PROJECT MANUAL

INCLUDING CONSTRUCTION SPECIFICATIONS

for

V-S035, - TERMINAL C ASC LEVEL 2 EMERGENCY EGRESS (D/B)

ORLANDO INTERNATIONAL AIRPORT

Orlando, Florida 32827

CONTRACT DOCUMENTS

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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 10 30 – Automated Passport Control System
20. 27 10 40 – Queue Management System
21. 27 20 00 – Common Use Systems
22. 27 25 16 – Integrated Airport Management System
23. 27 41 33 – IP Master Antenna Television System
24. 27 42 20 – Electronic Dynamic Signage System
25. 27 42 23 – Experiential Media Environment – Media Features
26. 27 42 24 – Experiential Media Environment – AV Specialty Systems
27. 27 51 13 – Emergency Communication System
28. 27 53 10 – Distributed Antenna System
29. 27 53 50 – Global Positioning System
30. 28 05 00 – Common Work Elements for ESS
31. 28 13 00 – Physical Access Control System
32. 28 16 00 – Intrusion Detection System
33. 28 23 00 – Video Surveillance System
34. 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
TMC	Technology Master Contractor -- a sub-contractor to the CMAR that shall have overall responsibility for performing and delivering all scopes of work as defined in the Division 27 and 28 specifications, T-series, TS-series and TA-series Contract Drawings and related Contract Drawings. Additionally the TMC shall have responsibility for the related scope of work in referenced Division 23 specification sections.
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 Divsions 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. Contractor: The Technology Master Contractor (TMC)
8. Furnish: Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
9. 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.
10. 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 *Dual Construction Manager At-Risk (CMAR) Project*. Each 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.
2. The Technology Master Contractor (TMC) shall be responsible for the overall 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. The TMC shall be known as the "Contractor" in this and all related specification sections, T-, TA- and TS-series Contract Drawings.
   a. TMC shall report full-time to the project site and serve as a main point of contact for the OAR staff for all aspects of the technology and security work. The TMC shall coordinate with theTPM to ensure all infrastructure and systems between buildings, including any connections to the existing airport systems are completely coordinated and operational.
   b. The TMC shall have overall 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.
   c. The TMC 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.
      1) In addition to general CMAR construction meetings, the TMC shall attend technology, multimedia, and security coordination meetings with TPM, CMAR, Authority and/or Authority Vendors.
   d. The TMC shall be responsible for, at a minimum, the following tasks and activities:

1) Project Management
2) Schedule Management
3) IT System Impact Analysis
4) Staff Training
5) Performance Management
6) Change Management
7) Project Closeout
8) Estimating
9) Scheduling
10) Weekly Status Meetings including look-ahead
11) Cost Controls
12) Status Reporting
13) Contract Administration
14) Document Review
15) Contractor Change Order Review
16) Trend & Variance Reporting
17) Document Controls
18) “As Built” Schedule Updates

e. Systems within the TMC scope shall include, but not be limited to:
1) Common Use Systems
2) Electronic Dynamic Signage
3) IP Master Antenna Television (IPTV)
4) Experiential Media Environment (EME)
5) Integrated Airport Management System (IAMS)
6) Elevator Status/Control (Liftnet)
7) Passive Optical Network (PON) and Local Area Network (LAN)
8) Premise Distribution System (PDS)
9) Communication Rooms / Spaces (MDFs, IDFs, Control Rooms)
10) Distributed Antenna System (DAS) – Operations (460MHz), Public Safety (800MHz), Cellular
11) Physical Access Control System (PACS)
12) Video Surveillance System (VSS)
13) Intrusion Detection System (IDS)
14) Advanced Visual Docking Guidance System (A-VDGS)
15) TSA Checkpoint Queue Management System
16) Wireless Local Area Network (WLAN)
17) Bluetooth Indoor Wayfinding
18) Building Management System / Building Automation System
19) Emergency Communication System (ECS) / Paging
20) Automated Passport Control / Mobile Passport Control
21) VoIP Telephone System
22) Fire Alarm System

3. 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.

D. 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.

E. 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.

F. 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.

G. 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 matricies 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.

H. 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.

I. 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.

J. 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/interfacing 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 additional 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 TMC 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 TMC 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 TMC 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 TMC 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 weekupon 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. Wire basket cable tray system shall be provided in all corridors as indicated on the contract drawings and installed as herein specified.

