shall not deviate from the above, except if necessary to minimize crosstalk and to maximize signal-to-noise ratios.

E. Speakers

- 1. Mount ceiling speakers in pattern acceptable to architect in coordination with lights, sprinkler heads, etc and as directed by ceiling system contractor, manufacturer, and installer. Provide all required mounting hardware and/or accessories. In general, all speakers shall be recessed mounted in the ceiling system.
 - a. Speakers mounted in acoustical tile ceilings shall have Support Bridge.

F. Microphone Stations

1. Install microphone station where indicated on drawings.
2. Mic station shall be programmed to provide paging to all required areas based on installation location. Match existing configuration of north terminal paging stations and coordinate with GOAA operations prior to programming to confirm exact paging requirements at each location.

G. Elevators

1. Provide dedicated speaker circuit for each elevator shaft and connect to in cab speaker via elevator travel cable.
2. Coordinate exact interface requirements with elevator installers prior to installation to ensure they are providing correct follower cable to support in cab speaker.
3. Interface shall be made between paging system and elevator equipment in elevator control room. No connection allowed in shaft.

H. Cable/Wire

1. Splice cable only at terminal block units located in terminal cabinets.
2. Speaker cabling may not be "T" tapped and shall be supervised with EOL device. All speaker circuits shall be installed per IED manufacturer recommendations.
3. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at building surge protection devices and at amplifier and/or as otherwise required by applicable codes.
4. Install input circuits in separate cables and raceways/pathways from output circuits.
5. Install all cables no closer than 12" from any wire/cable installed for Premise Distribution System, power system cable/raceway, or fluorescent/ballasted light fixtures.
6. Leave 12 inches excess cable at each termination at speaker and termination blocks.
7. Leave 12 feet excess cable at the central system equipment/rack.
8. Provide protection for exposed cables where subject to damage.
9. Use suitable cable fittings and connectors.
10. Label cable at both ends indicating the originating and terminating location of each end. This labeling/identification shall be fully documented in as-built drawings.
11. Cables shall not be installed with bend radius less than that specified by the cable manufacturer.

I. Weather Alert System

1. Owners Vendor to provide PLC and Annunciators (Primary / Secondary) to be located in the ECS head end at ASC and provide inputs into the ECS system for the following alert conditions:
 - a. Level 1
 - b. Level 2
 - c. Level 3

- d. All Clear
 2. Contractor shall install vendor provided equipment into rack mounted panel in ECS Head End. Refer to details.
 3. System shall activate visual devices under all Levels, and deactivate once all clear is received
 4. Audible Notification shall be via pre-recorded message alerts
 - a. Coordinate with OAR for exact message content
 5. Contractor shall coordinate with OAR to confirm final sequence of operation
 6. Provided in ECS IDF rooms:
 - a. Provide Logic Relay with output to trigger wall mounted power supply for visual notification device.
 - b. Provide HPSA-PS (Visual device power supply) where indicated on drawings or as required to support local HPSA strobe.
 - c. Connect local HPSA to dedicated amplifier circuit in ECS cabinet
 7. Contractor shall provide surge protection on both speaker and visual device circuits supporting the HPSA's
 8. Mounting:
 - a. Coordinate all mounting with architect and structural engineer. Contractor to provide Signed and Sealed engineered shop drawings indicating exact mounting condition and wind loading calculation as required by local codes and standards.
 - b. Contractor shall fabricate mount using all SS hardware.
- J. IPTV Interface
1. Interface with IPTV payers located in adjacent IDF room from ECS equipment cabinets. Each IDF shall be provided with a relay output to trigger the local video players / controller to mute audio / video signals.
 2. Local relay shall be configured to activate when an airport page or emergency message is routed thru a local amplifier
- K. Room Volume Control
1. Where indicated on drawings provide a priority page override volume control for the local room speaker/s.
 2. Where required to support local volume control devices, install additional Logic Relay Module in ECS cabinet to provide trigger output to activate the priority page relay in all local volume controls.
 3. Provide power supply in ECS cabinet sized as required to handle local paging relays connected, as recommended by the manufacture.
 4. Priority Page relay shall activate when an emergency / fire page is made
- L. Ambient Sensors
1. Route all sensors to same amplifier as corresponding speaker circuit.
- 3.2 FIELD QUALITY CONTROL
- A. Refer to Specification Section 27 05 00 in addition to the following.

- B. Provide services of service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- C. Pre-testing: upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- D. Report of pre-testing: after pre-testing is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.
- E. Final test notice: provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
- F. Verify the absence of unwanted voltages between circuit conductors and ground.
- G. Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1-megohm for evaluation.
- H. Test all conductors for short circuits utilizing an insulation-testing device.
- I. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
- J. Verify the ACS control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
- K. Test the system for all specified functions according to the manufacturer's operating and maintenance manual.
- L. Re-testing: correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the specifications and complies with applicable standards.

3.3 TESTS AND ADJUSTMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The Contractor shall perform all tests and adjustments prior to the system demonstration and acceptance test.

- C. The Contractor will provide the test instrumentation such as, precision sound level meter, real time, audio frequency analyzer, dual trace oscilloscope, random noise generator, Impedance Bridge, etc. And as previously submitted and approved.
- D. Provide permanent staff - trained personnel to perform the tests and to adjust and equalize the systems, there will be no exceptions.
- E. Measure and record the input impedance of any active device used to terminate passive devices and record the total impedance of all such devices. Record the dc resistance of any terminating resistor used.
- F. Measure and record the frequency response of each mixer preamplifier and power amplifier in the system. Adjust as required.
- G. The documentation of tests, measurements and adjustments performed will include a list of personnel and the list of certified test equipment used.
- H. All information recorded from all testing is to be shown on the as-built documents.
- I. Speaker Circuits:
 - 1. Measure and record the impedance of each loudspeaker line before connecting the line to the output of its respective amplifier. Adjust, so that the load impedance will be equal to or greater than the rated impedance. Record the total impedance.
 - 2. Provide ground fault test on all speaker circuits before connecting to amplifier outputs.
 - 3. Perform polarity check on all speaker circuits prior to connection to amplifier outputs.
 - 4. Contractor to adjust speaker tap values and amplifier settings to achieve a target SPL of 90db and configure ambient sensors to maintain 15db above ambient up to 95db max
- J. Steerable line array aiming requirements:
 - 1. Contractor shall level, balance, and adjust the digitally steerable speakers for optimal levels, speech intelligibility, and overall sound quality.
 - 2. The Contractor shall coordinate a walk through with the Authority, OAR, and Engineer to demonstrate options for the steerable array software beam patterns.
 - 3. The Contractor shall validate the horizontal aiming angle on site.
 - 4. The Contractor shall engage an entity experienced in adjusting public address emergency communications systems in large atrium environments.
- K. Messaging:
 - 1. Test message playback thru out buildings including message request from Mic Stations, NTLs Comm Center, and Automated FIDS messages.
 - 2. Test interface between FIDS (AIDB) and ECS system controller for purpose of automated flight information messages.
 - 3. Test curtesy message playback and automated schedule

- L. Contractor shall adjust all speaker tap values, amplifier power setting, DSP (EQ, Limiters, Compressors) as required to provide a NFPA compliant ECS audio system meeting all intelligibility and audibility requirements
- M. Configure all ambient audio sensors for each speaker circuit being controller to allow for a 15db over ambient SPL. Adjustments and demonstration shall be made when building is empty and occupied to simulate daytime and nighttime ambient levels and prove system functionality. Testing shall be with AHJ, Owner, and EOR.
 - 1. Contractor shall include all additional time required to make all requested adjustments after demonstration.
- N. Test function of ALL fire alarm supervision and control relays during fire alarm activation and for system supervision.

3.4 SYSTEM DEMONSTRATION AND ACCEPTANCE TEST.

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. The demonstration and acceptance test will be performed after the system test and adjustments have been completed.
- C. The demonstration of the system shall be by the contractor.
- D. All final "as-built" drawings, run sheets, manuals, and other required documents, as detailed herein, shall be on hand. Two complete sets of these documents shall be delivered to the owner at this time. (One complete set shall have been delivered to the consultant prior to the scheduling of acceptance tests).
- E. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the consultant.

3.5 OWNER PERSONNEL TRAINING

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. During training Use submitted operation and maintenance manual as reference. Supplement with training materials as required.

END OF SECTION 27 51 13

SECTION 27 53 10 - DISTRIBUTED ANTENNA SYSTEM CELLULAR

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.
- B. Related to Specification Section 27 05 00 for referenced related specification sections.
- C. Reference Symbols:
 - 1. All device symbols are defined by the appropriate symbol schedule on the symbols and abbreviations sheet in the systems drawing package. Not all device symbols indicated may be required for the project.
 - 2. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Coordinate exact locations with all drawings and affected trades prior to submittal of shop drawings.
 - a. Coordinate exact locations with all security and telecommunications drawings and site plan drawings as well as all affected trades prior to submittal of any shop drawings.
- D. Abbreviations:
 - 1. Refer to Specification Section 27 05 00 for requirements.
- E. Definitions:
 - 1. Refer to Specification Section 27 05 00 in addition to the following:
 - a. Acceptance: Expressed approval by the customer
 - b. Active: DAS components that require AC/DC power for operation
 - c. Carrier Approval: Expressed approval to interconnect to the WSP macro network
 - d. Channel: A path for an RF transmission between two points
 - e. Component: A main system element of the DAS
 - f. Contractor: The prime contractor bidding the project
 - g. Passive: DAS components that do not require AC/DC power for operation

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This Section describes the technical and performance criteria for deploying an independent Distributed Antenna System (DAS) for Wireless Service Providers (WSP) for Cellular Telephones.. This system will make use of a collection of omni directional and directional antennas to provide coverage throughout the STC airside concourse expansion and in all applicable private and public areas and service passages. The system will make use of RF over fiber which digitizes the RF signal and passes it over the fiber optic backbone cabling. This configuration will allow for the signal to be passed further without amplification and will reduce the interference suffered in the application radio bands.

1. The intent of this document is to establish the design criteria which shall be adhered to by Authority's Cellular Distributed Antenna System designer and all contractor's responsible for the delivery and proper installation of the DAS.
 - a. The Authority's Cellular DAS vendor shall be responsible for the application, design and configuration of the system and shall be based on an extension of the DAS system installed as part of the STC Phase 1 project procured under a separate contract.
 - b. The Contractor shall be responsible for coordination with the Authority's DAS vendor for final placement of all elements as well as coordination with any other wireless systems.
- C. This Section includes the following:
 1. The DAS components specified in this document shall include but not limited to:
 - a. Donor Antennas
 - b. Coaxial Cabling, Connectors, Attenuators and Loads.
 - c. RF Circulators, Splitters, Combiners, Couplers, RF Switches, Filters and Diplexers,
 - d. Fiber-Optic Cable, Fiber-Optic Connectors, Fiber-Optic Jumpers,
 - e. Bi-Directional Amplifiers (BDA),
 - f. Fiber-Optic Cable, Fiber-Optic Connectors, Fiber-Optic Jumpers,
 - g. Fiber-Optic Master Unit and Fiber-Optic Remote Units.

1.3 SCOPE OF WORK

- A. Comply with the requirements of Specification Section 27 05 00 in addition to the following:
 1. Requirements set forth by Orlando first-responder radio communications requirements, and/or the Authority's shall supersede the requirements described herein and shall be met in their entirety. It is the Authority Vendor's responsibility to ensure that the DAS complies with local code, ordinances or requirements established by the Authority.
 2. The following Standards contain provisions, which, through reference in this text, constitute provisions of this Standard. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards referenced below. Included with all references to Regulatory Documents within this document, the most recent editions are required to be adhered to for all Scopes of Work.
 - a. RUS Standards (formerly REA)
 - b. Local State Uniform Fire Prevention and Building Code.
 - c. Local State Department of Labor Rules and Regulations
 - d. Association of Public Safety Communications Officers (APCO) "Avoiding Interference Between Public Safety Wireless Communications Systems and Commercial Wireless Communications Systems at 800 MHz"
 - e. Code of Federal Regulations (CFR) [Telecommunications] Title 47 Part 90
 - f. Code of Federal Regulations (CFR) [Telecommunications] Title 47 Part 15
 - g. Wireless Communications Principles and Practice, current edition
 - h. Motorola R-56
- B. Refer to contract drawing sheet T0.00.03 for the work responsibility matrix for the scope of work and responsibilities required for the Distributed Antenna System.

- C. Where listed on the drawing responsibility matrix, the following components shall be defined as follows.
1. **Headend and Software:** Authority Vendor shall furnish, install, and program all required headend equipment and software including, but not limited to any servers, management/administrative software, software licenses, and components which serve the purpose of performing system-wide coordination, monitoring, data processing, control and other global functions. This includes but is not limited to: base station interface, head end units, remote units, donor antennas, and radio consoles.
 2. **Integration to Existing System:** Authority Vendor shall provide all hardware, software, wiring, cabling, programming, protocol converters, interface devices and appurtenances as required to extend the physical or logical scope of an existing system, or to incorporate a new or disparate system into an existing system. This includes but is not limited to interfaces to base stations or extensions of existing connectivity to extend DAS coverage.
 3. **Interfaces:** Authority Vendor shall provide all system interfaces including, but not limited to all hardware, software, wiring, cabling, programming, interface devices and appurtenances as required for communication between systems, or between a given system and an operator, to provide the specified functionality. This includes but is not limited to: FAS, UPS/BMS and power monitoring if not done through the FAS.
 4. **Network Switch:** Refer to specification section 27 05 00 for requirements. Coordinate network programming requirements with GOAA IT when required. Contractor shall coordinate patching into the network with GOAA.
 5. **Backbone Cable:** Refer to specification section 27 10 00 for requirements. Contractor shall furnish and install all conduit boxes, fittings, pathways and raceways. The Authority Vendor shall furnish and install intra-building cable and fiber. The DAS requires dedicated fiber optic backbone cabling between headend units and remote end units. The furnishing and installation of the dedicated fiber optic cabling in support of the Cellular DAS shall include the following:
 - a. Fusion splices will be required by the Contractor in the Airside Concourse MDF. The Contractor shall be responsible to test DAS Fiber from the Airside Concourse IDF rooms to termination point in the South APM Cellular Radio Room.
 - b. Fusion splices will be required by the Contractor in the Landside Terminal MDF. The Contractor shall be responsible to test DAS Fiber from the Landside IDF rooms to termination point in the South APM Radio Room.
 6. **Horizontal Cable:** Contractor shall furnish and install all pathways, conduit, access hatches, termination equipment, communication room fittings, grounding and labeling included in this specification section. Horizontal cabling shall be furnished and installed by the GOAA Vendor. Horizontal cable includes the segment of the premises distribution system that provides connectivity from communications rooms to field devices. This includes all conduit, access hatches, and coaxial cable to connect to field devices. Antenna locations noted on the drawings must be confirmed by the Contractor and conduit must be installed prior to any antenna being mounted.

7. Field Devices: Authority Vendor shall furnish and install data outlets, testing, labeling, and all other work included in this specification section. This includes but is not limited to: omni or directional antenna, coaxial splitters, combiners, and filters as required. Contractor shall ensure the final location of all field devices is coordinated will all other wireless disciplines and proper coverage studies are conducted by the Authority Vendor for final mounting locations. Contractor is responsible for all conduit as required for the connection of field devices.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 for requirements.

1.5 SYSTEM DESCRIPTION

- A. The Distributed Antenna System specified herein provides coverage throughout the terminal and other public areas for cellular frequencies via a system of spatially separated antenna nodes. The system will consist of a Head End Unit (HEU) which connects to Remote End Units (REUs) via fiber optic cabling. The REUs will feed antenna placed throughout the terminal and related public areas providing cellular coverage while mitigating interference.

1.6 SUBMITTALS

- A. Refer to Specification Section 27 05 00 in addition to the following requirements:
 1. Contractor shall coordinate with Authority Vendor to obtain all submittal documents prior to final submittal.
 2. Submittals shall include, but not be limited to:
 - a. Product Data: Submit manufacturer datasheets for the following components:
 - 1) Donor and Coverage Antennas
 - 2) Coaxial Cable and Connectors
 - 3) Coaxial Attenuators and Loads
 - 4) RF Circulators
 - 5) Splitters, Combiners and Couplers
 - 6) RF Switches
 - 7) RF Filters and Diplexers
 - 8) Bi-Directional Amplifiers (BDA)
 - 9) Master Unit
 - 10) Remote Units
 - b. Shop Drawings: Submit the following items:
 - 1) Overlay of system Components on floor plans
 - 2) RF Propagation Analysis and Link Budget
 - 3) Drawings for Donor Antenna and Grounding
 - 4) Drawings for Rack Elevations
 - 5) Bill-of-Material (BOM)
 - c. Submittal Requirements Prior to Start of Construction
 - 1) Final RF link budget
 - 2) Overlay of system Components on floor plans
 - 3) Drawings for Donor Antenna and grounding
 - 4) Drawings for Rack Elevations

- 5) RF propagation modeling
 - 6) Signal to Noise Interference Ratio (SNIR) Map
 - 7) In-band Interference Analysis
 - 8) Bill-of-Material (BOM)
 - 9) Maintenance Service Contract
 - 10) Statement of Work (SOW): The contractor shall submit a SOW that has been accepted by the customer or customer's designated representative.
 - 11) Acceptance Test Plan (ATP): The contractor shall submit an ATP that has been accepted by the customer or customer's designated representative.
- d. Submittal Requirements at Close Out
- 1) Drawings: Submit as-built drawings indicating:
 - 2) Donor antenna, grounding and lightning protection details
 - 3) Cable routing, splitters, couplers and coverage antenna locations
 - 4) Active component locations, layout and configuration
- e. Test Reports
- 1) WSP DAS: Submit accepted ATP reports confirming the requirements have been met.
 - 2) Field Reports: Submit testing results for all cable runs.
 - 3) Field Reports: Submit OTDR test results for all fiber runs.
 - 4) Operation and Maintenance Data: Submit hardware and software manuals for all Active Components.
 - 5) Warranty Documents:
 - a) Submit for all manufactured components specified in this Section.
 - b) Submit Vendor's System Warranty.
 - c) Submit Manufacturer's Extended Warranty
- f. Antenna location shop drawings: Antenna locations indicated on the drawings are approximate and final determination shall be made by the Authority Vendor based on calculations using the performance characteristics of the Authority Vendor's proposed system. In addition coordination must be done with all providers of the Public Safety DAS and 460 MHz DAS systems (if kept separate) to ensure antenna locations do not create interference with other systems operating in the same frequency range. This includes coordination with WiFi design for WAP locations. All coordination must be done before shop drawings are submitted. Coordination includes identifying required conduit for all field devices and horizontal and vertical cabling. Contractor shall be responsible for coordination between DAS Vendors. Contractor shall submit revised antenna location shop drawings.

- g. DAS coverage prediction maps: Authority Vendor must perform an analysis of the coverage offered by the DAS in-building antenna locations submitted in the antenna shop drawings. DAS coverage prediction maps should account for all other DAS devices including (but not limited to) Public Safety DAS antenna, and 460 MHz antenna (if designed separately from the Public Safety DAS). The coverage prediction maps must ensure the required isolation is achieved to ensure proper operation of the both the public safety DAS system as well as any other DAS system. Coverage prediction maps shall be submitted prior to the start of system installation, including any conduit installation to antenna locations. Installation shall not proceed until submittal has been approved by the Authority and Owner Authorized Representative (OAR). Contractor shall ensure all conduit required to support field devices is installed prior to device installation.

B. Submit system documentation:

1. This Section requires complete documentation of the DAS for the purpose of system operation and maintenance during and after the Warranty period. It is intended that the operation and maintenance manuals be exhaustive in the coverage of the system to the extent that they may be used as the sole guide to the troubleshooting, identification, and repair of defective parts. All documentation, as described here-in shall be submitted to the Authority and OAR for approval sixty (60) days prior to final submission. Authority Vendor shall supply all required documentation to the Contractor prior to submittal deadlines. The Contractor shall be responsible for coordination with the Authority Vendor to obtain necessary documentation as well as submitting all documents to the Authority.
2. These manuals shall include basic wiring diagrams, schematics, and functional details such that any component, wire, or piece of equipment in the system may be easily identified by going to the actual equipment and making reference to this manual. It is required that everything in the system be neatly labeled and easily identifiable. Every terminal, wire, component, or piece of equipment, and other such items shall have a number or letter designation. All of these identification characteristics shall be included in the maintenance and operation manuals.
3. The maintenance manual requirement of this Section is in addition to Shop Drawing requirements. Maintenance manuals and Drawing sets shall be compiled after system fabrication and testing, and shall incorporate any changes made after Shop Drawing submittal. The maintenance manuals and drawing books shall be permanently bound in hard plastic covers.
4. Maintenance Manuals, Manufacturer's Literature: Provide manufacturer's standard literature, covering all equipment included in the system. The maintenance manuals shall contain specifications, adjustment procedures, circuit schematics, component location diagrams, and replacement parts identification. All references to equipment not supplied on this Project shall be crossed out.

5. As Built Documentation: The as built documents shall be produced with current version of AutoCAD and the electronic files shall be provided to the Authority at the completion of the Project on CD-ROM. Provide component identification and cross reference on the Drawings to allow the Authority and (OAR) to understand the function of each item (the block diagram), find the room where the device is mounted (Contract Document plans), find its location in a rack (Arrangement Drawings), find how it is wired (wiring diagrams), and its detailed Specifications (vendor data sheets), and how to repair it (spare part lists). Include the following drawings as a minimum:
 - a. System Block Diagram: This drawing shall depict the final DAS overview, including equipment types, location, and any special information. Final gain settings on all amplifiers in the system shall be recorded.
 - b. System Riser Diagram(s): These drawings shall show all DAS components, wire numbers, color codes, pin numbers, component locations and connections, depicting the "as-built", final configuration.
 - c. Rack / Wall Elevation and Wiring Diagram(s): The elevation diagrams shall depict the front views of the equipment racks and wall fields identifying all equipment installed within. Complete wiring diagrams of the rack / wall equipment shall also be included.
 - d. Floor plans of the communications room showing the location of all equipment affected as a part of this contract within the telecommunications room and throughout the building.
 - e. Wiring Diagrams: Provide wiring diagrams showing all field installed interconnecting wiring. Wire identification on the diagrams shall agree with the wire markers installed on the equipment.
 6. System Administrator Documentation: Supply three (3) hardcopies of administrator documentation and one (1) copy of the documentation in PDF format on CD-ROM that detail the operation of the system. This documentation shall provide complete information on the configuration, business rules, operation, maintenance, and trouble-shooting of the system.
- C. Submit a list of test equipment proposed for use in verifying installed performance of the system. Submit factory documentation showing test equipment has been calibrated within the last 12 months.
- D. Submit test report documentation.
1. Electronic and hardcopy versions of test reports shall be submitted together.
 2. Acceptance testing documentation showing the received signal strength index as well as signal-to-noise ratio at predefined locations.
- E. Warranty: Copy of the hardware and software warranty certifying that the final as-built installation is fully warranted by the manufacturer. See Section 1.11 for warranty requirements.
- F. Training materials: Submit training materials for review and approval at least two weeks before the start of scheduled training.

1.7 QUALITY ASSURANCE

- A. Refer to the requirements of Specification Section 27 05 00 in addition to the following:

- B. Contractor and Authority Vendor Qualifications: Submit written proof that the following experience requirements are being met.
 - 1. The Authority Vendor shall be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
 - 2. All members of the installation team shall be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Resumes of the entire team shall be provided along with documentation of completed training courses. Testing must be performed by an FCC licensed technician. Submit resume and copy of technician's license.
 - 3. A Technical resume of the Authority Vendor and Contractor's Project Manager and Field Supervisor documenting a minimum of five (5) years' experience installing similar size projects.
 - 4. Matching documentation for any Sub-Contractor who will assist the Contractor or Authority Vendor in performance of this work.
- C. Manufacturer: The manufacturing company specializing in producing products specified in this Section shall have a minimum of five years' experience in producing the products.

1.8 DELIVERY STORAGE AND HANDLING

- A. Refer to Specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

1.10 OPERATIONS AND MAINTENANCE

- A. Refer to Specification Section 27 05 00 for requirements.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 for requirements.

2.2 SYSTEM REQUIREMENTS

- A. The Contractor shall be responsible for coordination with Authority Preferred DAS Vendor to ensure the system meets all requirements listed below.

- B. The DAS shall deliver usable signal over the coverage areas defined in the Drawings.
- C. Coverage is defined as providing 99% coverage for talk-out and talk-in reliability for all elevator shafts, egress stairways, electrical/mechanical rooms, and baggage handling areas, fire department command center areas surrounding fire standpipes arrival and departure drop-off areas, as well as all apron and aircraft operations areas. All public access areas such as airline operations rooms, airline club lounges, restrooms, departure and arrival halls, baggage claim areas etc. shall be provided with coverage of 97% for both talk-out and talk-back reliability.
- D. Reliability for voice radio is defined as a usable signal level as defined below and Delivered Audio Quality (DAQ) of 3.4 at 97% or 99% of the samples taken within the above defined coverage areas.
- E. Usable signal is defined as receive signal strength 10dB greater than receive sensitivity of the mobile device or the minimum downlink receive signal levels (RSL) and reference signal receive power (RSRP) levels defined within this section, whichever is greater.
- F. WSP DAS:
 - 1. On a per channel basis, the WSP DAS downlink RSL and RSRP for each frequency band shall meet or exceed the criteria in Table 1.

Table 1. System Parameters

Parameters	Unit	700 MHz LTE	Cellular, PCS, AWS
Minimum downlink receive signal level (RSL), non-LTE	dBm	N/A	-85
Minimum Reference Signal Receive Power (RSRP), LTE only	dBm	-95	-105

- 2. S state the assumed channel loading and frequency bands for the proposed WSP in-building coverage. Prior to installation, contractors shall confirm the channel loading and frequency use in the serving area, and shall guarantee coverage for these channels per the criteria in Table 1.
- 3. Provide an In-band Isolation Analysis that describes the design methods used to avoid downlink and uplink interference.
- 4. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
- 5. WSP Approval: P provide the WSP with information each WSP requires to approve interconnection of the DAS to the WSP’s macro network.
- 6. All remote amplifiers shall be powered with a minimum of 30 minutes of backup power in the event of an outage.

7. All active components and UPS units shall be monitored by an SNMP based Network Management system.
8. The WSP DAS shall be designed with consideration of future growth and integrating emerging technologies (e.g. 5G).

2.3 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. DAS Equipment
 1. Commscope (Andrew)
 2. TE Connectivity
 3. Corning MobileAccess
 4. SOLiD Technologies
- C. Repeaters
 1. Commscope (Andrew)
 2. Corning MobileAccess
 3. Or approved substitution
- D. Antennas
 1. Andrew
 2. MaxRad
 3. Cellmax
 4. Mars
 5. Huber-Shuner
- E. Feeder and Distribution Coaxial Cable
 1. Andrew, or approved substitution

2.4 DAS EQUIPMENT

- A. Donor Antennas: Donor Antennas shall feature a multi-band design where possible, accommodating the applicable service frequencies in a single small antenna.
 1. Electrical:
 - a. Frequency bands: As proposed by the DAS designer to meet the performance specifications in this Section.
 - b. Gain: As proposed by the DAS designer to meet the performance specifications in this Section.
 - c. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
 - d. Polarization: As determined by WSP AHJ base stations
 - e. Front-to-back ratio: As proposed by the DAS designer to meet the performance specifications in this Section.
 - f. Impedance: 50 Ω
 - g. Azimuth Pattern: As proposed by the designer to meet the performance specifications in this Section.
 2. Mechanical:

- a. Radom material: UV-protected ABS
 - b. Pigtail cable: RG58, plenum rated
 - c. Connector: 50 Ω N Type Female
 - d. Mounting: Pole
 3. Environmental:
 - a. Temperature: -40 °C to +60 °C
 - b. Lighting protection: Direct ground
 - c. Waterproof level: IP 66
 - d. Wind Speed, maximum: 125 mph
 4. Approved Manufacturer: Andrew DB498-PS or approved substitution.
- B. Omni-Directional Coverage: Omni-Directional Coverage antennas shall feature a multiband design, accommodating multiple frequency bands in a single small antenna.
1. WSP Frequency Band:
 - a. Frequency Band: 698 – 894 MHz, 1710 – 1755 MHz, 1850 – 1990 MHz, 2110 – 2155 MHz
 - b. Gain: ≥ 1.5 dBi
 - c. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
 - d. Impedance: 50 Ω
 - e. Beamwidth, Horizontal: 360° omnidirectional
 2. Mechanical:
 - a. Connector: 50 Ω N Type Female
 - b. Mounting: Thru-hole ceiling mount
 - c. Radome material: ABS, UV resistant
 - d. Pigtail cable: KSR195, plenum rated
 3. Environmental:
 - a. Application: Indoor
 - b. Operating Temperature: 40 °C to +60 °C (40 °F to +140 °F)
 - c. Relative Humidity: Up to 100%
 4. Regulatory Compliance/Certifications: RoHS 2002/95/EC
 5. Approved Manufacturer: SOLiD/Commscope/or approved substitution.
- C. Directional Coverage Antennas: Directional coverage antennas shall feature a multi-band design, accommodating multiple frequency bands in a single small antenna. Specifications are identical to those for Omni-Directional indoor antennas with the exception of Gain and Beam-width.
- D. Fiber-Optic Cable and Connectors:
1. General Specifications:
 - a. Fiber optic cable shall be Single-mode, type OS2 and use standard colored tight-buffered construction.
 - b. Designed for point-to-point applications as well as mid-span access, and shall provide a high-level of protection for optical fiber installed in interior building environments.
 - c. Higher optical fiber count cables shall utilize a sub-unitized design with color-coded subunits for easy identification.

- d. The single-mode optical fiber shall be dispersion-unshifted optical fiber that meets ITU-T G.652c standards.
- e. Cable shall provide optimum performance over entire wavelength range from 1260 to 1625 nanometers.
- f. Cable shall support new and emerging applications that utilize extended E band, 1360 to 1460 nanometers.
- g. Cable shall also support existing and legacy single-mode applications that traditionally operate in 1310 and 1550 nanometer regions.
- h. Cable shall deliver a cost-effective upgrade path by expanding available wavelengths by 50 percent supporting 16 Channels of coarse wave division multiplexing (CWDM) on a single optical fiber and up to 400 Channels of dense wave division multiplexing (DWDM) on a single cable.
- i. Fire ratings: Plenum

E. Fiber-Optic Pigtails:

1. General Specifications:

- a. To maintain channel integrity, optical fiber patch cords and pigtails shall be fabricated to meet the performance parameters corresponding to the optical fiber cable approved product type specified below.
- b. Patch cord and pigtail plug connectors shall be equipped with boots, and shall have same colors as related optical fiber backbone cables, unless specified or indicated otherwise.
- c. Pigtails shall be fusion spliced to incoming backbone cables; mechanical splices shall not be acceptable. All connectors shall be factory-connectorized with pigtails; field-connectorized terminations shall not be acceptable.
- d. Optical fiber patch cords and pigtails shall be available with the following options as specified or indicated:
 - 1) Termination types: SC-APC
 - 2) Connector/cable configuration: Simplex
 - 3) Fire ratings: Riser, plenum and/or LSZH
 - 4) Pigtails: Ruggedized and tight-buffered optical fiber—0.9 millimeters (0.035 inches) outside diameter
 - 5) Lengths: As specified or indicated
 - 6) Approved Manufacturer: CommScope RFT-01RF09-8W-SCA-XX, single reinforced buffered 900 μ m, LightScope ZWP single-mode fiber, angled polished connector or equivalent.

F. Air Dielectric, Plenum Rated Coaxial Cable:

1. Material Characteristics:

- a. Jacket: Halogenated, Fire-Retardant
- b. Outer Conductor Material: Corrugated Aluminum or Corrugated Copper
- c. Inner Conductor Material: Copper-Clad Aluminum Wire

2. Electrical Characteristics:

- a. Impedance: $50 \pm 2.0 \Omega$
- b. Frequency Band: 1 - 8800 MHz
- c. Peak Power Rating: $\geq 40.0 \text{ kW}$

3. Mechanical Characteristics:

- a. Diameter Over Jacket: $\leq .627 \text{ in}$
- b. Minimum Bending Radius: $\leq 5 \text{ in}$
- c. One Time Minimum Bending Radius: $\leq 3 \text{ in}$

4. Attenuation Characteristics:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.848
450	≤ 1.53
800	≤ 2.105
2000	≤ 2.105

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

5. Approved Manufacturer: Andrew HL4RP-50A, AL4RPV-50A or equivalent.

G. Foam Dielectric Coaxial Cable:

1. Material Characteristics:

- a. Jacket: Non-halogenated, Fire-Retardant Polyolefin
- b. Outer Conductor Material: Corrugated Copper
- c. Inner Conductor Material: Copper-Clad Aluminum Wire or Copper Tube

2. Electrical Characteristics:

- a. Impedance: 50 ± 1.0 Ω
- b. Frequency Band: 1/2" Nominal: 1 - 8800 MHz, 7/8" Nominal: 1 - 5000 MHz
- c. Peak Power Rating: ≥ 40.0 kW

3. Mechanical Characteristics:

- a. Diameter Over Jacket: 1/2" Nominal: ≤ .630 in, 7/8" Nominal: ≤ 1.1 in
- b. Minimum Bending Radius: 1/2" Nominal: ≤ 5 in, 7/8" Nominal: ≤ 10 in
- c. One Time Minimum Bending Radius: 1/2" Nominal: ≤ 2 in, 7/8" Nominal: ≤ 5 in

4. Attenuation Characteristics: 1/2" Nominal

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.815
450	≤ 1.447
800	≤ 1.968
2000	≤ 3.251

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

5. Attenuation Characteristics: 7/8" Nominal:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.417
450	≤ .744
800	≤ 1.014
2000	≤ 1.683

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

6. Approved Manufacturer: SOLiD/Commscope/ or Equal.

H. Splitters, Combiners, Couplers, Coax Jumpers and Connectors:

1. Electrical:

- a. WSP Frequency Band: 698 – 894 MHz, 1710 – 1755 MHz, 1850 – 1990 MHz, 2110 – 2155 MHz

- b. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
 - c. Impedance: 50 Ω
 - 2. Environmental:
 - a. Operating Temperature Range: -33 °C to +50 °C
 - b. Relative Humidity up to 100%
 - 3. Mechanical Connector: 50 Ω N-Type
 - 4. Compliance:
 - a. FCC: Shall be FCC type certified.
 - 5. Approved Manufacturer: SOLiD/Commscope or approved substitution.
- I. WSP BDA: When the WSP dictates a BDA drive the DAS, the BDA shall be of modular design and use digital filtering to mitigate interference and accommodate multiple services for WSPs..
- 1. Characteristics:
 - a. Operating Temperature Range: -33 °C to +50 °C
 - b. Chassis: Shall be of modular design
 - c. Filtering: Digital
 - d. Separate Control: Each RF amplifier shall be capable of adjusting and controlling power levels for each WSP when multiple WSPs share a single amplifier.
 - e. Alarming: Shall support SNMP
 - f. Mounting Options: shall support rack, wall and pole mounting
 - g. Frequency Bands Supported: 698 – 894 MHz Cellular, 1710 - 1755 MHz AWS, 1850 – 1990 MHz PCS and 2110 – 2155 MHz AWS
 - 2. Compliance:
 - a. FCC: Shall be FCC type certified.
 - 3. Approved Manufacturer: SOLiD/Commscope or approved substitution.
- J. Fiber-Optic Master Unit: When building size dictates an Active fiber DAS, the Fiber-Optic Master Unit shall convert radio over coax to Radio-Over-Fiber (RoF) for distribution to Fiber-Optic Remote Units.
- 1. Characteristics:
 - a. Transmission Media: Single-mode fiber at 1310 nm
 - b. Operating Temperature Range: +5 °C to +40 °C
 - c. Impedance: 50 Ω
 - d. Chassis:
 - 1) Shall be of modular design capable of supporting \geq 32 Remote Units per 19," 4 RU chassis.
 - 2) Shall support redundant power supplies.
 - 3) Shall have the capability to remotely power the Remote Units via composite fiber-optic cable.
 - e. Automatic Gain Control (AGC): Shall provide AGC for optical loss compensation
 - f. Optical Budget: Shall support \leq 3 dB optical budget (~3 km or 2 miles)
 - g. Auxiliary Channel: Shall provide an input to support 400 to 2700 MHz for future expandability
 - h. Interlink: Shall support one fiber or two fibers bi-directional optical link for distances up to 20 km with a 10 dB optical budget

- i. Remote Supervision:
 - 1) Shall support the TCP/IP protocol, SNMPv2, FTP, HTTP, Telnet, and be fully compatible with general purpose SNMP managers.
 - 2) Remote access shall be available via Point-to-Point Protocol (PPP), over circuit-switched/packet data and wired/wireless modems.
 - 3) Each Active device shall be manageable via a Web GUI.
 - 4) Auto Mapping: Each board position shall be automatically mapped during system turn-up.
 2. Frequency Bands Supported:
 - a. WSP Units: 698 – 894 MHz Cellular, 1710 - 1755 MHz AWS, 1850 – 1990 MHz PCS and 2110 – 2155 MHz AWS
 3. Approved Manufacturer: SOLiD/Commscope/ or approved substitution.
- K. Fiber-Optic Remote Units: The Fiber-Optic Remote Unit converts the RoF signal back to radio over coax, as well as provides filtering so that multiple frequency bands can reside over the same passive cable and antenna infrastructure.
1. Characteristics:
 - a. Operating Temperature Range: +5 °C to +40 °C
 - b. Impedance: 50 Ω
 - c. Alarming: Shall support SNMP
 - d. MTBF (excluding external power supply): ≥ 160,000 hours
 - e. Physical: The Remote Unit shall consist of the following:
 - 1) Ingress Protection: IP31 or equivalent
 - 2) Frequency Bands supported:
 - a) WSP Units: 698 – 894 MHz Cellular, 1710 - 1755 MHz AWS, 1850 – 1990 MHz PCS and 2110 – 2155 MHz AWS
 - 1) Optical Port: 2xSC-APC connector (separated uplink/downlink)
 - 2) Antenna Port: Single 50 Ω N type female connector
 - 3) Auxiliary Ports: Two SMA female for future add-on modules
 2. Approved Manufacturer: SOLiD/Commscope or approved substitution.

2.5 RF CONNECTORS

- A. All connectors shall be low intermodulation (IM) connectors. Typically, this is a gold center conductor with silver-plating on the connector. Connectors using dissimilar metal contacts or ferrous materials (e.g., nickel plating) are not allowed. The connector shall use a silver plated body with gold plated inner conductor. Brass bodies and silver or brass inner conductors are also authorized. N-type connectors shall be used.

2.6 LIGHTNING ARRESTORS

- A. Lightning Arrestors shall provide surge path to ground with minimal degradation to RF performance over the full bandwidth of services identified within this section.

2.7 GENERATOR

- A. All DAS equipment shall be backed up on the facility's emergency generator.

2.8 LABELS

- A. In addition to all “Submittal” requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, the Contractor shall also conform to all requirements of this section
 - 1. All DAS components, areas, and cables shall be labeled; including but not limited to fiber cables, metallic cable, ground points, cross-connect fields, relay racks, patch panels, cabinets, and patch cords/jumpers shall be labeled following Authority’s-established labeling format. As-built to contain matching label information.
 - 2. Labeling guidelines are ANSI/TIA/EIA-606-A Administration Standards for Telecommunication Infrastructure of Commercial Buildings with Authority specific as-set nomenclature.
 - 3. All label material shall be suitable for intended usage and environment, meeting the legibility, defacement and general exposure requirements listed in UL 969 for indoor and outdoor use. Where insert labels are used the insert label shall be covered with clear cover and securely held in place.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 for requirements in addition to the following:
- B. In addition to the Cellular DAS specified herein, this project will also install a Public Safety Radio 800MHz DAS and a 460 MHz DAS within the same building spaces. The contractor shall coordinate with the Vendors providing these systems to ensure proper installation and performance of each DAS.
- C. Coordination items shall include, but not be limited to:
 - 1. Coordination of antenna placement within the building to minimize or eliminate radio frequency interference (RFI), intermodulation, and other undesirable effects or performance degradation within any DAS as a result of antenna placement. Performance of the system is the responsibility of the Authority Vendor.
 - 2. Coordination of Conduit Routing with Authority Vendors.
 - 3. Coordination of communications room space requirements, grounding requirements, electrical power requirements, and all other requirements with Authority Vendors.
- D. This coordination shall occur at all phases of the project to ensure proper functionality of all DAS systems as well as sufficient fiber optic cable, appropriate conduit placement, appropriate antenna placement, access hatch placement where necessary, and all other functional requirements of the various DAS systems are met as specified in the Contract Documents.
- E. In addition to coordination with additional DAS vendors the Contractor must perform a walkthrough with the Cellular DAS Vendor prior to any equipment installation. This walkthrough will be for the purposes of final conduit and device placement prior to any installation activities.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 for requirements.

3.4 EQUIPMENT INSTALLATION

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. The installation of all components is the responsibility of the Authority Vendor. Contractor will coordinate with the vendor to ensure the locations of the devices are compatible with other systems.
- C. Install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
- E. Adhere to the following during installation of the system:
 - 1. Underwriters Laboratories (UL) listing for restricted access installations in business and customer premises applications. This listing is required by the National Electric Code for customer premise installations.
 - 2. Fire resistance requirements specified by Underwriters Laboratories in UL 1459, 2nd edition.
 - 3. System installation and construction methods shall conform to the requirements of the Federal Communications Commission (FCC).
- F. Where undefined by codes and standards, apply a safety factor of at least two (2) times the rated load to all fastenings and supports of system components.
- G. Adhere to the installation schedule of the general contractor and should attend all construction meetings scheduled by the General Contractor.
- H. Install and configure all software required in this Specification in accordance with the software manufacturer's installation instructions. Apply the latest patches and security updates.
- I. Final configuration of the DAS and associated equipment shall be performed by the Authority Vendor. This includes, but is not limited to software installation and configuration, uplink and downlink gain configuration, splitter/combiner installation, and antenna placement. These final details must be coordinated with other DAS vendors to ensure the proper functionality of the Public Safety DAS, Cellular, and 460MHz DAS system(s) as well as the WiFi system. Coordination between various DAS Vendors shall be the responsibility of the Contractor.
- J. Place materials only in those locations that have been previously approved. Any other locations shall be approved, in writing, by the Authority and OAR.

- K. All wiring and cables shall be properly dressed and/or bundled with tie-wraps or cable ties with excess cut close to the barbs. Twisted wire, tape, rope, twine, phone wire and similar bits of debris usually available on site are not acceptable substitutes for proper securing hardware. All inter-rack cables and wiring must be properly routed, and where available, in cable trays. Overhead cables must be easily removed or re-worked within the cable trays. Proper care must be taken to ensure that new cables added to the trays are not stressed or intertwined with existing cables. Overhead cables may not cross perpendiculars or be suspended in mid-air without supports. No supports may be installed without prior approval from the Authority and OAR. All long cable runs must be properly identified at each end and every 100 feet indicating the carried frequency and communication room of origin. All cabling within the building must be cut to proper length.
- L. Obtain written permission from the Authority and OAR before proceeding with any work which requires cutting into or through any part of the building structures such as, but not limited to, girders, beams, concrete, carpeted or tiled floors, partitions or ceilings. Consult with the General Contractor before cutting into or through any part of the building structures where fireproofing or moisture proofing could be impaired.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements in addition to the following.
- B. Conduit shall be installed in all areas. Antenna locations noted on the drawings must be confirmed by the Contractor and conduit must be installed prior to any antenna being mounted. 2" Rigid Metal Conduit is required for Cellular DAS coaxial pathways. 2" Rigid Metal Conduit must stub with bushing 12-18" from the IDF cable tray. 2" Rigid Metal Conduit must stub with bushing at Cellular DAS locations 24-36" from the antenna or ceiling hatch.
- C. Ceiling hatches are required to access above the hard ceiling locations. If the antenna is to be mounted on the hatch, the hatch must be plastic.