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 will 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) EatonB – 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 ¼” 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 GBI144xxTMGB 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 over- lap 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 Contactor 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. ~~(2-hour class repeated 6 times spaced over a two-week interval.~~ 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 ~~(4-hour class repeated 3 times with six advanced users per class)~~. 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 ~~(24 hours of training shall be repeated 1 time for 1 system administrator)~~.

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, it 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, comprised of voice and data subsystems for the Orlando International Airport, South Terminal C, Phase 1 Project. This section shall apply to the following project components:

1. Airside Concourse Building
2. Central Energy Plant
3. Central Receiving Facility
4. Ground Support Equipment – Checkpoint Delta
5. Ground Support Equipment – Grinder Facility
6. Ground Transportation Facility
7. Landside Terminal Building
8. Landside Civil
9. Parking Garage Phase 2

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.
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.
2. Detailed floor plan layouts and riser diagrams showing system components and their location, interconnections, wiring/cabling, 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 ~~within one prior year of anticipated testing completion of project.~~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.
~~c.~~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.

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.

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.
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.
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: APC.

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.
   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 lug on top for connection to grounding system.
   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-moutned equipment 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 fastenend 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, ½” 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, and wall mounted 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-~~5000~~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.

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.

1. Acceptable ManufacturersChatsworth (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.

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 SUPRESSION

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.

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 phenoloc 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, IDFs, 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.

~~10.~~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 ~~Tier 1 and Tier 2 testing as described in ANSI/TIA-568-D, including an Attenuation Test and an Optical Time Domain Reflectometer (OTDR) test.~~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.

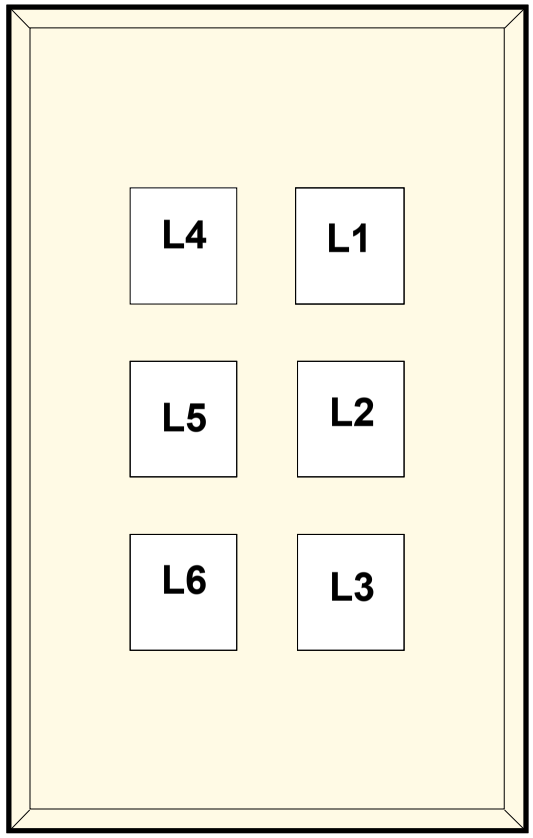
13. Any single wall phone height telephone jacks called for shall have type Cat 6 cable and matching components, and a single position wall phone jack.

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**

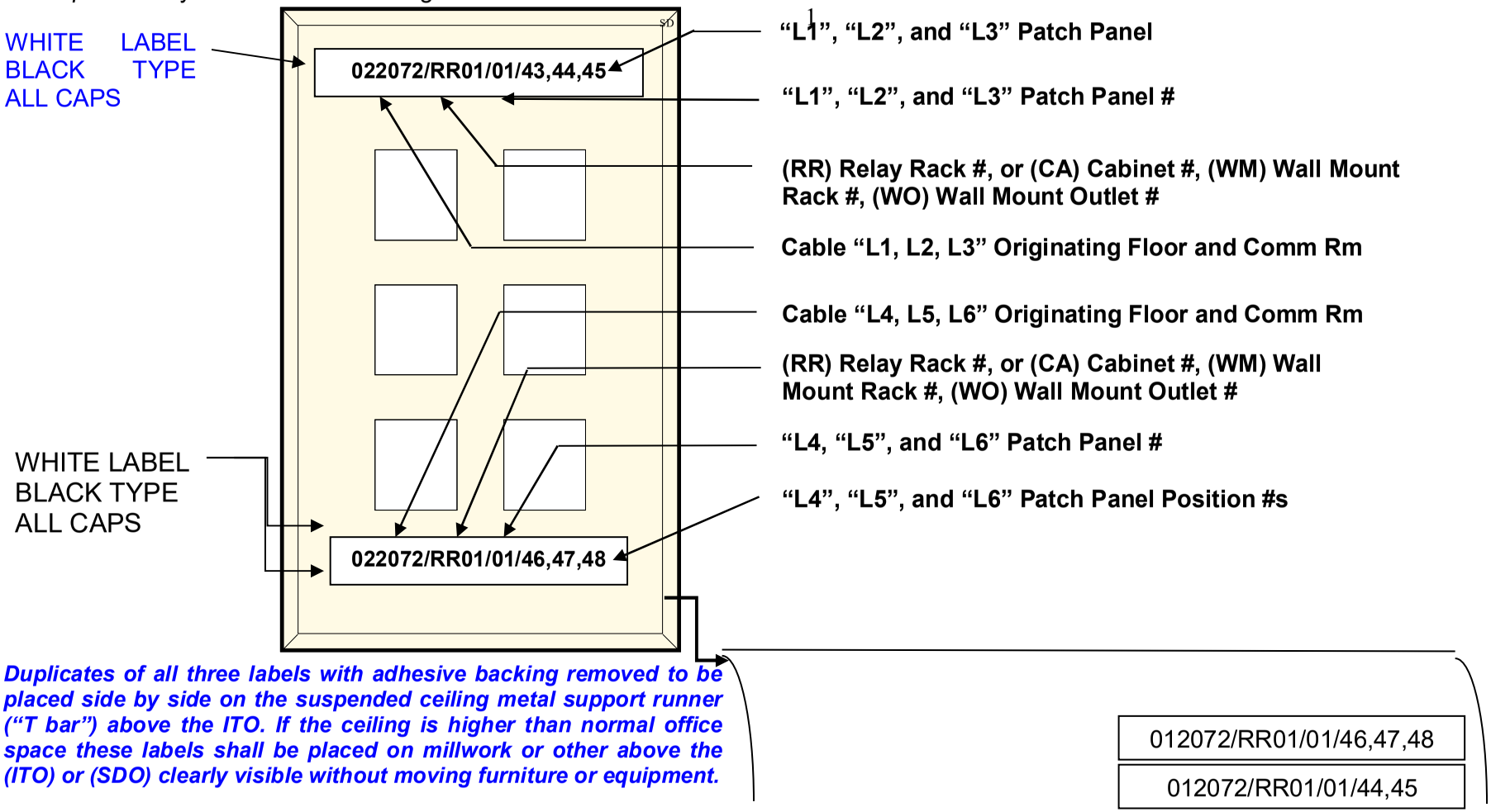
L3 - LAN JACK 568B
- **CATEGORY 6**
- **RJ45**
- **GREEN BEZEL**

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.



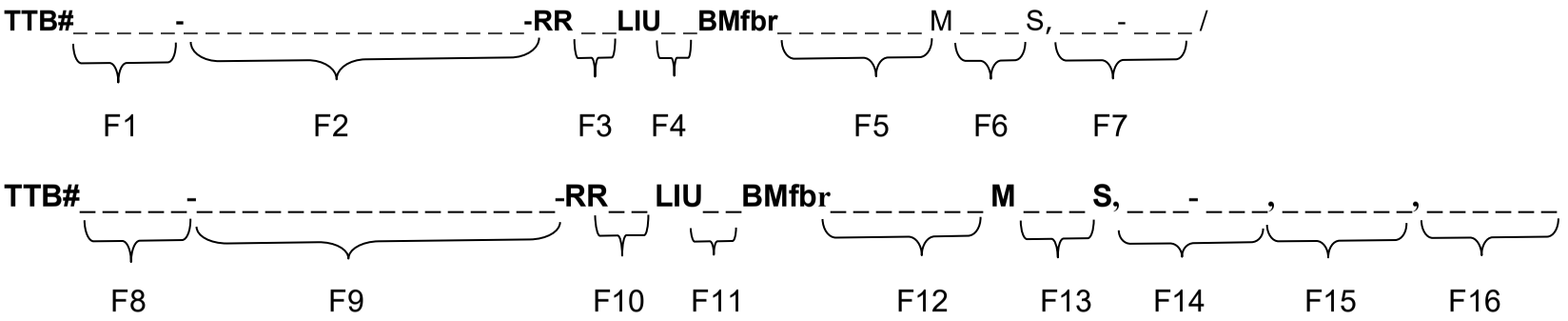
Duplicates of all three labels with adhesive backing removed to be placed side by side on the suspended ceiling metal support runner ("T bar") above the ITO. If the ceiling is higher than normal office space these labels shall be placed on millwork or other above the (ITO) or (SDO) clearly visible without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