3.6 ELECTRICAL POWER DISTRIBUTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 in addition to the following:
 - 1. Each lightning suppression device shall have its own home run ground cable. External ground busbar shall be connected to the building lightning protection system

3.8 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 for requirements

3.9 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE & SERVICE

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. Authority Vendor will be responsible for all maintenance and service of DAS equipment as detailed in this section.
- C. General
 - 1. Provide maintenance and support of all components associated with this system at no additional charge during the warranty period.
 - 2. Supply a list of special tools, test equipment, and outside inventory required for this Project. The Contractor may recommend specific items to facilitate long-term support of the system as an option.
 - 3. All lead technicians performing installation and maintenance shall have a minimum of two (2) years' experience on the proposed system and be manufacturer certified on all hardware/software applications. All maintenance technicians shall be provisioned to attend a one (1) week manufacturer training class each year. Pre-assigned backup technicians shall be available to backfill for onsite technicians who are on vacation, in training or who are out sick.
 - 4. Provide twenty-four (24) hours/seven (7) days a week telephone support as a minimum maintenance and support agreement. Respond to non-emergency service requests between 8am to 5pm, the next business day after a support call is placed.
- D. Network Hardware and Software Support
 - 1. Network Hardware and Software support shall be supplied by the Authority Vendor. Support shall cover all equipment and systems referenced in this Specification.
 - 2. All software shall be delivered with an installable backup.
- E. Requirements
 - 1. Preventive and Routine Maintenance: Preventive and routine maintenance services shall be provided in accordance with the provisions of the maintenance manual for each component during the warranty period. Preventative maintenance services shall include inspection, test, necessary adjustment, lubrication, parts cleaning, and upgrades. Routine maintenance services shall include scheduled overhauls as recommended by the equipment manufacturer.
 - 2. Emergency Failure: A system failure is considered an emergency if any of the key components are inoperative to the extent the system cannot function in a normal manner. Emergency services shall include inspections and necessary tests to determine the causes of equipment or software malfunction or failure during the warranty period. The emergency services shall include furnishing and installing components, parts, or software changes required to replace malfunctioning system elements. Provide telephone support twenty-four (24) hours a day, seven (7) days a week. Provide support on-site within eight (8) hours of request.

3.11 WARRANTY

- A. Authority Vendor will be responsible for all warranty requirements for the DAS system.

- B. In addition to all “Warranty” requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, the Contractor shall also conform to all requirements of this section.
- C. Provide a joint written warranty of the manufacturer(s) and the installer(s), on a single document. The document shall warrant complete installation of the radio equipment, cabling, antennas, connectors, and software to be free from defects in materials and workmanship for a period of no less than one (1) year, starting with the date of Final System Acceptance.
- D. Hardware Warranty:
 - 1. Warrant that all components meet or exceed the specifications provided in the product data submittal.
 - 2. Warrant that the proposed merchandise will conform to its description and any applicable specifications, and shall be of good quality for the known purpose for which it is intended.
 - 3. The product warranty shall cover material and labor for the replacement or repair of defective products.
- E. Software Warranty:
 - 1. The warranty shall allow for replacement or repair at the discretion of the Authority. All software necessary to compile, modify, and maintain software developed for this specification shall be included in this warranty.
 - 2. The warranties shall include the price of all software upgrades during the warranty period. If a new version of the system software becomes available during the warranty period, it shall be upgraded as part of the warranty.

3.12 FIELD SERVICES

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. Authority Vendor will be responsible for all field services for the DAS system components.
- C. In addition to all “Field Services” requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, conform to all requirements of this section.
 - 1. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been completed unless designated for storage.
- D. Acceptance will be withheld until the following have been completed successfully:
 - 1. Acceptance of all submittals
 - 2. Delivery of final documentation
 - 3. Successful testing
 - 4. Completion of training
 - 5. Demonstrate system to designated Authority personnel as required by applicable sections of these specifications. Use submitted operation and maintenance manual as reference during demonstration and training. Demonstrate as-built records are in format required and can lead troubleshooting technicians to port level of detail in field.

- E. Project Testing: The overall DAS project shall not be considered complete until On-Site Testing is completed on the entire DAS test results have been approved. The purpose is to test the complete system and demonstrate that all specified features and performance criteria are met. All requirements of the specification shall be tested, including:
1. Functionality, including signal coverage and audio quality test. Radio signal coverage, shall consist of testing a minimum of 100 points on each level of the Terminal. Audio quality test shall consist of making radio test call from each test point and recording both the received and transmitted audio quality on a scale of 1 to 5. A minimum audio quality of 3 at 95% of the test points is required.
 2. System capacity
 3. Hardware and software interaction
 4. Failure Recovery
 5. Report generation
- F. Test Plan/Procedure: Provide a copy of the proposed test plan/procedures for each testing phase for review by the Authority and OAR. The test plan for each phase of testing shall detail the objectives of all tests. The tests shall clearly demonstrate that the system and its components fully comply with the requirements specified herein. The submission of Test Plans shall adhere to the following:
1. A draft test plan shall be presented to the Authority and OAR at least forty-five (45) days prior to the scheduled start of each test.
 2. A workshop for reviewing comments shall be conducted with the Authority and OAR at least thirty (30) days prior to the scheduled start of each test.
 3. A final test plan shall be submitted to the Authority and OAR at least fourteen (14) days prior to the scheduled start of each test.
- G. Test plans shall contain at a minimum:
1. Functional procedures including use of any test or sample data.
 2. Test equipment is to be identified by manufacturer and model including spectrum analyzers and power meters.
 3. Interconnection of test equipment and steps of operation shall be defined.
 4. Expected results required to comply with specifications.
 5. Testing matrix referencing Specification requirements with specific test procedures.
 6. Record of test results with witness initials or signature and date performed.
 7. Pass or fail evaluation with comments.
- H. The test procedures shall provide conformity to all Specification requirements. Satisfactory completion of the test procedure is necessary as a condition of system acceptance.
- I. All Test plans must be reviewed by the Authority and OAR. To successfully complete a test, the test document must be signed and dated by the Contractor AHJ and Authority.
- J. The AHJ, Authority and OAR will review, witness and validate the execution of all formal test procedures prepared by the Authority Vendor and Contractor and deliverable under the contract to assure the tests cover all requirements and that there is a conformity between the conducted test, the test results and Specification requirements.

- K. Documentation verification both interconnects and operationally, shall be part of the test. Where documentation is not in accordance with the installed system interconnect and operating procedures, the system shall not be considered accepted until the system and documentation correlate.
- L. Provide the AHJ, Authority and OAR the opportunity(s) to participate in any or all of tests.
- M. Test Reports: Prepare, for each test, a test report document that shall certify successful completion of that test. Test reports shall be submitted to the Authority's representative for review and acceptance within seven (7) days following each test. The test report shall contain, at a minimum:
 - 1. Commentary on test results.
 - 2. A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution.
 - 3. Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other annotations entered during execution of the test.
 - 4. Signatures of persons who performed and witnessed the test.
- N. Test Resolution: Any discrepancies or problems discovered during these tests shall be corrected by the Contractor at no cost to the Authority. The problems identified shall be corrected and the percentage of the entire system re-tested as determined by the Authority and OAR before any subsequent testing is performed.

3.13 TRAINING

- A. Refer to Specification Section 27 05 00 for requirements in addition to the following
- B. Contractor shall coordinate with Authority Vendor to obtain training materials for the DAS system.
- C. In addition to all "Training" requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, conform to all requirements of this section.
 - 1. Provide the Authority specified trainees with detailed as-built information. The training shall provide trainees with a working knowledge of the system design and layout, ability to configure and monitor the system, and troubleshooting methods and techniques. In addition, the training shall cover testing, maintenance, and repair procedures for all equipment and applications, which are provided under this Specification.
 - 2. Course materials shall be delivered to the Authority. Final delivery of the course materials shall include a master hard copy of all materials and an electronic copy in a format reviewed in advance by the Authority. Supply a videotape of each training course.
 - 3. All training shall be completed a minimum of two weeks prior to the system becoming operational and utilized by the Authority. Training schedule subject to the Authority's review.

3.14 PROJECT CLOSEOUT REQUIREMENTS

A. Refer to Specification Section 27 05 00 for requirements.
END OF SECTION 27 53 10

SECTION 27 53 20 - DISTRIBUTED ANTENNA SYSTEM PUBLIC SAFETY 800 MHZ AND FACILITIES RADIO 460 MHZ

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 27 Specification Sections.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This Section describes the technical and performance criteria for deploying an independent Distributed Antenna System (DAS) for Public Safety Networks , and/or Facilities Radio System. In addition this DAS system will also pass VHF frequencies to support Customs and Border Patron (CBP). For the purposes of this document the PSN DAS is defined as the DAS carrying Public Safety, Facilities Radio, and CBP Radio frequencies. This system will make use of a collection of omni directional and directional antennas to provide coverage throughout the STC airside concourse expansion and in all applicable private and public areas and service passages for public safety radio bands. The system will make use of RF over fiber which digitizes the RF signal and passes it over the fiber optic backbone cabling. This configuration will allow for the signal to be passed further without amplification and will reduce the interference suffered in the application radio bands.
 - 1. The intent of this document is to establish the design criteria which shall be adhered to by Authority's preferred Distributed Antenna System designer and all contractor's responsible for the delivery and proper installation of the DAS.
 - a. The Authority's DAS vendor, Mann Wireless, shall be responsible for the application, design and configuration of the system and shall be based on an extension of the Motorola DAS system installed as part of the STC Phase 1 project procured under a separate contract.
The Contractor shall be responsible for coordination with the Authority's DAS vendor for final placement of all elements as well as coordination with any other wireless systems.
- C. This Section includes the following:
 - 1. The DAS components specified in this document shall include but not limited to:
 - a. Donor Antennas
 - b. Coaxial Cabling, Connectors, Attenuators and Loads.
 - c. RF Circulators, Splitters, Combiners, Couplers, RF Switches, Filters and Diplexers,
 - d. Fiber-Optic Cable, Fiber-Optic Connectors, Fiber-Optic Jumpers,
 - e. Bi-Directional Amplifiers (BDA),
 - f. Fiber-Optic Cable, Fiber-Optic Connectors, Fiber-Optic Jumpers,
 - g. Fiber-Optic Master Unit and Fiber-Optic Remote Units.

D. Definitions

1. Acceptance: Expressed approval by the customer
2. Active: DAS components that require AC/DC power for operation
3. Channel: A path for an RF transmission between two points
4. Component: A main system element of the DAS
5. Contractor: The prime contractor bidding the project
6. Passive: DAS components that do not require AC/DC power for operation

E. Related Specification Sections:

1. Refer to Specification Section 27 05 00 for a complete list of related specification sections.

1.3 SCOPE OF WORK

A. Comply with the requirements of Specification Section 27 05 00 in addition to the following.

B. The following Standards contain provisions, which, through reference in this text, constitute provisions of this Standard. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards referenced below. Included with all references to Regulatory Documents within this document, the most recent editions are required to be adhered to for all Scopes of Work.

1. NFPA 1221 - Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
2. RUS Standards (formerly REA)
3. Local State Uniform Fire Prevention and Building Code.
4. Local State Department of Labor Rules and Regulations
5. Association of Public Safety Communications Officers (APCO) "Avoiding Interference Between Public Safety Wireless Communications Systems and Commercial Wireless Communications Systems at 800 MHz"
6. Code of Federal Regulations (CFR) [Telecommunications] Title 47 Part 90
7. Code of Federal Regulations (CFR) [Telecommunications] Title 47 Part 15
8. Wireless Communications Principles and Practice, current edition
9. Motorola R-56

C. Refer to drawing sheet T0.00.03 for the work responsibility matrix for the scope of work and responsibilities required for the Distributed Antenna System.

D. Where listed on the drawing responsibility matrix, the following components shall be defined as follows.

1. Headend and Software: Authority Vendor shall furnish, install, and program all required headend equipment and software including, but not limited to any servers, management/administrative software, software licenses, and components which serve the purpose of performing system-wide coordination, monitoring, data processing, control and other global functions. This includes but is not limited to: base station interface, head end units, remote units, donor antennas, and radio consoles.

2. Integration to Existing System: Authority Vendor shall provide all hardware, software, wiring, cabling, programming, protocol converters, interface devices and appurtenances as required to extend the physical or logical scope of an existing system, or to incorporate a new or disparate system into an existing system. This includes but is not limited to interfaces to base stations or extensions of existing connectivity to extend DAS coverage.
3. Interfaces: Authority Vendor shall provide all system interfaces including, but not limited to all hardware, software, wiring, cabling, programming, interface devices and appurtenances as required for communication between systems, or between a given system and an operator, to provide the specified functionality. This includes but is not limited to: FAS, UPS/BMS and power monitoring if not done through the FAS.
4. Network Switch: Refer to specification section 27 05 00 for requirements. Coordinate network programming requirements with GOAA IT when required. Contractor shall coordinate patching into the network with GOAA.
5. Backbone Cable: Refer to specification section 27 10 00 for requirements Contractor shall furnish and install all fiber optic backbone cabling in support of the Public Safety DAS. The DAS requires dedicated fiber optic cabling between headend units and remote end units. The contractor shall provide all channeling per section 27 10 00 including all required fusion splicing and cross connect patch cables. Coordinate with the Authority Vendor for termination locations and fusion splicing within IDF. Contractor shall include fusion splicing for every strand terminating from each dedicated fiber cable in each MDF/IDF.
6. Horizontal Cable: Authority Vendor shall furnish and install all horizontal cabling, termination equipment, communication room fittings, grounding, and labeling included in this specification section. Contractor shall furnish and install all conduit, boxes, fittings, pathways and raceways. Horizontal cabling shall be furnished and installed by the GOAA Vendor. Horizontal cable includes the segment of the premises distribution system that provides connectivity from communications rooms to field devices.
7. Field Devices: Authority Vendor shall furnish and install data outlets, testing, labeling, and all other work included in this specification section. This includes but is not limited to: omni or directional antenna, coaxial splitters, combiners, couplers, and filters as required. Contractor shall ensure the final location of all field devices is coordinated will all other wireless disciplines and proper coverage studies are conducted by the Authority Vendor for final mounting locations. Contractor is responsible for all conduit as required for the connection of all field devices.

1.4 REFERENCES

- A. Refer to Specification Section 27 05 00 for requirements.

1.5 SYSTEM DESCRIPTION

- A. The Distributed Antenna System specified herein provides coverage throughout the building expansion areas and other public areas for public safety frequencies via a system of spatially separated antenna nodes. The system will consist of a Head End Unit (HEU) which connects to Remote End Units (REUs) via fiber optic cabling. The REUs will feed antenna placed throughout the terminal and related public areas providing public safety coverage while mitigating interference.

1.6 SUBMITTALS

- A. Contractor shall coordinate with Authority Vendor to obtain all submittal documents listed in this section prior to final submittal.
- B. In addition, to all “Submittal” requirements specified in Division 01, Specification Section 27 05 00 and all requirements by related Specification Sections, the Contractor shall also conform to all requirements of this Section.
1. Submittals shall include, but not be limited to:
- a. Product Data: Submit manufacturer datasheets for the following components:
 - 1) Donor and Coverage Antennas
 - 2) Coaxial Cable and Connectors
 - 3) Coaxial Attenuators and Loads
 - 4) RF Circulators
 - 5) Splitters, Combiners and Couplers
 - 6) RF Switches
 - 7) RF Filters and Diplexers
 - 8) Bi-Directional Amplifiers (BDA)
 - 9) Master Unit
 - 10) Remote Units
 - b. Shop Drawings: Submit the following items:
 - 1) Overlay of system Components on floor plans
 - 2) RF Propagation Analysis and Link Budget
 - 3) Drawings for Donor Antenna and grounding
 - 4) Drawings for Rack Elevations
 - 5) Bill-of-Material (BOM)
 - c. (SOW): Submit sample SOW
 - d. Acceptance Test Plan (ATP): Submit sample ATP
 - e. Recommended Spares
 - f. Warranty Documents:
 - 1) Submit for all manufactured Components specified in this Section.
 - 2) Submit Contractor’s System Warranty.
 - 3) Submit Manufacturer’s Extended Warranty.
 - g. Submittal Requirements Prior to Start of Construction
 - 1) Final RF link budget
 - 2) Overlay of system Components on floor plans
 - 3) Drawings for Donor Antenna and grounding
 - 4) Drawings for Rack Elevations
 - 5) RF propagation modeling
 - 6) Signal to Noise Interference Ratio (SNIR) Map
 - 7) In-band Interference Analysis

- 8) Bill-of-Material (BOM)
 - 9) Maintenance Service Contract
 - 10) Statement of Work (SOW): Submit a SOW that has been accepted by the customer or customer's designated representative.
 - 11) Acceptance Test Plan (ATP): Submit an ATP that has been accepted by the customer or customer's designated representative.
- h. Submittal Requirements at Close Out
- 1) Drawings: Submit as-built drawings indicating:
 - 2) Donor antenna, grounding and lightning protection details
 - 3) Cable routing, splitters, couplers and coverage antenna locations
 - 4) Active component locations, layout and configuration
- i. Test Reports
- 1) PSN: Submit Accepted ATP reports confirming the requirements have been met.
 - 2) Field Reports: Submit testing results for all cable runs.
 - 3) Field Reports: Submit OTDR test results for all fiber runs.
 - 4) Operation and Maintenance Data: Submit hardware and software manuals for all Active Components.
 - 5) Warranty Documents:
 - a) Submit for all manufactured components specified in this Section.
 - b) Submit Vendor's System Warranty.
 - c) Submit Manufacturer's Extended Warranty
- j. Product Datasheets: Submit catalog cut-sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten and/or highlighted to indicate exact selection. Identify applicable specification section reference for each product. Product data sheets shall be bound in a three ring binder and shall include a product index listing the model number and description of product.
- k. Antenna location shop drawings: Antenna locations indicated on the drawings are approximate and final determination shall be made by the Authority Vendor based on calculations using the performance characteristics of the proposed system. In addition coordination must be done with all providers of the Cellular DAS to ensure antenna locations do not create interference with other systems operating in the same frequency range. All coordination must be done before shop drawings are submitted. Coordination includes identifying required conduit for all field devices and horizontal and vertical cabling. Contractor shall be responsible for coordination between DAS Vendors. Contractor shall submit revised antenna location shop drawings.

5. As Built Documentation: The as built documents shall be produced with current version of AutoCAD and the electronic files shall be provided to the Authority at the completion of the Project on CD-ROM. Provide component identification and cross reference on the Drawings to allow the Authority and (OAR) to understand the function of each item (the block diagram), find the room where the device is mounted (Contract Document plans), find its location in a rack (Arrangement Drawings), find how it is wired (wiring diagrams), and its detailed Specifications (vendor data sheets), and how to repair it (spare part lists). Include the following drawings as a minimum:
 - a. System Block Diagram: This drawing shall depict the final DAS overview, including equipment types, location, and any special information. Final gain settings on all amplifiers in the system shall be recorded.
 - b. System Riser Diagram(s): These drawings shall show all DAS components, wire numbers, color codes, pin numbers, component locations and connections, depicting the "as-built", final configuration.
 - c. Rack / Wall Elevation and Wiring Diagram(s): The elevation diagrams shall depict the front views of the equipment racks and wall fields identifying all equipment installed within. Complete wiring diagrams of the rack / wall equipment shall also be included.
 - d. Floor plans of the communications room showing the location of all equipment affected as a part of this contract within the telecommunications room and throughout the building.
 - e. Wiring Diagrams: Provide wiring diagrams showing all field installed interconnecting wiring. Wire identification on the diagrams shall agree with the wire markers installed on the equipment.
6. System Administrator Documentation: Supply three (3) hardcopies of administrator documentation and one (1) copy of the documentation in PDF format on CD-ROM that detail the operation of the system. This documentation shall provide complete information on the configuration, business rules, operation, maintenance, and trouble-shooting of the system.
- E. Submit a list of test equipment proposed for use in verifying installed performance of the system. Submit factory documentation showing test equipment has been calibrated within the last 12 months.
- F. Submit test report documentation.
 1. Electronic and hardcopy versions of test reports shall be submitted together.
 2. Acceptance testing documentation showing the received signal strength index as well as signal-to-noise ratio at predefined locations.
- G. Warranty: Copy of the hardware and software warranty certifying that the final as-built installation is fully warranted by the manufacturer. See Section 1.11 for warranty requirements.
- H. Training materials: Submit training materials for review and approval at least two weeks before the start of scheduled training.

1.7 QUALITY ASSURANCE

- A. Refer to the requirements of Specification Section 27 05 00 in addition to the following.

- B. Contractor and Authority Vendor Qualifications: Submit written proof that the following experience requirements are being met.
 - 1. The Authority Vendor shall be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.
 - 2. All members of the installation team shall be certified by the manufacturer as having completed the necessary training to complete their part of the installation. Resumes of the entire team shall be provided along with documentation of completed training courses. Testing must be performed by an FCC licensed technician. Submit resume and copy of technician's license.
 - 3. A Technical resume of the Authority Vendor and Contractor's Project Manager and Field Supervisor documenting a minimum of five (5) years' experience installing similar size projects.
 - 4. Matching documentation for any Sub-Contractor who will assist the Contractor or Authority Vendor in performance of this work.
- C. Manufacturer: The manufacturing company specializing in producing products specified in this Section shall have a minimum of five years' experience in producing the products.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Refer to specification Section 27 05 00 for requirements.

1.9 RECORD DOCUMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

1.10 OPERATIONS AND MAINTENANCE

- A. Refer to specification Section 27 05 00 for requirements.

1.11 SOFTWARE AGREEMENT

- A. Refer to Specification Section 27 05 00 for requirements.

1.12 SPARE MATERIAL

- A. Refer to Specification Section 27 05 00 for requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Refer to Specification Section 27 05 00 for requirements.

2.2 SYSTEM REQUIREMENTS

- A. The Contractor shall be responsible for coordination with Authority DAS Vendor to ensure the system meets all requirements listed below.

- B. Refer to Specification Section 27 05 00 for additional information. The PSN DAS shall be an independent system and physically isolated from any other wireless systems and wireless service provider DAS.
- C. The DAS shall deliver usable signal over the coverage areas defined in the Drawings.
- D. Coverage is defined as providing 99% coverage for talk-out and talk-in reliability for all elevator shafts, egress stairways, electrical/mechanical rooms, and baggage handling areas, fire department command center areas surrounding fire standpipes arrival and departure drop-off areas, as well as all apron and aircraft operations areas. All public access areas such as airline operations rooms, airline club lounges, restrooms, departure and arrival halls, baggage claim areas etc. shall be provided with coverage of 97% for both talk-out and talk-back reliability.
- E. Reliability for voice radio is defined as a usable signal level as defined below and Delivered Audio Quality (DAQ) of 3.4 at 97% or 99% of the samples taken within the above defined coverage areas.
- F. Usable signal is defined as receive signal strength 10dB greater than receive sensitivity of the mobile device or the minimum downlink receive signal levels (RSL) and reference signal receive power (RSRP) levels defined within this section, whichever is greater.
- G. PSN DAS:
 - 1. Unless defined otherwise, the minimum downlink receives signal level for PSN and AO DAS shall be -95 dBm over the coverage area defined within.
 - 2. The PSN DAS shall comply with NFPA 72 2013, or current edition and other local code requirements that apply to the coverage area.
 - 3. The table below lists the PS and AO radio system stakeholders, frequency bands used and mode of operation.
 - 4. Contractors shall state the assumed channel count for the PSN Frequency Bands identified above with submittal of bid response. Prior to installation, contractors shall confirm the channel count and frequencies with the AHJ, and shall guarantee coverage for these channels per the criteria stated above.
 - 5. Provide an In-band Isolation Analysis that describes the design methods used to avoid downlink and uplink interference.
 - 6. The DAS shall be capable of upgrade, without additional hardware or software, to allow for changes to system frequencies within the deployed frequency band in order to maintain radio system coverage as originally designed.
 - 7. PSN Approval: When approval of the DAS deployment is required by code or ordinance, be responsible for facilitating the AHJ approval(s) per the requirements of the code or ordinance.
 - 8. All active components shall be powered with a minimum of 2 hours of backup power in the event of an outage.
 - 9. All active components and UPS units shall be monitored by an SNMP based Network Management system.
 - 10. All active components and battery system components shall be contained in a NEMA 4 or 4X-type enclosures.

11. All coaxial and fiber optic cable shall be plenum rated with pathway survivability Level 1, 2 or 3 as defined in NFPA 72.

2.3 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. DAS Equipment
 1. Commscope (Andrew)
 2. TE Connectivity
 3. Corning MobileAccess
 4. SOLiD Technologies
- C. Repeaters
 1. Commscope (Andrew)
 2. Corning MobileAccess
 3. Or approved substitution
- D. Antennas
 1. Andrew
 2. MaxRad
 3. Cellmax
 4. Mars
 5. Huber-Shuner
- E. Feeder and Distribution Coaxial Cable
 1. Andrew, or approved substitution

2.4 DAS EQUIPMENT

- A. Donor Antennas: Donor Antennas shall feature a multi-band design where possible, accommodating the applicable service frequencies in a single small antenna.
 1. Electrical:
 - a. Frequency bands: As proposed by the DAS designer to meet the performance specifications in this Section.
 - b. Gain: As proposed by the DAS designer to meet the performance specifications in this Section.
 - c. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
 - d. Polarization: As determined by PSN AHJ basestations
 - e. Front-to-back ratio: As proposed by the DAS designer to meet the performance specifications in this Section.
 - f. Impedance: 50 Ω
 - g. Azimuth Pattern: As proposed by the designer to meet the performance specifications in this Section.
 2. Mechanical:
 - a. Radom material: UV-protected ABS

- b. Pigtail cable: RG58, plenum rated
 - c. Connector: 50 Ω N Type Female
 - d. Mounting: Pole
 3. Environmental:
 - a. Temperature: -40 °C to +60 °C
 - b. Lighting protection: Direct ground
 - c. Waterproof level: IP 66
 - d. Wind Speed, maximum: 125 mph
 4. Approved Manufacturer: Andrew DB498-PS or equivalent.
- B. Omni-Directional Coverage Antennas: Omni-Directional Coverage antennas shall feature a multiband design, accommodating multiple frequency bands in a single small antenna.
 1. PSN Frequency Band:
 - a. Frequency Bands: 400-460 MHz, 760 – 860 MHz
 - b. Gain: \geq 1.5 dBi
 - c. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
 - d. Impedance: 50 Ω
 - e. Beamwidth, Horizontal: 360° omnidirectional
 2. Facilities Radio/CBP Frequency Bands:
 - a. Frequency Band: 400-470 MHz and 160-174 MHz (VHF)
 - b. Gain: \geq 1.5 dBi
 - c. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
 - d. Impedance: 50 Ω
 - e. Beamwidth, Horizontal: 360° omnidirectional
 3. Mechanical:
 - a. Connector: 50 Ω N Type Female
 - b. Mounting: Thru-hole ceiling mount
 - c. Radome material: ABS, UV resistant
 - d. Pigtail cable: KSR195, plenum rated
 4. Environmental:
 - a. Application: Indoor
 - b. Operating Temperature: 40 °C to +60 °C (40 °F to +140 °F)
 - c. Relative Humidity: Up to 100%
 5. Regulatory Compliance/Certifications: RoHS 2002/95/EC
 6. Approved Manufacturer: SOLiD/Commscope/or approved substitution.
- C. Directional Coverage Antennas: Directional coverage antennas shall feature a multi-band design, accommodating multiple frequency bands in a single small antenna. Specifications are identical to those for Omni-Directional indoor antennas with the exception of Gain and Beam-width.
- D. Fiber-Optic Cable and Connectors:
 1. General Specifications:

- a. Fiber optic cable shall be Single-mode, type OS2 and use standard colored tight-buffered construction
- b. Designed for point-to-point applications as well as mid-span access, and shall provide a high-level of protection for optical fiber installed in interior building environments.
- c. Higher optical fiber count cables shall utilize a sub-unitized design with color coded subunits for easy identification.
- d. The single-mode optical fiber shall be dispersion-unshifted optical fiber that meets ITU-T G.652c standards.
- e. Cable shall provide optimum performance over entire wavelength range from 1260 to 1625 nanometers.
- f. Cable shall support new and emerging applications that utilize extended E band, 1360 to 1460 nanometers.
- g. Cable shall also support existing and legacy single-mode applications that traditionally operate in 1310 and 1550 nanometer regions.
- h. Cable shall deliver a cost-effective upgrade path by expanding available wavelengths by 50 percent supporting 16 Channels of coarse wave division multiplexing (CWDM) on a single optical fiber and up to 400 Channels of dense wave division multiplexing (DWDM) on a single cable.
- i. Fire ratings: Listed as 2-hour fire resistive, meeting pathway survivability level 3.

E. Fiber-Optic Pigtails:

1. General Specifications:

- a. To maintain channel integrity, optical fiber patch cords and pigtails shall be fabricated to meet the performance parameters corresponding to the optical fiber cable approved product type specified below.
- b. Patch cord and pigtail plug connectors shall be equipped with boots, and shall have same colors as related optical fiber backbone cables, unless specified or indicated otherwise.
- c. Pigtails shall be fusion spliced to incoming backbone cables; mechanical splices shall not be acceptable. All connectors shall be factory-connectorized with pigtails; field-connectorized terminations shall not be acceptable.
- d. Optical fiber patch cords and pigtails shall be available with the following options as specified or indicated:
 - 1) Termination types: SC-APC
 - 2) Connector/cable configuration: Simplex
 - 3) Fire ratings: Listed as 2-hour fire resistive, meeting pathway survivability level 3.
 - 4) Pigtails: Ruggedized and tight-buffered optical fiber—0.9 millimeters (0.035 inches) outside diameter
 - 5) Lengths: As specified or indicated

F. Air Dielectric, Plenum Rated Coaxial Cable:

1. Material Characteristics:

- a. Jacket: Halogenated, Fire-Retardant
- b. Outer Conductor Material: Corrugated Aluminum or Corrugated Copper
- c. Inner Conductor Material: Copper-Clad Aluminum Wire

2. Electrical Characteristics:

- a. Impedance: $50 \pm 2.0 \Omega$
- b. Frequency Band: 1 - 8800 MHz
- c. Peak Power Rating: $\geq 40.0 \text{ kW}$
- 3. Mechanical Characteristics:
 - a. Diameter Over Jacket: $\leq .627 \text{ in}$
 - b. Minimum Bending Radius: $\leq 5 \text{ in}$
 - c. One Time Minimum Bending Radius: $\leq 3 \text{ in}$
- 4. Attenuation Characteristics:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.848
450	≤ 1.53
800	≤ 2.105
2000	≤ 2.105

Standard Conditions: VSWR 1.0, ambient temperature $20 \text{ }^\circ\text{C}$ ($68 \text{ }^\circ\text{F}$)

- 5. Approved Manufacturer: Andrew HL4RP-50A, AL4RPV-50A or equivalent.

G. Foam Dielectric Coaxial Cable:

- 1. Material Characteristics:
 - a. Jacket: Non-halogenated, Fire-Retardant Polyolefin
 - b. Outer Conductor Material: Corrugated Copper
 - c. Inner Conductor Material: Copper-Clad Aluminum Wire or Copper Tube
- 2. Electrical Characteristics:
 - a. Impedance: $50 \pm 1.0 \Omega$
 - b. Frequency Band: 1/2" Nominal: 1 - 8800 MHz, 7/8" Nominal: 1 - 5000 MHz
 - c. Peak Power Rating: $\geq 40.0 \text{ kW}$
- 3. Mechanical Characteristics:
 - a. Diameter Over Jacket: 1/2" Nominal: $\leq .630 \text{ in}$, 7/8" Nominal: $\leq 1.1 \text{ in}$
 - b. Minimum Bending Radius: 1/2" Nominal: $\leq 5 \text{ in}$, 7/8" Nominal: $\leq 10 \text{ in}$
 - c. One Time Minimum Bending Radius: 1/2" Nominal: $\leq 2 \text{ in}$, 7/8" Nominal: $\leq 5 \text{ in}$
- 4. Attenuation Characteristics: 1/2" Nominal

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.815
450	≤ 1.447
800	≤ 1.968
2000	≤ 3.251

Standard Conditions: VSWR 1.0, ambient temperature $20 \text{ }^\circ\text{C}$ ($68 \text{ }^\circ\text{F}$)

- 5. Attenuation Characteristics: 7/8" Nominal:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.417
450	$\leq .744$
800	≤ 1.014
2000	≤ 1.683

Standard Conditions: VSWR 1.0, ambient temperature $20 \text{ }^\circ\text{C}$ ($68 \text{ }^\circ\text{F}$)

6. Approved Manufacturer: SOLiD/Commscope/ or approved substitution.
- H. Splitters, Combiners, Couplers, Coax Jumpers and Connectors:
 1. Electrical:
 - a. PSN Frequency Band: 400-460 MHz, 760 – 860 MHz
 - b. Facilities Radio Frequency Band: 400-470 MHz
 - c. CBP Radio Frequency Band: 160-174 MHz (VHF)
 - d. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
 - e. Impedance: 50 Ω
 2. Environmental:
 - a. Operating Temperature Range: -33 °C to +50 °C
 - b. Relative Humidity up to 100%
 3. Mechanical Connector: 50 Ω N-Type
 4. Compliance:
 - a. FCC: Shall be FCC type certified.
 5. Approved Manufacturer: SOLiD/Commscope or approved substitution.
- I. PSN BDA: When the AHJ dictates a BDA drive the DAS, the BDA shall be of modular design and use digital filtering to mitigate interference and accommodate multiple services for PSNs.
 1. Characteristics:
 - a. Operating Temperature Range: -33 °C to +50 °C
 - b. Chassis: Shall be of modular design
 - c. Filtering: Digital
 - d. Separate Control: Each RF amplifier shall be capable of adjusting and controlling power levels.
 - e. FCC Part 90.219 Type Classification: Class A narrowband for LMR/SMR/ESMR frequency bands
 - f. Power Supply: PSN units shall have two independent power supplies, one primary and one secondary
 - g. Alarming: Shall support SNMP
 - h. Mounting Options: shall support rack, wall and pole mounting
 - i. Frequency Bands Supported: 380 - 512 MHz LMR, 769 - 806 MHz LMR, 806 - 869 MHz LMR/SMR/ESMR, 896 - 941MHz LMR/SMR/ESMR, 160-174 MHz VHF.
 2. Compliance:
 - a. NFPA: The BDA shall comply with NFPA-1 2009 edition Annex O In-Building Public Safety Radio Enhancement Systems.
 - b. FCC: Shall be FCC type certified.
 3. Approved Manufacturer: SOLiD/Commscope or approved substitution.
- J. Fiber-Optic Master Unit: When building size dictates an Active fiber DAS, the Fiber-Optic Master Unit shall convert radio over coax to Radio-Over-Fiber (RoF) for distribution to Fiber-Optic Remote Units.
 1. Characteristics:
 - a. Transmission Media: Single-mode fiber at 1310 nm
 - b. Operating Temperature Range: +5 °C to +40 °C

- c. Impedance: 50 Ω
 - d. Chassis:
 - 1) Shall be of modular design capable of supporting ≥ 32 Remote Units per 19," 4 RU chassis.
 - 2) Shall support redundant power supplies.
 - 3) Shall have the capability to remotely power the Remote Units via composite fiber-optic cable.
 - e. Automatic Gain Control (AGC): Shall provide AGC for optical loss compensation
 - f. Optical Budget: Shall support ≤ 3 dB optical budget (~3 km or 2 miles)
 - g. Auxiliary Channel: Shall provide an input to support 400 to 2700 MHz for future expandability
 - h. Interlink: Shall support one fiber or two fibers bi-directional optical link for distances up to 20 km with a 10 dB optical budget
 - i. Remote Supervision:
 - 1) Shall support the TCP/IP protocol, SNMPv2, FTP, HTTP, Telnet, and be fully compatible with general purpose SNMP managers.
 - 2) Remote access shall be available via Point-to-Point Protocol (PPP), over circuit-switched/packet data and wired/wireless modems.
 - 3) Each Active device shall be manageable via a Web GUI.
 - 4) Auto Mapping: Each board position shall be automatically mapped during system turn-up.
 - j. Power Supply: PSN units shall have two independent power supplies, one primary and one secondary.
2. Frequency Bands Supported:
- a. PSN Units: 380 - 512 MHz LMR, 769 - 806 MHz LMR, 806 - 869 MHz LMR/SMR/ESMR, 896 - 941MHz LMR/SMR/ESMR
 - b. Facilities Radio Units: 380 - 512 MHz LMR
 - c. CBP Radio Units: 160 – 174 MHz
3. Approved Manufacturer: SOLiD/Commscope/ or approved substitution
- K. Fiber-Optic Remote Units: The Fiber-Optic Remote Unit converts the RoF signal back to radio over coax, as well as provides filtering so that multiple frequency bands can reside over the same passive cable and antenna infrastructure.
1. Characteristics:
- a. Operating Temperature Range: +5 $^{\circ}\text{C}$ to +40 $^{\circ}\text{C}$
 - b. Impedance: 50 Ω
 - c. Power Supply: PSN units shall have two independent power supplies, one primary and one secondary
 - d. Alarming: Shall support SNMP
 - e. MTBF (excluding external power supply): $\geq 160,000$ hours
 - f. Physical: The Remote Unit shall consist of the following:
 - 1) Ingress Protection: IP31 or equivalent
 - 2) Frequency Bands supported:
 - a) PSN Units: 380 - 512 MHz LMR, 769 - 806 MHz LMR, 806 - 869 MHz LMR/SMR/ESMR, 896 - 941MHz LMR/SMR/ESMR
 - b) Facilities Radio Units: 380 - 512 MHz LMR
 - c) CBP Radio Units: 160 – 174 MHz
 - 3) Optical Port: 2xSC-APC connector (separated uplink/downlink)

- 4) Antenna Port: Single 50 Ω N type female connector
 - 5) Auxiliary Ports: Two SMA female for future add-on modules
2. Approved Manufacturer: SOLiD/Commscope or approved substitution.

2.5 RF CONNECTORS

- A. All connectors shall be low intermodulation (IM) connectors. Typically, this is a gold center conductor with silver-plating on the connector. Connectors using dissimilar metal contacts or ferrous materials (e.g., nickel plating) are not allowed. The connector shall use a silver plated body with gold plated inner conductor. Brass bodies and silver or brass inner conductors are also authorized. N-type connectors shall be used.

2.6 LIGHTNING ARRESTORS

- A. Lightning Arrestors shall provide surge path to ground with minimal degradation to RF performance over the full bandwidth of services identified within this section.

2.7 GENERATOR

- A. All DAS equipment shall be backed up on the facility's emergency generator.

2.8 LABELS

- A. In addition to all "Submittal" requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, the Contractor shall also conform to all requirements of this section
1. All DAS components, areas, and cables shall be labeled; including but not limited to fiber cables, metallic cable, ground points, cross-connect fields, relay racks, patch panels, cabinets, and patch cords/jumpers shall be labeled following Authority's-established labeling format. As-built to contain matching label information.
 2. Labeling guidelines are ANSI/TIA/EIA-606-A Administration Standards for Telecommunication Infrastructure of Commercial Buildings with Authority specific asset nomenclature.
 3. All label material shall be suitable for intended usage and environment, meeting the legibility, defacement and general exposure requirements listed in UL 969 for indoor and outdoor use. Where insert labels are used the insert label shall be covered with clear cover and securely held in place.
 4. For interior labeling; printer shall be of the thermal transfer type capable of printing self-laminating labels of various size up to and including 1.5"by 1.5" printable area with a 4.5" self-laminating tail. Label Printer Basis of Design: Brady TLS2200 or approved substitution. No non-self-laminating labels shall be approved.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Refer to Specification Section 27 05 00 in addition to the following:

- B. In addition to the PSN DAS specified herein, this project will also install a Cellular DAS within the same building spaces. The contractor shall coordinate with the Authority Vendors providing these systems to ensure proper installation and performance of each DAS.
- C. Coordination items shall include, but not be limited to:
 - 1. Coordination of antenna placement within the building to minimize or eliminate radio frequency interference (RFI), intermodulation, and other undesirable effects or performance degradation within any DAS as a result of antenna placement. Performance of the system is the responsibility of the Authority Vendor.
 - 2. Coordination of conduit routing with Authority Vendors.
 - 3. Coordination of communications room space requirements, grounding requirements, electrical power requirements, and all other requirements with Authority Vendors.
- D. This coordination shall occur at all phases of the project to ensure proper functionality of all DAS systems as well as sufficient fiber optic cable, appropriate conduit placement, appropriate antenna placement, access hatch placement where necessary, and all other functional requirements of the various DAS systems are met as specified in the Contract Documents.
- E. In addition to coordination with additional DAS vendors the Contractor must perform a walkthrough with the 800 MHz and 460 MHz DAS Vendor prior to any equipment installation. This walkthrough will be for the purposes of final conduit and device placement prior to any installation activities.

3.2 EQUIPMENT PROTECTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.3 WORK PERFORMANCE

- A. Refer to Specification Section 27 05 00 for requirements.

3.4 EQUIPMENT INSTALLATION

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. The installation of all components is the responsibility of the Authority Vendor. Contractor will coordinate with the vendor to ensure the locations of the devices are compatible with other systems.
- C. Install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.
- D. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

- E. Adhere to the following during installation of the system:
 - 1. Underwriters Laboratories (UL) listing for restricted access installations in business and customer premises applications. This listing is required by the National Electric Code for customer premise installations.
 - 2. Fire resistance requirements specified by Underwriters Laboratories in UL 1459, 2nd edition.
 - 3. System installation and construction methods shall conform to the requirements of the Federal Communications Commission (FCC).
- F. Where undefined by codes and standards, apply a safety factor of at least two (2) times the rated load to all fastenings and supports of system components.
- G. Adhere to the installation schedule of the general contractor and should attend all construction meetings scheduled by the General Contractor.
- H. Install and configure all software required in this Specification in accordance with the software manufacturer's installation instructions. Apply the latest patches and security updates.
- I. Final configuration of the DAS and associated equipment shall be performed by the Authority Vendor. This includes, but is not limited to software installation and configuration, uplink and downlink gain configuration, splitter/combiner installation, and antenna placement. These final details must be coordinated with other DAS vendors to ensure the proper functionality of the Public Safety DAS and Cellular DAS as well as the WiFi system. Coordination between various DAS Vendors shall be the responsibility of the Contractor.
- J. Place materials only in those locations that have been previously approved. Any other locations shall be approved, in writing, by the Authority and OAR.
- K. All wiring and cables shall be properly dressed and/or bundled with tie-wraps or cable ties with excess cut close to the barbs. Twisted wire, tape, rope, twine, phone wire and similar bits of debris usually available on site are not acceptable substitutes for proper securing hardware. All inter-rack cables and wiring must be properly routed, and where available, in cable trays. Overhead cables must be easily removed or re-worked within the cable trays. Proper care must be taken to ensure that new cables added to the trays are not stressed or intertwined with existing cables. Overhead cables may not cross perpendiculars or be suspended in mid-air without supports. No supports may be installed without prior approval from the Authority and OAR. All long cable runs must be properly identified at each end and every 100 feet indicating the carried frequency and communication room of origin. All cabling within the building must be cut to proper length.
- L. Obtain written permission from the Authority and OAR before proceeding with any work which requires cutting into or through any part of the building structures such as, but not limited to, girders, beams, concrete, carpeted or tiled floors, partitions or ceilings. Consult with the General Contractor before cutting into or through any part of the building structures where fireproofing or moisture proofing could be impaired.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

- A. Refer to Specification Section 27 05 00 in addition to the following requirements.
- B. Conduit shall be 1 ½" with long radius sweeps. Junction boxes shall be supplied at coupler locations when necessary.

3.6 ELECTRICAL POWER DISTRIBUTION

- A. Refer to Specification Section 27 05 00 for requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. Refer to Specification Section 27 05 00 for requirements.

3.8 GROUNDING AND BONDING

- A. Refer to Specification Section 27 05 00 in addition to the following requirements.
 - 1. Each lightning suppression device shall have its own home run ground cable. External ground busbar shall be connected to the building lightning protection system.

3.9 EQUIPMENT IDENTIFICATION

- A. Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE & SERVICE

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. Authority Vendor will be responsible for all maintenance and service of DAS equipment as detailed in this section.
- C. General
 - 1. Provide maintenance and support of all components associated with this system at no additional charge during the warranty period.
 - 2. Supply a list of special tools, test equipment, and outside inventory required for this Project. The Contractor may recommend specific items to facilitate long-term support of the system as an option.
 - 3. All lead technicians performing installation and maintenance shall have a minimum of two (2) years' experience on the proposed system and be manufacturer certified on all hardware/software applications. All maintenance technicians shall be provisioned to attend a one (1) week manufacturer training class each year. Pre-assigned backup technicians shall be available to backfill for onsite technicians who are on vacation, in training or who are out sick.
 - 4. Provide twenty-four (24) hours/seven (7) days a week telephone support as a minimum maintenance and support agreement. Respond to non-emergency service requests between 8am to 5pm, the next business day after a support call is placed.
- D. Network Hardware and Software Support

1. Network Hardware and Software support shall be supplied by the Authority Vendor. Support shall cover all equipment and systems referenced in this Specification.
2. All software shall be delivered with an installable backup.