012072/RR01/01/46,47,48

012072/RR01/01/44,45

LABELING BACKBONE FIBER OPTIC CABLES – DATA FIELD DEFINITIONS

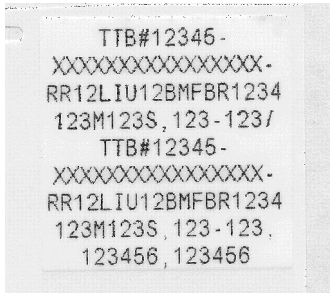
Physical Layer Administration - Attachment Two R3



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 **U**nique **C**able **I**dentifier (**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 **W**all **M**ount 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”.



Actual Basis of Design riser label with sample text, printable section. Label is still on backing, ready to be peeled. Line breaks to be as shown.
Brady label p/n PTL-34-427, top margin –0.02460in, left margin +0.01476in, font #6 (point size 10), horiz justify center, vert justify bottom.
Clear laminating tail extends below printable section another 4.5in.

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.~~1. ~~26 05 43 – Underground Ducts & Raceways For Electrical Systems~~
~~9.~~8. 26 05 53 – Identification for Electrical Systems
~~10.~~9. 27 05 00 – Common Work Elements for Communications
~~11.~~10. 27 10 00– Premise Distribution Systems
~~12.~~11. 27 10 05 – Passive Optical Network
~~13.~~12. 27 10 10 – Voice Over IP Telephone System
~~14.~~13. 27 10 15 – Wireless Local Area Network System
~~15.~~14. 27 10 20 – Visual Docking Guidance System
~~16.~~15. 27 10 30 – Automated Passport Control System
~~17.~~16. 27 10 40 – Queue Management System
~~18.~~17. 27 20 00 – Common Use Systems
~~19.~~18. 27 25 16 – Integrated Airport Management System
~~20.~~19. 27 41 33 – IP Master Antenna Television System
~~21.~~20. 27 42 20 – Electronic Dynamic Signage System
~~22.~~21. 27 51 13 – Emergency Communication System
~~23.~~22. 27 53 10 – Distributed Antenna System
~~24.~~23. 28 05 00 – Common Work Elements for ESS
~~25.~~24. 28 13 00 – Physical Access Control System
~~26.~~25. 28 16 00 – Intrusion Detection System
~~27.~~26. 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. A Passive Optical Network (PON) shall be installed throughout the entire terminal and associated support buildings. The system installed shall be designed and installed to support network communications and all connected systems throughout the South Terminal Complex (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.~~01~~ 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 Authority Vendor shall install all Optical Line Terminals (OLTs), connections to core switches, patch cords 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 North Terminal Complex 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 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. 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 passive optical splitters, and cabling to support ONTs.. Furnish all patch cables required to connect all ONTs and network systems. Refer to specification section 27 10 00 for additional information.
g. Field Devices: The Contractor shall Furnish and Install all Passive Optical Splitters and Zone Enclosures. The Authority shall furnish and Authority Vendor shall install all Optical Network Terminals.

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. Wall Mount: Construct a 2'x2' section of wall to match the actual mounting surface.
   b. Zone Enclosure Rack Mount: Install rack-mount 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 - FURNISH A QUANTITY OF 5 SPARE PASSIVE OPTICAL SPLITTERS OF EACH PORT COUNT/TYPE.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 optical line terminal 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.
2. The OLT shall, at a minimum, meet the following requirements:
   a. Line card / multiservice slot quantity: 14
   b. Total Gigabit PON ports: 56
   c. Shelf/chassis backplane bandwidth capacity: 1.12 Tbps
   d. Slot Bandwidth Capacity: 80Gbps
   e. Maximum ONTs Served: 1,792
   f. Maximum Ethernet Ports Served: 7,168
   g. Mounting: 19” Standard EIA/TIA
   h. Dual, redundant power supplies
3. OLT shall be Tellabs 1150E, Zhone MKX 823, or approved equal.

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 comply with the following requirements at a minimum:
   a. SC Angle Polished (SC/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
   e. Return Loss: >= 55dB
   f. Directivity: >= 55dB
   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.