E. Requirements

1. Preventive and Routine Maintenance: Preventive and routine maintenance services shall be provided in accordance with the provisions of the maintenance manual for each component during the warranty period. Preventative maintenance services shall include inspection, test, necessary adjustment, lubrication, parts cleaning, and upgrades. Routine maintenance services shall include scheduled overhauls as recommended by the equipment manufacturer.
2. Emergency Failure: A system failure is considered an emergency if any of the key components are inoperative to the extent the system cannot function in a normal manner. Emergency services shall include inspections and necessary tests to determine the causes of equipment or software malfunction or failure during the warranty period. The emergency services shall include furnishing and installing components, parts, or software changes required to replace malfunctioning system elements. Provide telephone support twenty-four (24) hours a day, seven (7) days a week. Provide support on-site within eight (8) hours of request.

3.11 WARRANTY

- A. Authority Vendor will be responsible for all warranty requirements for the DAS system.
- B. In addition to all "Warranty" requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, conform to all requirements of this section.
- C. Provide a joint written warranty of the manufacturer(s) and the installer(s), on a single document. The document shall warrant complete installation of the radio equipment, cabling, antennas, connectors, and software to be free from defects in materials and workmanship for a period of no less than one (1) year, starting with the date of Final System Acceptance.
- D. Hardware Warranty:
 1. Warrant that all components meet or exceed the specifications provided in the product data submittal.
 2. Warrant that the proposed merchandise will conform to its description and any applicable specifications, and shall be of good quality for the known purpose for which it is intended.
 3. The product warranty shall cover material and labor for the replacement or repair of defective products.
- E. Software Warranty:
 1. The warranty shall allow for replacement or repair at the discretion of the Authority. All software necessary to compile, modify, and maintain software developed for this specification shall be included in this warranty.

2. The warranties shall include the price of all software upgrades during the warranty period. If a new version of the system software becomes available during the warranty period, it shall be upgraded as part of the warranty.

3.12 FIELD SERVICES

- A. Refer to Specification Section 27 05 00 in addition to the following:
- B. Authority Vendor will be responsible for all field services for the DAS system components.
- C. In addition to all "Field Services" requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, conform to all requirements of this section.
 1. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been completed unless designated for storage.
- D. Acceptance will be withheld until the following have been completed successfully:
 1. Acceptance of all submittals
 2. Delivery of final documentation
 3. Successful testing
 4. Completion of training
 5. Demonstrate system to designated Authority personnel as required by applicable sections of these specifications. Use submitted operation and maintenance manual as reference during demonstration and training. Demonstrate as-built records are in format required and can lead troubleshooting technicians to port level of detail in field.
- E. Project Testing: The overall DAS project shall not be considered complete until On-Site Testing is completed on the entire DAS and PSN test results have been approved by the AHJ. The purpose is to test the complete system and demonstrate that all specified features and performance criteria are met. All requirements of the specification shall be tested, including:
 1. Functionality, including signal coverage and audio quality test. Radio signal coverage, shall consist of testing a minimum of 100 points on each level of the Terminal. Audio quality test shall consist of making radio test call from each test point and recording both the received and transmitted audio quality on a scale of 1 to 5. A minimum audio quality of 3 at 95% of the test points is required.
 2. System capacity
 3. Hardware and software interaction
 4. Failure Recovery
 5. Report generation
- F. Test Plan/Procedure: Provide a copy of the proposed test plan/procedures for each testing phase for review by the Authority and OAR. The test plan for each phase of testing shall detail the objectives of all tests. The tests shall clearly demonstrate that the system and its components fully comply with the requirements specified herein. The submission of Test Plans shall adhere to the following:

1. A draft test plan shall be presented to the Authority and OAR at least forty-five (45) days prior to the scheduled start of each test.
 2. A workshop for reviewing comments shall be conducted with the Authority and OAR at least thirty (30) days prior to the scheduled start of each test.
 3. A final test plan shall be submitted to the Authority and OAR at least fourteen (14) days prior to the scheduled start of each test.
- G. Test plans shall contain at a minimum:
1. Functional procedures including use of any test or sample data.
 2. Test equipment is to be identified by manufacturer and model including spectrum analyzers and power meters.
 3. Interconnection of test equipment and steps of operation shall be defined.
 4. Expected results required to comply with specifications.
 5. Testing matrix referencing Specification requirements with specific test procedures.
 6. Record of test results with witness initials or signature and date performed.
 7. Pass or fail evaluation with comments.
- H. The test procedures shall provide conformity to all Specification requirements. Satisfactory completion of the test procedure is necessary as a condition of system acceptance.
- I. All Test plans must be reviewed by the Authority and OAR. To successfully complete a test, the test document must be signed and dated by the Contractor AHJ and Authority.
- J. The AHJ, Authority and OAR will review, witness and validate the execution of all formal test procedures prepared by the Contractor and Authority Vendor and deliverable under the contract to assure the tests cover all requirements and that there is a conformity between the conducted test, the test results and Specification requirements.
- K. Documentation verification both interconnects and operationally, shall be part of the test. Where documentation is not in accordance with the installed system interconnect and operating procedures, the system shall not be considered accepted until the system and documentation correlate.
- L. Provide the AHJ, Authority and OAR the opportunity(s) to participate in any or all of tests.
- M. Test Reports: Prepare, for each test, a test report document that shall certify successful completion of that test. Test reports shall be submitted to the Authority's representative for review and acceptance within seven (7) days following each test. The test report shall contain, at a minimum:
1. Commentary on test results.
 2. A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution.
 3. Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other annotations entered during execution of the test.
 4. Signatures of persons who performed and witnessed the test.

- N. Test Resolution: Any discrepancies or problems discovered during these tests shall be corrected by the Contractor at no cost to the Authority. The problems identified shall be corrected and the percentage of the entire system re-tested as determined by the Authority and OAR before any subsequent testing is performed.

3.13 TRAINING

- A. Training for the DAS system will be the responsibility of the Authority Vendor.
- B. Contractor shall coordinate with Authority Vendor to obtain training materials for the DAS System.
- C. In addition to all "Training" requirements specified in Division 01, Specification Section 270500 and all requirements by related specification sections, conform to all requirements of this section.
 - 1. Provide the Authority specified trainees with detailed as-built information. The training shall provide trainees with a working knowledge of the system design and layout, ability to configure and monitor the system, and troubleshooting methods and techniques. In addition, the training shall cover testing, maintenance, and repair procedures for all equipment and applications, which are provided under this Specification.
 - 2. Course materials shall be delivered to the Authority. Final delivery of the course materials shall include a master hard copy of all materials and an electronic copy in a format reviewed in advance by the Authority. Supply a videotape of each training course.
 - 3. All training shall be completed a minimum of two weeks prior to the system becoming operational and utilized by the Authority. Training schedule subject to the Authority's review.

3.14 PROJECT CLOSEOUT REQUIREMENTS

- A. Refer to Specification Section 27 05 00 for requirements.

END OF SECTION 27 53 20

PART 1 - GENERAL

1.1 STIPULATIONS

A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this and all related Division 28 Specification Sections.

B. Related Sections:

1. 26 05 00 – Common Work Results for Electrical
2. 26 05 19 – Building Wire and Cable
3. 26 05 26 – Grounding and Bonding
4. 26 05 29 – Hangers and Supports
5. 26 05 33 – Conduit
6. 26 05 34 – Outlet Boxes
7. 26 05 35 – Pull & Junction Boxes
8. 26 05 53 – Identification for Electrical Systems
9. 27 05 00 – Common Work Elements for Communications
10. 27 10 00 – Premise Distribution Systems
11. 27 10 05 – Passive Optical Network
12. 27 51 13 – Emergency Communication System
13. 28 08 00 – Commissioning of Life Safety and Security Systems
14. 28 13 00 – Physical Access Control System
15. 28 23 00 – Video Surveillance System
16. 28 31 00 – Addressable Fire Detection and Alarm

C. Reference Symbols:

1. All device symbols are defined by the appropriate symbol schedules. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Not all device symbols as indicated may be required for the project.
 - a. Contractor shall coordinate exact locations with all architectural drawings, mechanical, electrical drawings, communications drawings, reflected ceiling and furniture plans, door hardware specifications as well as all affected trades prior to submittal of any shop drawings.

D. Abbreviations:

1. General: Refer to Specification Section 27 05 00 for Abbreviations.

E. Definitions:

1. General: Refer to Specification Section 27 05 00 for Definitions

1.2 SUMMARY

A. General: Refer to Specification Section 27 05 00 for all requirements.

1.3 SCOPE OF WORK

A. Refer to Specification Section 27 05 00 for general requirements.

B. Refer to individual Specification Sections for further system requirement.

1.4 REFERENCES

- A. General: Refer to Specification Section 27 05 00 for all References.

1.5 SYSTEMS DESCRIPTIONS

- A. At the minimum, the scopes of work covered by the Division 28 Specifications and the contract drawings shall include but are not limited to the following systems. Refer to related drawings and specifications for additional information.
1. The Division 28 Contractor shall be responsible for providing the proper installation, termination, programming, testing, commissioning, certification, modifications to existing North Terminal security systems. Include the integration of all related Division 28 systems in accordance with the Contract documents. Refer to all related project drawings and specifications for additional information.
- B. The Contractor shall install, program and certify all Physical Access Control System (PACS), servers, central processors, local door controllers, auxiliary power supplies, card readers, client workstations, electrical power, and all appurtenances in accordance with all applicable codes, manufacturers' requirements, project drawings and specifications.
1. At the minimum include the following;
 - a. Provide all related servers, central processors, local door controllers, components, cabling, conduits, materials, low voltage electrical power, programming, testing, certifications and all appurtenances as required for the installation of a complete and fully operational Physical Access Control System (PACS). The Contractor shall provide all of the above in accordance with all applicable life safety codes, building codes, as well as all related Specification Sections, drawings and manufacturers recommendations. Contractor to confirm that all PACS elements comply with the designed Sequence of Operation.
 - b. All Access Control devices, cabling as well as all remote sub-systems and/or control panels shall be supervised against unauthorized access, intentional or accidental tampering, deterioration of wiring or connections and operation failures. Any of the above conditions shall result in an audible and visual indication at select GOAA client alarm and admin workstations.
 - c. Coordinate with Division 26 to provide all necessary emergency / security 120 VAC circuits as required to provide proper operation of all system components.
 - d. The Contractor shall include the integration and programming of all electronic door hardware, fire alarm, video surveillance, network connectivity, and Duress Button systems, in accordance with all applicable codes, manufacturers' requirements, project drawings and specifications.
 - e. Provide all necessary modifications to existing North and South Terminal PACS as well as all related auxiliary systems as required for the seamless integration of the new system,
All PACS cabling shall be installed in dedicated raceways unless otherwise specified. All TCP/IP based access control system cabling shall be Category-6 installed in accordance with all requirements of related Specification Sections 27 05 00 and 27 10 00.

- C. The Contractor shall install, program and certify all Video Surveillance System (VSS) servers, recording components, cameras, video monitors, power supplies, electrical power and all appurtenances in accordance with all applicable codes, manufacturers' requirements, project drawings and specifications.
1. At the minimum include the following;
 - a. Provide all related devices, cameras, components, cabling, conduits, materials, programming, testing, certifications and all appurtenances as well as all emergency power as required for complete and fully operational TCP/IP based Video Surveillance. The Contractor shall provide all of the above in accordance with all applicable electrical codes, communication standards, building codes, related Specification Sections, drawings and manufacturers recommendations.
 - b. Coordinate with Division 26 to provide all necessary emergency / security 120 VAC circuits as required to provide proper operation of all system components.
 - c. The Contractor shall include the integration and programming of all VSS components in accordance with all applicable codes, manufacturers' requirements, project drawings and specifications.
 - d. Provide all necessary modifications to existing North & South Terminal VSS as well as all related auxiliary systems as required for the seamless integration of the expanded system,
 - e. Provide all documentation, testing, commissioning and certifications in accordance with all requirements of the Contract Documents.
 - f. All VSS cabling shall be installed in dedicated raceways unless otherwise specified. All TCP/IP based access control system cabling shall be Category-6 installed in accordance with all requirements of related Specification Sections 27 05 00 and 27 10 00.
 - g. Refer to all related Specification Sections for additional system requirements.
 - h. Contractor to provide mock-up of each camera type installation for GOAA and OAR review and approval prior to installation.
- D. The Contractor shall install, program and certify all Fire Alarm controls, processing components, initiating devices, notification appliances, annunciators, power supplies, electrical power and all appurtenances in accordance with all applicable codes, manufacturers' requirements, project drawings and specifications.
1. At the minimum include the following;
 - a. Provide all related devices, components, cabling, conduits, materials, programming, testing, certifications and all appurtenances as well as all emergency power as required for complete and fully operational fire alarm system. The Contractor shall provide all of the above in accordance with all applicable electrical codes, building codes, related Specification Sections, drawings and manufacturers recommendations.
 - b. Coordinate with Division 26 to provide all necessary emergency / life safety 120 VAC circuits as required to provide proper operation of all system components.

- c. The Contractor shall include the integration and programming of all electronic door hardware, sprinkler, fire suppression systems, smoke control and mechanical systems in accordance with all applicable codes, manufacturers' requirements, project drawings and specifications.
- d. Provide all necessary modifications to existing North Terminal Fire Alarm system as well as all related auxiliary systems as required for the seamless integration of the new system,
- e. Provide all documentation, testing, commissioning and certifications in accordance with all requirements of the Contract Documents.
- f. Refer to all related specification sections for additional system requirements.

1.6 SUBMITTALS

- A. General: Refer to Specification Section 27 05 00 for all requirements.

1.7 QUALITY ASSURANCE:

- A. General: Refer to Specification Section 27 05 00 for all requirements.

1.8 DELIVERY, STORAGE AND HANDLING

- A. General: Refer to Specification Section 27 05 00 for all requirements.

1.9 RECORD DOCUMENTS

- A. General: Refer to Specification Section 27 05 00 for all requirements.

1.10 OPERATION AND MAINTENANCE

- A. General: Refer to Specification Section 27 05 00 for all requirements.

1.11 SOFTWARE AGREEMENT

- A. General: Refer to Specification Section 27 05 00 for all requirements.

1.12 SPARE MATERIALS

- A. General: Refer to Specification Section 27 05 00 for all requirements.

1.13 ENVIRONMENTAL CONDITIONS

- A. General: Refer to Specification Section 27 05 00 for all requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. General: Refer to Specification Section 27 05 00 for all requirements.

PART 3 - EXECUTION

3.1 COORDINATION

- A. General: Refer to Specification Section 27 05 00 for all requirements.

3.2 EQUIPMENT PROTECTION

- A. General: Refer to Specification Section 27 05 00 for all requirements.

3.3 WORK PERFORMANCE

- A. General: Refer to Specification Section 27 05 00 for all requirements.

3.4 EQUIPMENT INSTALLATION

- A. General: Refer to Specification Section 27 05 00 for all requirements.

3.5 CABLE INSTALLATION

- A. General: Refer to Specification Section 27 05 00 for general requirements in addition to below items:
- B. All PACS security system cabling is to be concealed above ceilings and installed in “dedicated” conduits. All conduits shall be supported above ceilings to the building structure and shall not contain any AC carrying conductors or non-associated security system cables.
 - 1. Provide all access control cabling in accordance with all manufacturers’ requirements.
 - a. All security conductors shall be twisted pair, minimum 18 AWG unless otherwise noted or required by code, equipment manufacturer and/or noted elsewhere. Refer to related Specification Sections for additional information.
 - b. Twisted pair, minimum 16 AWG unless otherwise noted or required by code, shall be utilized for control of electrical and motorized doors and gates unless otherwise required by code, equipment manufacturer and/or noted elsewhere. Refer to related Specification Sections for additional information.
- C. All VSS cabling is to be concealed above ceilings and installed in dedicated conduit. Provide all Video surveillance system cabling in accordance with all manufacturers’ requirements, at the minimum all cabling shall conform to the following:
 - 1. All cabling associated with the installation of the VSS shall utilize Category-6 UTP cables. Refer to related Specification Sections 27 05 00 and 27 10 00 for additional information related to the proper installation of Category-6 UTP cables.
 - 2. Coordinate all system cabling with system provider prior to shop drawing submission.
- D. All security system conduits/raceways shall be installed in a manner that prevents tampering or removal when installed in areas exposed to the general population.
 - 1. Provide tamper-resistant installation utilizing “torx with peg” security-fastening devices for all conduits/raceways, equipment, devices and appurtenances in all areas accessible to the general population and/or areas subjected to tampering or vandalism.

3.6 ELECTRICAL POWER DISTRIBUTION

- A. General: Refer to Specification Section 27 05 00 for all requirements.

3.7 TRANSIENT VOLTAGE SUPPRESSION

- A. General: Refer to Specification Section 27 05 00 for general requirements.

- B. All exterior camera locations shall have din rail mounted Bussmann BSPD48RJ45 or approved equal surge suppression located at field device security outlet and Ditek rack mounted DTK-RM12POE or approved equal surge protection in the IDF.

3.8 GROUNDING AND BONDING

- A. General: Refer to Specification Section 27 05 00 for requirements.

3.9 EQUIPMENT IDENTIFICATION

- A. General: Refer to Specification Section 27 05 00 for requirements.

3.10 MAINTENANCE & SERVICE

- A. General: Refer to Specification Section 27 05 00 for requirements.

3.11 WARRANTY

- A. General: Refer to Specification Section 27 05 00 for requirements.

3.12 SERVICES

- A. General: Refer to Specification Section 27 05 00 for all requirements.

3.13 TRAINING

- A. General: Refer to Specification Section 27 05 00 for all requirements.

END OF SECTION 28 05 00

SECTION 28 08 00 - COMMISSIONING OF LIFE SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.
- B. Owner's Project Requirements (OPR) and the Basis of Design (BOD) documentation are included by reference for information only.
- C. Division 01 Section 01 81 13.14 Sustainable Design Requirements – LEED v4 BD+C for additional LEED v4 requirements related to commissioning.
- D. ASHRAE standard 90.1-2010 and ASHRAE Guideline 0-2013 (The Commissioning Process) and ASHRAE Standard 202-2013 Commissioning Process for Buildings and Systems.

1.2 SUMMARY

- A. This section includes commissioning process requirements for life safety systems, assemblies, and equipment; including fire detection and alarm, smoke control, access control and video surveillance systems.
- B. Related Sections:
 - 1. Division 01 Section 01 91 13 "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION

- A. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for the description of commissioning.

1.4 DEFINITIONS

- A. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for definitions.

1.5 SUBMITTALS

- A. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for CxA's role.
- B. Refer to Division 01 Section "Submittal Procedures" for specific requirements. In addition, provide the following:
- C. In addition, provide the following:
 - 1. Certificates of readiness
 - 2. Certificates of completion of installation, prestart, and startup activities.

3. O&M manuals
4. Test reports

1.6 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractor will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

- A. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the specific contractors / subcontractors for the various systems defined under Division 28 shall ultimately be responsible for all standard testing equipment for the respective systems (fire alarm, smoke control, security, etc.) in Division 28. A sufficient quantity of two-way radios shall be provided by each contractor.
- B. Special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.
- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

- A. With assistance from the installing contractor, the CxA will prepare construction Verification Checklists for all commissioned components, equipment, and systems, the contractor shall execute the Verification Checklists.

- B. Red-lined Drawings:
 - 1. The contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
 - 2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
 - 3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.
 - 4. The contracted party, as defined in the Contract Documents will create the as-built drawings.

- C. Operation and Maintenance Data:
 - 1. The CM at Risk will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems.
 - 2. The CxA and the A/E will review the O&M literature once for conformance to project requirements.
 - 3. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the CM at Risk and the Contractor.

- D. Demonstration and Training:
 - 1. CM at Risk and the subcontractor will provide demonstration and training as required by the specifications.
 - 2. A complete training plan and schedule must be submitted by the CM at Risk and the Subcontractor to the CxA a minimum of four (4) weeks prior to any training.
 - 3. A training agenda for each training session must be submitted by the CM at Risk and the Subcontractor to the CxA, the A/E and the OR a minimum of one (1) week prior the training session.
 - 4. The CxA shall be notified at least 72 hours in advance of scheduled tests so that testing may be observed by the CA and Owner's representative. A copy of the test record shall be provided to the CxA, the A/E, and the OR.
 - 5. Engage a Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.
 - 6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
 - 7. Review data in O&M Manuals.

- E. Systems Manual requirements:
 - 1. The Systems Manual is intended to be a usable information resource containing all of the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.
 - 2. The CM at Risk shall include final approved versions of the following information for the Systems Manual:
 - a. As-Built System Schematics
 - b. Verified Record Drawings
 - c. Test Results (not otherwise included in Cx Record)

- d. Periodic Maintenance Information for computer maintenance management system
 - e. Recommendations for recalibration frequency of sensors and actuators
 - f. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information
 - g. Training Records, Information on training provided, attendees list, and any on-going training
3. This information shall be organized and arranged by building system, such as fire alarm, chilled water, emergency power system, smoke control system, etc.
 4. Information should be provided in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

3.2 CM at RISK & SUBCONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meetings.
- C. Participate in life safety and security systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- D. Provide information requested by the CxA for final commissioning documentation.
- E. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.
- F. Prepare preliminary schedule for life safety systems' and security systems' orientations and inspections, operation and maintenance manual submissions, training sessions, equipment start-up and task completion for owner. Distribute preliminary schedule to the CM at Risk and the CxA.
- G. Update schedule as required throughout the construction period.
- H. During the startup and initial checkout process, execute the related portions of the verification checklists for all commissioned equipment.
- I. Assist the CxA with all verification and functional performance tests.
- J. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- K. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to the A/ E and the CxA within 45 days after submittal acceptance.
- L. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

- M. Notify the CxA and the A/E a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.
- N. Participate in, and schedule vendors and contractors to participate in the training sessions.
- O. Provide written notification to the CxA and the A/E that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
 - 1. Fire detection and alarm systems, including smoke detectors, heat detectors, pull stations, alarm indication devices (horns, speakers, and strobes), water flow switches and firefighters' phone system
 - 2. Smoke control system, including exhaust fans, supply (pressurization) fans, door releases, elevator override testing and system testing under emergency power.
 - 3. Security systems, including access control and video surveillance systems.
- P. The equipment supplier shall document the performance of his equipment.
- Q. Provide a complete set of red-lined drawings to the CxA and the A/E prior to the start of Functional Performance Testing.
- R. Provide training of the Owner's operating staff using expert qualified personnel, as specified.
- S. Equipment Suppliers
 - 1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
 - 2. Assist in equipment testing per agreements with contractors.
 - 3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
- T. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for additional Contractor responsibilities.

3.3 OWNER'S RESPONSIBILITIES

- A. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for Owner's Responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

- A. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for Design Professional's Responsibilities.

3.5 Cx AUTHORITY'S RESPONSIBILITIES

- A. Refer to Division 01 Section 01 91 13 "General Commissioning Requirements" for CxA's Responsibilities.

3.6 TESTING PREPARATION

- A. Certify in writing to the A / E and the CxA that life safety systems and security systems, including subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.
- C. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- D. Inspect and verify the position of each device and interlock identified on checklists.
- E. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.7 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of life safety system and security system testing shall include the entire fire detection and alarm system(s), the entire smoke control systems(s), the entire physical access control system(s), and the entire video surveillance system(s). Testing shall include evaluating and verifying the effectiveness of all operational, monitoring and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA, along with the CM at Risk, and the various life safety and security subcontractors, including the fire detection and alarm, security and BAS controls subcontractors, shall prepare detailed testing plans, procedures, and checklists for the life safety and security systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the life safety and security systems, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.8 ELECTRICAL SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 26, Division 27 and Division 28 technical sections. Provide submittals, test data, inspector record, and certifications to the CxA.
- B. Life Safety and Security Systems' Testing: Field testing plans and testing requirements are specified in technical sections of these specifications. Assist the CxA with preparation of testing plans.
- C. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:
 - 1. Automatic temperature controls integrated with the life safety and security systems
 - 2. Coordination and functionality with the Building Automation System / DDC Controls System integrated with the life safety and security systems
 - 3. Fire Detection and Alarm System – all devices
 - 4. Smoke Control System
 - 5. Stair Pressurization System
 - 6. Elevator Recall and Override Operation
 - 7. Security – Physical access control systems
 - 8. Security - Video surveillance systems
 - 9. Security systems integration and alarm call-up

3.9 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

- A. Refer to Division 01 Section 01 91 13 “General Commissioning Requirements” for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.10 APPROVAL

- A. Refer to Division 01 Section 01 91 13 “General Commissioning Requirements” for approval procedures.

3.11 DEFERRED TESTING

- A. Refer to Division 01 Section 01 91 13 “General Commissioning Requirements” for requirements pertaining to deferred testing.

3.12 OPERATION AND MAINTENANCE MANUALS

- A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.
- B. Refer to Division 01 Section 01 91 13 “General Commissioning Requirements” for the A/E and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.

3.13 TRAINING OF OWNER PERSONNEL

- A. Refer to Division 01 Section 01 91 13 “General Commissioning Requirements” for requirements pertaining to training. All training shall be videotaped for future use.
- B. Life Safety System and Security System Contractors. Shall have the following training responsibilities:
 - 1. Provide the CM at Risk with a training plan for review by the CxA, the A/E, and the OR a minimum of two (2) weeks before the planned training.
 - 2. Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned life safety and security system equipment.
 - 3. Training shall start with classroom sessions, if necessary, followed by hands on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
 - 4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
 - 5. The appropriate trade or certified factory manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise, as well as in-depth knowledge of all modes of operation of the specific piece of equipment, is required. More than one party may be required to execute the training.
 - 6. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
 - 7. Training shall include:
 - a. Use the printed installation, operation and maintenance instruction material included in the O&M manuals.
 - b. Include a review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
 - c. Discuss relevant safety issues and concerns.
 - d. Discuss warranties and guarantees.
 - e. Cover common troubleshooting problems and solutions.

- f. Explain information included in the O&M manuals and the location of all plans and manuals in the facility.
- g. Discuss any peculiarities of equipment installation or operation.
- 8. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance of all pieces of equipment.
- 9. The life safety system and security system contractors shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central control system.
- 10. Training shall occur after functional testing is complete, unless approved otherwise by the Owner's.

END OF SECTION 28 08 00

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SECTION 28 13 00 – PHYSICAL ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 and all related Specification Sections shall apply to this Section. Contractor shall review all Divisions, Sections, and Drawings to ensure proper interface as required for a fully functional system.
- B. Related Sections:
1. 08 71 00 – Door Hardware
 2. 08 42 29.23 – Sliding Automatic Entrances
 3. 14 21 00 – Traction Elevators
 4. 14 24 00 – Hydraulic Elevators
 5. 26 05 01 – Basic Electrical Requirements
 6. 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
 7. 26 05 26 – Grounding and Bonding for Electrical Systems
 8. 26 05 29 – Hangers and Supports for Electrical Systems
 9. 26 05 33 – Conduit for Electrical Systems
 10. 26 05 33.16 – Boxes for Electrical Systems
 11. 26 05 34 – Outlet Boxes for Electrical Systems
 12. 26 05 38 – Floor Boxes
 13. 26 05 53 – Identification for Electrical Systems
 14. 27 05 00 – Common Work Elements for Communications
 15. 27 10 00 – Premise Distribution Systems
 16. 27 10 05 – Passive Optical Network
 17. 27 10 10 – Voice Over IP Telephone System
 18. 28 05 00 – Common Work Elements for ESS
 19. 28 08 00 – Cx of Life Safety and Security Systems
 20. 28 23 00 – Video Surveillance System
 21. 28 31 00 – Addressable Fire Detection and Alarm
 22. Baggage Handling System Project and Contractor
- C. Reference Symbols:
1. All device symbols are defined by the appropriate symbol schedules. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location.
 2. Contractor shall coordinate exact locations of all equipment with all site plan and architectural floor plan drawings as well as related Specification Sections for all affected systems and prior to submittal of any shop drawings.
- D. Abbreviations:
1. Refer to Specification Section 28 05 00 for additional information.
- E. Definitions:
1. Refer to Specification Section 28 05 00 for additional information.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This specification section applies to the GOAA PACS system that is also utilized by CBP.
- C. This contract shall extend the existing GOAA Software House C-Cure 9000 system. The intent of this specification is to establish a standard of quality, functions, and features for the installation of a TCP/IP-based Physical Access Control System (PACS) as indicated on the contract drawings and/or herein specified.
- D. This specification as well as contract details and drawings define the technical requirements. Refer to the Appendix section of this specification for functional operation of each typical PACS door type and other misc. subsystems and elements.
- E. The scope of work shall include all necessary programming as required to seamlessly integrate the new PACS with the existing C-Cure 9000 physical access control, system located in the North and South Terminal Complex. The PACS shall be an extension of the existing enterprise-based system and shall include all work, materials, infrastructure, equipment, programming, and any other items or services as required to provide a fully integrated and operational system as herein specified. This includes expanding the interface with the VSS system. GOAA IT will be providing any headend modifications, software upgrades, licenses, workstations, and/or servers related to the expansion of this existing system.
 - 1. The installation, performance, features, functions, software and programming modifications as specified herein as well as all related specification sections have been designed to offer the maximum system efficiency ease of operation, occupant safety and the protection of equipment as recommended by GOAA and OAR.
 - a. Any deviations from the specified criteria shall be documented, reviewed and agreed to in writing by GOAA and Owner's Authorized Representative (OAR) prior to submission of bids. Refer to Division 01, and 28 05 00 Specification Section for product substitutions.
 - 1) The required information shall include but not be limited to: reason for deviation, all differences in performance, operation, and function from the herein specified requirements, all benefits, and added features to owner as a result of the deviations and any additional incurred costs to owner for maintenance and long-term ownership.
 - 2) Failure to provide GOAA and OAR with the required information shall result in all shop drawing submissions being returned for non-conformance with the contract requirements.
 - 2. It shall be the responsibility of the contractor to ensure that the installed system meets or exceeds every standard set forth in these specifications. The contractor shall be responsible for providing a complete and functional enterprise-based system, including all necessary components, devices, electrical power, programming, commissioning, testing and all appurtenances as well as the integration to all ancillary systems as necessary to provide a complete and fully operational system whether specifically included in this section or not. GOAA IT will be providing servers, workstations, software, licenses, and active network equipment.

- a. The system shall consist of, but not be limited to, all equipment, devices, servers, client workstations, network servers, remote intelligent door controllers, readers, input devices, output devices, network communications equipment, power supplies, printers, conduits, cabling, software, programming, door hardware and all appurtenances as well as the integration of the facility's Fire Alarm System, and all related systems necessary to provide a complete operating TCP/IP based networked system in accordance with the contract documents.
 - 1) The Contractor shall have a registered RCDD professional review and seal all system shop drawings demonstrating industry standard design, installations and certifications of all structured cabling networks related to the installation and operation of the TCP/IP based Physical Access Control System and all related TCP/IP based electronic security systems.
 - 2) Refer to Specification Sections 27 05 00 and 27 10 00 for all TCP/IP based cabling requirements.
- F. The installation of the PACS shall comply with the applicable sections of NFPA-70 National Electrical Code (Article 760). The system shall be electrically supervised and monitor the integrity of all input/alarm conductors. Off normal power/battery and panel communications status shall be supervised. In addition, the system shall meet all applicable requirements of NFPA 72 for the integration to Protected Premises Signaling Systems, NFPA 731 for the Installation of Electronic Premises Security Systems.
 1. The contractor and all sub-contractors for this work shall have read all of the General Conditions, Special Requirements, General Requirements and all applicable related specification sections and in the execution of all work shall be bound by all of the conditions and requirements therein.
- G. Prior to the submission of the Bid, any discrepancies or inconsistencies noted within these specifications and/or project drawings shall be brought to the immediate attention of GOAA and Owner's Authorized Representative (OAR).
 1. All equipment symbols are shown on drawings as close as possible to their intended location. Contractor shall coordinate the installation of all equipment, devices, controls, cabling and integration of any systems with all affected trades and system integrators. The Contractor shall document all coordination requirements at the time of shop drawing submissions.
 2. The Contract Drawings for this work are diagrammatic and intended to convey the extent, general arrangement and locations of the work. Because of the scale of these drawings, certain basic items such as access panels, conduits, cabinet sizes, penetration sleeves, pull boxes, back-boxes and junction boxes may not be shown.
 - a. The contractor shall include all equipment, materials, components, device, controls and all appurtenances where required by code, by manufacturers' recommendations, and all related Contract Documents in order to ensure proper installation operation and integration of all components, equipment, devices and/or systems.

- H. The Contract drawings and specifications may not deal individually with every part, control, device, software or programming, which may be required to produce the equipment and/or system performance specified or as necessary for the installation and integration of all door hardware and systems in accordance with all requirements of the Contract Documents.
1. The Contractor shall include all such items and components, as required, for the complete and operational installation of all system components as defined by the Contract Documents, whether or not specifically indicated and/or specified
 - a. Include such items, as required, for a complete operational system, whether or not specifically indicated.
 - b. Coordinate with other applicable trades in submittal of shop drawings and the installation of all systems.
 - c. Shop drawings shall detail space conditions to accommodate other concerned trades, subject to final review by GOAA and OAR.
 - d. If installation of equipment, raceways, cable trays and/or conduit is performed prior to coordination with other trades, which interferes with work of other trades, make necessary changes to correct the condition at no additional cost to GOAA.
 - e. The contractor shall be responsible for providing all wiring, connections to all equipment, circuits and devices as well as all coordination and programming for the integration of all electronic door hardware, ancillary systems impacting the operation of PACS. Refer to the contract drawings and related Specification Sections for additional information.
- I. All references to industry and trade association standards as well as all building codes are minimum installation requirements for this system. The codes, standards and agencies listed in Specification Section 28 05 00 shall form a part of this Specification Section and all work shall comply with the latest adopted standards.
1. The publications listed in Specification Section 28 05 00 (including all amendments, addenda, revisions, supplement, and errata) shall form a part of this Specification Section to the extent referenced. The publications are referenced in the aforementioned Specification Section by the basic designation only.
 - a. Where the contract drawings and/or Specification Sections mandate a greater requirement or performance than those specified by the aforementioned referenced codes and standards in Section 28 05 00, shall then be the governing requirements for this project. Refer to Specification Section 28 05 00 for all minimum codes and standards to be applied for this project.
- J. The PACS shall be modular in construction for ease of expansion and service. The system shall include all necessary equipment, components, modules, devices, door hardware, network servers, TCP/IP based remote door control panels, HMI client workstations, active network electronics, electrical power, software, programming, commissioning and testing as necessary to provide a complete fully operational system. In addition, the PACS shall be fully capable of remote communications employing TCP/IP protocols over GOAA's wide area network for remote off-site operations via dedicated WAN connection at the primary server.

1. The PACS shall include the full operational integration of all man doors, overhead doors, sliding doors, baggage related doors, elevators, jetway controls, or other related systems where indicated on the contract drawings and/or as herein specified.
 2. The PACS extension shall support to use of the existing GOAA-issued 13.56 MHz contactless smart card technology.
 3. The PACS shall support the importation of GOAA's identification and informational databases to permit the population of authentication and access rights for all of GOAA's employees.
 4. The PACS shall also include the expansion of the existing interface with the Video Surveillance System (VSS) in accordance with the requirements of this Specification Section and all related Specification Sections.
 5. It shall be the Contractors responsibility to fully integrate the PACS with the facility's fire alarm system. The fire alarm system to support the full integration of access-controlled doors for automatic release of all electronic locking mechanisms in accordance with all requirements of IBC and NFPA 72 upon activation of any building fire alarm system for required means of egress doors where required. Functional operation of each PACS door type and door details define which doors require fire alarm release.
- K. All PACS components shall be on replaceable panels and/or modules to accommodate functional changes when required. All system wiring and components shall be fully supervised to annunciate a trouble signal if removed or disconnected.
- L. The contractor shall be responsible for providing all wiring, connections to all equipment, circuits and devices as well as all coordination and programming for the integration of all ancillary systems impacting the operation of the physical access control system. Refer to the contract drawings and related Specification Sections for additional information.
1. Note: The physical access control system shall be based on a TCP/IP protocols and shall be configured as a dedicated structured cabled LAN. The Contractor shall furnish and install all necessary patch panels, all peripheral network components, as well as all Category-6 UTP, fiber optic cabling and appurtenances in accordance with all requirements of the Contract Documents. Refer to Specification Sections 27 05 00 and 27 10 00 for additional information related to network communications equipment and cabling requirements.
 2. The contractor shall assume total system responsibility for providing all inter-building wiring, any connections to the stations local and wide area networks (for remote off premises communications by GOAA, any GOAA provided common carrier network equipment, integration of any GOAA provided systems, equipment, and/or databases as it relates the operation of the physical access control system.
- M. Prior to final programming of the access control system coordinate with GOAA and OAR, all GUI based graphic screens, video surveillance system integrations, all alarm functions as well as all operational features for the entire system. The contractor shall provide to GOAA and OAR a functional demonstration of all system graphics and operational features and functions prior to final programming.

1. This demonstration shall be performed on site and shall include an operational demonstration of the system for this facility. The functional demonstration shall include but not limited to, all door alarm and control functions, surveillance camera alarm call- ups
 - a. Failure to provide the required coordination with GOAA shall require the contractor to provide any and all system modifications and programming changes necessary to meet the requirements of GOAA.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 and 28 05 00 in addition to the following.
- B. Refer to drawing sheet TS0.00.01 for the work responsibility matrix for the scope of work required for the Physical Access Control System and for any work provided by GOAA and/or GOAA Vendors.
- C. Where listed on the drawing responsibility matrix, the following components shall be defined as follows.
 1. Software Licenses: GOAA IT will be furnishing and installing all required PACS platform software licensing (except Situator door licenses) including, but not limited to servers, reader expansion, redundancy, workstation licenses, operating software license or any other software required to expand the existing system to support all new elements added under this contract. Contractor shall be required to coordinate requirements as well as scheduling license installation.
 2. Connection to Existing System: Contractor shall furnish and install all devices and make final connection to existing system as needed to expand the system under this contract. Items include, but not limited to intelligent controllers, reader modules, input/output modules, power supplies or similar need to fully extend the existing system in new areas under this contract. Supervision by GOAA is required to ensure that system is fully extended and connected to the existing system per GOAA standards. Contractor is responsible to coordinate schedule and supervision with GOAA.
 3. Software Programming: Contractor is responsible to program and properly label all new system elements into the existing system. Items include, but not limited to intelligent controllers, reader modules, input/output modules, readers, other door devices, and power supplies or similar need to fully extend the existing system in new areas under this contract. Supervision by GOAA is required to ensure that system is programmed and labeled per GOAA standards as well as for monitoring of data quality. Contractor is responsible to coordinate schedule and supervision with GOAA.
 4. Alarm and Badging Workstations: GOAA IT will be furnishing and installing any required security workstations and peripherals including, but not limited to workstation, keyboards, mice, printers, and monitors. Contractor shall be required to coordinate known minimum hardware requirements as well as scheduling with GOAA.

5. Interface to Base Building Facility Systems: Contractor shall furnish and install all interfaces to achieve the defined functional security/operational requires of the PACS system. Based building systems include, but not limited to Fire Alarm System (FAS), Baggage Handling System (BHS), Building Management System (BBMS), elevators, jetway controls, powered door controllers, and similar so that the PACS can monitor and control the portals as shown in the drawings. Contractor is responsible to coordinate with other contractors as required.
6. Interface to Video Surveillance System (VSS): GOAA IT will be furnishing and expanding the PACS to VSS interface via the Qognify Situator platform. Contractor is responsible to coordinate with GOAA on all new PACS and VSS items add to each system so that the interface between the two can be 'mapped' and interfaced per GOAA standards. Contractor is required to provide additional per door licenses for the Situator system under this contract. Licensing and installation shall be coordinated with GOAA IT.
7. Network Components: Refer to specification section 27 05 00 and Technology Responsibility Matrix for requirements. Coordinate network programming requirements with GOAA IT for PACS operation on the GOAA network. Contractor shall coordinate patching into the network with GOAA.
8. Backbone Cable: Refer to specification section 27 10 00 for requirements.
9. Horizontal Cable: Provide dedicated PACS copper signal cabling from field devices to control panels. Contractor shall furnish and install all required horizontal cabling as required for the PACS extension.
10. Door Hardware: Division 8 Contractor shall furnish and install all required electrified door hardware and accessories as required for monitoring and/or control of portals as indicated in the drawings. Contractor is responsible to coordinate with Division 8 contractor to ensure that the doors meet the security/operational functionality as detailed in the drawings and defined in the appendix of this specification.
11. Field Devices – Readers and local audible/visual (AV) alarm devices. Contractor shall furnish and install all field devices including, but not limited to door field devices: readers, readers with keypad, and local AV devices.
Duress Devices:
 - a. CBP Duress Buttons: Contractor shall furnish and install all duress buttons, local alarm units, and keyed disabled switches as identified in the drawings for CBP's use in FIS areas based upon location. These buttons will be connected to and monitored by the GOAA PACS.

1.4 SYSTEMS DESCRIPTION

- A. Refer to Specification Section 28 05 00 for additional information.

1.5 SUBMITTALS

- A. In addition to all requirements as specified by Specification Section 28 05 00 the physical access control system shall also be provided in accordance with the following requirements.
 1. Provide a complete termination schedule of all door locations; indicate on the construction drawings door identifications corresponding with schedule.

2. Provide a complete alarm matrix for all door locations, indicate all associated alarm call-ups and camera pre-sets for every camera indicated on the contract drawings, include the related device activation and/or event for each pre-set and alarm call-up.
3. Provide a complete video surveillance camera integration schedule indicating each camera position relevant to door input location as well as a diagram indicating each termination position in the appropriate equipment cabinet intelligent system controller and/or remote door controller panel.
4. Provide a complete integration schedule indicating all ancillary system locations as well as a diagram indicating each termination position in the appropriate equipment cabinet intelligent system controller and/or remote door controller panel.
5. All integration protocols, communications connectivity and interface components to all, fire alarm, intrusion detection, local door management alarm and video surveillance systems as well as any ancillary systems.
6. Wiring diagrams and wire run lists shall indicate all wiring for each field device as well as all wiring interconnections between each device and all controls and/or associated equipment, in addition, all electrical power connections with electrical circuit numbers shall be indicated to all equipment requiring electrical power.

B. Mock-Ups

1. Prepare mockups and coordination with other trades and millwork/furniture as required for the following.
 - a. Passive/location based mock-ups for CBP review and approval for the typical rooms that have a combination of duress buttons, key switches, local duress annunciators and remote door release buttons.
 - 1) Outbound Interview rooms
 - b. Passive/location based mock-ups for CBP/GOAA review and approval for international/domestic mode control reader and all remote LED annunciator typical locations.

1.6 QUALITY ASSURANCE

- A. In addition to all requirements as specified by Specification Section 28 05 00 the Access Control system shall also be provided in accordance with the following requirements.
1. The physical access control system equipment manufacturer shall be an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQ Q9001-1997.
 2. All control equipment must have transient protection to comply with UL864 requirements. Where security circuits leave the building, additional transient protection must be provided for each circuit. Devices must be UL listed under standard #497B (Isolated Loop Protectors). Refer to specification section 28 05 00 for additional information related to the installation of all surge and transient protection requirements.
 3. The Contractor shall be an established security alarm provider, duly licensed to provide security systems within in the municipality of the project location and is an authorized distributor of the equipment supplied for this project with full manufacturer's warranty privileges.

4. Installation and start-up of all systems shall be under the direct supervision of the certified Contractor. This system supplier shall be an accredited and authorized distributor of the equipment manufacturer of all equipment being provided and be prepared to offer a service contract for system maintenance at completion of the guarantee period. Personnel providing wiring, terminations, programming, and configuration shall be certified by the Manufacturer of the existing system: Software House C-Cure 9000.
5. The contractor shall show satisfactory evidence, upon request, that the equipment supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
6. Contractor shall coordinate the installation and wiring terminations for all applicable door hardware associated with all doors equipped with electronic security protection. Refer to related electronic security system drawings and related all Divisions 08 and 28 Specification Sections related for all electronic door security measures.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Refer to Specification Section 28 05 00 for additional information:

1.8 RECORD DOCUMENTS

- A. Comply with all requirements of Specification Section 28 05 00.

1.9 SOFTWARE AGREEMENT

- A. Comply with all requirements of Specification Section 28 05 00.

1.10 OPERATIONS AND MAINTENANCE

- A. Comply with all requirements of Specification Section 28 05 00.

1.11 SPARE MATERIAL

- A. In addition to all requirements as specified by Specification Section 28 05 00 the following spare materials shall be provided as part of this project:
 1. Two Percent (2%) 13.56 MHz proximity card readers with keypad of each type used in the project as spares.
 2. Two Percent (2%) local audible/visual devices of each type used in the project as spares.
 3. Two Percent (2%) International/Domestic mode annunciators used in the project as spares.
 4. Two Percent (2%) duress buttons and key switches of each type used in the project as spares.

- B. All spare materials shall be delivered at the time of final acceptance of the system(s). At no time is the contractor to use the spare materials provided for this project to replace malfunctioning equipment and or components prior to final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Comply with all requirements of Specification Section 28 05 00.

2.2 MANUFACTURERS

- A. Acceptable manufacturers for this project, providing full compliance with this Specification Section and all requirements of Specification 28 05 00 shall be as follows:
 - 1. C-Cure9000 - No Substitutions as this is an expansion of an existing system.
- B. Manufacturers listed as acceptable shall not negate the contractor's responsibility for providing the PACS system in accordance with all functions and performance requirements of this specification.

2.3 SYSTEM DESCRIPTION

- A. The contractor shall extend the existing system to provide a fully operational TCP/IP enterprise based physical access control system (PACS). The scope of work shall include, but not be limited to, the furnishing and installation of all, access control system components, devices and equipment, connectivity to all door hardware, cabling, conduits, and all appurtenances as required to meet the design and performance requirements as indicated on the contract drawings and/or as herein specified.
 - 1. The Contractor shall provide the necessary integration of all door hardware (furnished under Division 08 Specification), fire alarm systems, intrusion detection system, duress buttons, surveillance system cameras, as well as all system programming and training required to provide a fully operating system as indicated on the contract drawings and/or as herein specified.
- B. The PACS shall communicate with all network servers, intelligent door controllers, and client workstations residing on the access control systems network by LAN/WAN connections utilizing standard TCP/IP communications protocols.
- C. The PACS extension of this contract shall provide all existing system functions.
- D. Coordinate the interface to life safety systems with the appropriate trades. Electronic locks shall not inhibit egress of a code identified means of egress pathway in the event of any emergency.

- E. All PACS intelligent door controllers shall seamlessly integrate with the primary access control network server located at the North Terminal. In addition, the remote panels shall integrate all associated door position switches, egress devices and electric door hardware, as well as any baggage handling doors, overhead / sliding door controller, and gate arm controllers. The programming at the access control network servers shall make the final determination of access granted and denials. All system output programs assigned via control-by-event interlock programming to be activated by valid access indication shall be executed, and the associated system outputs shall be activated.
- F. All Intelligent Door Controllers shall be provided with an integral power supply and battery charger designed to charge required amp hour batteries in order to support up to 24-hours of standby system operation.

2.4 MATERIALS

- A. Comply with all requirements of Specification Section 28 05 00.

2.5 PERFORMANCE REQUIREMENTS

- A. All current performance features and characteristics of the existing system shall be fully extended to the extension of this system by this contract. This includes any existing hardware or software upgrades or modifications as needed for a fully operation extension

2.6 AUXILIARY POWER SUPPLIES

- A. Provide as required UL listed auxiliary power supplies with battery backup in sufficient quantities to ensure proper operation of the entire system. Power supplies shall be 24 volts as required to support all power requirements associated with all electronic door locking mechanisms, ancillary system controls and all manufacturers recommendations. The auxiliary power supply units shall at the minimum meet the following requirements
 1. The power supplies shall size to provide power for all access control system electronic door locks, and/or remote ancillary items and panels.
 2. The power supply shall be rated at a minimum of 9.0 amps continuous of regulated 24-volt power as required by the manufacturer recommendations. It shall include an integral charger designed to charge required amp hour batteries in order to support 4-hour standby power for all alarm, processor and door lock operations.
 3. The auxiliary power supplies shall include power limited circuitry, per 2003 UL standards and shall be UL listed.
 4. Altronix Maximal7 with enclosure or approved equal which includes (2) Altronix ACM8CB power distribution modules. Provide additional power supply and/or additional power distribution modules as required per each panel's load and configuration. Alternate power supplies and distribution configuration by Life Safety Power is approved as long as it does not exceed the shown panel footprint in regard to wall space.

2.7 PROCESSING AND AUTHENTICATION CONTROL DEVICES

- A. Door Controllers / Reader Modules / Input/Output Modules and associated power supplies (non-door devices).
1. Furnish and install all components that are fully compatible with the existing C-Cure 9000 system. IStar Ultra SE controllers and listed modules and accessories should be provided as required to expand the existing system.
 2. Each PACS door controller location shall include the GCM main controller and (2) ACM interface cards.
 3. Each PACS door controller location shall include an intelligent power supply with battery backup capable of no less than 4 hours under normal traffic. Power supplies shall be monitored for 'abnormal' power conditions as well as monitored tamper switch provided.
 4. Provide 2GB of memory for local storage of card information.
 5. Each door controller shall have 20% spare capacity in regard to remaining reader ports available for future connections.
 6. Expansion modules: iStar RM-4E door, R8 output, and I8 input modules can be used as needed. Remote RM-4E modules shall only be used when the distance from door to PACS controller exceeds manufacturer's maximum distance for door device connections.
- B. Contactless Readers – GOAA Approved Standards
1. GOAA: Furnish and install combination contactless\keypad type card readers as indicated on the Contract drawings. All contactless readers shall be ISO 14443A compliant operating at a minimum frequency of 13.56 MHz. Provide HID Signo Keypad Reader 40K units that are fully compatible with the existing system and meet GOAA current standards. For all interior locations, units with the plug option (no pig tail) shall be provided (Model 40KTKS-T2-000000). For all exterior locations, units with the pigtail shall be provided (Model 40KNKS-T2-000000). Plastic spacers shall be used when readers are mounted on metal surfaces. GOAA standard readers listed above shall be provided and installed at all PACS door types except for PACS type 6A and 6J. For portals with in/out readers, the readers shall be wired in parallel so that only one reader port utilized per portal is required, unless otherwise noted in schedules and/or door details.
 2. CBP: Furnish and install combination contactless\keypad type card readers as indicated on the Contract drawings. In addition to the same requirements as the GOAA units specified above, these units shall be capable of reading the CBP issued PIV cards. HID pivCLASS RPK40 units or equal with the plug option (no pig tail) shall be provided and fully compatible with the existing system and meet GOAA and CBP current standards (Model 921NHRTEK0033A, flashed with CFG SEC9X-CRD-0-004M REV J) to match phase 1 installed readers. Plastic spacers shall be used when readers are mounted on metal surfaces. These units shall be provided and installed at all PACS door type 6A, 6J, and 6JR locations.

2.8 DOOR CONTROL DEVICES

- A. Request to Exit
1. Supplied and installed under the Door Hardware Specification Section 08 71 00. Wired by Division 28 Contractor. Coordinate with door hardware provider for exact device type, quantities, wiring requirements and locations.

- a. In addition to causing the release of the door lock, the unit shall cause the bypassing of the door contact for a period of time as determined by GOAA and OAR.
 - b. This function can be either integral into the door lock lever or panic bar – incorporating into the door hardware eliminates alarms and is a project requirement.
- B. Door Position Switch/Door Contact
1. Supplied and installed under the Door Hardware Specification Section 08 71 00. Wired by Division 28 Contractor. Coordinate with door hardware provider for exact device type, quantities, wiring requirements and locations
- C. Delayed Egress Devices
1. Supplied and installed under the Door Hardware Specification Section 08 71 00. Wired by Division 28 Contractor. Coordinate with door hardware provider for exact device type, quantities, wiring requirements and locations.
- D. Electric Power Transfer
1. Supplied and installed under the Door Hardware Specification Section 08 71 00. Wired by Division 28 Contractor. Coordinate with door hardware provider for exact device type, quantities, wiring requirements and locations.
- E. Local Audible / Visual Device
1. Wheelock MTWP-24/75W-NW Multi-tone with a white strobe (Amber strobe for exterior locations) is the GOAA standard to be provided and installed.
- F. International / Domestic Mode Visual Annunciators
1. Federal Signal SCB-024TC tri-color wall units in each gate's boarding pier to match GOAA standards used in Phase 1 Terminal C gates.
 2. Federal Signal USI/USIS-024TC tri-color ceiling units in each gate's hold room side to match GOAA standards used in Phase 1 Terminal C gates.
 3. Above units shall indicate the status of each gate using three different colors: International mode, Domestic mode, and non-operational. Color assignment for each mode shall be coordinated with GOAA and CBP to match exiting GOAA international gates. Units shall be 24vdc and powered and controlled from the PACS. Units shall be mounted adjacent to type 6J and 6JR readers located in each boarding pier as well as one ceiling mounted on the hold room side of each pier door to provide local indication of interlocking status for international and domestic mode. Refer to Appendix A for functional operation.

- G. Each access-controlled door shall have a door interface box (DIB) installed on the secure side of the door whenever possible. The DIB shall be the intermediate termination point between the door devices and the access control panel. Each box shall be min 15.75" x 15.75" x 8" NEMA 1 with locked hinged door. DIB shall be locked with key selected by the GOAA. Each box shall have a terminal strip with enough terminations to accommodate all devices being interfaced at the location. DIBs shall not be located directly over door. DIBs shall be mounted no higher than 10' AFF and shall be located adjacent to doors so that maintenance at the box does not interfere with passage thru the door that is being worked on. All conductors shall be labeled in the enclosure with self-laminating wire labels indicating door and device. Some PACS doors, due to Architecture or field conditions, may require the DIB to be placed in the floor below and the Contractor shall adjust door details and door device cable/raceway routing as required. Contractor to field coordinate each DIB location and include any labor or additional material costs due to this field coordination at no additional cost to the project.
- H. Door Tags
1. Doors being installed with PACS shall have a GOAA standard door tag mounted on the header of the door, both sides.
- I. Duress Buttons and Key Switches
1. CBP Buttons
 - a. Duress - Under counter latching and keyed reset: Amseco #HUSK-20 to match GOAA STC phase 1 project.
 - b. Duress - Wall mounted, momentary, normally open contact, red mushroom button without any labeling on button or plate: Security Door Controls (SDC) #4320-U-R-B to match GOAA STC phase 1 project.
 2. Key switch: Units that allow both enabling/disabling of duress button as well as resetting local AV device locally shall be provided. Securitron #MKA2 to match GOAA STC phase 1 project. Coordinate with Division 08. Cylinder and core area supplied and installed under the Door Hardware Specification Section 08 71 00, wired and connected by Division 28.
- J. Electric Door Strike and Electrified Locks
1. Supplied and installed under the Door Hardware Specification Section 08 71 00. Wired by Division 28. Coordinate with door hardware provider for exact device type, quantities, wiring requirements and locations.
- K. Cabling
1. General: Refer to PACS door and misc. details for cable requirements to each device. Cables listed below are generic cable types and listed for reference only. Contractor shall verify the manufacturer's recommended cables and use the appropriate types. All cables provided as part of this contract shall be rated for actual installation such as plenum, riser, outside plant, etc. The sized of some of these cables may vary, and the conduit size shall be adjusted accordingly. Contractor shall provide fill calculations for the actual cables proposed. Contractor shall not exceed minimum 40% fill per NEC requirements, Contractor shall upsize any conduit as required.

2. Type A – AV and other misc. output devices: 4 conductor 18awg unshielded. Belden 5302UE or equal.
3. Type B - Door contacts and other misc. input devices: 4 conductor 22awg unshielded. Belden 5502UE or equal
4. Type C – Card readers: 4 pair 18awg shielded. Belden 5343FE or equal.
5. Type D – Delayed egress hardware: 4 conductor 18awg unshielded. Belden 5302UE or equal. 2 conductors for authorized release and other 2 for delayed egress activation alarm.
6. Type I - Backbone input cable from controller to door interface box: 12 conductor 22awg unshielded. Belden 5545FE or equal
7. Type L – Lock Power: 4 conductor 18awg unshielded. Belden 5302UE or equal. 2 conductors for switched power (constant power for delayed locks) and 2 conductors for fire alarm release for delayed egress.
8. Type O – Backbone output cable from controller to door interface box: 7 conductor 16awg unshielded. Belden 5205UE or equal.
9. RS-485: 1 twisted pair shielded. Belden 9841 per Software House requirements for controller to RM4E reader modules (PBB jetway control application).

PART 3 - EXECUTION

3.1 COORDINATION

- A. Comply with all requirements of Specification Section 28 05 00.
- B. Baggage Handling System: Contractor is required to coordinate with the Design/Build Baggage Handling System Contractor for all monitoring and control functions as defined in this project related to belt control and security shutter/chop door alarms. BHS Contractor control panels/interface point locations shall be coordinated and not more than 100 feet away from the PACS DIB panels to facilitate troubleshooting of both boxes by one technician.
- C. Building Management System: Contractor is required to coordinate with the BMS Contractor for PACS relay outputs for the BMS use for pressurization of boarding piers. Status of each gate's jetway door shall be provide – one relay output for each gates jetway door type 1J in 'extended hold open'. Refer to PACS/BMS interface detail.
- D. Elevator: Contractor is required to coordinate with the elevator Contractor for all connectivity and control functions as defined in this project related to hall call and in-cab floor select control/restrictions. All reader installation, interface and connection to any travel cabling shall be coordinated.

- E. Jetway Bridge Controls: Contractor is required to coordinate with the passenger boarding bridge (PBB) contractor/vendor for all connectivity and control functions as defined in this project related to jetway control/restrictions. As well as control/monitoring of each jetways service door. All reader installation, interface, local enclosure housing provision, local power provision, and connection to any travel cabling shall be coordinated. Jetway control and stairway door readers shall utilize RS-485 from door controller located in GOAA IDF rooms to a PBB interface box then utilize PBB provided travel cable. Local Software House RM-DCM-2 module/enclosure and an Altronix AL125UL shall be housed above each jetways service door for connection to travel cable, readers, and power. Refer to PACS type 1JS and JBX details for additional information.

3.2 EQUIPMENT PROTECTION

- A. Comply with all requirements of Specification Section 28 05 00.
 - 1. Examine all physical and environmental conditions, door hardware specifications, equipment locations, and local and wide area network connectivity requirements impacting the installation of the systems and report any unsatisfactory conditions in writing to GOAA and Design Professional.

3.3 INSTALLATION

- A. Comply with all requirements of Specification Section 28 05 00.

3.4 WORK PERFORMANCE

- A. In addition to all requirements as specified by Specification Section 28 05 00 the Access Control system shall also be provided in accordance with the following requirements:
 - 1. Prior to the final programming of any systems, the Contractor shall provide a review with GOAA and OAR addressing all system features, functions, operations, integrated system responses, graphic maps and related operational programming.
 - a. Failure to provide this review and get final sign-off prior to programming shall result in any costs related to changes requested by GOAA and OAR at no additional costs to the project.

3.5 EQUIPMENT INSTALLATION

- A. In addition to all requirements as specified by Specification Section 28 05 00 the PACS shall also be provided in accordance with the following requirements:
 - 1. All TCP/IP based physical access control system network cabling shall utilize Category-6 UTP cables and installed in accordance with the requirement of Specification Sections 27 05 00 and 27 10 00. All cabling shall not contain any AC carrying conductors or non-associated system cables within the cable raceways\conduits or cable bundles.

- a. All PACS cabling being routed from the facility to any remote location external in the project shall be utilize fiber optic cable and installed in dedicated conduits, unless otherwise detailed. This Contractor shall coordinate all fiber optic cabling requirements with the Division 27 Contractor.
 - b. Contractor shall provide equipment, components, devices, hardware, patch panels and all appurtenances necessary to provide a fully operational system utilizing a UTP cabling topography. Coordinate all system cabling with system provider prior to shop drawing submission. Coordinate all fiber and network related system cabling with Division 27 Contractor prior to shop drawing submission.
2. In addition to all power requirements stipulated in Specification Section 28 05 00 and the related Chapters of this Specification Sections, all electrical power for remote system components shall be obtained from dedicated power supplies. All 120-Volt electrical power for any PACS components and/or devices shall be supplied from the emergency / security branch form the nearest appropriate emergency electrical distribution panels. System components employing the use of plug-in transformers for power shall not be acceptable. Division 28 shall coordinate all 120-Volt requirements with Division 26.
- a. All system power supplies serving exterior system components or devices shall be provided with the appropriate transient surge and suppression protection on both the line side as well as the load side. Refer to Specification Section 28 05 00 for additional requirements.
 - b. Installation of all equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate trade contractors.

3.6 CABLE INSTALLATION AND REQUIREMENTS

- A. Comply with all requirements of Specification Section 28 05 00.

3.7 COMMUNICATIONS CABLING REQUIREMENTS

- A. Comply with all requirements of Specification Section 28 05 00.

3.8 ELECTRICAL POWER DISTRIBUTION

- A. Comply with all requirements of Specification Section 28 05 00.

3.9 TRANSIENT VOLTAGE SUPPRESSION

- A. Comply with all requirements of Specification Section 28 05 00.

3.10 GROUNDING AND BONDING

- A. Comply with all requirements of Specification Section 28 05 00.

3.11 EQUIPMENT IDENTIFICATION

- A. Comply with all requirements of Specification Section 28 05 00.

3.12 MAINTENANCE AND SERVICE

- A. Comply with all requirements of Specification Section 28 05 00.

3.13 WARRANTY

- A. Comply with all requirements of Specification Section 28 05 00.

3.14 FIELD SERVICES

A. Testing

1. In addition to all requirements as specified by Specification Section 28 05 00 the physical access control system shall also comply with the following requirements.
 - a. The completed access control system shall be fully tested in accordance with all requirements of NFPA 731. Upon completion of a successful testing, the contractor shall so certify in writing to GOAA and OAR all was completed, tested, certified and left in first class operational condition, include all completed NFPA 731 certification and test reports.
 - b. The service of a competent, factory-trained engineer or technician authorized by the equipment manufacturer shall be provided to technically supervise installation and participate during initial system programming, start-up, final testing, and assist in the final acceptance testing as well as GOAA demonstrations.
 - c. At the minimum all acceptance testing, demonstrations and training shall include, but not be limited to the following:
 - 1) Secondary Power Distribution Capabilities
 - 2) Security Device Monitoring/Control Functions.
 - 3) Door Monitoring/Control Functions.
 - 4) HMI GUI map Integration and Functionality.
 - 5) Video Surveillance System Integration and Operations.
 - 6) Video Surveillance Camera Alarm Call-up Functions into both the GOAA shared and the CBP specific VSS...
 - 7) Network Connectivity.
 - 8) International / Domestic mode control, operation, annunciation, and release functions.
 - 9) Seamless Integration to Existing c-Cure 9000 System.
 - 10) All programming and operational functions and features as herein specified.
 - 11) Cable Supervision System (random points to be selected by GOAA and/or OAR).
 - d. Demonstrate successful operation of each system and subsystem. The demonstration shall include, but not be limited to the following:
 - 1) Designate actual location of each component of a system or subsystem and demonstrate successful operation of its designed function and its relationship to other components within the system.

- 2) Demonstrate the operation of all client servers, door interlock and bypass functions, camera call-up operations, graphic map functions, administration set-up, configurations and operations, badging functions and operations, emergency operations and system reboot procedures.
 - 3) Demonstrate all systems and subsystems operations by actual “LOCK/UNLOCK, ARM/DISARM” cycling showing how to work controls, how to reset devices, how to replace fuses and emergency operating/operations procedures.
- e. Upon final inspection, a factory-trained and certified representative of the equipment manufacturer shall demonstrate to GOAA that the system functions properly in every respect and is in full compliance with the contract documents. This requirement is in addition, to all testing requirements listed in Specification Section 280500 and related Specification Sections.

3.15 TRAINING

- A. Comply with all requirements of Specification Section 28 05 00

APPENDIX A – FUNCTIONAL OPERATION

MAN DOOR TYPE 1A(Single) & 2A(Double) – READ IN-FREE OUT VIA LEVER

1. Monitor: RTE of electric lock (lever) and door status from DPS.
2. Control: Release of door (electric lock) and local AV sounder.
3. Valid access: (from non- egress side) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Valid egress: (from egress side) When inside hardware is utilized, the requests to exit switch shall shunt the DPS for a user defined time period. Upon door closing the door shall close and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.

MAN DOOR TYPE 6A(CBP Single) – READ IN-FREE OUT VIA LEVER

1. Monitor: N/A – Keyless entry only configuration.
2. Control: Release of door (electric lock).
3. Valid access: (from ingress side) Upon valid reader activation, the PACS shall immediately release the lock for a user defined time period. Upon door closing the door shall lock.
4. Valid egress: (from egress side) Utilize inside mechanical egress hardware.

MAN DOOR TYPE 1B(Single) & 2B(Double) – READ IN-FREE OUT VIA PUSHBAR

1. Monitor: RTE of push bar and door status from DPS.
2. Control: Release of door (electric lock) and local AV sounder.
3. Valid access: (from non- egress side) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Valid egress: (from egress side) When inside hardware is utilized, the requests to exit switch shall shunt the DPS for a user defined time period. Upon door closing the door shall close and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.

MAN DOOR TYPE 2BA(Double) – READ IN-READ OUT (ALARM VIA PUSHBAR)

1. Monitor: Door status from DPS.

2. Control: Release of door (electric lock) and local AV sounder.
3. Valid access: (from either side) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate, and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from either side) If door is forced open from ingress side or push bar used on egress side without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.

MAN DOOR TYPE 1C(Single) & 2C(Double) – READ IN-READ OUT (DELAYED EGRESS)

1. Monitor: Door status from DPS, FA relay activation, and delayed egress alarm status,
2. Control: Release of door (delayed egress side), delayed egress alarm reset/relock, and local AV sounder
3. Valid access: (from both sides) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Delayed egress: (from egress side) When inside hardware is utilized without activation of reader, then a delayed egress activation starts (after 1-3 second nuisance delay), activates delayed egress alarm, and internal hardware sounder activates. After 30 seconds the door unlocks. If and when the door is opened, then a door forced open signal is active, local AV shall activate, and a door forced open signal shall create an alarm in the system. Reset/relock is accomplished locally at the door or remotely from the PACS alarm workstations.
6. Fire Alarm Activation: Fire alarm relay in the IDF adjacent to PACS door controller shall create an alert in the system that the door is unlock. Additionally, the FA relay shall be directly connected to FA release of delayed egress to eliminate the delay before unlocking. If and when the door is opened, then a door forced open signal is active and a door forced open signal shall create an alarm in the system

SINGLE MAN DOOR TYPE 1J – READ IN-RTE OUT VIA PANIC BAR AND DOOR HOLD OPEN

1. Monitor: RTE of push bar and dual door status from DPS. For GOAA to program 'extended hold open' each door shall be provided with a DPDT (dual DPS contacts) version and both contacts monitored by PACS.
2. Control: Release of door (electric lock), local AV sounder, and hold open device. Additionally, a PACS relay output shall provide the status of each gates 1J status of 'extended hold open' so that the BMS can pressurize the boarding pier.
3. Valid access: (from non- egress side) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time. Upon door closing

the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.

4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Valid egress: (from egress side) When inside hardware is utilized, the requests to exit switch shall shunt the DPS for a user defined time period. Upon door closing the door shall close and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
6. Hold Open operation: Hold opens will normally be de-energized. Upon activation of command code for the reader an agent can specify the time allowed for the doors to be held in an open position. The DPS shall also be shunted for the same user defined time period. Prior to expiration of time, the keypad shall should to allow agents to reenter a new time or close the door. If door is not closed by expiration time, then the local AV device shall activate a door ajar signal sent to the system. If the door is closed prior to expiration, the DPS shunt shall ends and return the hold open device to non-energized.

SINGLE MAN DOOR TYPE 1JS(Single) – READ IN-READ OUT – JETWAY SERVICE DOOR

1. Monitor: Door status from DPS.
2. Control: Release of door and local AV sounder.
3. Valid access: (from both sides) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from either side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.

DURESS, AV, AND KEYSWITCH TYPE – CBP OUTBOUND INTERVIEW ROOMS

1. Monitor: Under desk duress and wall mounted duress buttons (2) as well as outside the room key switch status
2. Control: Local AV sounder
3. Key switch on: Upon duress button activation the PACS shall activate the local AV device and create a duress alarm signal into the system. Turning the key switch into the off position shall silence the local AV device. Duress button shall be manually reset so the system can be cleared.
4. Key switch off: Which the key switch in the off position the duress button will be bypassed, preventing any activation causing an alarm, and the AV device will remain off.

MAN DOOR TYPE 1N(Single) and 2N(Double) – DELAYED OUT ONLY (DELAYED EGRESS)

1. Monitor: Door status from DPS, FA relay activation, and delayed egress alarm status.

2. Control: Release of door (delayed egress side), delayed egress alarm reset/relock, and local AV sounder
3. Valid access: (from non-egress side) Not allowed for this door type, but can be done remotely from PACS alarm monitoring/control workstation.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Delayed egress: (from egress side) When inside hardware is utilized without activation of reader, then a delayed egress activation starts (after 1-3 second nuisance delay), activates delayed egress alarm, and internal hardware sounder activates. After 30 seconds the door unlocks. If and when the door is opened, then a door forced open signal is active, local AV shall active, and a door forced open signal shall create an alarm in the system. Reset/relock is accomplished locally at the door or remotely from the PACS alarm workstations.
6. Fire Alarm Activation: Fire alarm relay in the IDF adjacent to PACS door controller shall create an alert in the system that the door is unlock. Additionally, the FA relay shall be directly connected to FA release of delayed egress to eliminate the delay before unlocking. If and when the door is opened, then a door forced open signal is active and a door forced open signal shall create an alarm in the system. Reset/relock is accomplished locally at the door or remotely from the PACS alarm workstations.

MAN DOOR TYPE 1P(Single) and 2P(Double) – MONITORED ONLY

1. Monitor: Door status from DPS
2. Control: None
3. Valid access: (from either side) Not allowed for this door type, but door alarm monitoring can be remotely bypassed/shunted from PACS alarm monitoring/control workstation.
4. Non-valid access: (from either side) If door is opened from either side then a door open signal shall create an alarm in the system.

MAN GATE 1S(Single) – READ IN-FREE OUT MAN GATE

1. Monitor: RTE of electric lock (lever) and door status from DPS.
2. Control: Release of door (electric lock) and local AV sounder.
3. Valid access: (from non- egress side) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Valid egress: (from egress side) When insidrdware is utilized, the requests to exit switch shall shunt the DPS for a user defined time period. Upon door closing the door shall close and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.

MAN DOOR TYPE 2J(Double) – READ IN-READ OUT AND DOOR HOLD OPEN

1. Monitor: Door status from DPS, FA relay activation, and delayed egress alarm status,
2. Control: Release of door (delayed egress side), delayed egress alarm reset/relock, and local AV sounder
3. Valid access: (from both sides) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Delayed egress: (from egress side) When inside hardware is utilized without activation of reader, then a delayed egress activation starts (after 1-3 second nuisance delay), activates delayed egress alarm, and internal hardware sounder activates. After 30 seconds the door unlocks. If and when the door is opened, then a door forced open signal is active, local AV shall activate, and a door forced open signal shall create an alarm in the system. Reset/relock is accomplished locally at the door or remotely from the PACS alarm workstations.
6. Fire Alarm Activation: Fire alarm relay in the IDF adjacent to PACS door controller shall create an alert in the system that the door is unlock. Additionally, the FA relay shall be directly connected to FA release of delayed egress to eliminate the delay before unlocking. If and when the door is opened, then a door forced open signal is active and a door forced open signal shall create an alarm in the system
7. Hold Open operation: hold opens will normally be de-energized. Upon activation of command code for the reader an agent can specify the time allowed for the doors to be held in an open position. The DPS shall also be shunted for the same user defined time period. Prior to expiration of time, the keypad shall should to allow agents to reenter a new time or close the door. If door is not closed by expiration time then the local AV device shall activate a door ajar signal sent to the system. If the door is closed prior to expiration, the DPS shunt shall ends and return the hold open device to non-energized.

MAN DOOR TYPE 2JA(Double) – READ IN-READ OUT (RLC MASTER) AND DOOR HOLD OPEN

1. Monitor: Door status from DPS and delayed egress alarm status.
2. Control: Release of door/delayed egress alarm reset/relock, local AV sounder, and hold open devices
3. Valid access: (from both sides) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Delayed egress: (from egress side) When inside hardware is utilized without activation of reader, then a delayed egress activation starts (after 1-3 second nuisance delay), activates delayed egress alarm, and internal hardware sounder activates. After 30 seconds the door

unlocks. If and when the door is opened, then a door forced open signal is active, local AV shall activate, and a door forced open signal shall create an alarm in the system. Reset/relock is accomplished locally at the door or remotely from the PACS alarm workstations.

6. Fire Alarm Activation: Fire alarm relay in the IDF adjacent to PACS door controller shall create an alert in the system that the door is unlock. Additionally, the FA relay shall be directly connected to FA release of delayed egress to eliminate the delay before unlocking. If and when the door is opened, then a door forced open signal is active and a door forced open signal shall create an alarm in the system
7. Hold Open operation: hold opens will normally be de-energized. Upon activation of command code for the reader an agent can specify the time allowed for the doors to be held in an open position. The DPS shall also be shunted for the same user defined time period. Prior to expiration of time, the keypad shall should to allow agents to reenter a new time or close the door. If door is not closed by expiration time then the local AV device shall activate a door ajar signal sent to the system. If the door is closed prior to expiration, the DPS shunt shall ends and return the hold open device to non-energized.

MAN DOOR TYPE 2JB(Double) – READ IN-READ OUT (RLC SLAVE) AND DOOR HOLD OPEN

1. Monitor: Door status from DPS and delayed egress alarm status.
2. Control: Release of door, delayed egress alarm reset/relock, local AV sounder, and hold open devices
3. Valid access: (from both sides) This door shall follows the same lock/unlock action as adjacent door type 2JA.
4. Non-valid access: (from non-egress side) If door is forced open without valid card reader activation at adjacent door 2JA, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Delayed egress: (from egress side) When inside hardware is utilized without activation of reader, then a delayed egress activation starts (after 1-3 second nuisance delay), activates delayed egress alarm, and internal hardware sounder activates. After 30 seconds the door unlocks. If and when the door is opened, then a door forced open signal is active, local AV shall activate, and a door forced open signal shall create an alarm in the system. Reset/relock is accomplished locally at the door or remotely from the PACS alarm workstations.
6. Fire Alarm Activation: Fire alarm relay in the IDF adjacent to PACS door controller shall create an alert in the system that the door is unlock. Additionally, the FA relay shall be directly connected to FA release of delayed egress to eliminate the delay before unlocking. If and when the door is opened, then a door forced open signal is active and a door forced open signal shall create an alarm in the system
7. Hold Open operation: This door shall follow the same hold open energized/de-energized action as adjacent door type 2JA.

MAN DOOR TYPE 2K(Double) – READ IN-READ OUT AND DOOR HOLD OPEN

1. Monitor: Door status from DPS.
2. Control: Release of door , local AV sounder, and door hold open devices.
3. Valid access: (from both sides) Upon valid reader activation, the PACS shall immediately release the lock and shunt the DPS for a user defined time period. Upon door closing the door shall lock and remove the shunt period. If the door is not closed before DPS shunt time

out, then the local AV device shall activate and a door ajar signal shall create an alarm in the system.

4. Non-valid access: (from either side) If door is forced open without valid card reader activation, then the local AV shall activate and a door forced open signal shall create an alarm in the system.
5. Hold Open operation: hold opens will normally be de-energized. Upon activation of command code for the reader an agent can specify the time allowed for the doors to be held in an open position. The DPS shall also be shunted for the same user defined time period. Prior to expiration of time, the keypad shall allow agents to reenter a new time or close the door. If door is not closed by expiration time then the local AV device shall activate a door ajar signal sent to the system. If the door is closed prior to expiration, the DPS shunt shall end and return the hold open device to non-energized.

BAGGAGE DOOR TYPE 3D – INBOUND BAGGAGE (READER CONTROL)

1. Monitor: Door status / Contact closure from BHS PLC or BHS provided sensors
2. Control: Release of start button at each tug man BHS activation station
3. Valid activation/starting: Upon valid reader activation, the PACS shall send a signal to BHS control station to allow tug man start button to be activated.
4. Alarm condition: The BHS shall provide a contact closure of an 'unsecure condition' after 2 minutes of no belt movement and the security / chop door is not secure. PACS upon receipt of this signal shall cause an alarm into the system.
5. Contractor shall coordinate all interfacing, installation, and functionality with BHS design/build contractor/project.

SPECIALTY TYPE 4A – ELEVATOR – CARD READER HALL

1. Monitor: None
2. Control: Activation of elevator hall call buttons (assumed to be both up and down unless specified in PACS door schedule)
3. Valid activation/starting: Upon valid reader activation, the PACS shall send a signal to elevator controller to allow hall/call select buttons for a user defined time period.

SPECIALTY TYPE 4B – ELEVATOR – CARD READER IN-CAB/INSIDE ELEVATOR

4. Monitor: None
5. Control: Activation of elevator floor call buttons (refer to PACS door schedule for floor/s to be controlled)
6. Valid activation/starting: Upon valid reader activation, the PACS shall send a signal to elevator controller to allow floor/call select button for a user defined time period.

SPECIALTY DOOR TYPE 4C(SINGLE READER) AND 4J(DUAL READER) – POWERED OVERHEAD ROLL UP – CARD READER

1. Monitor: Door status from DPS
2. Control: Release of start button at overhead operation station

3. Valid activation/starting: Upon valid reader activation, the PACS shall send a signal to overhead door control panel to allow open button to be activated and shunt the DPS for a user defined time period. If the doors are not closed within a certain time period, then a door ajar signal call be created.
4. Non-valid access: (from either side) If door is forced open without valid card reader activation, then a door forced open signal shall create an alarm in the system.
5. Manual Stopping: The overhead door can be manually closed at any time. When the door closes, the DPS shunt time shall expire.

DOOR TYPE 4G – OVERHEAD DOOR – MONITORED ONLY

1. Monitor: Door status from DPS
2. Control: None
3. Valid access: (from either side) Not allowed for this door type, but door alarm monitoring can be remotely bypassed from PACS alarm monitoring/control workstation.
4. Non-valid access: (from either side) If door is opened from either side then a door open signal shall create an alarm in the system.

DOOR TYPE 4K – SLIDING GLASS DOORS BOARDING PIER

1. Monitor: Door status from DPS
2. Control: Door open signal to sliding door controller and international/domestic mode status to dynamic sign located at each door.
3. Valid access (either side): Upon valid reader activation, the PACS shall send a signal to sliding door control panel to open the door as well as shunt the DPS for a user defined time period. If the doors are not closed within a certain time period, then a door ajar signal call be created.
4. Non-valid access: If door is forced open without valid card reader activation, then a door forced open signal shall create an alarm in the system.
5. Dynamic Sign: Program a PACS output so that it changes state when the door's associated gate in put into international mode. This change in gate status will cause the dynamic sign (type C42) to change content. Coordinate interface and connection with signage contractor.

SPECIALTY TYPE JBX – JETWAY BRIDGE CONTROLLER READER (EXPANSION GATES)

1. Monitor: Jetway control bypass switch
2. Control: Activation to allow the use of the jetway controls (contact closure to jetway controller)
3. Valid activation/starting: Upon valid reader activation, the PACS shall send a signal to jetway controller to allow the jetway to be controlled for a user defined time period and log useage.

TYPE 6J – BOARDING PIER DOMESTIC/INTERNATIONAL MODE READER AND ANNUNCIATOR

1. Monitor: Separate door status from each door's DPS (2J and 4K).

2. Control: (3) LED lights on annunciator plate: Color 1 shall indicate “Domestic Mode” with holdroom 2J door unlocked and swing gate 4K door locked. Color 2 shall indicate “International Mode” with holdroom 2J door locked and swing gate 4K door unlocked. Three annunciator units shall be provided per gate, one wall mounted above control reader on domestic side, one wall mounted above control reader on FIS side, a ceiling mounted on the holdroom side of the boarding pier door.
3. Mode Control from each gate reader: Upon valid reader activation and keypad code from either control reader, the PACS shall toggle between Domestic and International mode.
4. Interlock: Only one set of doors shall be electrically unlocked at a time. If one door is unlocked and attempt is made at the other then the other door shall not unlock. Door shall be programmed to be interlocked in a sally port type configuration.

TYPE 6JR – BOARDING PIER DOMESTIC/INTERNATIONAL MODE READER AND ANNUNCIATOR (RLC / COBUS LOADING AREA)

1. Monitor: Separate door status from each door’s DPS (lower 2JA & 2JB and upper 2JA).
2. Control: (3) LED lights on annunciator plate: Color 1 shall indicate “Domestic Mode” with lower holdroom 2JA & 2JB doors unlocked and upper FIS 2JA door locked. Color 2 shall indicate “International Mode” with lower holdroom 2JA and 2JB doors locked and upper FIS 2JA door unlocked. Three annunciator units shall be provided, one wall mounted above control reader in RLC circulation area, one wall mounted above control reader on FIS side, and one wall mounted near holdroom area.
3. Mode Control from each gate reader: Upon valid reader activation and keypad code from either control reader, the PACS shall toggle between Domestic and International mode.
4. Interlock: Only one set of doors shall be electrically unlocked at a time. If one door is unlocked and attempt is made at the other then the other door shall not unlock. Door shall be programmed to be interlocked in a sally port type configuration.

END OF APPENDIX A

END OF SECTION 28 13 00

PART 1 - GENERAL

1.1 STIPULATIONS

- A. Project drawings and general provisions of the Contract, including but not limited to all General and Supplementary Conditions, Division 01 and all related Specification Sections shall apply to this Section.
- B. Related Sections:
 - 1. 14 21 01 – Traction Elevators
 - 2. 14 24 00 – Hydraulic Elevators
 - 3. 26 05 01 – Basic Electrical Requirements
 - 4. 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
 - 5. 26 05 26 – Grounding and Bonding for Electrical Systems
 - 6. 26 05 29 – Hangers and Supports for Electrical Systems
 - 7. 26 05 33 – Conduit for Electrical Systems
 - 8. 26 05 33.16 – Boxes for Electrical Systems
 - 9. 26 05 34 – Outlet Boxes for Electrical Systems
 - 10. 26 05 38 – Floor Boxes
 - 11. 26 05 53 – Identification for Electrical Systems
 - 12. 27 05 00 – Common Work Elements for Communications
 - 13. 27 10 00 – Premise Distribution Systems
 - 14. 27 10 05 – Passive Optical Network
 - 15. 28 05 00 – Common Work Elements for ESS
 - 16. 28 08 00 – Cx of Life Safety and Security Systems
 - 17. 28 13 00 – Physical Access Control System
- C. Reference Symbols
 - 1. All device symbols are defined by the appropriate symbol schedules. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location.
 - a. Because of the scale of the drawings, symbols are shown on drawings as close as possible to the mounting location. Contractor shall coordinate exact locations of all equipment with all architectural drawings, mechanical, electrical drawings and reflected ceiling plans, as well as all affected trades prior to submittal of any shop drawings.
- D. Abbreviations:
 - 1. Refer to Specification Section 28 05 00 for additional information.
- E. Definitions:
 - 1. Refer to Specification Section 28 05 00 for additional information.

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This specification section applies to the following (2) two separate and dedicated systems: GOAA and CBP.

- C. The intent of this specification is to establish a standard of quality, functions, and features for the installation and expansion of the existing TCP/IP-based Video Surveillance System (VSS) as indicated on the contract drawings and/or herein specified.
1. Additionally, the scope of work shall include all necessary programming as required to seamlessly integrate the new VSS extension with the existing Qognify Situator video surveillance system platforms located in the North & South Terminal Complex. The VSS shall be an extension of the existing enterprise-based systems and shall include all work, materials, infrastructure, equipment, software, and programming as required to provide a fully operational system as herein specified. GOAA IT will be providing any headend modifications, software upgrades, or licenses related to the expansion of this existing system.
 - a. The contractor shall be responsible for providing all installation, programming, commissioning, testing, and certifications as necessary to provide a complete fully integrated and operating TCP/IP-based Video Surveillance System in accordance with the Contract Documents and/or as herein specified.
- D. The installation, performance, features, functions, software, licenses, and programming criteria as specified herein as well as all related specification sections have been designed to offer the maximum system efficiency, ease of operation, occupant safety and the protection of equipment as recommended by GOAA.
1. Any deviations from the specified criteria shall be documented, reviewed, and agreed to in writing by GOAA and Owner's Authorized Representative (OAR) prior to submission of bids. Refer to Division 01, and 28 05 00 Specification Sections for product substitutions.
 - a. The required information shall include but not limited to: reason for deviation, all differences in performance, operation, and function from the herein specified requirements, all benefits, and added features to owner as a result of the deviations and any additional incurred costs to owner for maintenance and long term ownership.
 - b. Failure to provide with the required information shall result in all shop drawing submissions being returned for non-conformance with the contract requirements.
- E. The scope of work for this project shall include, but not limited to providing all necessary conduits, cabling, equipment, components, cameras, encoder/input units, brackets, materials, and ancillary systems in order to provide a seamless and fully integrated video management system. GOAA IT will be providing servers, workstations, all software (except Situator camera license), network video recorders and storage drives.

1. It shall be the responsibility of the contractor to ensure that the installed system meets or exceeds every standard set forth in these specifications. The contractor shall be responsible for providing a complete and functional enterprise-based system, including all necessary cameras, devices, electrical power, Situator camera licenses, programming, commissioning, testing and all appurtenances as well as the integration to all ancillary systems as necessary to provide a complete and fully operational system whether specifically included in this section or not. GOAA IT will be providing servers, software, workstations, recording hardware, active network electronics as coordinated and required for the extension of this existing system.
 - a. The surveillance system, at a minimum, shall include but not be limited to all cameras, housings, mounts, Category 6 cabling, fiber optic cabling, conduits, electrical power, patch panels, network servers, network video recorders (NVR), storage arrays, video encoders, video monitors, cameras, fiber optic transceivers, remote viewing software, and all appurtenances.
 - b. It shall be the responsibility of the Contractor to provide all technical assistance including but not limited to all shop drawings, system designs, equipment and coordination with the Division 26 and 27 Contractors necessary for the proper installation all video surveillance system equipment, controls, devices, cabling, cable terminations and related system integration. The video surveillance system shall be installed in accordance with all requirements of the Contract Documents, NFPA 731 all applicable codes and standards as well as requirements of GOAA.
 - 1) The Contractor shall have a BICSI-accredited Registered Communication Distribution Designer (RCDD) professional review and seal all system shop drawings demonstrating that the contractor's design and installation methods of any structured cabling and/or network connectivity provided as part of this Contractor's scope of work related to the installation and operation of any TCP/IP – based video surveillance system components meet industry standards and best practices.
 - 2) Refer to Specification Sections 27 05 00, 27 10 00, and 27 10 05 for all TCP/IP based cabling requirements.
 2. The surveillance system shall be based on TCP/IP protocols and shall be configured as a dedicated structured cabled LAN. The Contractor shall be responsible for all coordination related to the installation of all equipment, patch panels, peripheral network components, as well as all Category-6 UTP, PON connectivity, fiber optic cabling and necessary appurtenances in accordance with all contract documents.
 - a. Any structured cabling, fiber optic cabling, and any related network connectivity shall I comply with the requirements of related Specification Sections 27 05 00, 27 10 00, and 27 10 05.
- F. It shall be the responsibility of the Contractor to provide and install all components, devices, equipment, conduits, cabling and ancillary systems and shall insure that these installed systems and\or components meet or exceed every standard set forth in these specifications.

- G. Prior to the submission of the Bid, any discrepancies or inconsistencies noted within these specifications and/or the project drawings shall be brought to the immediate attention of GOAA.
1. All equipment symbols are shown on drawings as close as possible to their intended location. Contractor shall coordinate the installation of all equipment, devices, controls, cabling, and integration of any systems with all affected trades and system contractors. The Contractor shall document all coordination requirements at the time of shop drawing submissions.
 2. The Contract Drawings for this work are diagrammatic and intended to convey the extent, general arrangement, and locations of the work. Because of the scale of these drawings, certain basic items such as access panels, conduits, cabinet sizes, penetration sleeves, pull boxes, backboxes and junction boxes may not be shown.
- H. The Contract drawings and specifications may not deal individually with every part, control, device, software or programming, which may be required to produce the equipment and/or system performance specified or as necessary for the installation and/or integration of any systems in accordance with any requirements of the Contract Documents. The Contractor shall include all such items and components, as required, for the complete and operational installation of all system components as defined by the Contract Documents, whether or not specifically indicated and/or specified.
1. If the installation of any equipment, components, raceways, cable trays, and/or ancillary systems is performed prior to coordination with all contract documents and other systems, which interferes with work of other trades, disciplines, or systems this contractor shall make necessary changes to correct the condition at no additional cost to the Project.
 2. The contractor shall be responsible for providing all equipment terminations, connections to any related systems, circuits, and/or devices as well as all coordination and programming efforts to the proper integration of all ancillary systems impacting the operation of surveillance system. Refer to the contract drawings and related specification sections for additional information.

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 and 28 05 00 in addition to the following
- B. Refer to drawing sheet TS0.00.01 for the work responsibility matrix for the scope of work required for the Video Surveillance System and for any work provided by GOAA and/or any GOAA Vendor.
- C. Where listed on the drawing responsibility matrix, the following components shall be defined as follows.
1. Network Video Storage: GOAA IT will be furnishing all required network video storage hardware and software, not limited to servers, RAID controllers, hard drives, and all required software related to recording video. Contractor shall be required to coordinate known minimum hardware/storage requirements, scheduling, installation and rack space with GOAA. NVRs for the GOAA shared cameras shall be located in the Airside and Landside GOAA MDF rooms. NVRs for the CBP specific Landside cameras will be located in the Landside CBP SLAN room.

2. Software Licenses: GOAA IT will be furnishing and installing all required VSS software licensing (except Situator camera licenses) including, but not limited to servers, VSS platform camera license expansion, recording licenses, analytic license, redundancy elements, workstation licenses, operating software license or any other software required to expand the existing system to support all new cameras and other VSS elements added under this contract. Contractor shall be required to coordinate requirements as well as scheduling license installation.
3. Headend: While not anticipated, GOAA IT will be furnishing and installing all required headend hardware and software modifications including, but not limited to servers, processors, network components, memory, hard drives, headend licenses, workstation licenses, operating software license or any other hardware or software required to expand the existing VSS system to support all new cameras and other VSS elements added under this contract. Contractor shall be required to coordinate any known change requirements as well as scheduling modifications.
4. Viewing Workstations, video decoders, and monitors: GOAA IT will be furnishing any required security workstations, decoders, and peripherals including, but not limited to workstation, encoders, keyboards, mice, printers, and monitors. Contractor shall be required to coordinate known minimum hardware requirements as well as scheduling installation with GOAA.
5. Programming to existing System: Contractor is responsible to program and properly label in a coordinated effort approved by GOAA IT and security all new system elements into the existing system. Items include, but not limited to cameras, workstations, analytics, or similar as needed to fully extend the existing system in new areas under this contract. Supervision by GOAA is required to ensure that system is programmed and labeled per GOAA standards. Contractor is responsible to coordinate schedule and supervision with GOAA.
6. Interface to Physical Access Control System (PACS): GOAA IT will be furnishing and expanding the PACS to GOAA VSS interface via the Qognify Situator platform. Contractor is responsible to coordinate with GOAA on all new PACS and VSS items add to each system so that the interface between the two can be 'mapped' and interfaced per GOAA standards. Contractor is required to provide additional per camera licenses for the Situator system under this contract. Licensing and installation shall be coordinated with GOAA IT.
7. Network Components: Refer to specification section 27 05 00 and Technology Responsibility Matrix for requirements. Coordinate network programming requirements with GOAA IT for VSS operation on the GOAA network. Contractor shall coordinate patching into the network with GOAA.
8. Backbone Cable: Refer to specification section 27 10 00 for requirements. Coordinate system backbone requirements with backbone cable Contractor.
9. Horizontal Cable and patch cords: Refer to specification section 27 10 00 for requirements. Contractor shall furnish and install all horizontal VSS cable, including patch cords, required for the VSS extension. Contractor is responsible to coordinate with other contractors and GOAA IT as required.

10. Field Devices – Cameras, Microphones, convertors, brackets and accessories: Contractor shall furnish and install all field devices including, but not limited to: Cameras, microphones, media convertors, encoder/input units, brackets, mounting adaptors, fasteners, or any element required to mount VSS elements such as cameras securely to buildings or other structures.
11. GOAA PACS interface to CBP VSS: Contractor shall provide the VSS encoders with inputs as well as the PACS output modules so that PACS alarms can cause alarm call-up within the CBP specific VSS.

1.4 REFERENCES

- A. Publications and standards listed in Specification Section 27 05 00, 28 05 00 and/or authored by the organizations listed below (including amendments, addenda, revisions, supplement, and errata) shall form a part of this specification to the extent referenced. The publications are referenced in this text by the basic designation only.
 1. Open Network Video Interface Forum (ONVIF)
 2. U.S. Custom and Border Protection – Airport Technical Design Standard
 3. Transportation Security Administration – Checkpoint Design Guide
- B. All references to industry and trade association standards as well as all building codes are minimum installation requirements for this system. The codes, standards and agencies listed in Specification Section 28 05 00 shall form a part of this Specification Section and all work shall comply with the latest adopted standards.
 1. Where the Contract Documents mandate a greater requirement or performance than those specified by the aforementioned referenced codes and standards then the greater requirement shall be the governing design application for this project.

1.5 SYSTEMS DESCRIPTION

- A. The contractor shall provide a fully operational extension of the existing video surveillance system capable of monitoring and recording of cameras added under this project over GOAA's wide area network. All features of the existing system shall be available and apply to the new devices added to the system under this contract.
- B. The scope of work for the surveillance system shall include but not be limited to the following:
 1. Provide all IP video surveillance cameras, microphones, media convertors, video encoders, mounts, housings, network/video/power cabling, conduits/raceways, power supplies, and programming, as well as all appurtenances necessary to provide a fully operational, networked TCP/IP video surveillance system. GOAA IT will be providing servers, network recording, video monitors, network video workstations, video decoders, and active network components.
 2. Furnish, mount, adjust, and connect all VSS elements where indicated on the Contract drawings. Network all cameras, servers, communications equipment, encoders, video monitors and recording equipment as required to provide the performance of an enterprise TCP/IP-based video surveillance system.

3. The Video Surveillance System, both GOAA shared and CBP specific systems, shall be sized to meet all project requirements in accordance with the Contract Documents. In addition, the system shall be configured to accommodate, at a minimum, a system expansion of sixteen (16) additional cameras and two (2) additional video monitors.
 - a. To meet the future expansion requirement above, the system shall include server processing capacity, video storage capacity, and spare physical ports to accommodate the additional device quantities listed.
 - b. The Contractor shall coordinate with GOAA and OAR all unique camera designations and descriptions.
4. All video surveillance cameras and monitors shall be controlled and monitored from any new and all existing graphical user interface (GUI)-based network video workstations (NVW), the NVWs shall provide full, seamless manual and automatic operation of camera call-up, monitor selection and Pan/Tilt/Zoom (PTZ) functions using integrated GUI based graphic maps.
5. All cameras shall be installed based on the optimum camera placement to obtain the maximum visible surveillance of all areas. Coordinate each camera position, configuration settings, surveillance coverage area and alarm call-up with GOAA and OAR prior to final programming. Additional coordination with CBP is required in all CBP spaces.
 - a. "Alarm call-up" shall refer to a function of the video surveillance system which entails the automatic display of one or more selected cameras on a given monitor in response to a system alarm or event. Typically, the camera associated with a given alarm will be one that can provide the optimum surveillance coverage of affected location and/or path of egress (e.g., a camera whose field of view includes the access-controlled door or other sensor currently in alarm). Such functionality shall be included in the programming and integration with the PACS and other systems as described elsewhere in this and related specification sections.
 - b. Manual camera selection by an operator shall be available from any network video workstation, and shall direct the camera display to any other operator-selected video monitor(s) on the system.
 - c. The system shall be programmed to automatically reposition PTZ cameras to multiple pre-set positions as part of the system's alarm call-up functionality. The pre-set PTZ camera position associated with a given alarm shall provide optimum surveillance coverage of affected location and/or path of egress.
 - d. All PTZ cameras shall be programmed for auto-tour and auto-tour reset after a pre-programmed elapsed time. Manual PTZ camera selection by an operator shall be available from any network video workstations, and shall be capable of directing the camera display to any selected video monitor(s) on the system.
 - e. PTZ camera position pre-sets and camera alarm call-ups shall be configured for activation by any the following devices, systems and/or locations;
 - 1) PACS doors
 - 2) Duress Buttons
 - 3) Other system devices building areas as specified elsewhere or shown on the Contract Drawings

6. All system(s) cameras shall be recorded continuously (“24/7/365”) by dedicated digital NVRs sized to support all cameras in accordance with all project requirements. Recoding is accomplished by the uses of NVR’s located with multiple NAS servers as required to record the designated cameras. Viewing and reproduction of all camera recordings shall be accessed from the dedicated networked video workstations via 10/100/1000 Mbps Ethernet connectivity.
 - a. Contractor shall coordinate and install owner provided equipment which shall include but not be limited to:
 - 1) Network Video Recorders (NVRs)
 - 2) NAS Storage Arrays
 - 3) Viewing Workstation and associated accessories
 - 4) Recoding Servers
7. Provide all connections to the facility’s emergency / security electrical power as necessary for the proper operation of all system(s) equipment and components in accordance the requirements of the Contract drawings and/or as herein specified.

1.6 SUBMITTALS

- A. In addition to all requirements as specified by Division 01 and Specification Section 28 05 00, the video surveillance system shall also be provided in accordance with the following requirements:
 1. Shop drawings shall detail space conditions to accommodate other concerned trades.
 2. Provide a complete termination schedule of all camera locations; indicate on the construction drawings camera identification corresponding with schedule.
 3. Provide a complete alarm matrix for all camera locations, indicate all associated alarm call-ups and camera pre-sets for every camera indicated on the contract drawings, include the related device activation and/or event for each pre-set and alarm call-up.
 4. Provide a complete Camera/NVR schedule indicating each camera position relevant to NVR input location as well as a diagram indicating each NVR position in the appropriate equipment cabinet.
 5. Provide calculations demonstrating the hard drive storage capacity of all network/digital video recorders meeting and/or exceeding all requirements as herein specified. Coordinate all used recording parameters with GOAA.
 6. Provide any new integration protocols, communications connectivity and interface components to the facility’s Physical Access Control, Intrusion Detection, Door Controllers, Fire Alarm System, and/or Emergency Call systems.
 7. All information related to the required coordination and proper integration of the video surveillance system and the facility’s Physical Access Control System. Wiring diagrams shall indicate all wiring for each field device as well as all wiring interconnections between each device and all controls and/or associated equipment, in addition, all electrical power connections with electrical circuit numbers shall be indicated to all equipment requiring electrical power.

8. GOAA IT requires a dedicated VSS submittal. The following list reflects Contractor's requirement to coordinate with GOAA IT in order to successfully bring the new extension on-line to the existing GOAA VSS platform as well as describe the process.
 - a. Contractor shall fill out GOAA standard OAR VSS spreadsheet with all data available. A project Map shall be provided by the Contractor with the camera's MAC and installed location.
 - b. Contractor shall submit for GOAA Cameras number with the OAR VSS spreadsheet properly and filled out. All camera types and quantiles need to be submitted so GOAA IT can calculate NVR quantities.
 - c. When NVR servers are on-site and available, submit request for GOAA IT configuration.
 - d. When network components are on-site and available, submit request for GOAA IT configuration.
 - e. When the communication rooms are ready, perform IT hardware installation
 - f. After cameras are terminated and cables tested, submit cable tests for GOAA IT review. Contractor shall provide a screen shot from the patch panel, tag the image with the GOAA camera number for submittal. After GOAA security review of the preliminary field of view, there may be some field of view adjustments required by the contractor.
 - g. After network in place, cameras terminated, servers installed, and preliminary field of views approved then a request is required for the GOAA's network team to bring the cameras on-line.
 - h. After cameras are online and NVRs are installed, GOAA IT Control system team will install the recording software.
 - i. After above is completed, GOAA IT Control system team will configure the cameras onto GOAA's existing VSS enterprise platform.
 - j. GOAA security then needs to approve final configuration (field of view and image quality) or they will request a change. If a change is needed then GOAA IT Control system team will work with the contractor to re-aim and adjust camera.
 - k. Contractor shall keep cameras at their factory settings as GOAA IT will configure, set image quality, network setting and all other camera configurations.

B. Mock-Ups

1. Prepare mockups and coordinate with other trades and millwork/furniture as required for the following.
 - a. Passive/location based mock-ups for GOAA review and approval of each type of camera and housing options for each camera.
 - b. Active/location based mock-ups for CBP review and approval of camera and associated built-in microphones for the following typical CBP spaces: Recording of video field of view and audio quality is required to be played back for CBP approval.
 - 1) Outbound Interview rooms

1.7 QUALITY ASSURANCE

- A. In addition to all requirements as specified by Specification Section 28 05 00, the video surveillance system shall also be provided in accordance with the following requirements:
 - 1. All control equipment must have transient protection to comply with UL864 requirements. Where security circuits leave the building, additional transient protection must be provided for each circuit. Devices must be UL listed under standard #497B (Isolated Loop Protectors). Refer to Specification Section 28 05 00 for additional information related to the installation of all surge and transient protection requirements.
 - B. The Contractor shall be an established security alarm provider, licensed to provide security systems within in the municipality of the project location and shall be an authorized stocking distributor of the equipment supplied for this project with full manufacturer's warranty privileges.
 - C. VSS contractor shall be manufacturer-certified on the Qognify system currently in place. Certification must be valid at time of bid, and must be maintained throughout this project. This applies for both installation as well as configuration, programming, and testing.
 - D. Installation and start-up of all systems shall be under the direct supervision of the Contractor. This system supplier shall be an accredited and authorized distributor of the equipment manufacturer of all equipment being provided. and shall tender an offer prior to system testing for a service contract covering system maintenance at completion of the guarantee period.
 - 1. The contractor shall show satisfactory evidence, upon request, that the equipment supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
 - E. The Contractor shall have a BICSI-accredited Registered Communications Distribution Designer (RCDD) professional review and seal all system shop drawings, demonstrating that the contractor's design and installation methods of any structured cabling and/or network connectivity provided as part of this Contractor's scope of work related to the installation and operation of any TCP/IP - based video surveillance system components meet industry standards and best practices.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Comply with all requirements of Specification Section 28 05 00.
- 1.9 RECORD DOCUMENTS
- A. In addition to all general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections, comply with all requirements of Specification Section 28 05 00.
- 1.10 OPERATIONS AND MAINTENANCE
- A. Comply with all requirements of Specification Section 28 05 00.
- 1.11 SOFTWARE AGREEMENT

- A. In addition to all general provisions of the Contract, including but not limited to all; General and Supplementary Conditions, Division 01 Specification Sections Comply with all requirements of Specification Section 28 05 00.

1.12 SPARE MATERIALS

- A. In addition to all requirements of Specification Section 28 05 00 provide the following spare material:
 - 1. Two (2) cameras for each type utilized for spares including each type of housing and bracket for each camera type.
- B. All spare materials shall be delivered at the time of final acceptance of the system(s). At no time is the contractor to use the spare materials provided for this project to replace malfunctioning equipment and or components prior to final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

- A. Comply with all requirements of Specification Section 28 05 00.

2.2 MANUFACTURERS

- A. Acceptable manufacturers in each product category for this project shall be as follows, providing full compliance with this Section, Specification Section 28 05 00 and all related Specification Sections:
 - 1. Video Surveillance Cameras, Housing, and Mounts
 - a. Refer to each approved camera type
 - b. Or GOAA IT Approved Equal that is compatible with the existing Qognify system
 - 2. Video Management Software (VMS)
 - a. Qognify (NICE)
 - b. No Substitutions
 - 3. POE+ over coax converters
 - a. Axis
 - b. Or approved substitution
- B. Manufacturers listed as acceptable or equal shall not negate the contractor's responsibility for providing all system components in accordance with all functions and performance requirements as herein specified.

2.3 MANUFACTURED PRODUCTS

- A. Comply with all requirements of Specification Section 28 05 00.

2.4 CAMERA TYPE A – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type A cameras characteristic:
 - 1. Camera location – Indoor applications only
 - 2. Form Factor – Dome. Dome must be smoked/tinted type
 - 3. Image Resolution – 1280(H) x 720(V) pixels
 - 4. Frame Rate – up to 60 FPS at full resolution
 - 5. Lens – 3 to 9mm
 - 6. Network interface – RJ45 PoE

7. Power Requirements – PoE powered
8. Standard Mounting Methods – Surface mount device, mount for hard and drop ceiling, corner, and wall is separate item.
9. Camera Model – Bosch Flexidome IP starlight 7000 VR model NIN-73013-A3AS or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.
11. For all Bosch cameras - the Contractor is to make use of project pricing from Bosch, whether contracting directly thru Bosch or through distribution channels, unless project pricing does not offer an advantage to Contractor's current costs. Project pricing from Bosch is available under project "GOAA".

2.5 CAMERA TYPE B – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type B cameras characteristic:
1. Camera location – Indoor applications only
 2. Form Factor – Dome. Dome must be smoked/tinted type
 3. Image Resolution – 1920(H) x 1080(V) pixels
 4. Frame Rate – up to 30 FPS at full resolution with WDR, 60 FPS without WDR
 5. Lens – 3.4 to 8.9mm
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Surface mount device, mount for hard and drop ceiling is separate item.
 9. Camera Model – Axis P3265-V or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.6 CAMERA TYPE C – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type C cameras characteristic:
1. Camera location – Indoor applications only
 2. Form Factor – Dome. Dome must be smoked/tinted type
 3. Image Resolution – 2592(H) x 1944(V) pixels
 4. Frame Rate – up to 30 FPS
 5. Lens – 3 to 8mm
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Surface mount device, mount for hard and drop ceiling is separate item.
 9. Camera Model – Axis P3267-LV or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.7 CAMERA TYPE D – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type D cameras characteristic:
1. Camera location – Indoor/Outdoor
 2. Form Factor – PTZ Dome. Clear lower dome
 3. Image Resolution – 1920(H) x 1080(V) pixels
 4. Frame Rate – up to 60 FPS at full resolution
 5. Lens – 40x optical and 16x digital zoom
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE+ Powered
 8. Standard Mounting Methods – Pendant mount device, optional mounting equipment available.
 9. Camera Model – Panasonic WV-X6531N or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.8 CAMERA TYPE E – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type E cameras characteristic:
1. Camera location – Outdoor
 2. Form Factor – Dome. Dome must be smoked/tinted type
 3. Image Resolution – 1280(H) x 720(V) pixels
 4. Frame Rate – up to 60 FPS at full resolution
 5. Lens – 2.8 to 10mm
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Surface mount device, mount for hard and drop ceiling is separate item. No Substitutions Accepted.
 9. Camera Model – Panasonic WV-S2511LN or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.9 CAMERA TYPE F – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type F cameras characteristic:
1. Camera location – Outdoor
 2. Form Factor – Dome. Dome must be smoked/tinted type
 3. Image Resolution – 1920(H) x 1080(V) pixels
 4. Frame Rate – up to 30 FPS at full resolution with WDR, 60 FPS without WDR
 5. Lens – 3.4 to 8.9mm
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Surface mount device, mount for hard and drop ceiling is separate item.
 9. Camera Model – Axis P3265-LVE or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.

10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.10 CAMERA TYPE G – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type C cameras characteristic:
 1. Camera location – Outdoor
 2. Form Factor – Dome. Dome must be smoked/tinted type
 3. Image Resolution – 2592(H) x 1944(V) pixels
 4. Frame Rate – up to 30 FPS at full resolution
 5. Lens – 3 to 8mm
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Surface mount device, mount for hard and drop ceiling is separate item.
 9. Camera Model – Axis P3267-LVE or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.11 CAMERA TYPE H (INDOOR) – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type H (indoor) cameras characteristic:
 1. Camera location – Indoor applications only
 2. Form Factor – 360 degree FOV Dome
 3. Total Sensor Pixels – 12MP
 4. Frame Rate – up to 30 FPS at full resolution
 5. Lens – 360 degree Hemispheric
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Flush, surface, and pendant mount options.
 9. Camera Model – Bosch Flexidome IP Panoramic 7000 Series model NIN-70122-FOA or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted. Use Bosch accessories for surface mount, in-ceiling housing, and pendant wall/ceiling mounting options.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.
 11. For all Bosch cameras - the Contractor is to make use of project pricing from Bosch, whether contracting directly thru Bosch or through distribution channels, unless project pricing does not offer an advantage to Contractor's current costs. Project pricing from Bosch is available under project "GOAA".

2.12 CAMERA TYPE H (OUTDOOR) – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type H (outdoor) cameras characteristic:
 1. Camera location – Outdoor
 2. Form Factor – 360 degree FOV Dome
 3. Total Sensor Pixels – 12MP

4. Frame Rate – up to 30 FPS at full resolution
5. Lens – 360 degree Hemispheric
6. Network interface – RJ45 PoE
7. Power Requirements – PoE Powered
8. Standard Mounting Methods – Flush, surface, and pendant mount options.
9. Camera Model – Bosch Flexidome IP Panoramic 7000 Series model NDS-7004-F360E or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted. Use Bosch accessories for surface mount, in-ceiling housing, and pendant wall/ceiling mounting options.
10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.
11. For all Bosch cameras - the Contractor is to make use of project pricing from Bosch, whether contracting directly thru Bosch or through distribution channels, unless project pricing does not offer an advantage to Contractor's current costs. Project pricing from Bosch is available under project "GOAA".

2.13 CAMERA TYPE J – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type J cameras characteristic:
1. Camera location – Indoor/Outdoor
 2. Form Factor – 180 degree FOV Dome. Dome must be smoked/tinted type
 3. Image Resolution – 4 imagers 2048(H) x 1536(V) pixels
 4. Frame Rate – up to 10 FPS at full resolution
 5. Lens – 4 individual lenses – 5.4 mm
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Surface mount device, various mount for hard and drop ceiling is separate item.
 9. Camera Model – Arecont AV12586DN or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.14 CAMERA TYPE K – GOAA APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type K cameras characteristic:
1. Camera location – Indoor/Outdoor
 2. Form Factor – 360 degree FOV Dome. Dome must be smoked/tinted type
 3. Image Resolution – 4 imagers 2048(H) x 1536(V) pixels
 4. Frame Rate – up to 10 FPS at full resolution
 5. Lens – 4 individual lenses – 2.8 mm unless otherwise noted
 6. Network interface – RJ45 PoE
 7. Power Requirements – PoE Powered
 8. Standard Mounting Methods – Surface mount device, various mount for hard and drop ceiling is separate item.
 9. Camera Model – Arecont AV12276DN-28 (2.8 lens option unless otherwise noted) or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.

10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.15 CAMERA TYPE CBP-CO – CBP CORNER MOUNT APPROVED STANDARD

- A. Furnish and install as per construction documents, GOAA type CBP-CO cameras characteristic:
 1. Camera location – Indoor applications only
 2. Form Factor – impact-resistant stainless-steel corner
 3. Image Resolution – 2304(H) x 1728(V) pixels
 4. Frame Rate – up to 30 FPS at full resolution
 5. Lens – 2.4mm
 6. Audio – built in microphone
 7. Network interface – RJ45 PoE
 8. Power Requirements – PoE Powered Standard Mounting Methods – Surface mount corner device.
 9. Camera Model – Axis Q9216-SLV in white or most current production model replacing this unit with prior GOAA IT Approval. No Substitutions Accepted.
 10. Camera Firmware: Contractor to confirm with and load the GOAA IT approved firmware version so it is certified on the existing Qognify platform.

2.16 ELEVATOR CAMERAS

- A. Coordinate with the elevator contractor for installation of GOAA camera type A, flush ceiling bracket, and POE+ over coax convertors. Elevator contractor shall provide the coax travel cable, space for converter in car control panel and access to travel cable and to ceiling for camera installation. Coordinate with Elevator vendor so that ceiling will have cut out to accept the Bosch VDA-PLEN-DOME in-ceiling housing bracket. This contractor will provide the camera, camera bracket as well as both base and end unit of the Axis T8604 POE+ over coax adaptor kit. Contactor shall provide and install any coax and/or Cat6 patch cords to provide connectivity from Data outlet to base unit and device unit to cameras being provided in each elevator. Refer to elevator camera detail and elevator specifications for additional information.

2.17 PASSENGER BOARDING BRIDGE (PBB) CAMERAS

- A. Coordinate with the PBB contractor for installation of GOAA camera type H that shall be installed at the end of each PBB. Camera placement shall include field of view of jetway control, plane entry, ramp stair door, and see down the PBB toward the building. PBB provided horizontal travel cable shall be utilized for connectivity to the GOAA network. Refer to PBB documents and T series for cabling and connections back to building GOAA IDFs. Coordinate mounting and installation with PBB vendor/contractors as required.

2.18 RECORDING NETWORK VIDEO SERVER (NVS) AND SOFTWARE

- A. Install GOAA provided rack mounted recording servers and NAS storage arrays in quantities and sizes to support all video surveillance system performance in accordance with all manufacturers' requirements, contract drawings and as herein specified. All software licenses or modification to any existing headend components shall be provided by GOAA IT, but contractor shall schedule and coordinate any work.

- B. All system(s) cameras shall be recorded continuously (“24/7/365”) by multiple network video recorders (NVR)s sized to support all cameras in accordance with all project requirements. Recoding is accomplished by the uses of NVR’s located as required to record the designated cameras.

- 1. Contractor shall coordinate and install owner provided equipment which shall include but not be limited to Recoding Servers

2.19 NETWORK VIDEO MANAGEMENT SOFTWARE (VMS)

- A. Provide the necessary network video management software (VMS) configured to support all video surveillance system operations and performance criteria in accordance with the Contract drawings and/or as herein specified. All software licenses or modification to any existing headend components shall be provided by GOAA IT.

2.20 VIEWING WORKSTATIONS AND MONITORS

- A. All required hardware and software shall be furnished and installed by GOAA IT. Minimum hardware configuration shall be giving to GOAA IT. Coordination with GOAA IT for physical space as well as providing all data and power connections is the contractor’s responsibility.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Comply with all requirements of Specification Section 28 05 00.

3.2 EQUIPMENT PROTECTION

- A. Comply with all requirements of Specification Section 28 05 00.

3.3 INSTALLATION

- A. In addition to all requirements as specified by Specification Section 28 05 00 the video surveillance system shall also be provided in accordance with the following requirements:
 - 1. The network infrastructure in support of the surveillance system shall be based on a passive optical network (PON) topology provided under Division 27 Specifications and Drawing Packages. It shall be this Contractor’s responsibility to review all related Division 27 drawings and specifications and provide the necessary coordination to ensure that video surveillance system is properly integrated with PON topology and meets all performance criteria as herein specified.
 - 2. All patch cords between the PON components and the video surveillance system cameras and/or devices shall be provided by the ESSI. All interface cabling provided by the ESSI shall be installed in accordance with all requirements of 28 05 00 shall not contain any AC carrying conductors or non-associated system cables within the cable raceways/conduits or cable bundles.
 - a. In addition, all structured cabling associated with the installation of the video surveillance system provided by the ESSI shall comply with all requirements of Specification Section 28 05 00 and for the proper installation, termination and testing of all fiber optic and Category-6 UTP cabling.

- b. All video surveillance cabling being routed from the facility to any remote site locations shall utilize fiber optic cable and be installed in dedicated conduits, unless otherwise detailed. This Contractor shall coordinate all fiber optic cabling requirements with the Division 27 Contractor.
 - c. Contractor shall provide all equipment, components, devices, hardware, and all appurtenances necessary properly integrate with the Division 27 scopes of work as required to provide a fully operational system utilizing the PON topology. Coordinate all system cabling with Division 27 Contractor prior to shop drawing submission.
 3. All cameras shall be installed in such manor that the camera views shall be free from all obstructions in order to provide unrestricted viewing angles. Cameras installed in areas with non-finished ceilings shall be mounted directly to walls, structural supports, or the underside of the roof deck of the facility. No cameras shall be mounted to any piping and/or conduits, or block any access hatches, equipment, or entrances.
 4. For all exterior cameras, preventative measures shall be taken to prevent and discourage birds from landing or nesting on any camera arms or housings. Products such as bird spikes or similar shall be provided as required.
 5. In addition to all power requirements stipulated in Specification Section 28 05 00 and the related Chapters of this Specification Sections, all electrical power for remote system components shall be obtained from dedicated power supplies located at the nearest GOAA communications room. All 120-Volt power for any video surveillance system components and/or devices shall be supplied from the emergency/ security branch from the nearest appropriate emergency electrical distribution panels. Systems components employing the use of plug-in transformers for power shall not be acceptable.
 - a. All system power supplies serving exterior system components or devices shall be provided with the appropriate transient surge and lightening suppression protection on both the line side as well as the load side. Refer to Specification Section 28 05 00 for additional requirements.
- B. Installation of all equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate trade contractors.
- C. Backing shall be provide as required so that VSS cameras and associated brackets can be securely fastened to the building structure. Coordinate with other trades such as framers so that cameras can me mounted per manufacturers' recommendations.

3.4 WORK PERFORMANCE

- A. In addition to all requirements as specified by Specification Section 28 05 00 the video surveillance system shall also be provided in accordance with the following requirements:
 1. Prior to the final programming of any systems, the Contractor shall provide a review with GOAA and OAR addressing all system features, functions, operations, integrated system responses, graphic maps and related operational programming.
 - a. Failure to provide this review and get final sign-off prior to programming shall result in any costs related to changes requested by GOAA and OAR as not being charged to the project.

3.5 EQUIPMENT INSTALLATION

A. Comply with all requirements of Specification Section 28 05 00.

3.6 COMMUNICATIONS CABLING REQUIREMENTS

A. Comply with all requirements of Specification Section 28 05 00.

3.7 ELECTRICAL POWER DISTRIBUTION

A. Comply with all requirements of Specification Section 28 05 00.

3.8 TRANSIENT VOLTAGE SUPPRESSION

A. Comply with all requirements of Specification Section 28 05 00.

3.9 GROUNDING AND BONDING

A. Comply with all requirements of Specification Section 28 05 00.

3.10 EQUIPMENT IDENTIFICATION

A. Comply with all requirements of Specification Section 28 05 00.

3.11 MAINTENANCE & SERVICE

A. Comply with all requirements of Specification Section 28 05 00.

3.12 WARRANTY

A. Comply with all requirements of Specification Section 28 05 00.

3.13 FIELD SERVICES

A. Testing

1. In addition to all requirements as specified by Specification Sections 28 05 00, 27 05 00, and 27 10 00, the video surveillance system shall also be tested in compliance with the following requirements:

- a. The completed video surveillance system shall be fully tested in accordance with all requirements of NFPA 731. Upon completion of a successful testing, the contractor shall so certify in writing to GOAA and OAR all was completed, tested, certified, and left in first class operational condition, include all completed NFPA 731 certification and test reports.
- b. The service of a competent, factory-trained engineer or technician authorized by the equipment manufacturer shall be provided to technically supervise installation and participate during initial system programming, start-up, final testing, assist in the final acceptance testing and demonstrations.
- c. At the minimum all acceptance testing, demonstrations and training shall include, but not be limited to the following:
 - 1) Integration with Existing Video Management Platform
 - 2) Camera Video Transmission and Signal Performance
 - 3) All Camera Alarm Call-up Functions
 - 4) NVW GUI map Integration and Functionality
 - 5) Pan\Tilt\Zoom Functions and Pre-Sets
 - 6) Physical Access Control System Integration
 - 7) Fire Alarm System Integration

- 8) Camera Frame Rate/Image Quality and Storage Functionality
 - 9) Remote System Access (LAN/WAN) Functions.
 - 10) All programming and operational functions and features as herein specified.
- d. Demonstrate each system, subsystem and integrated system. The demonstration shall include, but not be limited to the following:
- 1) Designate actual location of each component of a system or subsystem and demonstrate its function and its relationship to other components within the system.
 - 2) Demonstrate the operation of all client servers, graphic map functions, administration set-up, configurations, and all system operations, emergency operations, and system reboot procedures.
 - 3) Demonstrate all systems and subsystems operations by actual cycling through system features demonstrating how to work controls, how to reset devices, how to replace fuses, and emergency operating/operations procedures.
 - 4) Demonstrate all camera views, and alarm call-up functions.
- e. Upon final inspection, a factory-trained and certified representative of the equipment manufacturer shall demonstrate to GOAA and OAR that the system functions properly in every respect and is in full compliance with the contract documents. This requirement is in addition, to all testing requirements listed in Specification Section 28 05 00 and all related Specification Sections.

3.14 TRAINING

- A. Comply with all requirements of Specification Section 28 05 00.

END OF SECTION 28 23 00

SECTION 28 31 00 - ADDRESSABLE FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Contractual Conditions and Division 01 Specification sections apply to this section.
- B. Related Specification Sections:
 - 1. Refer to Specification Section 27 05 00 for requirements
 - 2. Refer to Specification Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C" for additional requirements

1.2 SUMMARY

- A. Refer to Specification Section 27 05 00 in addition to the following.
- B. This section provides requirements for the installation and configuration of an extension of the existing fire alarm system located throughout the South Terminal Complex (STC)

1.3 SCOPE OF WORK

- A. Refer to Specification Section 27 05 00 and 28 05 00 in addition to the following.
- B. Refer to drawing sheet FA0.00.03 for the work responsibility matrix for the scope of work required for the system and for any work provided by the Authority.
- C. Where listed on the drawing responsibility matrix, the following components shall be defined as follows.
 - 1. Headend and Software: Contractor shall furnish, install, and program all required headend equipment and software including, but not limited to licensing, system expansion, redundancy, workstation licenses, operating software license or any other software required to expand the existing system to support all new elements added under this contract. Contractor shall be required to coordinate requirements as well as scheduling license installation. Headend and software include any panels, cabinets, management/administrative software, software licenses, programming, and components which serve the purpose of performing system-wide coordination, monitoring, data processing, control and other global functions.
 - 2. Integration to Existing System: Energizing and connecting of new or modified system components to the existing fire detection and alarm system shall be performed by the Authority's current Testing, Certification and Repair (TC&R) Contractor. The TC&R Contractor shall perform all necessary testing to certify the system extension/modification and perform the necessary programming changes required for a complete operating system. The work performed by the TC&R contractor is part of the contract and shall be included in the bid price and fully coordinated by the contractor.

- a. The Authority's current TC&R Contractor is Commercial Systems Group, 151 Semoran Commerce Place, Apopka, FL 32703, P 407/814-0225, F 407/814-8868, C 321-228-1626, www.comsysgroup.com.
3. Interfaces: Contractor shall provide all system interfaces. Interfaces include all hardware, software, wiring, cabling, programming, interface devices and appurtenances as required for communication between systems, or between a given system and an operator, to provide the specified functionality.
4. Network Switches: Contractor shall provide a complete FAS as described in this section. For LAN requirements, refer to specification section 27 05 00. Coordinate network programming requirements with GOAA IT for FAS operation on the GOAA network. Contractor shall coordinate patching into the network with GOAA.
5. Backbone Cable: Refer to specification section 27 10 00 for requirements. Coordinate system backbone requirements with backbone cable Contractor.
6. Horizontal Cable: Contractor shall provide dedicated FAS signal cabling as described in this section.
7. Field Devices: Contractor shall provide all field devices including, but not limited to power supplies, initiating devices, notification appliances, indicators, speakers, auxiliary devices, and similar equipment or appliances.

1.4 DESCRIPTION

- A. Provide all labor, materials, equipment, and services necessary and required to provide, install and test a complete extension of existing automatic fire detection and alarm system to comply with these specifications and all regulatory requirements.
- B. Provide a complete extension of existing fire alarm detection system. The system shall include but not be limited to all control panel components, power supplies, batteries, signal initiating devices, notification devices, wire, fittings, accessories, programming, software licenses, and interfaces to other systems required to provide a complete operating system.
- C. The Fire Alarm system shall interface with the ECS system to provide voice annunciation for the fire alarm system. Fire alarm shall interface with the ECS system to provide the following functionality:
 1. Supervision of ECS system fault and supervisory conditions at all active components. Additionally, faults in ECS system shall be display on fireworks GUI in actual location of equipment (by comm. Room and cabinet designation where equipment is located)
 2. Notification zone control of ECS system via supervised contact closure input to ECS. One input for each notification zone minimum. Additional inputs/outputs shall be use for proper system interface.
 3. FA system shall distribute line level audio to ECS for notification to all building areas. All fire alarm messages shall be generated at local building FACP and shall feed into local building ECS ACS controller.
- D. The contractor shall coordinate with other systems required to provide a complete and operational system. These shall include but not be limited to the following:

1.5 SOUTH TERMINAL COMPLEX

- A. Existing system is an EST3 Network system which located throughout the STC. STC system reports to the North Terminal Complex (NTC) Comm Center fireworks workstation.
- B. All initiating devices shall be addressable. Control shall be microprocessor based and field-programmable node. All electronics shall be solid state. All notification devices shall match the existing system.
- C. System to be a zoned, non-coded, closed circuit supervised fire alarm system. The entire fire alarm system shall be continuously electrically supervised against interruption or failure of the initiation and notification circuits including switches and electrical contacts. Detect opens, shorts, and grounds in the system.
- D. Coordinate with other Work to assure completeness of system including but not limited to: conduit, raceways, outlet boxes, wire, cable, supports, surge suppression, junction boxes, pull boxes, identification, enclosures, cabinets, and grounding.
- E. Provide all required control and interlock wiring between fire alarm system and building equipment. Controls are required to/for/from: fire/smoke air and duct detectors, fire/smoke dampers and smoke dampers, supply/return and exhaust fans, smoke evacuation equipment, automatic fire extinguishing systems, sprinkler and fire system water sprinkler system components, etc. (as applicable to Work).
- F. No additions, modifications or alterations to an existing fire alarm system shall proceed prior to appropriate notification of the OAR and GOAA's Maintenance Department Life Safety Division. Notifications shall be made via the TC&R Contractor. Maintenance Department Electronic shop shall be notified prior to returning fire alarm system back to service and shall have a representative present.
- G. The Contractor shall provide and install the Fire Alarm system (including all equipment, wiring, etc.) in accordance with the manufacturer's recommendations.
 - 1. Installation of devices shall be in accordance with the manufacturer's requirements as well as the requirements of the contract Documents. Recommendations by the manufacturer for the proper installation of the Fire Alarm system and its equipment shall not preclude the requirements for the Contractor to comply with the requirements of the contract Documents.
 - 2. Termination of Fire Alarm circuits shall be in accordance with the manufacturer's recommendations, applicable requirements of the National Electric Code (NFPA 70), ADA, other applicable Codes and the Contract Documents.
 - 3. Voice evacuation audio shall be provided thru the Emergency communications System (ECS) refer ECS drawings and specs for additional information.

4. The Fire Alarm installer shall be responsible for ensuring that prior to bidding the project the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the fire Alarm System Manufacturer's recommendations for proper installation of the system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.
- H. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The Contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.
- I. All fire alarm cabling shall be in raceway.
- J. The Fire Alarm System shall be tested, by the Contractor, in the presence of the City of Orlando Fire Department, upon permanent installation of the equipment in the new Communication Center and prior to acceptance by the Owner. This testing shall be in addition to any other testing required by these project documents. The Contractor shall be responsible for including all costs for this testing within his bid. The testing procedure shall include in-depth testing of all portions of the system that have been moved, modified or worked in as part of this project. In addition, this testing shall, as a minimum, involve random testing of devices at the discretion of the Orlando Fire Department.
- K. The Contractor shall be responsible for providing personnel necessary to accomplish either a fire watch and/or a security watch in unprotected areas during times when the fire alarm system is off-line.
 1. Where the fire alarm system is inactive in any area due to the work of this project the Contractor shall, as a minimum, provide personnel necessary to observe the status of each fire alarm control panel in the affected area.

2. When security functions provided by the fire alarm system are off-line in any area or partial area the Contractor shall, as a minimum, provide one person at each AOA door until the system is operational. During those times where the off-line time is planned the Contractor shall station personnel fifteen (15) minutes prior to the commencement of off-line operations. During those times where the off-line time is accidental the Contractor shall station personnel within five (5) minutes of the system going off-line.
- L. The Contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code to, to accomplish incidental functions of the fire alarm system including but not limited to the following:
1. HVAC system control and/or shutdown of all equipment over 2000CFM.
 2. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown.
 3. Smoke Control system control and/or shutdown.
 4. Control of fire, smoke, and/or combination fire/smoke dampers.
 5. Monitoring of fire suppression and or extinguishing systems (Inergen System, Halon System, and clean agent system).
 6. Control of fire and/or smoke doors, dampers, shutters, etc.
 7. escalator shut down
 8. gas/fuel
 9. elevators
 10. access control on egress doors
 11. Override of third party and tenant / vendor systems per NFPA.
 12. Interface with ECS system for voice notification and supervision.
 13. Updating to the existing Firework Workstation GUI to indicate additional buildings and devices. Including all programming, equipment, firmware, licenses, etc required.
- M. The fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.
- N. Although they may not be indicated on the Fire Alarm system diagram and/or drawings, all required control and interlock wiring between the Fire Alarm system and building equipment shall be provided hereunder, Controls are required to/for/from:
1. Fire/smoke air and duct detectors
 2. Fire, smoke and/or combination fire/smoke dampers.
 3. Supply/Return fans, Exhaust fans, and/or Fan Terminal Boxes (FTB)
 4. Automatic fire extinguishing systems
 5. Smoke evacuation equipment
 6. Sprinkler and/or Fire Protection system components
- O. Provide and install all relays (electric-electric, electric-pneumatic, and/or pneumatic-electric) as required for a complete and operational fire alarm system, complying with all applicable codes and all requirements, and coordinated with all divisions of these specifications.

- P. Zoning
 - 1. Alarm Zones.
 - a. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
 - 1) One per 3000 square feet per floor, for pull stations and heat detectors.
 - 2) One per 3000 square feet per floor, for smoke detectors.
 - 3) One for each duct smoke detector.
 - 2. Notification Zones.
 - a. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
 - 1) One per floor. Breakdown circuits as required for load and distances involved.

1.6 SYSTEM OPERATION

- A. System operation shall meet the operation requirements of all codes and regulatory requirements.
- B. The system shall provide, as a minimum, the same operation and functions of the existing system, plus all new functions as specified.
- C. Refer to Life safety / Mechanical plans and specs for all smoke control related sequence of operation.
- D. Upon activation of the Fire Alarm System by a manual station the following shall take place:
 - 1. Energize all alarm signaling devices.
 - 2. Sound all audible alarms and flash visual signals throughout the building.
 - 3. Alert local fire department or proprietary system.
 - 4. Cause alarm to be displayed on the annunciator section of the control panel.
 - 5. Close all doors, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
 - 6. Unlock all electrically locked doors (coordinate with architect and door hardware supplier, provide all electrical required).
- E. Upon activation of the Fire Alarm System by any smoke detector, any sprinkler flow alarm switch or other automatic detection device, the following shall take place in addition to the above:
 - 1. Shut down all air handlers and exhaust fans supplying or exhausting air in at least the zone where the alarm is initiated.
 - 2. Shut all smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down, in at least the zone where the alarm is initiated. (Coordinate with mechanical and provide all electrical as required).
 - 3. Transmit signals to building elevator control panel to initiate return to main floor or alternate floor.
 - 4. Transmit signals to building automation system to tell system that the fire alarm system has taken control of respective mechanical system.

5. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.
 6. Send a signal to all non-fire alarm sound reinforcement systems. Fire alarm signals shall override all other sound systems. Alarm notification signals shall take precedence over all other signals. Operation of other sound systems shall resume after fire alarm system clears alarm.
- F. Elevator: Smoke detectors associated with elevator lobbies and machine rooms shall be types approved by the Florida State Fire Marshall under F.A.C. Chapter 4A-47 Uniform Fire Safety Standards for Elevators. Elevator recall shall be initiated ONLY by elevator lobby and machine room smoke detectors. In addition to those functions outlined in "A" above, elevator detector(s) shall initiate the following functions.
1. The operation of any one Elevator Lobby Product of Combustion Detectors associated with a single bank of elevators shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures, floor(s) of recall, and alternate floor(s) of recall.
 2. The operation of any elevator machine room Product of Combustion Detector that is part of this Fire Alarm System shall signal the elevator controls to commence required procedures for that bank of elevators. Refer to Division 14 for required procedures.
 3. The activation of the smoke detector(s) in a machine room shall cause a suitable warning light to flash. The light is to be located adjacent to the "Phase One" recall switch or elevator hall button at the designated and alternate fire department access level.
 4. Fire alarm system shall monitor shunt trip voltage per NFPA 72.
- G. System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall place the system in the trouble mode, which causes the following system operations:
1. Visual and audible trouble signal indicated be zone at the fire alarm control panel.
 2. Visual and audible trouble signal indicated at remote annunciator panel.
- H. Manual acknowledgement function at fire alarm control panel shall silence audible trouble signal; visual signal shall be displayed until initiating failure or circuit trouble is cleared.
- I. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.
- J. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.
- K. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.

- L. Where required by codes or authority having jurisdiction:
 - 1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.
 - 2. The fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.
 - 3. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

1.7 SUBMITTALS

- A. Submit in accordance with Section 28 05 00 Common Work Results for ESS and Section 01 33 23 Shop Drawings, Product Data, and Samples.

1.8 PROJECT RECORD DOCUMENTS

- A. Submit in accordance with Section 28 05 00 Common Work Results for ESS and Section 01 78 00 Closeout Submittals.

1.9 O & M MANUALS

- A. Submit in accordance with Section 28 05 00 Common Work Results for ESS and Section 01 78 00 Closeout Submittals.

1.10 QUALITY ASSURANCE

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Manufacturer: Company specializing in manufacturing the products specified with minimum ten (10) years experience and with service facilities within 50 miles of Project.
- C. Installer:
 - 1. Company specializing in installing the products specified with minimum ten (10) years experience and certified by the State of Florida as fire alarm installer.
 - 2. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, the fire alarm system manufacturer.
 - 3. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
 - 4. The installing Contractor shall be capable to provide emergency service 7-days-a-week, 24 hours a day. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least five consecutive years from date of bid opening.

1.11 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

- A. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes, and in particular the ADA requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant system. Additional devices shall be shown on shop drawings submitted by Contractor.
- B. In addition to the above-mentioned devices, Contractor shall include in his bid price the cost of installing the following additional devices (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior substantial completion date. At least two weeks prior to substantial completion system shall be fully operational. After system is operational GOAA OAR, EOR and the system installer shall review the placement of and coverage provided by visual and audible signals throughout the facility for compliance with all codes and in particular, the ADA requirements and NFPA 72. System installer shall provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion. The following shall be included with all required raceway, cable, programming, power supplies, modules, etc. required for them to be completely operational.
 - 1. (40) Additional Visual notification strobes
 - 2. (20) Connections to Fire / Smoke Dampers with associated duct detectors
 - 3. (20) Additional smoke detectors
 - 4. (10) Relays for AHU shutdown
 - 5. (10) Manual Pull Stations
- C. After the project has had its first annual safety inspection, the system installer shall install within one week notice any additional audible/visual signals that have been determined to be required during said inspection from the balance of the additional devices noted above. There shall be no cost for these added devices provided the total does not exceed the balance remaining of the devices noted above. The final balance of the additional devices included in bid price shall be turned over to the Owner as spare material after any fire alarm issues identified during the first annual safety inspection are resolved.

1.12 OWNER'S INSTRUCTION:

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Provide instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel operation and on peripheral device operation, including what are normal indications and alarm indications of each type of new/added device.
 - 1. Videotape all training sessions and deliver (4) copies of tapes to Owner's Authorized Representative (for use in future training).

1.13 EQUIPMENT WARRANTY

- A. Refer to Specification Section 28 05 00 in addition to the following.

- B. Warrant all equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by GOAA, repair or replace any equipment found to be defective.
 - 1. No charges shall be made by the installer for any labor, equipment or transportation during this period to maintain functions.
 - 2. Respond to service call within twenty-four (24) hours after receipt of such a call.

1.14 REFERENCES AND REGULATORY REQUIREMENTS

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. The equipment and installation shall comply with, but not be limited to the current or applicable provisions of the following:
 - 1. National Electric Code, Article 760.
 - 2. National Fire Protection Association Standards:
 - a. NFPA 70 - National Electrical Code.
 - b. NFPA 72 - Application, performance, installation and maintenance of fire alarm systems and their components.
 - 1) NFPA 72: Chapter 24 Emergency Communications System
 - 2) NFPA 72: Chapter 24.3.3 Required Emergency Communications Systems
 - 3) NFPA 72: Chapter 24.3.5.2 Loudspeakers for ECS
 - c. NFPA 101 - Life Safety Code.
 - d. NFPA 90A: Air Conditioning and Ventilating Systems.
 - 3. Underwriters Laboratories Inc. The system and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
 - a. UL 864/UOJZ: APOU Control Units for Fire Protective Signaling Systems.
 - b. UL 268: Smoke Detectors for Fire Protective Signaling Systems.
 - c. UL 268A: Smoke Detectors for Duct Applications.
 - d. UL 521: Heat Detectors for Fire Protective Signaling Systems.
 - e. UL 464: Audible Signaling Appliances.
 - f. UL 1638: Visual Signaling Appliances.
 - g. UL 1481: Power Supplies for Fire Protective Signaling Systems.
 - h. UL 1480: Speakers.
 - i. UL 1424: Cables.
 - j. UL 1971: Signaling Devices for the Hearing Impaired.
 - k. UL 228: Door holders for Fire Protective Signaling Systems.
 - l. UL 38: Manually activated signaling boxes.
 - m. UL 1711: Amplifiers for Fire Protective Signaling Systems.
 - n. UL 1224
 - 4. Florida Building Code: Latest adopted edition.
 - 5. Florida Administrative Code. All applicable chapters including but not limited to:
 - a. Chapter 4A Rules, including but not limited to:
 - 1) Ch 4A-48 Fire Safety Standards for the Fire Alarm Systems.

- 2) Ch 4A-46 Fire Protection System Contractors and Systems.
- 3) Ch. 4A-3 Fire Prevention - General Provisions.
- b. Florida Department of Insurance:
 - 1) Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.
 - 2) Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal.
6. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
7. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Accessibility Guidelines (ADAAG).
8. Department of Community Affairs Florida Board of Building Codes and Standards - Accessibility Requirements Manual.
9. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.
10. State of Florida: Division of State Fire Marshal.
- C. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
- D. All Control Equipment shall be listed under UL category UOJZ.
- E. The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.
- F. IEEE: The fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in Table 1, Location Category a High Exposure of ANSI/IEEE Standard C62.41-1980 (formerly IEEE Standard 587).

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all equipment necessary for a complete extension of existing Fire Alarm system.
- B. All equipment shall be new and UL listed for intended fire alarm purposes.
- C. Provide all equipment to match existing equipment required to perform all functions and features even though not specifically noted or specified herein.
- D. See drawings for description of devices.

- E. Match existing equipment.
 - 1. Existing system in the STC APM/ITF is EST/EDWARDS SYSTEMS TECHNOLOGY. Equipment added to the system shall be EST-3 or latest “Signature” series.
- F. All devices (except beam detectors) shall be addressable type.
- G. Provide back box as recommended by system manufacturer for all devices.
- H. Provide manufacture statements that confirm that the adhesive products used meets the California Department of Public Health (CDPH) Standard Method v1.1 2010 using the applicable exposure scenario

2.2 FIRE FIGHTER CONTROL PANEL (FFCP)

- A. Located in Fire Command Room, and shall provide graphical layout indicating all Smoke Exhaust and Pressurization related equipment.
 - 1. Existing Fireworks PC Workstation and graphics to be updated to include the additional areas being added and/or modified.
- B. Panel shall indicate both positive indication of system and device status and manual control over all points in the systems per NFPA 92 and 72.
- C. Include indication of each LS UPS (status) connected to FA/ECS system operations.
- D. Refer to details in drawings for additional layout information.
- E. Basis of Design: EST3 Fireworks

2.3 FIRE ALARM CONTROL PANEL (FACP)

- A. FACP shall consist of a full height cabinet capable of supporting (3) chassis assemblies with the capability of seven local rail module spaces each. Provide with inner and outer door.
- B. Shall be equipped with CPU and LCDXL display modules.
- C. Provide all fiber optic communications cards as required to connect to existing EST fire alarm network.
- D. Shall be extension of existing EST3 FA System and compatible with all existing equipment
- E. Basis of Design: EST3

2.4 POWER SUPPLY

1. The power supply for the panel and all peripheral fire alarm devices shall be integral to the control panel. The power supply shall provide all control panel and peripheral power needs as well as 3.0 amperes of unregulated 24 VDC power for external audio-visual devices. The audio-visual power may be increased as needed by adding additional modular expansion power supplies (NAC expander). All power supplies shall be designed to meet UL and NFPA requirements for power-limited operation on all external signaling lines, including initiating circuits and indicating circuits.
2. All power supplies shall be provided by the same manufacturer as the fire alarm control panel (FACP). Power supplies provided by manufacturers other than the manufacturer of the fire alarm control panel (FACP) shall not be acceptable.
3. Circuit breakers or other over-current protection on all power outputs.
4. Input power shall be 120 VAC, 60 Hz. The power supply shall provide internal batteries and charger. Internal battery capacity shall be as required.
5. The battery pack shall provide 24 hours maximum normal operating and supervisory power and, at the end of that required period of time, provide 15 minutes power to operate all alarm signals as required by NFPA 72.
6. Increase quantities/sizes of all expansion power supplies, batteries, circuits, etc., as necessary to meet NFPA 72 requirements for circuit loading, voltage drops, etc.

2.5 FIRE ALARM TERMINAL CABINET (FATC)

- A. Remote Closet Cabinets are surface mounted and come in sizes providing space three chassis, with room for standby batteries.
- B. Remote Closet Cabinets have left hand hinged doors and are available with red finish only.
- C. RCC cabinets can also be used as remote battery cabinets.
- D. Provide all required mounting hardware and terminal strips to support all cabling and devices being installed in terminal cabinet.
- E. Provide terminal strips for all field cable.
- F. Manufacturer: EST3 #3-CAB21

2.6 BOOSTER POWER SUPPLY (BPS)

- A. Supply, where needed or as indicated on drawings, Booster Power Supplies (BPS) that are interconnected to and supervised by the main system.
- B. The BPS shall function as a stand-alone auxiliary power supply with its own fully-supervised battery compliment.
- C. The BPS battery compliment shall be sized to match the requirements of the main system and be capable of mounting addressable relay for control and interface.

- D. The EBPS shall be capable of supervising and charging batteries having the capacity of 24 ampere-hours for Mass Notification/Emergency Communication (MNEC), life safety and security applications, and the capacity of 65 ampere-hours for access control applications.
- E. The BPS shall provide a minimum of four independent, fully supervised Class B circuits that can be field configurable for notification appliance circuits or auxiliary 24 Vdc power circuits. BPS NACs shall be convertible to a minimum of two Class A NACs.
- F. Each BPS output circuit shall be rated at 3 amperes at 24 Vdc. Each output circuit shall be provided with automatically restoring over current protection.
- G. The BPS shall be operable from the main system NAC and/or Edwards Signature Series control modules.
- H. Fault conditions on the BPS shall not impede operation of main system NAC. The EBPS shall be provided with ground fault detection circuitry and a separate AC fail relay.
- I. Provide Sync Module in BPS for all local NAC circuits.
- J. Manufacture: EST3 #EBPS10A

2.7 INITIATING DEVICES (ADDRESSABLE)

- A. Manual Station: Surface mounted non-coded type, double action manual station, non break-glass type. Reset key to match existing pull station key/lock.
 - 1. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Provide where device is exposed to the elements
- B. Spot Heat Detector: Fixed temperature, or combination rate-of-rise and fixed temperature, rated 135 degrees F (57 degrees C), and temperature rate of rise of 15 degrees F (8.3 degrees C).
- C. Ceiling Mounted Smoke Detector: NFPA 72, photoelectric type with adjustable sensitivity, plug-in base, auxiliary relay contact (where required), and visual indication of detector actuation, suitable for mounting on 4-inch (102 mm) outlet box.
- D. Duct Mounted Smoke Detector: NFPA 72, photoelectric type with auxiliary SPDT relay contact (where required), key-operated NORMAL-RESET-TEST switch, duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing.
- E. Beam-Type Smoke Detector (BEAM): NFPA 72, Each detector consists of a separate transmitter and receiver with the following features:
 - 1. The projected beam type smoke detector shall be listed to U.L. 268 and shall consist of up to two integrated transmitter, receiver detector heads and single low level remote control unit.

2. The detector shall operate between a range of 26.2 ft to 328 ft (8 m to 100 m).
 3. The temperature range of the system shall be -4°F to 131°F (-20°C to 55°C).
 4. The beam detector heads shall include an integral built-in laser pointer to assist prism mounting. The beam detector shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on the lenses and prisms.
 5. The beams detector heads shall include AutoOptimise self-correcting motorized head feature to ensure unit is always receiving maximum signal available, and shall automatically compensate for building shift.
 6. The unit shall include a low level remote display and control unit with LCD read-out for set-up, reporting and testing of up to 2 separate detector heads.
 7. The System shall have separate Trouble and Alarm relays for each of the 2 channels.
 8. Manufacturer: Fireray #5000
- F. Open-area Smoke Imaging Detector (OSID): NFPA 72, use in ASC HUB. Each detector consists of a multiple emitters and receiver with the following features:
1. Dual wavelength LED-based smoke detection
 2. Optical imaging with CMOS imaging chip
 3. On-board event log for fault and alarm diagnostics
 4. Simple DIP switch configuration
 5. Three selectable alarm thresholds
 6. Status LEDs for Fire, Trouble and Power
 7. Conventional alarm interface for straightforward fire system integration
 8. Provide remote test and reset station in accessible area for each receiver
 9. Provide emitters and receivers where indicated on plans
 10. All components shall be hardwired and power via local BPS
 11. Provide light shields for receivers
 12. Manufacture: Xtralis OSI-90
- G. Air Sampling Smoke Detector (AS): NFPA 72, each detector consists of air sampling heads, trunk and branch piping, and remote controller unit with the following features:
1. Flair detection technology delivers reliable very early warning in a wide range of environments with minimal nuisance alarms
 2. Multi stage filtration and optical protection with clean air barriers ensures lifetime detection performance
 3. Four alarm levels and an ultra wide sensitivity range deliver optimum protection for the widest range of applications
 4. Intuitive LCD icon display provides instant status information for immediate response
 5. Flow fault thresholds per port accommodate varying airflow conditions
 6. Smart on-board filter retains dust count and remaining filter life for predictable maintenance
 7. Extensive event log (20,000 events) for event analysis and system diagnostics
 8. Auto Learn™ smoke and flow for reliable and rapid commissioning
 9. Referencing to accommodate external environmental conditions to minimize nuisance alarms
 10. Fully backward compatible with VLP and VESDAnet

11. Remote monitoring with iVESDA for system review and proactive maintenance
12. Ethernet for connectivity with Xtralis software for configuration, secondary monitoring and maintenance
13. Industry first. Aspirating detector secondary monitoring and maintenance via WiFi
14. USB for PC configuration, and firmware upgrade using a memory stick
15. Two programmable GPIs (1 monitored) for flexible remote control
16. Field replaceable sub-assemblies enable faster service and maximum uptime
17. Control Software: Contractor shall provide and configure manufactures test and supervision software for all air sampling panels. All panels shall be provided with a CAT6 LAN connection to the nearest IDF/MDF room and connected to appropriate V-LAN. Provide computer workstation and software to real time monitor all panels in fire fighter control room and at location determined by GOAA maintenance.
18. Piping: Provide piping per project specification between air sampling heads and controller. Piping shall meet the following minimum requirements:
 - a. Comply with manufacture installation instruction and recommendations
 - b. Shall be FM Global Approved CPVC Pipe
 - c. Shall be sized as required per manufacturer's installation requirements.
 - d. Basis of design: FlowGuard Gold - Pipe and Fittings
19. Power Supply: Located at each Air Sampling panel. The VPS-100US consists of three main components:
 - a. The mounting enclosure, the transformer and the main circuit board. It uses two backup batteries (supplied separately).
 - b. The VPS300US consists of one VPS-100US Power Supply and one VBC-001 Battery Cabinet. Together the two units can hold up to 6 batteries (supplied separately).
 - c. Note: The VESDA Power Supply uses sealed acid, 12VDC, 12 Amp/hour batteries. To order, use part number VBT-012 (minimum 2).
 - d. Manufacturer: VESDA # VPS300US
20. Supervision: Provide local EST3 motherboard and required modules to supervise the VESDA control panels at all locations. Shall report trouble, supervisory, and alarm conditions at a minimum.
21. Manufacturer: VESDA-E #VEU-A10

2.8 NOTIFICATION APPLIANCES

- A. General:
 1. All notification devices shall be white in color
- B. Interior Visual Alarm Devices: Xenon strobe lights with clear polycarbonate lens. Mount lenses on a white faceplate. The word "ALERT" is engraved in minimum 1-inch (25-mm) high letters on the lens. Provide 75 cd minimum per Florida Building Code 11-4.28.3(4).
 1. Devices have a minimum light output as required by NFPA and ADA.
 2. Devices have a minimum light output as indicated on the Drawings
 3. Strobe Leads: Factory connected to screw terminals.

4. Combination devices consist of factory-combined, audible and visual alarm units in a single mounting assembly.
 5. Synchronized flash outputs.
 6. Comply with UL 1971.
 7. Manufacturer: EST3 Genesis Series
 - a. Wall Mounted: G1WA Series
 - b. Ceiling Mounted: GCWA Series
- C. Exterior Visual Alarm Devices: Xenon strobe lights with clear polycarbonate lens. Mount lenses on a Red faceplate. The word "ALERT" is engraved in minimum 1-inch (25-mm) high letters on the lens. Provide 75 cd minimum per Florida Building Code 11-4.28.3(4).
1. Devices have a minimum light output as required by NFPA and ADA.
 2. Devices have a minimum light output as indicated on the Drawings
 3. Strobe Leads: Factory connected to screw terminals.
 4. Combination devices consist of factory-combined, audible and visual alarm units in a single mounting assembly.
 5. Synchronized flash outputs.
 6. Provide gasket and SS hardware
 7. Comply with UL 1971.
 8. Manufacturer: EST3
 - a. Exterior Locations: CS405 Series
- D. Remote Alarm Indicator: LED type, mounted flush in a single gang wall plate.
1. Connected to indicate the alarm operation of a single detector or other device.
 2. Legend: "Alarm."
- E. Horns: Electronic sounder type, operating on 24-V dc, horns produce a sound-pressure level of 90 dB, measured 10 feet (3 m) from the source.
- F. Voice/Tone Speakers: Comply with UL 1480.
1. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.
 2. High-Range Speaker Units: Rated 2 to 15 W.
 3. Low-Range Speaker Units: Rated 1 to 2 W.
 4. Speaker Mounting: Flush, Pendant, semi recessed, surface, or surface-mounted bidirectional as indicated.
 5. Speaker cone shall be mylar cone type.

2.9 AUXILIARY DEVICES

- A. Door Release: Magnetic door holder with integral diodes to reduce buzzing.
- B. Power supplies, controllers, modules, relays, housings, etc. as required by system manufacturer to support all devices required for a complete and operational system.
- C. Isolation Modules:
 1. The Isolator Module (IM) is an addressable device that protects a signaling line circuit (SLC) from a to wire-to-wire short.

2. The module monitors line voltages and opens the data line when a short is detected, isolating the short between the two modules located electrically closest to the short.
 3. The loop controller assigns an address to the module.
 4. The module uses one detector address on the SLC.
 5. Manufacturer: EST3 SIGA-IM
- D. Addressable control Modules:
1. Provide Input / Output / relays as required and as shown on details
 2. Where installed in motherboards provide appropriate version.
 3. Manufacturer: EST3 SIGA Series
- E. Addressable Circuit Interface Modules:
1. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that cannot otherwise be equipped for multiplexing communication. Modules transmit identification and status to the FACP using a communication transmitter and receiver with unique identification and capability for status reporting to the FACP. Modules shall be used for monitoring of non-addressable devices such as water flow, valve tamper, non-addressable detectors, and for control of notification appliances and AHU systems.
 2. Addressable Circuit Interface Modules shall be capable of mounting in a standard electric outlet box.
- F. Control Relays: UL listed SPDT or DPDT 10 amp rated contacts, status LED. Provide metal enclosure w/LED Viewing Port
1. A single relay may be energized from a voltage source of 24 Vdc, 24 Vac, 115 Vac or 230 Vac by wiring to appropriate input terminals.
 2. Each relay position contains a red light emitting diode (LED) which indicates the relay coil is energized.
 3. Relays may be “snapped apart” from a standard four-module assembly and used independently.
 4. Provide dust proof metal enclosure with LED viewing hole for all modules.
 5. Manufacturer: EST3 #MR101/C and MR104/C
- G. Universal I/O Motherboards: Used in AM-1 and AM-2 control modules, and other areas where required. These shall have the following features:
1. Provide mounting and wiring terminations for up to six Signature Series plug-in UIO (SIGA-“M” series) modules.
 2. UIO motherboards slide into a rigid extruded track (included) with mounting pads for convenient mounting into a variety of equipment enclosures.
 3. UIO modules plug into the board and are held securely in place with captive machine screws. All field wiring connects to terminal blocks on the motherboard, which permits rapid removal and replacement of modules for troubleshooting.
 4. Provides mounting and wiring terminations for up to six UIO modules, and feature a riser #1 input and a riser #2 input bus. Jumpers on riser #1 input, between modules, facilitate sharing a single riser among more than one module. This significantly reduces wiring requirements.

5. Enclosure: Each motherboard shall be provided with MFC-A enclosure
6. Manufacturer: EST3 #UIO6/R

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. All of the work specified in this section shall be included within the scope of the contract. The contractor shall retain the Aviation Authority's TC&R Contractor to perform, at a minimum, the following tasks:
 1. Make final connections between new or modified components and the existing fire detection and alarm system.
 2. Provide any programming required at the fire alarm control panels, remote panels or firework computer. This includes programming in support of outages, planned or unplanned, of the system.
 3. Test and certify the completed system in accordance with all regulatory requirements.
 4. Update the system as-built drawings, CAD files and bitmaps.
- C. Locate, install, and test fire alarm and detection system in accordance with the equipment manufacturer's written instructions, and the latest editions of the NFPA, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes referenced in this specification.
- D. Modify/rework existing system as required for extension to new devices and/or as required for proper operation of entire system, adding new zone modules, surge suppression, power supply and battery capacity or new devices to meet regulatory requirements.
- E. Rework/modify/reprogram existing fire alarm control panel and remote control panels to accept and reflect all changes made by alterations as specified.
- F. Modify/update the existing fire alarm as-built (Mylars and blue-line) drawings and CADD files to reflect modifications, additions, etc. made by this project. Provide blue-line sets of changes for approval and comply with all additional requirements as outlined in specifications.
- G. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.
- H. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.
- I. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.

- J. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.
- K. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.
- L. Installation plans and wiring diagrams shall bear the signature and license number of the licensed Fire Alarm Planning Superintendent, the date of installation and the name, address, and certificate-of-registration number of the registered firm.
- M. After completion of the installation of the system, the licensee shall complete a NFPA installation certificate. The installation certificate format shall be furnished by the State Fire Marshal. When an installation certificate form has been completed, legible copies shall be distributed as directed by the State Fire Marshal.
- N. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the installation certificate. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a “tie-on” tag. It shall be as required in the Fire Safety Rules as promulgated by the Florida State Fire Marshal.
- O. All components shall be completely wired. System shall be fully operable when main power service has failed and the Emergency Standby Generator has assumed emergency system loads. This shall require that any devices which required 120 volt power shall receive supply from an emergency 120 volt source.
- P. Power supplies are to be loaded to a maximum of 75% of their capacity. Provide additional power supplies where required to comply with this maximum loading requirement.
- Q. Rework existing fire alarm control panel fiber optic network as required for additional panels. Provide all programming and modules required to interface new fire alarm control panels with the existing system.
- R. Provide SLC isolation relays at each FATC. Connect to building SLC loop for local SLC devices. Each local Isolated Circuit shall be routed to allow for a maximum of 50 addressable devices.
- S. Systems shall remotely monitor and annunciate on fireworks station status of EPG building generators and power availability of all Life-Safety Branch power UPS systems.

3.2 RACEWAYS AND BOXES

- A. Refer to Specification Section 28 05 00 in addition to the following.

- B. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.
- C. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.
- D. Provide supporting devices per Section 26 05 29 Hangers and Supports.
- E. Identify raceways and boxes per Section 26 05 53 Identification for Electrical Systems.

3.3 WIRE/CABLE

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Conductor: 98% conductivity, solid copper or stranded copper with maximum of 7 strands. If stranded conductors are used, then a compression lug shall be installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductors without crimp-on lugs may be terminated into terminal strips of box-lug connectors.
- C. Insulation: A type approved by NEC for the application. All cable shall be UL listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types.
- D. Color Coded:
 - 1. Wiring shall be color coded as required to match existing system.
 - 2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.:
- E. UL:
 - 1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
 - 2. Non-Power Limited: Fire protective signaling circuits classified as non-power limited shall use cable listed under UL Electrical Construction Materials Directory. Category HNHT, "NON-POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such cable shall have fire resistance, listing and markings as described in NEC 760-17. Minimum cable marking shall be NPLF.
 - 3. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, "POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.

4. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760-49. All such cable shall bear a cable marking that includes a Type designation as given in NEC Table 760-50. Provide Type FPL.
- F. Connections of Installation Wiring:
1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
 2. Connections of installation wiring to alarm initiating device and alarm indicating appliances shall be monitored for integrity.
 3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.
 4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
 5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

3.4 PULL STATION

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Install at 48 inches AFF to top of device.
- C. All manual stations shall be in unobstructed locations.
- D. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.
- E. Provide additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.5 VISUAL SIGNAL DEVICES

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Shall comply with the requirements of NFPA, the Americans with Disabilities Act, and other applicable handicap/accessibility codes including but not limited to:
 1. The appliance shall be placed 80 in. above the highest floor level within the space or 6 in below the ceiling, whichever is lower.
 2. In general, no place in any room or space required to have a visual signal appliance shall be more than 50 ft. from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft. across, without obstructions 6 ft. above the finished floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft. in lieu of suspending appliances from the ceiling.
 3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 ft. from the signal.
- C. Provide additional visual signal devices (from that shown on drawings) as required to comply with above requirements.

3.6 END-OF-LINE DEVICE

- A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit. Provide and install nameplate on plate with point number and "EOL."

3.7 AUXILIARY CONTROL RELAYS

- A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.
- B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.

3.8 SPRINKLER FLOW SWITCHES

- A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm panel.
- B. Run conduit and wiring to the flow switches, and connect to provide an operable supervised sprinkler alarm system per NFPA standards, state and local codes.
- C. Provide all electrical including zones as required by Authority Having Jurisdiction and codes.

3.9 SPRINKLER VALVE SUPERVISORY SWITCHES

- A. Coordinate the electrical and operating characteristics of the supervisory switches with the fire alarm panel.
- B. Run conduit and wiring to the supervisory switches, and connect to provide an operable supervised sprinkler alarm system per NFPA standards, state and local codes.
- C. Provide all electrical including zones as required by authority having jurisdiction and codes.

3.10 INSTALLATION OF AIR SAMPLING DETECTORS

- A. Install per manufacture recommendations and in compliance with complete project specifications.
- B. Install per all Local Codes and Standards
- C. Maintain at least 500 mm (20 inches) of straight pipe before the pipe terminates at the detector.
- D. Use bend or sweep elbow connectors to change the direction of the pipe. Bends maintain better airflow than elbows.
- E. All sampling pipes should be fitted with an endcap.

- F. System piping design shall be developed by the contractor to ensure proper system operation. Calculations shall be submitted at time of sop drawings review.
- G. Piping and detections shall be configured for cross zone detections as indicated on drawings. Provide all required equipment to accommodate this requirement.
- H. Contractor shall provide test point in a readily accessible location for annual system testing.

3.11 INSTALLATION OF DETECTORS

- A. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.
- B. All concealed detectors shall be provided with a remote indicating lamp installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.
- C. Label each device with point number.

3.12 INSTALLATION OF DUCT DETECTORS

- A. Comply with all applicable codes and standards including but not limited to:
 - 1. NEMA Guide for Proper Use of Smoke Detectors in Duct Applications.
 - 2. Full requirements of detector UL listing.
 - 3. NFPA 90.
 - 4. Refer to PART 1 - GENERAL for additional standards.
- B. Location: To permit proper sampling of the air within a duct, locate supply air duct detectors downstream from fans, filters, humidifiers, and heating/cooling elements (if Codes permit). Locate supply or return air duct detectors at least six duct widths (diameters) from any opening, detector, bend, or branch connection. When physical parameters or codes make it impossible to meet the six width requirement, locate the detector as far as possible from the obstacle.
- C. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing.
- D. All concealed detectors shall be provided with a remote indicating lamp installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.

3.13 MAIN FIRE ALARM CONTROL PANEL AND ASSOCIATED EQUIPMENT

- A. Install all programming and software changes to existing fire alarm control panel to provide a complete and operational extension of the existing system as specified.

- B. All functions/operations/performance specified are to match the same functions/operations/performance of the existing fire alarm system.
- C. All color graphic AutoCAD bit maps shall be updated and tested.

3.14 EQUIPMENT LABELING

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Engraved laminate labels shall be screw installed on terminal cabinets, FACP, etc. equipment.

3.15 EQUIPMENT MOUNTING

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. All equipment and associated wiring shall be installed in a neat manner and firmly secured with appropriate hardware in the equipment enclosure or to ceiling/wall.

3.16 CABLE/DEVICE IDENTIFICATION

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Provide and install permanent machine-printed cable markers/device labels on all cables/wire lines, telephone lines, modules, etc., at terminal strips, terminal cabinets and at main equipment. Numbers and markings shall also correspond to point-to-point diagrams. (See Section 26 05 53 Identification for Electrical Systems and Section 27 10 00 Premise Distribution System for additional requirements.)

3.17 FIELD QUALITY CONTROL

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Testing:
 - 1. General: A final inspection of the system shall be rendered by the authorized factory representatives. Final inspection shall include a comprehensive verification audit with inspection and test of 100% of all fire alarm system equipment. Audit performers shall have license or certification acceptable to the authority with jurisdiction.
 - 2. NFPA 72: Testing procedures shall be in accordance with NFPA 72 as stipulated for new system acceptance testing. The following paragraphs list minimum verification audit procedures that may require additional work to meet NFPA 72.
 - a. Fire Alarm Control Equipment: Make a visual and functional test of all fire alarm control and auxiliary control equipment.
 - b. Visual Inspection: Make a visual inspection to establish that all electrical connections and equipment are properly installed and operating.
 - c. Fault Simulation: Make a functional fault simulation test on all relevant field wiring terminations to ensure that all wiring is properly supervised.
 - d. Indicators: All indicators shall be tested to ensure proper function.

- e. Auxiliary Functions: All control panel auxiliary functions such as door holder release, central station connection, elevator capture, exit sign flashing and fan control shall be functionally tested to verify proper operation.
 - f. Load and Stress Testing: Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. Three minute general alarm stress tests, both under ac power and standby power, shall be conducted to further ensure complete operation of the system.
 - g. Annunciators: All annunciators shall be tested to ensure that each point activates properly and labeling correctly defines the area of alarm.
 - h. Fire Alarm Peripheral Devices: All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
 - i. Initiating Devices - Manual:
3. Each manual fire alarm station shall be functionally tested for alarm operation.
4. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
- a. Initiating Devices - Automatic:
 - 1) Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
 - 2) Each automatic initiating device shall be functionally tested for proper wiring supervision.
 - 3) Each automatic initiating device shall be inspected to ensure proper placement and mounting.
5. Notification Appliances:
- a. Each notification appliance shall be tested and the decibel reading taken at ten feet from the device and recorded to ensure proper operation.
 - 1) For speakers installed in finished spaces, audibility testing shall be done after all interior walls, partitions, furniture systems, carpet and finishes have been installed. Only the base building may be tested in "shell" condition (prior to buildout), if necessary in order to obtain occupancy certificate from local authority having jurisdiction.
 - 2) Each alarm signaling device shall be functionally tested for proper wiring supervision.
 - 3) Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility and that appropriate sound-pressure level is achieved. Decibel readings shall be included on as-built documents and record documents on CD.
 - 4) All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
 - b. Alarm Verification: Procedures per NFPA 72.
 - c. Multiplex System: Procedures per NFPA 72.

- d. Audit Reporting: Upon completion of the verification audit a report shall be sent to the Designer indicating that all fire alarm equipment has been tested and is in 100% operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The final report shall be generated in a format approved by the equipment manufacturer's headquarters to ensure integrity and uniformity of all audit procedure reporting.
 - e. Specific testing of each elevator recall and shunt trip systems for correct operation.
- C. Record of Completion:
- 1. A Record of Completion (certificate of compliance), as illustrated by Figure 1-7.2.1 in NFPA 72 shall be prepared for each system. Parts 1, 2, and 4 through 10 shall be completed after the system is installed and the installation wiring has been checked. Part 3 shall be completed after the operational tests have been performed. A preliminary copy of the certificate shall be given to the OAR and to any other parties requested by the OAR, after completion of the installation of the wiring tests. A final copy shall be given after completion of the operational acceptance tests.
 - 2. Provide to the Fire Official a copy of the certification as required in Standard Fire Prevention Code article 603.7.6.
 - 3. Provide the OAR with documentation per Florida Statutes 633.701.
- D. An acceptance test run shall be performed by the authorized factory representative in the presence of the Owner, OAR, Designer, and Authority Having Jurisdiction. The AHJ shall be consulted for any requirements for the condition of the system during acceptance testing. Fire alarm device testing methodology shall meet requirements of AHJ and State Fire Marshal fire safety rules and standards.
- E. Coordination: Coordinate all requirements of the Work of other trades surrounding installation of the fire alarm system. Ensure installation and interface to all peripheral items required to interact with the fire alarm and communication system.
- F. Posting: Provide posting of documentation required by Authority Having Jurisdiction in protective enclosure at the fire alarm control panel.
- G. Fill out all programming sheets required by manufacturer. Submit sheets with O & M manuals.

3.18 DEMONSTRATION

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. When system is complete it shall be demonstrated to OAR representative who shall be given complete instructions, parts, manuals and maintenance information.
- C. Demonstrate normal and abnormal modes of operation, and required responses to each.

3.19 AUTHORITY HAVING JURISDICTION

- A. Refer to Specification Section 28 05 00 in addition to the following.
- B. Coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the Designer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the Authority Having Jurisdiction.

END OF SECTION 28 31 00

SECTION 34 77 13 - PASSENGER BOARDING BRIDGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Division 0 BIDDING AND CONTRACT REQUIREMENTS and Division 01 GENERAL REQUIREMENTS Specification Sections apply to this Section:

1.2 SUMMARY

This Section includes the following:

- A. Passenger Boarding Bridges: Provide new apron drive passenger boarding bridges (PBB), complete including all structural, support, mechanical, electrical, and finish requirements, roof top 10 ton PBB Air Handling Units (AHU), 90 and 180 KVA Ground Power Units (GPU) per gate design, aircraft cooling AHU (45 ton and 90 ton) per gate design, and Water Cabinets to serve the aircraft mix indicated on the provided drawings. Provide a bridge monitoring system for all installed bridges.
- B. Fixed Walkways: Provide new fixed walkways as indicated on the drawings and in these specifications. The fixed walkway shall meet all structural, dimensional, and finish requirements specified for the PBB.

1.3 INTENT

- A. The intent of this specification is to describe the design requirements, quantities, performance, and maintenance properties of the passenger boarding bridges and affiliated equipment required at Orlando International Airport (MCO). Operator training, maintenance training, installation requirements, and acceptance conditions are also requirements of this Specification.
- B. Safety of passengers, other personnel, aircraft, and equipment is of prime importance. Nothing in these specifications shall relieve the Contractor of the responsibility for providing safe products.

1.4 APPLICABLE STANDARDS:

- A. The design, fabrication, and construction, including all manufactured components, fittings, and hardware, shall be in U.S. standard units (metric or SI units shall be presented in parentheses following the U.S. standard units), and shall conform to the current issue at the time this project is advertised, of one or more of the following codes and standards as applicable and as referenced herein:
 - 1. City of Orlando and Greater Orlando Aviation Design Standards
 - 2. Society of Automotive Engineers (SAE)

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3. American Society for Testing and Materials (ASTM)
 4. American Welding Society (AWS)
 5. American Iron and Steel Institute (AISI)
 6. American Society of Mechanical Engineers (ASME)
 7. American National Standards Institute (ANSI)
 8. National Electric Code (NEC)
 9. National Electrical Manufacturers Association (NEMA)
 10. National Fire Protection Association (NFPA)
 11. Florida Building Code (FBC)
 12. American Institute of Steel Construction (AISC)
 13. Occupational Safety and Health Administration (OSHA)
 14. Underwriters Laboratory (UL)
 15. Americans with Disabilities Act (ADA)
 16. Florida Accessibility Code for Building Construction (FACBC)
 17. Society for Protective Coatings (SSPC)
 18. Any/all applicable Orlando, FL State or Federal Govt. department's requirements

1.5 SUBMITTALS

- A. Shop Drawings Product Data and Samples: Submit complete and detailed shop drawings for review in accordance with the requirements of Division 01. No fabrication and/or assembly of any of the passenger boarding bridge components shall begin until the shop drawings for such components have been reviewed and approved by the Owner's Authorized Representative (OAR). Additional shop drawings shall be submitted as necessary to fully describe the PBBs, GPUs, Air Handlers and Water Cabinets to be delivered and ensure proper interface with the external environment. All drawings, sketches, details, and material shall be submitted in the English language and in Inch-Pound units, including dimensions, volumes, weights, and forces. Shop drawings shall include but not be limited to the following:
 1. An index prepared in chronological order listing all drawings, sketches, details, and material submitted.
 2. Product Data: Manufacturer's technical product data, including specifications. Include data substantiating that materials comply with requirements.
 3. Interior Finishes:
 - a. Interior finish schedule including interior wall and ceiling finishes.
 - b. Transition details.
 - c. Wall finish attachment methods.
 - d. LED Light fixture details, ceiling materials, layout, and maintained illumination calculations at floor using the actual interior finishes

- e. Joint details.
 - f. PBB section dimensions and general arrangement drawings.
 - g. Tunnel floor finish.
 - h. Cab floor finish.
 - i. Flooring edging details, including lines of demarcation to/from hard surfaced floor at wall areas, and treatment at doors and thresholds.
 - j. Floor Covering.
 - k. Insulation.
 - l. Handrail details.
 - m. Roof mounted PBB air conditioning unit and ducting system for bridge cooling
4. Exterior Configuration:
- a. General PBB, GPU, Air Handler, Water Cabinet and Fixed Walkway layout.
 - b. Exterior elevations.
 - c. Graphics/signage details.
 - d. Paint finishes.
 - e. Flashing (building to PBB & Fixed Walkway sections)
 - f. Ramp service stairway.
 - g. KCI Jet Bridge Belt Loader or owner approved similar belt.
 - h. Service/maintenance ladder, cage and cab roof handrails.
 - i. PBB roof tie-off safety cable system.
 - j. Hurricane tie down details and locations.
 - k. PBB wall penetration and exterior duct.
5. Cab:
- a. Operator's cone of visibility, including mirrors/camera viewing screens for visualizing drive wheels and apron.
 - b. Control panel location and functional layout.
 - c. View panels.
 - d. Safety devices.
 - e. Aircraft interface.
 - f. Modifications necessary for proper connection with required aircraft types including auto-leveling devices.
 - g. Operating instructions placard.
 - h. Cab saloon doors.
 - i. VDGS controller location.
 - j. Camera with visibility of operator and aircraft door viewable within the gate monitoring system.

6. Fixed Walkway:
 - a. Structural calculations sealed by a professional engineer licensed in the State of Florida.
 - b. Design of structure to support fixed walkway.

7. Aesthetics and Safety Markings:
 - a. Color and finish, exterior.
 - b. Safety markings and labels.
 - c. Signage and plaques (interior).
 - Transition ramp signs: Signage size, lettering, colors, and message shall match existing signage at current gates in the North Terminal.
 - Smoke Detectors

8. Electrical, Mechanical, Structural:
 - a. Certifications of Compliance with all listed Design and Construction Standards.
 - b. Electrical power calculations that shall be signed and sealed by a professional engineer legally licensed in the State of Florida.
 - c. Electrical power and control schematic diagrams.
 - d. Hydraulic schematics.
 - e. Interface requirements for foundations and building supplied utilities. Provide exact location of electrical power and communications J-boxes.
 - f. Structural drawings including all pertinent calculations which shall be signed and sealed by a professional engineer licensed in the State of Florida. PBB must meet all wind loading requirements for the greater Orlando area. Minimum wind loading shall be 170 mph.
 - g. The bridge manufacturer shall provide the Owner's Authorized Representative (OAR) with actual foundation loading data sheets for each type of bridge provided based on load requirements specified in the "Structural Design and Support Elements" Article in PART 2 of this SECTION.

9. Communications and Data:
 - a. Cable access, raceways and routing along with all interfaces and coordination details with interior and exterior finishes.
 - b. All cable assemblies for communications and data cables including CAT 6 and ACS Beldin Cable #9841.

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- c. Connection, termination, and interface details for all communications and data cables within the PBB and with the building.
 - d. Connection and mounting details for Physical Access Control System (PACS).
 - e. Connection and mounting details for cameras.
 - f. Connection and mounting details for WIFI antenna.
 - g. Flow and control diagrams for all systems including interfaces with PACS.
10. Confirmation of aircraft parking plan and PBB slopes.
 11. Certificates of compliance with NFPA 415 from a certified testing company located in the continental United States. The manufacturer shall also provide affidavits attesting to the passenger boarding bridge's compliance with NFPA 415. NFPA Certificate of Compliance, and all the supporting test results, and the certificates must be submitted with the bid documents.
 12. Notarized certifications that all electrical, mechanical, and hydraulic designs, components, and installations meet the requirements prescribed in this specification.
- B. Spare Parts:
1. Submit list of recommended spare parts, prices and sources within 60 calendar days after the date of the Notice to Proceed.
 2. Pricing shall be provided for the following spare parts at the time of Bid. Price provided on the following items shall be valid for five (5) years after substantial completion and will be used for replacement parts for bridges in the North and South terminals:
 - a. Thyssen Krupp
 - Full Canopy Replacement Kit
 - Canopy, Tube Motor 120V / 60 Hz, Thyssen Krupp #A4230300
 - Canopy, Pulley, Complete, Right, Thyssen Krupp #A4230293
 - Canopy, Pulley, Complete, Left, ThyssenKrupp #A4230294
 - Variable Frequency Drive, 7.5HP, 480 VAC, UL, Thyssen Krupp #2552042
 - Display, Magelis, 5.7" Color, Thyssen Krupp #25524121
 - Hydraulic Cylinder 10FT STRK, (Rebuilt - Re-Sealed cylinder)
 - b. JBT
 - Full Canopy Replacement Kit
 - Bridge Operator Display Screen
 - Cab curtain and barrel right side assembly for bottom tension 125 CORNELL JBT # 3716699
 - Canopy Curtain, Kit, ACFT Clos/Inr, Std, JBT #3656365
 - Ball Screw, Vertical Column, JBT #3640979.01
 - Motor, Vertical Drive, 3 HP, W/Mounting Bracket, JBT #2136033.01

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- VFD, AC Motor Driver, 3. 5.5Kw, (used at PBB control console), Schneider # ATV312HU55N4
 - Bearing, Rotex bearing for Jetway PBB Boggie Housing, Kit Brg. Rdl, Lwr,Dr. Col Std., JBT # 3721723
- c. Other Manufacturers
- Identify and price the top ten (10) parts (by highest cost) that may likely be replaced within the first five (5) years of operation. Candidates are canopies and canopy components, hydraulic components, ball screws, motors, etc.
- C. Manuals:
1. Not less than 30 days prior to acceptance inspections, supply three (3) copies of technical manuals for each passenger boarding bridge furnished under this Contract. Manuals shall not be generic in nature and shall reflect the exact construction of each bridge furnished. Non-applicable items and drawings shall not be included in the manuals. Manuals may have descriptive type photographs. Pages shall have reinforced edges. Manuals shall be compact in size and bound. Manufacturer shall also provide one (1) copy of all listed manual information on a USB/jump drive.
 2. The technical manuals shall be all inclusive but must contain the following information:
 - a. Description and operation of all systems and components.
 - b. Electrical drawings specific for each bridge furnished. Provide one set of bound, laminated electrical drawings for each bridge, to be placed in the control console.
 - c. Maintenance instructions including troubleshooting/diagnostics guidelines.
 - d. Overhaul instructions.
 - e. List of parts and part numbers.
 - f. Illustrated parts list of all components.
 - g. Recommended spare parts list and source.
 - h. Complete and detailed Preventive Maintenance Program for each type of boarding bridge furnished under this Contract.
 - i. Diagrams that show the interconnections with 400 Hz Power and PCA and PBB cooling AHU.
 - j. Instructions for the transition of key activation to PACS card reader activation.
- D. Test Reports: Submit all factory and field test reports to the Owner's Representative prior to the final inspection.

1.6 QUALITY ASSURANCE

- A. Qualifications:
1. The manufacturer and PBB installer shall provide evidence of at least ten (10) years of satisfactory experience in the design and fabrication of passenger boarding bridges specified herein.
 2. Bridges shall be manufactured in the US and shall be made of parts manufactured within the US whenever possible.
 3. Qualified proposers must provide references/proof of at least fifty (50) airport passenger loading bridges manufactured in the US, installed and in use in US airports within the past five (5) years.
- B. Regulatory Requirements: The PBB shall be designed to conform to all applicable Federal, State and Municipal Codes and regulations as applicable to the project site in effect at the time of manufacture.
1. Structural Design and Construction Standards:
 - a. Code of Standard Practice for Steel Buildings and Bridges.
 - b. American Welding Society Standards. All welds shall exhibit adequate penetration and shall be clean and free of slag. Welds shall not be ground to improve appearance except as required for flush surfaces or where nonstructural parts are involved. On site welding and pedestal modifications shall be performed by an AWS 6G certified welder.
 - c. American Iron and Steel Institute Specification for the Design of Cold- Formed Steel Structural Members, Van Karmon theory and buckling studies by Peterson and Card, finite element analysis or other approved method.
 - d. All sheared or sharp metal edges shall be deburred or broken. All exposed metal comers shall have minimum radii in accordance with the appropriate material specification.
 2. Mechanical and Hydraulic Specifications and Standards:
 - a. All mechanical and hydraulic components and designs shall conform to the recommendations and standards established by the Society of Automotive Engineers, Joint Industrial Conference and the American Society of Mechanical Engineers.
 - b. All threaded fasteners shall incorporate suitable locking devices.
 3. Electrical Specifications and Standards:
 - a. All electrical equipment and methods of installation shall conform to the Electrical Manufacturers Association, Joint Industrial Conference, the National Electrical Code, and modifications to the NEC by the local authority having jurisdiction.
 - b. All electrical components utilized shall be recognized by Underwriters Laboratories in all cases where UL maintains a listing category for the devices installed.

- c. All low voltage pathways and cabling equipment and methods of installation shall conform to applicable TIA standards.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver PBB with protective covering to prevent exposure of interior to weather, dirt, water and nearby construction activities.
- B. Storage: Coordinate delivery/storage with the owner.
- C. At all times, protect interior from weather, dirt, water, and construction debris.
- D. Handling: Handle PBB according to manufacturer's written rigging and installation instructions for unloading, transporting, storing and setting in final location.

1.8 SEQUENCING, SCHEDULING AND COORDINATION

- A. Working Area: Coordinate the location of PBB staging areas, storage areas and erection areas with Airport Operations Authorities and other Contractors.
- B. Bridge Foundation: Coordinate the installation of PBB with installation of PBB foundations. The PBB foundations will be completed by others. Bridge foundation components must be designed to support wind speed up to and including 170 miles per hour.
- C. Bridge Monitoring and Installed Equipment: Provide, coordinate and install the 400 Hz equipment, preconditioned air handlers, potable water cabinets, bridge monitoring system and building interface electrical and communication services to ensure a complete and operational installation of the PBB. The PBB work shall include the PBB roof top cooling units and all electrical and communication components of the PBB from the building interface outward.
- D. Coordinate the breakouts and terminations of all low voltage cabling assemblies with contractor installed items, in addition to item provided by the manufacturer, prior to shop drawing submittal, PBB installation and manufacturing.
- E. Thoroughly review GOAA STC construction documents, including specifications, for PBB interface requirements prior to shop drawing submittal, PBB installation and manufacturing.

1.9 MAINTENANCE

- A. Extra Materials:
1. Within 60 calendar days after the date of the Notice to Proceed, furnish a list of recommended spare parts, including prices and sources.
 2. Provide the following materials for each bridge at Substantial Completion:
 - a. Spare fuses, minimum one (1) each size per bridge. A spare set of fuses shall be provided for all power and control types used on all bridges and turned over to GOAA maintenance.
 - b. Paint touch-up kits.
 - c. Aircraft closure repair kits.
 - d. Three (3) bridge stands.
- B. The Contractor shall maintain an adequate inventory of all proprietary or Contractor fabricated or modified parts, especially the long lead time items considered as insurance, for routine maintenance of the unit. All stock shall be maintained, whether or not the unit is in current production for a minimum of ten (10) years from the date of the last unit's final acceptance. An adequate inventory of all industry standard parts shall also be available.
- C. The Contractor shall provide the Owner with Service Bulletins outlining product improvement data resulting from continuing field operation experiences. Service Bulletins shall be sent to the Director of Operations: Orlando International Airport, 1 Jeff Fuqua Blvd, Orlando, FL 32827, United States and e-mailed to PBBSERVICEBULLETINS@GOAA.ORG.

1.10 OPERATOR TRAINING

- A. Training Requirements:
1. The Contractor shall conduct training utilizing prepared texts, slides, actual boarding bridges, and other instructional aides as appropriate.
 2. Provide a minimum forty (40) hours of maintenance training and sixteen (16) hours of operator training, in separate sessions, by a qualified manufacturer's representative for the models and types of boarding bridges purchased under this Contract.
 - a. Training shall be conducted at the installation site and in classrooms as designated and provided by the Owner.
 - b. Maintenance training shall include proper demonstration of cut-away models of critical parts, full instruction of proper maintenance and trouble-shooting, and instructions on proper use of manuals. Operator training shall include proper demonstration as well as actual use of correct bridge operations to avoid damaging the equipment by improper use of the controls.
 - c. One session of each type of training shall be recorded on USB/Jump drive and shall be provided to the owner.

3. Training shall be provided for classes of up to 16 attendees per session, classes will be offered during the morning/daytime shift and during the afternoon/evening shift at a time and place mutually agreed upon by the Contractor and the Owner. Dates shall be prior to scheduled commercial service of the boarding bridges.
4. The Owner will assign the individuals and/or companies to be trained.
5. Upon completion of training program, provide the Owner with ten (10) operating instruction brochures and ten (10) maintenance manuals for each model or type passenger boarding bridge. Copies shall also be provided on individual USB/Jump drives.
- 6.

1.11 WARRANTY

- A. Provide special project warranty signed by the Contractor, installer and manufacturer, agreeing to replace, repair or restore defective materials and workmanship of passenger boarding bridge work during the minimum two (2) year warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.
 1. "Defective" is hereby defined to include, but not by way of limitation, operation, or control system failures, performance below required minimums, excessive wear, unusual deterioration or aging of materials of finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unusual, unexpected, and unsatisfactory conditions.
 2. Warranty period is a minimum of two (2) years on all components (AHU, GPU, Water Cabinets and PBB) (excluding wear and tear/ water hoses) following the date of passenger boarding bridge final acceptance. Extended warranty periods beyond the minimum two (2) years will be considered as favorable.
- B. Provide coincidental product warranties where available for major components of passenger boarding bridge work. Submit with maintenance manuals.
- C. The Contractor shall warrant that the PBB's and all components and accessories comply with the requirements of the Contract Documents, including approved drawings and this specification. The PBB's shall perform to the design function for a minimum period of twenty (20) years from the date of final acceptance of each PBB by the Owner. Failures caused by normal wear and tear, Acts of God, and modifications by the Owner, which have not been approved by the manufacturer, will be excluded from the coverage in this Section.

- D. The Contractor shall warrant that the PBB's and all components are new and manufactured using new materials, and are of good quality, suitable for aircraft use, and are free and clear from liens, encumbrances and title defects.
- E. The Contractor shall repair or replace any warranty defect, including both parts and labor at Contractor's expense, within forty-eight (48) hours of written or notification from the Owner. (On site authorized representative response requirements differ.)
- F. The firm performing warranty service shall be authorized by the Contractor and approved by the Owner. In addition, the authorized firm shall be located on site of Orlando International Airport.
- G. Service calls during the warranty period shall require a 10 minute response time from 3 a.m. to 12 a.m. midnight, seven days a week. A factory-authorized representative is required to respond to these service calls.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. JBT AeroTech.
 - 2. ThyssenKrupp, Inc.
 - 3. Other Bridge Manufacturers who may be deemed qualified by the Authority and meet required manufacturing, install and use requirements as stated in section 1.6.A.3 of this specification.

2.2 MATERIALS

- A. Material Specifications:

Component	Applicable Standard
Structural Plate	ASTM A36
Structural Steel & Shapes	ASTM A36 or ASTM A572 Grade
Steel Hollow Structural	ASTM A500 Grade B
Steel Pipe	ASTM A53 Grade B
Steel Sheet	ASTM A570, ASTM A569 or ASTM A653
T-1 Steel	ASTMA514or ASTM A517
Hinge Pins	ASTM A311 Grade 1018 or Grade 1144 or ASTM A576 Grade
Bolts-Standard	ASTM A307
Bolts-High Strength	ASTM A325, SAE-J429 Grade 5 or 8, or ASTM A490

- 1. Mechanical and Hydraulic Specifications and Standards:

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- a. All mechanical and hydraulic components and designs shall conform to the recommendations and standards established by the Society of Automotive Engineers (SAE), Joint Industrial Conference (JIC) and the American Society of Mechanical Engineers (ASME).
 - b. All threaded fasteners shall incorporate suitable locking devices.
2. Fire Protection Standards: The bridges shall conform to the requirements of the National Fire Protection Association (NFPA) "Standards Airport Terminal Buildings, Fueling Ramps Drainage, and Loading Walkways," NFPA-415, latest edition.
 3. Electrical Specifications and Standards:
 - a. All electrical equipment and methods of installation shall conform to the requirements and recommendations of the American Insurance Association (AIA), National Electrical Manufacturers Association (NEMA), Joint Industrial Conference (JIC), National Electrical Code (NEC), and latest issue and modifications to the NEC by the City of Orlando.
 - b. All electrical components utilized shall be recognized by Underwriters Laboratories (UL) in all cases where UL maintains a listing category for the devices installed.
 - c. All equipment and controls which are exposed to the weather shall be of weatherproof type or shall be contained within weatherproof housings.
 - d. Where required by the type of components installed therein and the installation environment, electrical panels or cabinets which are mounted externally to the bridge, shall be equipped with heaters or electric components to control condensation.
 - e. All electrical installations shall comply with the Greater Orlando Aviation Authority Electrical Standards.

2.3 APRON DRIVE PASSENGER BOARDING BRIDGE GENERAL REQUIREMENTS

A. Design:

1. The passenger boarding bridges shall be of telescoping tunnel design. The telescoping tunnels, cab and canopy shall permit servicing of all commercial jet aircraft indicated in the drawings. No other bridge models, other than the ones listed, shall be acceptable.
2. Terminal floor elevation varies above the apron at the face of the building.
3. Where the passenger boarding bridge rotunda is installed at the face of the terminal building, it shall be supported entirely by its own structural support and no load or structural stress shall be transmitted to the aircraft or terminal building.

4. The vertical dimension from the passenger service lee finished floor to the top of concrete rotunda foundation and the horizontal dimension from the service level face of the building to the center of the rotunda column anchor bolt pattern shall be field verified by contractor.
5. The fixed walkway tunnels may be supported by support angles from the terminal building; support angles shall be provided and installed by the Contractor. The Contractor shall, as part of the work under this Contract, design, furnish, and erect the fixed walkways as necessary to complete the installations. The long and short fixed walkways shall meet all the structural, dimensional and finish requirements specified for apron drive PBB's. Fixed walkways shall be installed where shown on the drawings. Construction of the fixed walkway tunnel shall be substantially identical to that of the telescoping tunnels. Continuous handrails with returned ends shall be installed the full length and on both sides of the fixed walkways.
6. Reflected loads imposed on the terminal shall not exceed 5 kips applied horizontally, parallel to the face of the building.
7. Basis of Design Model Numbers and Operational Limits. Models and bridge size may vary and it is the manufacturer's responsibility to ensure that the proper bridge fit/size is used at each location.

GATE	PBB	THYSSEN MODEL NUMBER	EXTENDED LENGTH (FT.)	RETRACTED LENGTH (FT.)	JBT MODEL NUMBER	EXTENDED LENGTH (FT.)	RETRACTED LENGTH (FT.)	FIXED WALK WAY (FT.)
258		TB 45.0/21.0-3	69.88	148.62	A3 61/127	64.29	123.35	NO
257		TB 45.0/21.0-3	69.88	148.62	A3 61/127	64.29	123.35	NO
256		TB 45.0/21.0-3	69.88	148.62	A3 61/127	64.29	123.35	NO
255		TB 45.0/21.0-3	69.88	148.62	A3 60/119	64.07	115.09	NO
254		TB 45.0/21.0-3	69.88	148.62	A3 58/116	60.79	112.85	NO
253		TB 45.0/21.0-3	69.88	148.62	A3 61/127	64.29	123.35	NO
252		TB 45.0/21.0-3	69.88	148.62	A3 61/127	64.29	123.35	NO
251		TB 45.0/21.0-3	69.88	148.62	A3 58/116	60.79	112.85	NO
250	C	TB 43.0/20.5-3	68.24	142.06	A3 65/133	67.8	129.85	14.5
	B	TB 45.0/21.0-3	69.88	148.62	A3 65/133	67.8	129.85	NO
	A	TB 45.0/21.0-3	69.88	148.62	A3 72/150	74.8	146.85	19.5
241	B	TB 45.0/21.0-3	69.88	148.62	A3 68/144	71.3	140.35	38.5
	A	TB 43.0/20.5-3	68.24	142.06	A3 61/127	64.29	123.35	37.5
243	B	TB 45.0/21.0-3	69.88	148.62	A3 72/150	74.8	146.85	NO
	A	TB 41.0/19.5-3	64.96	135.5	A3 58/110	60.79	112.85	NO
245	B	TB 45.0/21.0-3	69.88	148.62	A3 72/150	74.8	146.85	NO
	A	TB 37.0/18.5-3	61.68	122.37	A3 61/127	64.29	123.35	NO
244	B	TB 45.0/21.0-3	69.88	148.62	A3 72/150	74.8	146.85	NO
	A	TB 45.0/21.0-3	69.88	148.62	A3 68/141	71.09	137.07	NO

242	B	TB 45.0/21.0-3	69.88	148.62	A3 72/150	74.8	146.85	NO
	A	TB 41.0/19.5-3	64.96	135.5	A3 61/127	64.29	123.35	NO
240	C	TB 45.0/21.0-3	69.88	148.62	A3 68/144	71.3	140.35	14.5
	B	TB 43.0/20.5-3	68.24	142.06	A3 68/141	71.09	137.07	NO
	A	TB 41.0/19.5-3	64.96	135.5	A3 61/127	64.29	123.35	NO
236	B				A3 72/150	74.8	146.85	NO
	A				A3 61/127	64.29	123.35	NO
235	B				A3 72/150	74.8	146.85	NO
	A				A3 53/104	57.08	100.09	NO
234	B				A3 72/150	74.8	146.85	NO
	A				A3 60/119	64.07	115.09	NO
233	B				A3 72/150	74.8	146.85	NO
	A				A3 65/133	67.8	129.85	NO

B. Operation Limits:

1. The passenger boarding bridge shall be capable of moving to any point on the terminal apron within its design operation range. The passenger boarding bridges shall be capable of having simultaneous directional movements: extension-retraction, lateral motion, vertical elevation, and cab rotation.
2. The passenger boarding bridge shall be able to reach and service all aircraft indicated on the plans without operating in a slowdown mode, including the 1U door for the A380.

C. Operating Environment: The bridges shall operate satisfactorily under ambient temperatures from -25°F to 125°F with sustained winds up to 65 mph on wet apron surfaces. The entire bridge shall be weatherproof when extended while parked to the aircraft and in the stowed position with the cab door closed. Equipment and controls exposed to the weather shall be of weatherproof type or housed in weatherproof enclosures. Electrical panels or cabinets mounted external to the bridge shall be equipped with heaters or electric components to control condensation where required by the installation environment.

D. Operating Instructions: A weatherproof and water resistant placard outlining the bridge operating instructions shall be displayed in a prominent location in the cab of each bridge in plain sight of the Operator. A qualified graphics expert shall prepare the placard and the displayed instructions.

E. Safety Requirements:

1. All equipment shall be designed to be fail-safe and all controls that regulate bridge motions (i.e., horizontal travel, vertical travel, and cab rotation) shall be of the dead-man type. Dead-man type shall mean controls that require the operator to apply constant pressure to be engaged. Once the pressure is released the control is disengaged.
2. All operating mechanisms (i.e., horizontal and vertical drive, cab rotation) shall be designed so the drive mechanism is locked when power fails or is shut off.
3. Positive mechanical stops shall be provided to prevent over-travel where any component might become disengaged from its guiding or restraining component. The positive stop shall be in addition to all limit switches provided to restrict over-travel during normal operating conditions, including drive wheel steering motions and cab rotation. This does not apply to tunnel rotation which shall have dual limit switches. Mechanical stops shall be identified and detailed on the shop drawings.
4. The operator's position in the control cab shall be designed to provide the operator adequate visibility to position the boarding bridge with the cab weather door closed. Suitable enclosures, guard rails, and other restraint devices shall be provided to protect the operator from being pitched out the open end of the cab in case of sudden stops or inadvertent movements of the bridge when operated with the door open. A handhold shall be attached to the wall on both sides of the cab weather door.

F. Maintenance Provisions:

1. Maintenance requirements shall present no special problems to personnel knowledgeable in their respective fields of hydraulics, electrical power and controls, or general mechanical assembly.
2. Install bridge components with adequate access and appropriate fastener types to permit change-out by one person. If a component's weight requires mechanical assistance to lift, the component or assembly shall be provided with lift eyes, fork lift guides, or other means of providing a mechanical advantage. Components shall be simple, rugged and easily accessible for routine maintenance, lubrication, exchange and adjustment. Electrical cabinets, hydraulic cabinets and pumps shall be located so they are always accessible to maintenance personnel standing at ground level without the use of a ladder, regardless of the vertical position of the bridge.
3. Access panels, where required to gain access to equipment or maintenance areas, shall be sized to allow necessary tools and equipment to be inserted to complete the work. The panel shall be permanently attached to the structure by hinges, and any fasteners required shall be permanently affixed to the panel.

4. Provide all product specific tools required for routine maintenance.
 5. Modular components: Utilize standardized modular components that are readily available in the continental United States to provide rapid corrective measures of malfunctioning critical components. Critical bridge components shall be located to allow for ease of access and installation.
 6. All hardware items required including, but not limited to, bolts, studs, nuts, washers and fasteners shall be provided in Inch-Pound unit sizes.
 7. The manufacturer shall maintain an adequate inventory of all proprietary or contractor fabricated and modified parts for routine maintenance of the unit. All stock shall be maintained, whether or not the unit is in current production, for a minimum of fifteen (15) years from date of the last unit's final acceptance.
 8. All mechanical and electrical systems shall be protected from potential damage resulting from climatic conditions, falling objects or collision with aircraft service equipment and other moving vehicles.
- G. Power Characteristics:
1. The apron drive passenger boarding bridge shall operate on a 480 volt, 3 phase, 60 Hz, 60 Amp circuit, with ground and neutral. A minimum of four spare conductors shall be included in the bridge control circuitry for possible future additions or changes to the control system.
 2. The power supplies for the electrical receptacles and lighting shall be supplied from separate sources from the building. The receptacles shall be designed for two separate circuits equally distributed through the passenger boarding bridge interior and exterior. Power sources for the receptacles shall alternate as much as possible.
 3. Provide transformers and circuit breakers as required to transform the 480 volt, 3 phase power for the bridge drive to 120 / 208 volt or 120 / 240-volt power for the bridge lighting and other power distribution and controls on the bridge.
 4. All exterior electrical components shall be housed in weather-tight and corrosion resistant enclosures conforming to NEMA 4X stainless steel.
 5. Provide sufficient cable lengths to reach the panel board or disconnect switches mounted on the face of the terminal wall at the apron level.
 6. Provide strain relief devices on all unsupported cables.

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7. Provide cabling for the following across each bridge: Bridge drive, bridge controls, 400 Hz frequency converter, bridge lights, VOIP telephone and controls, preconditioned air system, and bridge sign light. Cables shall be flexible copper. Plastic tie-wraps are not allowed on the project. The Contractor shall use Adel clamps for all cable attachment and bundling. Refer to the Utilities section within this specification for further information.
 8. The control cables for the air handling units shall be installed into the bridge wiring during bridge factory fabrication. Cables for the temperature sensor as well as the cable for the air handling unit pushbutton control shall be provided and installed by the passenger boarding bridge manufacturer for installation and incorporation by the passenger boarding bridge. Flush mounted 2"x 4" junction boxes shall be installed in the PBB cab for the cabin temperature sensor ("Occupied/Unoccupied" switch and the "On/Off" switch). The cabin temperature sensor bypass switch and the bypass potentiometer shall be installed in the PBB control panel. Bypass switch shall be key operated. Provide 26 keys.
 9. Rotunda Column Grounding: Provide a grounding stud on the rotunda base plate and attach to new or existing grounding system rod in accordance with NEC and local codes. Rotunda base anchor bolts are not ground rods and shall not be considered as such.
 10. Electrical Components:
 - a. General: All electrical equipment and components shall be manufactured in Inch-Pound units and conform to recommendations and standards listed in the Quality Assurance Article.
 - b. Electrical Junctions: All electrical junction points and connections within the boarding bridge shall be made directly to terminal strips, no splices are allowed.
 - (1) Power cables shall be hardwired from the passenger boarding bridge directly to a distribution panel mounted at the terminal.
 - (2) Electrical or communication service conduit shall not be permitted on the exterior sides of the passenger boarding bridge.
 - (3) All cables and wiring shall be installed in cable carrying devices approved by the Owner's Authorized Representative (OAR).
 - (4) All electrical switch and receptacle device plate covers shall be stainless steel and shall match the device configurations, and on exposed wiring shall exactly fit the outlet box dimensions.
 - c. All electrical circuitry shall be successfully tested before the unit leaves the manufacturer's plant.

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- d. Primary Power: The main primary power "ON" indicator light shall be located on the operator's control panel adjacent to the power "ON/OFF" controls.
 - e. Anti-Chafing Devices: Whenever electrical cables and/or plumbing fixtures are required to slide or move, anti-chafing devices shall be provided. Acceptable anti-chafing devices include grommets, flexible sleeves and jackets, and other similar approved devices.
 - f. Identify all cables with wire/cable identification bands on both ends. Bands shall be pre-numbered plastic coated style or type-on style with clear plastic self-adhesive cover flap, numbered to show circuit identification numbers indicated on shop drawings.
 - g. All J-boxes shall be labeled with engraved placards to indicate usage (i.e., 400Hz, AHU, Bridge Power).
 - h. Breakers in the raceways or J-box shall be re-settable from a locked box located on the side of the bridge, accessible from the service stairs and labeled appropriately.

11. Electrical Control Elements:

- a. Primary power for the PBB will be supplied from the Terminal Building by a 480/277 volt, three phase, 60 Hz, 200 amp or 400-amp distribution panel with circuit breaker mounted on the exterior of the building. Transformers shall be supplied and installed by the Contractor. Power for the PBB shall be separately supplied from breakers within the panel through rotunda mounted disconnects. Include a separate disconnect switch for each service at the rotunda and provide separate power cabling from the rotunda to the cab for bridge power.
- b. The electrical disconnect panel and transformer shall adapt the specified terminal power to the PBB's electrical requirements, shall be provided and installed by the Contractor, and shall be mounted on the rotunda support column.
- c. The transformer and separate circuit breakers for lighting and control power shall be mounted in the power control panel provided by the Contractor.
- d. It shall be the responsibility of the Contractor to advise the Owner concerning the primary power requirements.
- e. In case of power failure, power to energize the PBB shall be available on a manual selective basis as determined by the Owner's operational procedures. This emergency power supply is selected via manual switches inside the terminal building.
- f. The Contractor shall check and verify the quality of the PBB's power supply and its suitability for use with solid state equipment, or other system components that are sensitive to the quality of power supply.
- g. The PBB electrical/electronic components and systems shall be designed to operate in the lightning environment of the Orlando

area. The manufacturer will provide necessary lightning suppression equipment to ensure continued, safe operation of all provided equipment.

- h. PBB's utilizing solid state equipment or other system components sensitive to the quality of the power supply shall be provided with surge protection which shall protect the fastest logic circuits and loads, even if destroyed, providing protection for all modes (normal, common, metallic, transverse or longitudinal). The surge protector shall be located in the equipment cabinet and the Contractor shall provide a new ground, if needed for the system.

H. Communications and Security Characteristics:

- 1. Comply with specification section 27 10 00 for all voice/data communications cabling and specification 28 23 00 for security camera connectivity.
 - a. Cables in the PBB shall be outside plant (OSP) rated.
 - b. Furnish and install twelve (12) OSP-rated Category 6 cables with overall foil shield (F/UTP).
 - (1) Refer to section 2.6 M. within this document for connected devices.
 - (2) PBB manufacturer to provide a minimum of 15 feet of extra cable (for each cable run) at the building interface for connection to the building system. The total required length shall be coordinated by the PBB manufacturer with the building low voltage contractor.
 - c. Voice/data communications cabling shall not share raceway with current-carrying electrical conductors.
 - d. Voice/Data communications cabling shall be installed as part of PBB factory fabrication.
- 2. A low voltage communications panel.
 - a. Shall be located at the cab end of the PBB and shall be accessible from the cab interior.
 - b. Can be separate or a section in one of the PBB control cabinets.
 - (1) Must be lockable.
 - (2) Lock must be independent of control cabinet locks.
 - c. Panel shall have an eight (8) port CAT6 Ethernet patch panel.
 - d. Enough Cat6 cable shall be provided in the panel to allow for future connection of up to two (2) cameras and one (1) WIFI device on the ceiling of the cab (minimum 15 feet each cable).
- 3. Manufacturer to coordinate all cable lengths, transitions, and terminations from building interface to end device.
- 4. All connections at the building interface shall be provided with harsh environment quick disconnect connectors.
- 5. Access Control Systems:
 - a. Furnish and install one (1) Belden Cable #9841 for use with the PACS. Cable shall be routed from the building interface to a junction box mounted near the control panel.

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- b. Building interface junction box shall have a minimum of 15 feet of spare cable for connection to the building. The total required length shall be coordinated by the PBB manufacturer with the building low voltage contractor.
 - c. Junction box at the control panel shall be a deep single gang box ready to accept the access control card reader.
 - d. All access control items and installations shall be coordinated with the building security contractor.
6. Wireless Access Point:
- a. Provide conduit, weather proof housing, and mounting structure for the installation of an Aruba AP-365 Omni- Directional access point.
 - b. Location of the antenna shall be on the exterior front of the PBB cab roof.
 - c. Conduit shall be routed from the antenna weather proof housing to the low voltage communications panel in the cab of the PBB.
 - d. Antenna will be purchased by GOAA and installed by the building low voltage contractor.
- I. Mechanical Characteristics:
- 1. Mechanical and Hydraulic Design and Components:
 - a. Only standard components readily available in the continental United States, manufactured in Inch-Pound standard units and conforming to recommendations and standards listed in the Quality Assurance Article shall be used.
 - b. All operating mechanical and hydraulic components shall be assembled and tested before the unit leaves the manufacturer's plant. The Owner's Authorized Representative (OAR) may witness testing.
 - c. Hydraulic cylinders shall be designed for seal replacement by maintenance technicians.
 - d. Drip pans shall be provided under all hydraulic components to prevent hydraulic fluid from dripping on the pavement.

2.4 PERFORMANCE REQUIREMENTS

- A. Aircraft: Unless otherwise directed by Owner's Authorized Representative (OAR), the boarding bridge shall be capable of accommodating the first and, if applicable, second forward door of the aircraft as shown on the drawings. The telescoping tunnel shall permit servicing of all commercial jet aircraft as indicated on the drawings.
 - 1. Maximum height above the apron at cab floor level: 25'-0".
 - 2. Minimum height above the apron at cab floor level: 12'-0".
- B. Telescoping Tunnel Slope: Maximum slope shall be 8.33% (1:12) measured from the terminal rotunda center point to the center point of the adjustable cab floor (except at the transition ramps), for each aircraft type serviced.

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- C. Cab Rotation: The cab shall be designed to rotate a total of 125° (90°-95° counterclockwise and 30°-35° clockwise from center) at a maximum speed of 145° per minute in either direction.
 - D. Bridge Rotation: The rotunda shall permit the entire unit to rotate 175° (87.5° clockwise and 87.5° counterclockwise).
 - E. Drive Wheel Rotation: Steer angle shall be 180° in place and in motion. Steer speed shall be between 9° and 14° per second.
 - F. Vertical Lift Speed: 2.5 feet per minute (fpm) to 4 fpm as measured at the cab spacer.
 - G. Drive Speed: The drive system shall permit the unit to extend/retract and rotate to any point within its operating envelope at a variable speed between 0 and 90 fpm.
 - H. Deceleration: The horizontal drive system shall include a decelerator device to reduce or eliminate shocks when approaching maximum extension, or when horizontal travel is stopped or reversed suddenly, for protection of the equipment and passenger boarding bridge operator.

2.5 STRUCTURAL DESIGN AND SUPPORT ELEMENTS

- A. Loads: In addition to the dead loads and dynamic effects caused by movement, the entire passenger boarding bridge shall support the following minimum loads, unless the governing building code prescribes more severe requirements. These loads may be applied in total or in part, singularly or simultaneously. The design shall be based on the combination that imposes the most adverse loading.
 - 1. Dead loads shall be determined by the weight of the structural system and any fixed materials (partitions, ceilings, etc.)
 - 2. Live loads (Extended or Retracted): FLOORS 40 lb. per sq. ft. ROOFS 25 lb. per sq. ft., 250 pounds concentrated load anywhere in the roof.
 - 3. Wind loads: Per ASCE-7-10, V=170 mph for Category IV buildings. Wind pressures on the structure shall be determined in accordance with ASCE 7-10 Sections 27.3.2 and 27.4.1 for Main Wind Resisting Systems and in accordance with ASCE 7-10 Sections 30.3.2 and 30.4.2 for components and cladding.
 - 4. Equipment minimum loads (approximate):
 - a. PCA AHU at rotunda end: 3,500 lbs.
 - b. 400 Hz 90 KVA Power Unit: 2,750 lbs.
 - c. 400 Hz 180 KVA Power Unit: 2,750 lbs.
 - d. 400 Hz Cable Hoist: 600 lbs.
 - e. PBB air handling unit: 1500 lbs.

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- f. Duct work for air systems.
 - g. Potable Water Cabinet: 500 lbs.
- 5. The structural design shall provide sufficient torsion rigidity to minimize sway when the boarding bridge is brought to a gradual stop.
 - 6. All mechanisms for actuating, guiding and restraining the boarding bridge and its components shall be designed to minimize the noise, deflection, and vibration apparent to passengers. No operating vibrations or loads shall be transmitted to the terminal building.
 - 7. Fixed Ground Services Trunk: The passenger boarding bridge shall be structurally capable of supporting installation of a fixed ground services trunk to carry preconditioned air ducts and related components. The total combined weight for all systems will not exceed forty (40) pounds per linear foot. These systems may be installed on the side or underneath the passenger boarding bridge. The Contractor shall install the PCA/AHU system on the PBBs.
 - 8. The Contractor shall verify the structural suitability of the design of the PBB rotunda foundation. This verification shall be based on the information received from the foundation's structural engineer and based on actual field measurements. The Contractor shall advise the Owner's representative of any deficiencies or conflicts prior to beginning the fabrication of the PBBs.

2.6 BRIDGE ASSEMBLY ELEMENTS

A. Rotunda Assembly:

1. Corridor:

- a. The rotunda entry corridor shall be a fixed rectangular tunnel at a constant height that connects the terminal building or fixed walkway with the rotunda.
- b. The rotunda entry corridor shall be cantilevered from the rotunda column to the terminal building face or the mating frame of the fixed walkway.
- c. Provide flashing to create a weather-tight connection between the rotunda entry corridor and the terminal building or fixed walkway. Flashing shall be sloped so as not to trap or pond water. Flashing shall also be installed on the interior. Flashing shall be continuous to provide a weather tight seal around the entire periphery between the bridge and the building, and to allow independent thermal movement of building structure, and shall meet the requirement of the NFPA 415, current edition.

2. Rotunda:

- a. The rotunda shall be a cylindrical structure supported on a tubular column. The rotunda floor shall remain level at all positions and shall be installed at the same elevation as the terminal.
- b. Flap type seals (dual) shall be provided for complete weather tightness between the rotunda and the hinged telescoping tunnels.
- c. Rotunda side curtain shall be galvanized steel and provided with adjustable tensioning devices, positive tracking system, and interior weather seals. Covers shall be full length with galvanized or stainless steel hinged access panel to allow access to curtain idled barrel grease fittings.
- d. Provide interior metal flashing to allow bridge movement.
- e. Provide flashing to create a weather-tight connection between the rotunda entry corridor and the terminal. Flashing shall be sloped so as not to trap or pond water. Flashing shall also be installed on the interior. Flashing shall be continuous to provide a weather tight seal around the entire periphery between the bridge and the building, and to allow independent thermal movement of building structure, and shall meet the requirement of the NFPA 415, current edition.
- f. Terminal Door Threshold: Install a threshold at the terminal door/boarding bridge interface that allows for bridge movement. The threshold shall be aluminum diamond plate.
- g. Striker plate on the side door shall be installed as to avoid damaging/scratching of paint when the door opens/closes.

3. Support Column: The rotunda column shall not be anchored or secured to the terminal building, nor shall it transmit any live or dead loads or vibrations to the terminal building. An industry standard #7, 8-anchor bolt foundation pattern or 16 bolt pattern shall be used.

B. Telescoping Tunnels:

1. Telescoping tunnels shall be rectangular in cross-section, constructed of 14- gauge (or stronger) corrugated or smooth sided metal panels and hinged at the rotunda end for vertical motion. Minimum inside dimensions of the telescoping tunnels, not including handrails, shall be:
 - a. Minimum Interior Width: 4'-10"
 - b. Minimum Interior Height: 6'-10"
 - c. Minimum Transition Ramp Width: 4'-8"
2. Where telescoping sections overlap, low angle transition ramps shall be provided to accommodate the difference in elevation. The inner tunnel transition ramp shall be hinged and slope shall be less than 3° relative to the tunnel centerline slope. Means shall be provided to adjust and maintain the ramp lip clearance to preclude flooring wear. Where the design permits the ramp lip to ride the flooring, it shall be sheathed in a smooth Teflon or similar low friction material to minimize wear.

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3. Provide and install overhead uneven surface caution signs at each transition ramp.
 4. Provide flat roof tunnel or method to create a flat roof tunnel with adequate provisions for water to run off. Appropriate measures must be taken to ensure no water collection/pooling on any point of the PBB roof, even when the bridge is at its lower extremes.
 5. Design the telescoping tunnels and all other elements of the structure to resist the accumulation of water at low points and pockets in the structure. Drain holes shall be provided where necessary to drain collection points in any operating height. Drains from internal gutters shall be carried clear of the structure and shall be sized to prevent blockage by accumulated debris. Install yellow/black safety tape in all interior gutters.
 6. Provide mechanical stops with elastomeric bumpers to prevent over-travel in the event of limit switch failure.
 7. Maintain clearance between the telescoping tunnels such that no soiling or wear of the interior surfaces occurs as the result of movement.
 8. Utilize flap-type seals (dual) between the individual tunnel assemblies to provide a weather tight seal and to prevent the entrance of fire and/or smoke in the event of an apron fire. Exterior seals shall utilize EPDM rubber and ALFA fire material.
 9. The telescoping tunnels shall be equipped with an exterior pantograph style electrical cable conveyance system mounted on the side of the passenger boarding bridge. This system must be accessible to maintenance personnel for inspection. Plastic tie-wraps are not allowed on the project. The Contractor shall use Adel clamps for all cable attachment and bundling. These shall be installed on the right side of the PBB unless it would restrict or interfere with movement of the bridge in relation to specific terminal building components.
 10. Provide stainless steel safety cables installed on top of bridge for service mechanic to connect with the safety harness.
- C. Fixed Walkways:
1. Fixed walkways shall be of similar construction to that of the telescoping tunnels.
 2. Minimum inside dimensions of the fixed walkway, not including handrails, shall be:
 - a. Minimum Height: 7'-7"
 - b. Minimum Width: 5'-7"
 3. Fixed walkways shall be supported by and cantilevered from the rotunda column, except where support columns are indicated on the drawings.

4. Fixed walkways shall be anchored or secured to the terminal building face by structural steel supports angles designed and provided by the Contractor only where indicated on the drawings.
 5. The fixed walkway for the PBB at gate 250A shall be designed to support a VDGS control / display unit.
 - a. The support shall have a vertical six (6) inch diameter pole located as shown on the drawings.
 - b. The top of the pole shall be seventeen (17) feet above the apron pavement with the top six (6) feet of the pole clear for mounting of the VDGS unit.
 - c. Data and power conduit and cabling shall be provided. Connections to the power and data systems shall be coordinated with other parts of this specification along with the building and VDGS contractors.
- D. Aircraft Cab:
1. The cab shall be equipped with a forward facing operator control station located behind a window to permit the operator full view of the aircraft contact area. Additional visibility shall be provided through windows on the left side of the control station.
 2. Cab roll-up side curtains shall be galvanized or stainless steel. The left and right curtains shall be equipped with interior weather seals and shall be interchangeable. The exterior metal curtain covers shall be full length, hinged and galvanized or stainless steel.
 3. Weather door: Cab shall be equipped with half glass “French” style doors installed to seal the interior from outside weather conditions when the doors are closed. The minimum opening width shall be 43-inches and minimum height shall be 7'-1". Operations of the PBB shall be possible without opening the door.
 4. The cab shall be rotated by a gear motor and chain drive operating on the circumference of the fixed circular floor section of the PBB cab. Adjustable limit switches and fixed physical stops shall control the limits of rotation.
 5. Articulating Cab Floor: The aircraft end of the cab shall be provided with an automatic level device when the cab is rotated at an angle up to 95° off the centerline of the bridge tunnels.
 - a. The articulating cab floor shall level automatically and shall be equipped with a manual override control switch. The floor shall be capable of providing a level surface adjacent to the aircraft doorsill for passenger boarding bridge slopes from -10% to +10%.
 - b. No portion of the cab floor shall exceed 8.33% slope in the direction of expected passenger traffic.

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- c. The system shall include a double hinge floor. The maximum slope of this floor shall be limited to +/- 6.5° (11.4%).
 6. Spacer: Provide a spacer spanning the full outside width of the boarding bridge cab opening, along the front edge of the cab floor at the point of contact with the aircraft.
 - a. Spacer installation and material shall not mark the aircraft skin, and shall prevent any damage or abrasion of the aircraft skin when the bridge is in contact with the aircraft.
 - b. The spacer shall provide bodily support when stepped upon, and shall have a Shore A Durometer hardness of 70 +/- 5 when measured in accordance with ASTM D2240.
 - c. The spacer material shall be an EPDM, or other suitable polymer, compounded to meet the fireproofing requirements of NFPA 415.
 - d. Passenger boarding bridge motion control or limit devices mounted on the spacer shall be located at the extreme outboard ends or continuously across the spacer's face along its centerline.
 - e. Provide Safety Track or 3M anti-skid on C-channel between the cab floor and spacer.
 - f. No metal trim or structural element shall be capable of contacting the aircraft fuselage outside the canopy padding and/or spacer.
 - g. All bridges shall be provided to accommodate the door of all aircraft indicated in the gate schedule as shown on the drawings. Provide cutout in the cab spacer to miss the B737 pitot tube.
 7. VDGS Operator Panel: Install operator panel as furnished by Division 27 VDGS provider. Refer to specification section 27 10 20 for additional information. Refer to Utilities paragraph within this specification for connectivity requirements.
 - E. Aircraft Closure (Canopy):
 1. The aircraft end of the cab shall be equipped with an adjustable closure with folded accordion bellows to make a weather-tight seal against the aircraft. Canopy frame shall be seven bow system. Provide inner liner curtain that covers the canopy frame members.
 2. The closure shall be able to enclose both the open aircraft door and doorway of all aircraft indicated at each gate.
 3. The entire Aircraft Closure shall be designed to be water-resistant, withstand weathering, remain elastic and flexible between -25°F and 125°F, be tear-resistant, and meet fire resistance requirements of NFPA 415. The aircraft closure color shall be gray.
 4. Each side of the canopy arms should independently seal to conform to critical aircraft contours to provide a weather-tight seal. The mechanism

shall be designed to preclude excessive pressure on the aircraft fuselage. Arms must be protected so as not to cause wear/grease stains on the interior walls of the canopy.

5. Cushion pad seals shall be provided at the point of contact between the canopy and aircraft fuselage to prevent denting and/or scratching of the aircraft skin or cabin and cockpit windows. This includes damage to rain diverters or troughs that may be located over the doors. The pads shall be reduced in thickness to account for Pitot tubes. The seals that contact the aircraft shall be segmented and attached to the main closure assembly by Velcro-type fastener strips.
 6. Canopy supports or stiffening rods shall be thoroughly padded to prevent contact with the aircraft and protect canopy material when in its retracted position. The padding shall be firmly attached in such a manner that it will not slip, turn, twist, or distort from repeated usage. Allow replacement of the padding sides and top, and any inserts in sections, without replacing the entire canopy.
 7. Changes in the position of the aircraft and/or passenger boarding bridge while the canopy is in contact with the fuselage shall not cause excessive loads to be exerted on the aircraft skin. Pressure exerted by closure against the aircraft fuselage shall not exceed 2 psig. Dependence upon the automatic leveling device to prevent such an occurrence is not acceptable.
 8. Any chains, cables, or electrical wire that penetrates the floor or wall structure shall have adequate clearance, be protected, and securely fastened.
 9. Cab seal shall be resilient bellows type. Tarpaulin types are not acceptable.
 10. The canopy, when in its retracted position, shall be protected by a hood or other device to prevent water from laying in the folds of the canopy material when the bridge is not in use. Exterior liner shall include a third strap made from the same material and size as the existing end straps at center of top canopy liner, or other suitable method to prevent water ponding.
- F. Service Assembly:
1. Provide a service door, stair and landing located on the right side of the cab. Door shall open outward.
 2. Service door: The service door shall be hollow core, steel construction and shall meet or exceed a 3/4-hour fire rating. It shall be of a standard size with nominal dimensions of 2'-6" x 6'-8" with half wire mesh upper window.

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- a. The door shall be provided with a Simplex Lock Set model # L1000 with five button combination lock with interior push plate and exterior pull handle and plate. If a key is required for the removal of the Lock Set, all lock cores shall be keyed the same.
 - b. Provide and install a 30" x 28" stainless steel kick plate on both sides of the door.
 - c. The door hardware shall be heavy duty industrial-type (using zinc plated or stainless steel standard U.S. hinges and finish hardware), and it shall be provided with an automatic heavy duty door closer installed on inside of the door.
 - d. A door stop shall be provided to prevent damage to the passage set and/or door. Provide a latch to hold door in open position located on the second railing up from the floor.
 - e. The door shall be constructed so the door and its components can be removed and reset or replaced for maintenance.
3. Service Platform: The service platform shall be constructed of open mesh (gripstrut) steel grating equipped with tubular steel handrails on the outside perimeter in accordance with OSHA Standards. All bridges shall be fitted with an access ladder with safety cage to the cab roof, accessible from the service landing platform. Cab roof handrails shall be included with the access ladder. All steel material shall have galvanized dipped finish. Platform and access ladder is required even if roof access is not required for regular maintenance. All PBB's shall be equipped with stainless steel roof tie-off cables that run from the cab roof to the terminal for tying off to when working on roof (must be provided in all areas not protected by hand rail).
 4. A photoelectric operated weatherproof light shall be provided above the landing which shall consist of a LED fixture installed in such a manner as to optimally illuminate the stairway and landing when actuated by a photoelectric switch.
 5. Service Stairs: The service stair assembly shall be galvanized steel and equipped with equal self-adjusting risers with open mesh steel treads (gripstrut) and supported at the apron on minimum 6-inch diameter wheels.
 - a. The wheels shall have solid rubber tires designed to operate on concrete or asphalt pavement in elevated temperature conditions.
 - b. All steps shall have an equal rise, with a tread width of 28 inches and a minimum depth of 9-1/2 inches.
 - c. Both sides of the stair shall be equipped with tubular galvanized steel handrails of proper height to comply with applicable building codes and OSHA Standards.
 - d. Clear width between handrails shall be a minimum of 31 inches.
 - e. The service stair shall be fully usable at all boarding bridge elevations and positions.

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6. Baggage Handling
- a. Baggage Conveyor – A motorized baggage conveyor will be attached to the PBB/ service stairs with a structurally sound fastening system.
- (1) Baggage conveyor shall have the same minimum width as required of baggage slides and must be supported on the bottom end by rubber casters or wheels and automatically adjust to move with the PBB both horizontally and vertically.
 - (2) Baggage conveyor shall be adjustable so that baggage personnel may raise or lower the conveyor rubber belt surface.
 - (3) Baggage conveyor shall be equipped with all necessary items (trays and flip down side) for conveyance of motorized wheelchairs.
 - (4) Baggage conveyor shall be capable of handling up to 500 lbs. of baggage or motorized equipment.
 - (5) Baggage conveyor shall have controls at the both ends of the unit to allow baggage personnel to turn the device on or off, reverse the direction of the belt, and also have an 'E-Stop' function to stop the device in case of an emergency.
 - (6) Baggage conveyor shall be powered from the PBB and operate on 120 VAC power and shall in no way impact the operation of the loading bridge if the conveyor is inoperable.
 - (7) Baggage conveyor shall have a timer or time out function that will detect inactivity or provide for timed operation and turn off power to the unit accordingly.
 - (8) Baggage conveyor lengths shall be chosen based on the PBB model and the aircraft serviced at the particular gate to avoid excessive angles.
 - (9) Baggage conveyor shall be designed for ease of maintenance from the ramp level for ease of repair, replacement, adjustment or inspection of belts, rollers, idler arms, and any other mechanical, electronic or electrical components.
7. Service/maintenance stair and cab roof handrails shall be provided for OSHA- approved access to service equipment.
- G. Drive Column: The drive systems shall be either hydraulic or electro-mechanical and meet the criteria listed below:
1. Vertical Drive- Hydraulic:
 - a. The hydraulic pump and motor drive for vertical travel of the bridge shall be an integral part of the drive wheel assembly, accommodate and weight of the bridge, and operate smoothly and quietly.

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- b. The hydraulic power system shall permit simultaneous vertical travel and horizontal travel and steering.
 - c. The hydraulic power system shall utilize a heavy-duty oil-based hydraulic fluid with corrosion inhibitors.
 - d. The operating temperature environment shall determine hydraulic oil viscosity.. Coordinate hydraulic oil requirements with the manufacturer based on the Orlando environment.
 - e. All hydraulic components shall be designed for maximum corrosion resistance and compatibility with the hydraulic fluid used.
 - f. Vertical travel shall occur by driving two hydraulic cylinders to the desired height by means of solenoid-operated hydraulic valves.
 - g. Hydraulic cylinder rods shall be chrome plated. The hydraulic cylinders shall be equipped with a vertical drive pump brake (pilot-operated check valves) which automatically releases when hydraulic pump(s) are in operation and vertical motion, up or down, is signaled from the operator's console or from the auto-level circuit.
 - h. Vertical rate of travel shall be adjustable from 2.0 to 3.6 feet per minute.
 - i. Pilot-operated check valves located at hydraulic cylinders shall prevent bridge downward movement in the event of a total hydraulic system failure, including rupture of any hydraulic hose in the system.
 - j. Each drive column shall be designed to support the full weight of the bridge if the other should fail.
 - k. Provide manual vent valves at the high points of the vertical drive system to bleed air from the hydraulic system.

2. Vertical Drive- Electro-Mechanical:

- a. The bridge shall be moved vertically by means of two re-circulating ball bearing screw assemblies. Each assembly shall be independent of the other, with individual motors. Each assembly shall be capable of supporting the passenger boarding bridge under full design load. The lifting mechanism shall hold its position at any elevation within the travel range with or without power supplied.
- b. The ball screw ball nut shall be equipped with wiper brushes to remove grit or dirt from screw threads and a self-locking acme-type thread which will prevent unit collapse in the event of ball nut failure.
- c. The vertical drive motors shall be AC induction motors with integral reducer and brake. The brakes shall be spring-applied and electrically released only when signal is received from the operator's console or the auto-level system.
- d. The brakes shall hold securely at all elevations, without creeping, whether the bridge is in operation or not.

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- e. A fault detector shall sense differential motion of the ball screw assemblies. The fault detector circuit shall shut down the electrical power to the vertical drive motors and set the brakes independently of the operator if a fault is detected.
 - f. A tapered collar that prevents the screw from disengaging the ball nut shall be attached to the ball screw's lower end.
 - g. Boarding bridge vertical rate of travel shall be a constant speed.
 - h. Reference stripes shall be painted or mechanically fastened on the inner tube(s) to indicate column travel limits, both high and low.
 - i. Backup emergency plunger-type limit switches shall be provided in the vertical circuit, for both high and low limits.
 - j. Inspection holes in each column tube shall be provided to allow baroscopic inspection of the ball screw surface. All holes shall be aligned in inner and outer column tubes. Cover plates shall be provided in outer tube.

3. Horizontal Drive - Electro-Mechanical:

- a. A variable speed electro-mechanical drive system shall provide horizontal travel of the passenger boarding bridge. The drive shall be two-wheeled with solid rubber tires.
- b. An AC gear motor shall independently drive each wheel. The gear motors shall be provided with integral brakes. Solid-state variable frequency motor controllers shall drive the AC motors. The controller shall provide built-in diagnostics to assist in trouble shooting.
- c. A regenerative braking system shall allow the bridge to come to a smooth, controlled stop. Integral electrically-released spring actuated brakes shall be provided with each drive motor and shall lock the bridge in place whenever electrical power is cut off, either by moving the control lever to the neutral position or if power fails.
- d. Provide a manual override to release drive wheel brakes to permit towing the passenger boarding bridge into or out of position on the apron in case of power failure. The override system shall be mechanically interlocked to preclude normal operation with the brakes locked out.
- e. Connection lugs shall be provided to allow the bridges to be towed in the event of power failures.
- f. Provide positive identification for both the front and backsides of the wheel bogie. Such identification shall be clearly readable by the operator while operating the control panel. Include instrumentation (a wheel bogey position indicator) on the control console.

4. Wheels and Tires:
 - a. Passenger boarding bridge wheels and tires shall be of sufficient width and surface quality to preclude damage to apron pavement and shall be designed to operate on Portland cement or asphalt pavement.
 - b. The tires shall be solid rubber type suitable for use by passenger boarding bridges. Tires shall be manufactured of a rubber compound that will not chip or fray at the edges, and not be affected or damaged due to contact with oil, lubricating and hydraulic fluids, and/or fuels from aircraft and servicing equipment, including Skydrol hydraulic fluid.
 - c. Each tire shall have a wheel loading, under full, dead and live loading, not to exceed 300 psi. Only the wheel to axle hub bolts/nuts shall be able to be removed while the wheel is mounted on the wheel bogie.
 - d. The wheel and tire changing procedures shall be specified in the Maintenance Manual.

- H. Controls: All operations of the Passenger Boarding Bridge shall be controlled by a PLC manufactured by Allen - Bradley.
 1. Control Station General Requirements:
 - a. Locate all passenger boarding bridge operator controls on the bridge cab control console in a position that provides maximum operator visibility as the bridge is maneuvered near the aircraft with the cab weather door closed.
 - b. Locate the operator control station to provide adequate space for the operator and maintenance access to the electrical control components as required by voltage classification in the National Electrical Code.

 2. Control Console: The control console shall be located in the operator compartment and protected from the outside environment. The control console shall be tamper and theft proof. Provide two door locks, top and bottom, and hold open gas shock. Provide hinged console face and support rod.
 - a. Provide lighted and labeled controls for all switches and indicators. Console shall have a lamp test button to test all console lamps and alarms. Lamp test shall be enabled in the operator switch "OFF" position only and shall supply 110 volts or 24VDC to console lamps. All console lamps shall be LED.
 - b. Controls: All passenger boarding bridge motion controls shall be the momentary contact (dead man) type. All motion controls shall be located to be relative to the function of the passenger boarding bridge being controlled (i.e., with raise and lower functions, the

"RAISE" push button will be located above the "LOWER" push button). The control console includes the following control switches and indications. All switches shall be Cutler Hammer or Square D with engraved lens. A touch screen located on the control panel is acceptable for various secondary functions.

- (1) Master Control Switch, Off/Operate/Auto (Automatic Leveling) Card reader must capture user who initiates use of the PBB/auto level as well as user who terminates use of the PBB/auto level.
 - Provide interfacing for PACS card reader. Provide all necessary connections, switches, cabling and programming to utilize the PACS card reader to enable PBB control.
 - PACS card reader shall remove the requirement for a key for normal operation of the PBB.
 - Provide support to the owner within the service agreement and/or warranty to assist with this type of control interface.
 - Require a maintenance access/override to be utilized should a card reader fail.
- (2) Power On (Green illuminated) (Black Button).
- (3) Cab Rotate Left and Right (White illuminated) (Black Button).
- (4) Canopy Up/Down Left Side (White Illuminated) (Green Button/Arrow).
- (5) Canopy Up/Down Right Side (White illuminated) (Green Button/Arrow).
- (6) Cab Floor in Auto On/Off (White illuminated) (Black ON Button, Red OFF Button).
- (7) Cab Floor in Manual Tilt Left or Right (White illuminated).
- (8) Travel Warning Bell (Blue Button).
- (9) Steering Left of Right (White illuminated) (Blue Button Arrow).
- (10) Forward or Reverse Spring Loaded 2-way Joystick.
- (11) Spring Loaded 4-way Quad Joystick.
- (12) Vertical Up or Down (White illuminated) (Blue Button/Arrow).
- (13) Lamp Test (Black Button).
- (14) Flood Lights On/Off (White illuminated) (Black ON Button, Red OFF Button).
- (15) Manual Operated Cab Weather Door.
- (16) 400 Hz Cable Hoist Deployed Light (Yellow lens illuminated).
- (17) 400 Hz On Light (Red lens illuminated) (Horizontal drive interlock applied and alarm).

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- (18) Warning Alarm for 400Hz Failure.
 - (19) Warning Alarm for Auto Level Failure.
 - (20) Oversteer Alarm (Red lens illuminated) if oversteer is possible without use of a mechanical lock.
 - (21) Door Open Alarm Blank White (White illuminated).
 - (22) Lift Column Fault (Red illuminated).
 - (23) Canopy Down (Red illuminated).
 - (24) Auto Level On (Yellow illuminated).
 - (25) Auto Level Alarm (Red illuminated).
 - (26) Swing Limit Warning (Red illuminated).
 - (27) Swing Digital Readout (Black Button).
 - (28) Height Meter and Swing Read Meter (LED).
 - (29) Wheel Position Indicator, showing arrow and wheels.
 - (30) Emergency Stop (Red Button).
 - (31) Preconditioned Air in use (Green).
 - (32) Pair cabin temperature by-pass switch.
 - (33) PCAir cabin by-pass temperature potentiometer.
 - (34) Maintenance Override Key Switch.
- c. Labeling: All switches and/or push buttons shall be labeled. Each function shall be spelled out (i.e. "Canopy", "Extend", "Retract").
- d. Warning devices:
- (1) Swing Limits.
 - (2) Slope Limits.
 - (3) Auto Level (Red Strobe Light- Failure Indicator).
 - (4) Vertical Column Fault lighted indicator/alarm on Control Console.
 - (5) Over steer.
 - (6) Warning Rotating Beacon or strobe beacon under cab when bridge is in Operation Mode only.
 - (7) 110-volt Travel Alarm Bell.
3. Hydraulic Manual Control System for Emergency Use: Each passenger boarding bridge which uses a hydraulic motion or lift control system shall be equipped with a manual control (dead man type) system to permit bridge operation at ground level in the event of a complete control system failure. The controls shall be located in a safe area so the operator has a clear unobstructed view of the aircraft spacer interface, and the passenger boarding bridge will not injure the operator in any way while manually maneuvering the passenger boarding bridge at ground level.

4. Interlocks:
 - a. General: The control system logic shall preclude damage to circuits or mechanical systems due to simultaneous contrary control signals or an otherwise unsafe control signal combination.
 - b. Contrary Control Signal Interlock: All boarding bridge motion shall be precluded whenever contrary control signals (i.e., extend and retract) are activated simultaneously.
 - c. Control Console Doors: Provide safety interlock switches on all control console doors; upper console, console face and console front door.
 - d. Canopy Interlock: Interlock shall prevent all forward or reverse horizontal drive operation when canopy is lowered. All passenger boarding bridge motion, except auto-leveling, shall be possible only when the canopy is in a fully retracted position. Provide for a dead man- type mechanical override to permit the retraction only in case of mechanical emergency or bridge failure with the canopy not in the fully retracted position.
 - e. 400 Hz Interlock: Interlock shall prevent horizontal drive operation when the 400 Hz unit is engaged, and the hoist is lowered. The control console shall be equipped with flashing light to indicate when:
 - (1) 400 Hz hoist is lowered.
 - (2) 400 Hz cable is engaged and the unit is operating (to be independent of each other).
 - f. The passenger boarding bridge shall provide a dry contact interface that is interconnected by a signal provided by the PCA Unit. The horizontal drive system shall then be interlocked to preclude passenger boarding bridge movement if the PCA is in "run" operation. PBB manufacturer shall coordinate this interconnection with the PCA Unit and the PBB shall provide all specified interconnections between the PBB and the PCA system.

5. Limit Switches: Electrical limit switches shall be provided on all passenger boarding bridge movement actuator systems, cab spacer and canopy system. These shall include fail-safe proximity limit switches activated near the end of horizontal and vertical travel. These switches shall de-energize their respective actuator systems when contacted.
 - a. Bridge extension and retraction: Provide two limit switches, one for slow down and one for stop.
 - b. Cab rotation: Provide limit switches to control the extremes of cab rotation.
 - c. Drive wheel: Provide limit switches to control over steer of drive wheels.
 - d. Rotunda rotation: The rotunda shall be equipped with adjustable limit switches to control the traversable area of the bridge. If

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- the bridge activates the limit switch, all power shall be disconnected, stopping the bridge. The limit switch located on the rotunda shall only be reset locally when activated.
- e. When the 400 Hz power is energized all bridge motion (except for auto leveling) shall be precluded. (Option must be available for specific air carrier needs to reprogram this function.)0.0.
 - f. Upper Console: Cabinet or housing for AC drive packs shall be:
 - (1) Waterproof.
 - (2) Equipped with a service light.
 - (3) Equipped with a thermostatically controlled heat strip.
6. Building Management System (BMS) Interface: The PBB, GPU and PCA control PLCs shall be connected to the building network. Refer to section 2.6 M. within this specification for connectivity requirements. Communication with the BMS shall be via the PBB, GPU or PCA control PLC manufacturer's standard communications protocol over Ethernet (example: Modbus over Ethernet). All PLC alarms and status messages shall be able to be monitored remotely via this connection. The following alarms and operational statuses specifically shall be programmed into the BMS for monitoring for each PBB:
- a. Auto Level Alarm.
 - b. All Anti-Collision Alarms.
 - c. PBB On.
 - d. PBB in Auto.
 - e. PBB general trouble Alarm.
 - f. PBB in Maintenance Over Ride.
 - g. GPU On / Off.
 - h. GPU Power Output (KW).
 - i. PCA On / Off.
 - j. PCA Mode Wide body, Narrow Body, etc.)
 - k. PCA Output Pressure.
 - l. PCA Output Temperature.
 - m. All GPU, PCAir, PBB failure alarms, faults and diagnostic issues must be transmitted in real time.
 - n. Equipment status
 - o. Up to five additional points as may be requested by the owner.
7. Anti-Collision System: For a PBB that are to be used in combination with another PBB to service the same aircraft, an anti-collision system shall be provided.
- a. This system shall be of the manufacturer's standard design. The system shall use any combination of proximity detection devices or PBB position indicators as required to ensure bridge separation.
 - b. The system shall place the PBB in slow down mode when approaching the neighboring bridge. The distance required shall

be as recommended by the manufacturer but in no case shall be less than 10 feet.

- c. The system shall stop the PBB before a collision occurs. The distance required shall be as recommended by the manufacturer but in no case shall allow the PBBs to contact each other even if the PBB is rocking due to momentum.

I. Automatic Leveling:

- 1. Passenger boarding bridge shall be equipped with an automatic leveling device. The auto-leveling system shall automatically respond to intermittent changes in aircraft elevation that occur during aircraft loading and unloading to maintain a constant relationship between the aircraft floor and the boarding bridge floor. The auto-leveling system shall function with equal reliability for all aircraft contours.
 - a. The auto-leveling system shall be engaged when the master control is positioned to "AUTO".
 - b. The leveling system shall not exert any stress on the boarding bridge.
 - c. The leveling device actuating mechanism or sensor which contacts the aircraft shall be located on the right side of the cab behind the canopy actuator covers.
 - d. The leveling system shall function reliably on all aircraft specified regardless of door location, fuselage contour, and aircraft door sill height and shall allow a required range of adjustment for designated aircraft movement up or down.
 - e. The auto-leveler circuit shall include an adjustable solid-state sustained travel timer. The timer shall limit the automatic leveler's continuous response in either direction to an adjustable range from 1.6 to 6 seconds. A fault condition shall be identified when the timer has tripped. Upon sensing of a fault condition, all motor power shall be disconnected, and audible and visual alarms shall be energized.
 - f. The circuitry shall include an audible alarm and a red warning light at the control station, and the rotunda and a red strobe light on the exterior base of the PBB in the general ramp area, which shall produce a distinctively different sound than any other on the passenger boarding bridge. These warning systems shall be automatically activated by any movement of the PBB except when in the auto level mode.
 - g. The orange rotating beacon shall illuminate when the key switch is in the "Operate" position.
 - h. When the timer circuit is interrupted, the vertical lift system shall automatically be locked in position and de-energized, and a vertical travel brake automatically engaged.

J. Lighting:

1. All PBB lighting fixtures shall utilize LED technology and fixtures for light sources. References to incandescent or other light sources within this document are only to be used for approximate light output values. Design enhancements such as custom interior lighting effects that may lead to an enhanced customer/passenger experience may be considered by the Owner.
2. Exterior Lighting:
 - a. Service platform light shall be controlled by a photo cell mounted on the exterior of the PBB.
 - b. Cab exterior LED light.
 - c. Exterior flood lights: Weatherproof
 - d. Provide two (2) adjustable flood lights with safety cages having a minimum intensity of three hundred (300) watts each (LED equivalent) and located on the exterior base of the bridge-head/cab, and controlled from the control panel. An additional flood light shall illuminate the area around the drive column and be controlled by the photo cell for the service platform light.
 - e. Provide a lit gate identification sign consistent with signs installed on loading bridges in the Orlando North Terminal with contrasting colors
3. Interior Lighting: Provide separate lighting circuits for the PBB. Each shall be controlled independently by motion detectors located at the cab and rotunda for apron drive bridges. All receptacle device plate covers shall be stainless steel. Lights shall be placed every eight (8) feet in the boarding bridge and oriented so there will be no conflicts with the installation of the bridge cooling system ductwork.
 - a. Lamps: LED fixtures and bulbs.
 - b. Controller shall be provided for 0°F cold weather rated applications.
 - c. Tunnel: LED fixtures and bulbs.
 - d. Rotunda: LED fixtures and bulbs.
 - e. Cab: Console LED fixtures and bulbs
4. Emergency lighting controller shall be provided in the following locations to operate when bridge power is lost. The red power indicating light shall be located in the tunnel light fixture.
 - a. Rotunda ceiling light.
 - b. A-tunnel middle and end.
 - c. B-tunnel middle and end.
 - d. C-tunnel middle and end.

- e. Cab external light.
- 5. Emergency LED Lamp Power Supply: Provide self-contained battery powered inverter unit for direct mounting in designated LED fixtures. Provide unit with 120Vac input, fully automatic two rate charger, nickel-cadmium battery, automatic low voltage battery disconnect, AC "ON" pilot light, and test switch. Unit shall automatically transfer to battery supply on loss of normal AC power and operate one 4-foot LED fixture with a minimum output of 1100 lumens for 1-1/2 hours.
 - 6. Illumination Level: Intensity of illumination will be measured at the floor.
 - a. Tunnel and Cab: 25 foot-candles average.
 - b. Cab lighting: Twenty (20) foot-candles. Control panel area shall have sixty (60) foot-candles. It shall be possible for the operator to turn off cab lights at the control console to eliminate glare when positioning the bridge to the aircraft during hours of darkness.
 - 7. All lighting fixtures shall have adequate access for replacement and fixture cleaning.
 - 8. Provide 120V, 20-amp electrical circuit with conductors terminated in a weatherproof junction box located on the underside of the cab.
 - 9. Provide electrical circuit to extend the building lighting circuit to power a bridge mounted sign located at the cab end. Provide a 277 volt, 20-amp circuit and conductors from the face of the terminal building under the passenger boarding bridge to the weatherproof junction box located on the underside of the cab.
 - 10. A minimum of eight (8) spare conductors shall be provided from the rotunda to the control panel for future systems. In addition, provide and install two (2) 12-pair sheaved control cables (22-gauge wire) from a weatherproof junction box under the rotunda to weatherproof box under the cab for the PCA system, such as cabin temperature control sensor, jumbo gates wiring for the second hose damper, etc. Coordinate number, locations and routing with Owner's representative.
- K. Insulation:
- 1. Insulation shall be provided in the walls and ceiling.
 - 2. Insulation materials shall not be exposed to the weather or applied with glues or tape.
 - 3. All insulation materials shall be covered with appropriate weather resistant finish material.

4. Insulation shall be installed full width of ceiling with all areas insulated. Insulation shall butt against light frame edges with separate piece over light fixture.
 5. The design shall eliminate the possibility of condensation in the insulation that might cause unsightly water stains appearing on the interior finished surfaces and rust at the interface of the insulation and outer shell.
 6. The use of asbestos or asbestos products as an insulation material or for any other use is not permitted.
- L. Windows: Provide windows as follows:
1. Cab: Provide clear safety glass front window to permit operator at control console full view of the aircraft contact area. Provided a wire reinforced safety glass window to the left side of the control station.
 2. Cab roll up side curtains: Provide two wire-reinforced glass windows in every other panel, 1/4" thick x 1-3/4" wide x 12" long. The windows shall be in the low normal positions on the right side and high normal position on the left side.
 3. Service door: Equip the door with a 1/4" thick x 14-7/8" wide x 2' 5-7/8" high wire reinforced glass window.
 4. The manufacturer may propose the use of windows as a customer enhanced experience in the fixed bridges or passenger boarding bridges and/or tunnels for the owner's consideration.

M. Utilities:

1. The apron drive bridges telescoping tunnels shall be furnished with an under bridge cable assembly consisting of twelve (12) Category 6 cables from cab to rotunda. Connect from rotunda to communications enclosure provided at the exterior terminal wall. Terminate cables as specified below.
 - a. Telephone: One (1) of the Category 6 cables shall be reserved for a VoIP telephone. Terminate cable in cab near console on wall. An RJ-45 outlet for the installation of telephone or intercom equipment shall be in an enclosure located on left side wall adjacent to the control console no higher than 54 inches above the floor or as dictated by ADA requirements. Telephone instrument to be furnished by the Authority.
 - b. Video Surveillance Cameras: Two (2) of the Category 6 cables shall be reserved for security cameras.
 - (1) One (1) cable shall be used for the Authority security camera.
 - (2) One (1) cable shall be used for future airline camera.
 - (3) Both camera cables shall be routed to the communications panel in the cab and terminated in the patch panel.
 - (4) Furnish and install a 4"x4" ceiling-mounted backbox to support an Authority security camera. Conduit shall be routed to the communications panel in the cab. Route security camera cable in conduit to the backbox from the communications panel. Terminate cable in an RJ-45 connector. Refer to security drawings for camera location within the PBB.
 - c. VDGS Operator Station: (1) of the Category 6 cables shall be reserved for the VDGS operator station. Coordinate with the work of Division 27 to determine termination type and location.
 - d. BMS Interface: One (1) of the Category 6 cables shall be reserved for the PBB control PLC connection. An RJ-45 outlet shall be installed in the PLC enclosure for connection to the PLC. Connection between the PLC and RJ-45 connector shall be via a standard Category 6 jumper cable
 - e. PCA: One (1) of the Category 6 cables shall be reserved for the PCA control PLC connection. An RJ-45 outlet shall be installed in the PLC enclosure for connection to the PLC. Connection between the PLC and RJ-45 connector shall be via a standard Category 6 jumper cable.
 - f. 400 Hz: One (1) of the Category 6 cables shall be reserved for the 400 Hz control PLC connection. An RJ-45 outlet shall be installed in the PLC enclosure for connection to the PLC. Connection between the PLC and RJ-45 connector shall be via a standard Category 6 jumper cable.
 - g. WIFI Antenna: One (1) of the Category 6 cables shall be reserved for the WIFI antenna. Cable shall be routed to the antenna via the communications panel located in the cab. The cable shall be terminated in the communications panel and then routed to the WIFI antenna.

- D. Guardrail: Provide a guardrail of the same size and shape as the handrails located at the junction of the “A” and “B” tunnels. The guardrail is to be positioned such that it diverts people from encountering the horizontal air conditioning duct installed at the ceiling of the “A” tunnel.
- E. Jack Stand: Provide three (3) standard jack stand structures suitable to straddle and support the boarding bridge from the ground. It shall be designed to support the weight of the bridge for servicing undercarriage components, and the cab lifting mechanisms. Furnish all jack stands with hydraulic jacks (if necessary). The jack stands shall be delivered prior to substantial completion.
- F. Tow Bar: Provide one tow bar designed and constructed to be stored, transported and connected to the boarding bridge undercarriage for towing of a disabled unit. Tow bar shall be configured for connection to a standard height hitch on a pickup truck.
- G. Gate Sign: Provide outdoor lighting and signage for sign as indicated, complete with wiring and circuit over current protection and disconnect.
- H. Pre-Conditioned Air and Bridge Cooling: Pre-conditioned air (Air Handlers) and bridge cooling systems shall be provided in accordance with specification section 23 90 00 – Pre-Conditioned Air Units and Specialties. Suggested mounting locations are as shown on the plans but PBB manufacturer specific standard mounting shall be acceptable. All mounting brackets and weldments required for the installation of the equipment shall be performed in the factory prior to shipment of the equipment.
- I. 400 Hz Ground Power Units (GPU): 400 Hz GPUs shall be provided in accordance with specification section 26 61 00 – 400HZ Frequency Converters. Suggested mounting locations are as shown on the plans but PBB manufacturer specific standard mounting shall be acceptable. All mounting brackets and weldments required for the installation of the equipment shall be performed in the factory prior to shipment of the equipment.
- J. Potable Water Cabinets: Potable water cabinets shall be provided in accordance with specification section 22 37 00 – Potable Water Cabinet. The potable water cabinet shall be mounted on PBB. Suggested mounting locations are as shown on the plans but PBB manufacturer specific standard mounting shall be acceptable. All mounting brackets and weldments required for the installation of the equipment shall be performed in the factory prior to shipment of the equipment.
- K. Hurricane Tie Downs:
 - 1. The Contractor shall provide hurricane tie down requirement details and verify their location as shown on the plans in accordance with the PBB manufacturer’s recommendation and adjust as necessary.

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2. The PBB manufacturer shall provide a complete hurricane tie-down appurtenance kit for each PBB, including equipment and incidentals needed to tie-down the PBB in hurricane wind loads up to 170 miles per hour.

2.8 FINISHES

- A. Exterior Paint System: All exterior steel surfaces shall be protected from corrosion by the following:
 1. Surface Preparation: De-burr and remove all weld splatter and dingle berries, also grind excessive/rough welds smooth, and round sharp edges and comers. Contaminants (oil, grease, dirt, etc.) shall be removed from surfaces in accordance with SSPC-SPI (Solvent Cleaning) requirements and appropriate SSPC commentaries. Exterior steel surfaces shall be dry abrasive blast cleaned with garnet grit in accordance with SSPC-SP6 (Commercial Blast Cleaning) or better to obtain an angular 1-3 mils profile depth. If steel is not new or is corroded, blast to SSPC-PC 10 standard. Thoroughly clean with dry high pressure air to remove dust and grit, then mask all necessary areas before priming. The blast cleaned surface must be primed soon enough to prevent corrosion form occurring on the profile.
 2. Prime Coat: Apply one coat of Sherwin-Williams chromate free High Build Epoxy Primer E65AC8/E65AC12 (or equivalent) or American Coatings Rustlock 8010 Series Epoxy-two component (or equivalent) at a dry film thickness of 12 mils to the exterior surfaces, per manufacturers' instructions in the Product Data sheet. Follow all manufacturers' handling and curing instructions.
 3. Finish Coat: Apply one coat of Sherwin-Williams "POLANE H" polyurethane (or equivalent) or American Coatings WB Series Roof Mastic (or equivalent) for the roof topcoat and American Coatings SU Series (or equivalent) for all other surfaces; finish paint to a dry film thickness of 12 mils, per manufacturers' instructions in the Product Data sheet. Follow all manufacturers' handling and curing instructions. Color in accordance with table below.
 4. Sealer Finish Coat: Minimum 6 mil DFT.
 5. Total exterior dry film thickness: 30 mils minimum.
 6. Colors and finishes shall be selected by the Owner from full color range.
 7. All exterior finishes shall be warranted for a period of five (5) years for the date of Final Acceptance.
 8. Approved Manufacturers:
 - a. Products manufactured by Sherwin-Williams are listed in order to establish a level of quality and performance required on this project.

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- b. Equivalent materials manufactured by American Coatings, Carboline or Tnemec may be submitted for approval by the Owner, providing they are of the same generic type as the specified products and meet or exceed the ASTM performance criteria of the specific projects.
- B. Exposed Interior Paint System:
1. Surface Preparation: De-burr and remove all weld splatter and dingle berries, also grind excessive/rough welds smooth, and round sharp edges and comers. Contaminants (oil, grease, dirt, etc.) shall be removed from surfaces in accordance with SSPC-SPI (Solvent Cleaning) requirements and appropriate SSPC commentaries. Mechanical clean in accordance with SSPC-SP3 (Power Tool Cleaning) to remove loose scale and contaminants from the surfaces where required. The cab surface shall be dry abrasive blast cleaned with garnet grit in accordance with SSPC-SP6 (Commercial Blast Cleaning) or better grit to obtain an angular at 1-3 mils profile depth. If steel is not new or is corroded, blast to SSPC- PC 10 standard. Thoroughly clean with dry high pressure air to remove dust and grit. Then mask all necessary areas before priming. The blast cleaned surface must be primed soon enough to prevent corrosion form occurring on the profile.
 2. Prime Coat: Apply one coat of Sherwin-Williams chromate free High Build Epoxy Primer E65AC8/E65AC12 (or equivalent) or American Coatings Rustlock 8010 Series Epoxy-two component (or equivalent) at a dry film thickness of 12 mils to the cab surfaces, per manufacturers' instructions in the Product Data sheet. Follow all manufacturers' handling and curing instructions.
 3. Finish Coat: Apply one coat of Sherwin-Williams "POLANE H" polyurethane (or equivalent) or American Coatings SU Series (or equivalent) finish paint to a dry film thickness of 12 mils, per manufacturers' instructions in the Product Data sheet. Follow all manufacturers' handling and curing instructions. Color in accordance with table below.
 4. Sealer Finish Coat: Minimum 6 mil DFT.
 5. Total interior dry film thickness: 30 mils minimum.
 6. Colors and finishes shall be selected by the Owner from full color range.
 7. Approved Manufacturers:
 - a. Products manufactured by Sherwin-Williams are listed in order to establish a level of quality and performance required on this project.
 - b. Equivalent materials manufactured by American Coatings, Carboline or Tnemec may be submitted for approval by the Owner, providing they are of the same generic type as the specified

products and meet or exceed the ASTM performance criteria of the specific projects.

C. Non-Exposed Interior Paint System:

1. Surface Preparation: Contaminants (oil, grease, dirt, etc.) shall be removed from surfaces in accordance with SSPC-SPI (Solvent Cleaning) requirements and appropriate SSPC commentaries. The minimum surface preparation for all non-exposed interior surfaces shall be in accordance with SSPC-SP3 (Power Tool Cleaning) at 1-3 mils profile depth. Thoroughly clean with dry high pressure air to remove dust and loose scale. Mask all necessary areas before priming.
2. Primer Coat: Apply one coat of Sherwin-Williams corrosion resistant lead and chromate free, Kern AQUA 70P (or equivalent) metal primer at a dry film thickness of 4-6 mils, per manufacturers' instructions in the Product Data Sheet. Follow all manufacturers' handling and curing instructions.
3. Approved Manufacturers:
 - a. Products manufactured by Sherwin-Williams are listed in order to establish a level of quality and performance required on this project.
 - b. Equivalent materials manufactured by American Coatings, Carboline or Tnemec may be submitted for approval by the Owner, providing they are of the same generic type as the specified products and meet or exceed the ASTM performance criteria of the specific projects.
4. Small Miscellaneous Assemblies:
 - a. Dry abrasive blast clean in accordance with SSPC-SP 6 or better or obtain a 0.5-1.5 mil profile. If steel is not new or is corroded, blast to SSPC-PC 10 standard.
 - b. Apply one coat of MORTON INTL. Corvel Zinc Rich, Gray, Epoxy 3/4 Powder 13-7007 (or equivalent) heated to 350 F for 35 minutes at 4-6 mils.

D. Exterior colors and finishes shall be as follows (Owner to select color from full range of custom color chart):

1. All PBB's to be painted with exterior colors as determined by the Owner.
2. Tunnels, cab, sides, underside GOAA Arctic White
3. Roof White non-skid
4. Cab curtain side covers GOAA Arctic White
5. Service stairs, landing & handrails Galvanized Steel
6. Upper lift column section, outer tubes GOAA Arctic White

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|----|------------------------------------------------------------------------------------|-------------------|
| 7. | Inner-tubes, lower drive column section & rotunda support column below the bearing | GOAA Arctic White |
| 8. | Aircraft closure hood & side skirts | Grey |
| 9. | Cab area forward of the cab doors, actuator covers and the outside door face | GOAA Arctic White |

E. Interior colors and finishes shall be as follows:

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| 1. | Wall trim | Aluminum/Black Centers |
| 2. | Tunnel end trim | Color selected by Owner |
| 3. | Ceiling to wall trim | Flat Black |
| 4. | Kick plate | Flat Black |
| 5. | B&C Tunnel Rain Gutters | Flat Black w/Yellow & Black Zebra Tape |
| 6. | Flooring molding Aluminum | Clear Anodized |
| 7. | Cab floor | Black Ribbed Rubber |
| 8. | Ceilings (All) 7 ¼" | Aluminum (brushed) or of coiled coated galvanealed steel sheet Color to be selected by the Owner |
| 9. | Rotunda & cab walls | Color to be selected by the Owner |
| 10. | Flooring | Mohawk MCR-191 Round Profile Gauge 3.00mm 65025-123, norament round 0733, Steel Blue or owner approved similar product. |
11. Interior Tunnel Walls:
- a. Interior wall treatment shall consist of 3/8-inch thick fire-rated particle board sandwiched between two high pressure laminates (Wilson Art Color Product, Nevamar, Formica or approved equal) wall panels laminated on both sides to prevent bowing, four feet on centers with aluminum trim and recessed black accent strips or 20 gauge (minimum) coiled coated galvanealed flat steel panels four feet on centers with trim finished in accordance with the specified exposed interior paint system. Provide water drain holes in the bottom J-channel.
 - b. The finished product shall carry a UL label and shall meet the flame spread test as listed in ASTM E84.
 - c. The design shall allow each panel to be removed individually.
 - d. Owner to select color and finish from full range of premium and custom color chart.
12. Interior Floor:
- a. Tunnel floors shall be constructed of minimum 3/8-inch aluminum or smooth galvanealed steel.

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- b. The cab, cab bubble, and rotunda floors shall be constructed of minimum 3/8-inch aluminum or smooth galvanealed steel.
 - c. Transition ramps shall be constructed of 3/8-inch aluminum or galvanized steel. Transition ramps shall be hinged. A tunnel ramp shall be full width of tunnel. Nosing on ramps shall have abrasive anti-skid surface. Ramps shall slope starting in each tunnel to meet ADA slope requirements. Ramps shall not cut or mark the tunnel floor the ramp is riding over. Ramps shall be covered with 1/4-inch ribbed rubber matting with yellow chamfered edge.
 - d. Tunnels and rotunda floors, except as noted, shall be covered with selected rubber flooring
 - e. Cab Floor Finish: One-quarter inch ribbed fire-resistant black rubber with anti-skid surface shall be installed from terminal side of service door to the aircraft spacer assembly. Rain gutter ends, door threshold and rubber matting seams shall be sealed with black silicone.
 - f. Gutters: Install yellow/black safety tape in all gutters.
13. Interior Ceiling:
- a. All ceiling areas shall be finished with linear solid metal-faced panels (matching the width of the light fixtures) or painted 20 gauge (minimum) coiled coated galvanealed steel panels running the width of the bridge. Panels shall be separated by approximately 1/2 to 3/4 -inch black reveals. Panels shall be brushed aluminum tile or if utilizing aluminum or coiled coated galvanealed steel panels, finished in accordance with the specified exposed interior paint system. Owner shall make selection of either the brushed finish or the painted finish. The panels located at the ends of the light fixtures shall have a black finish to match the fixtures.
 - b. The aluminum corner molding that finishes the ends of the ceiling panels and top edge of the wall panels is painted black to match the light fixture.
14. Interior flashing shall be 1-inch wide x 1/8-inch thick with flat felt backing.
15. Architectural Metal and Trim Items: Anodized aluminum and other galvanized, aluminum, or stainless steel trim items shall have a satin finish.
16. Paints and flooring adhesives shall have a maximum VOC of 3.5 lbs. /gal for field applied applications. Stated VOC shall be un-thinned maximum as certified by the manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. The Contract Documents indicate the location of each aircraft position at each gate. The Contractor shall be responsible for verifying all locations of aircraft positions for the various types of aircraft serviced at each gate, and advise the Owner's Representative of any conflict or code violations prior to beginning the fabrication of the passenger boarding bridge. Any modification to the Documents as necessary to eliminate conflicts or code violations will be made by the Owner's Authorized Representative (OAR).
2. Verify the exact terminal building door sill and bridge foundation elevation, and foundation bolt patterns and dimensions at each gate prior to preparation of shop drawings. Notify the Owner's Authorized Representative (OAR) of any discrepancies with Contract Documents or passenger boarding bridge requirements.
3. Verify apron elevations at each bridge location. Coordinate these elevations with the bridge operation requirements, layout and maximum slope.

3.2 INSTALLATION

A. Structural Support Elements:

1. All anchor bolts are existing or provided by others in the foundation construction, and shall be protected from bending and damage during PBB installation. After installation, tack weld the anchor nuts to the base or provide two nuts. All zinc coating removed or damaged by welding or any other means shall be cleaned and repaired with galvanizing repair primer meeting the requirements of Federal Specification TT-P-641 G (1), Type II.
2. An approved non-shrink grout shall be used underneath the column base plate and leveling-plate. Grout shall be a no-iron mix to avoid rust marks. Grouting of the rotunda base plate shall be formed and poured using the holes in the base plate. Grouting by dry packing and filling the center area with bags and blocks will not be acceptable. The grouting shall be done to American Concrete Institute or structural standards and as approved by the Owner's Representative.
 - a. Grout shall be 3-inches minimum and 7-inches maximum.
 - b. Setting of rotunda requires a leveling nut and washer on each anchor bolt on the underside of the rotunda base plate and one or two nuts and one washer on the top.

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3. Flooring Installation: The Contractor shall furnish all flooring and install the flooring in strict accordance with the manufacturer's printed installation instructions and the following specifications.
 - a. Prior to installation, verify with the Owner's Authorized Representative (OAR) all edging techniques, lines of demarcation between flooring and hard surfaced floor and wall areas, and treatment at doors and thresholds.
 - b. The contractor shall install the flooring by direct glue method, free of wrinkles.
 - c. Adhesive and primer shall be compatible.
 - d. Install edge strips where flooring abuts other flooring including door openings where thresholds are not indicated. Secure edge strips with countersunk flat head stainless steel screws at 12 inches on center maximum.
 - e. Finished appearance shall be smooth, level, free from misalignment, neatly cut and closely fitted at projections and openings, with joints as close and inconspicuous as possible.
 - f. After the flooring installation is complete, Contractor shall clean all drains, gutters and rain diverters to remove any excess material, construction debris and flooring cutouts, to provide an unobstructed free flowing drainage system.
 - g. Contractor to vacuum the flooring and cover with non-staining, protective materials.
 4. During the on-site delivery, storage, and installation process, the Contractor shall be responsible for securing all PBB elements, tools and equipment against hurricane force winds.

3.3 FIELD QUALITY CONTROL

A. Inspection:

1. Preliminary Inspection:
 - a. Manufacturer's representative shall perform a functional inspection and demonstration of each unit at the installation site in the presence of the Owner's Representative.
 - b. Verification of compliance with this Specification shall be accomplished by inspection, review of data, demonstration, testing (if required), or combination of these.

2. Final Acceptance Inspection:
 - a. Owner's Representative shall perform the final inspection of the unit after full compliance by the Contractor of all outstanding punch list items as determined from the preliminary inspection.
 - b. Full acceptance of the unit shall be made in writing to the Contractor after satisfactory completion of all punch list items as determined by the Owner's Representative.

B. Manufacturer's Field Services:

1. Provide qualified manufacturer's technical representative and service personnel during the entire installation of the boarding bridge to assure a proper installation, and to ensure adequate and reliable field service support to correct any and all equipment failures that normally occur during the initial operating period.
2. In addition, this field service support representation shall be on-site from 3 a.m. to 12 a.m. midnight for three calendar days after each gate enters service as scheduled by the Owner. thereafter in accordance with the warranty provisions of PART 1 - GENERAL 1.11 WARRANTY.
3. This representation shall be available to the Owner's Representative at no charge for the first 60 days after installation. The manufacturer's field service representative shall ensure the installer follows:
 - a. The manufacturer's field installation manual.
 - b. Compliance with all safety requirements.
 - c. Provides accurate and complete reports and records maintenance.

PART 4 - METHOD OF MEASUREMENT

2.014.01 METHOD OF MEASUREMENT

- A. Passenger Boarding Bridges will be paid on a per unit basis. Each unit shall be measured based on each unit and shall include all cables, shipping, connections, labor, materials, tools, etc. as required to get each unit operational.
- B. Fixed Walkways will be paid on a linear foot basis. Each walkway shall be measured including all cables, shipping, connections, labor, materials, tools, etc. as required for operation of the fixed walkway.

~~PART 6~~ - PART 5 - BASIS OF PAYMENT

2.015.01 BASIS OF PAYMENT

A. Payment will be made using the following.

Item 34 77 12 – 5.1	Passenger Boarding Bridge	Per Unit
Item 34 77 12 – 5.2	Fixed Walkway Section	Per LF

END OF SECTION 34 77 12