B. All passive optical splitters shall be furnished with cable management provisions.

C. 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 (Tagging/Detagging, Marking/Demarking 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 Flush Wall Mount
   a. Mounting: Standard single-gang backbox
   b. Ports: (4) RJ-45 Ethernet
   c. Power source: 48VDC
   d. PoE Capacity: 60W
   e. Shall be Tellabs 140W or approved equal.
3. 4-Port Casework or Device Mount
   a. Mounting: Shelftop or bracket
   b. Ports: (4) RJ-45 Ethernet
   c. Power source: 48VDC or 120VAC
   d. PoE Capacity: 60W
   e. Shall be Tellabs 140C or approved equal.

4. 24-Port Rackmount

   a. Mounting: 19” Standard EIA/TIA
   b. Ports: (24) RJ-45 Ethernet
   c. Power source: 120/240VAC
   d. PoE Capacity: 450W
   e. Shall be Tellabs 729GP or approved equal.

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 Terminals 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, 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 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.

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 IDENTEFICATION

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. 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 – Low-Voltage Electrical Power Conductors and Cables
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 10 10 – Voice Over IP Telephone System
13. 27 10 15 – Wireless Local Area Network System
14. 27 10 20 – Visual Docking Guidance System
15. 27 10 30 – Automated Passport Control System
16. 27 10 40 – Queue Management System
17. 27 20 00 – Common Use Systems
18. 27 25 16 – Integrated Airport Management System
19. 27 41 33 – IP Master Antenna Television System
20. 27 42 20 – Electronic Dynamic Signage System
21. 27 51 13 – Emergency Communication System
22. 27 53 10 – Distributed Antenna System – Cellular
23. 27 53 50 – Global Positioning System
24. 28 05 00 – Common Work Elements for ESS
25. 28 13 00 – Physical Access Control System
26. 28 23 00 – Video Surveillance System
27. 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 systems drawing package. Not all device symbols indicated may be required for the project.

2. Due to the scale of the drawings, symbols are shown on the drawings close as possible to the intended mounting location. The Contractor, GOAA, and GOAAs Vendor 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, site plan drawings as well as related

Specification Sections of affected trades and systems prior to the 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 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
2. Central Energy Plant
3. Central Receiving Facility
4. Ground Support Equipment – Checkpoint Delta
5. Ground Support Equipment – Grinder Facility
6. Ground Transportation Facility
7. Landside Terminal Building
8. Parking Garage Phases 2 and 3

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.

1. The GOAAs Vendor 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 the Authority and OAR.
   d. GOAAs Vendor shall be responsible for providing all wiring, connections, patch cords at the telephony devices, within the closet, termination points to support all equipment, circuits and devices as well as all coordination and programming for the integration of all VoIP integration, ancillary systems impacting the operation of existing PBX. Refer to the contract drawings and related Specification Sections for additional information.

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. Installing all telephones and 3rd party accessory devices, mountings throughout the terminal regardless of procurement responsibility.
   a. Installing telephones consist of distribution of desk phone, wall phones, installing mounts for each application, routing of patch-cord through telephone cable guides.

b. Routing patch cable through furniture to reach voice and data outlet.
c. Installing conference room speakerphones.
d. Installing expansion button selector on phones identified on drawings.

2. The Contractor shall furnish and install all phones and accessories not furnished by GOAA and GOAAs vendor.
3. GOAA vendor shall coordinate with the Contractor and 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.
4. 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.
5. ~~(1) TTY phone shall be mounted at every bank of courtesy phones.~~ Refer to drawings for TTY phone locations and additional requirements.
6. Courtesy phone ~~enclosure~~ mounting. Contractor shall be responsible for mounting courtesy phone within ADA required ~~enclosure~~elevation.
7. The Division 27 contractor shall install telephones to ADA requirements.

J. GOAAs Vendor shall be responsible for all integration with the LAN and necessary configuration to provide the functionality described within this document. Any configuration shall be performed in coordination with and approval by the Authority and Owner's Authorized Representative (OAR).

1. GOAAs Vendor shall furnish and install the following systems as part of the VoIP solution:
   a. All software, licensing, latest firmware and hardware components necessary for VoIP to function as specified.
   b. All required active network switches dedicated for the telephone switch.
   c. Cross connections and intra-connections to service provider incoming telecommunication trunk lines.
   d. System training as specified.
   e. System warranty as specified.
   f. System testing and acceptance plans as specified.

K. GOAAs Vendor shall be responsible for relocating one of two Avaya Pods FX headend cabinets from the north terminal complex to the south terminal complex. Relocating the Pod FX the contractor shall furnish, install and include:

1. GOAAs vendor shall provide GOAA with and be contracted for implementing the following:
   a. A scheduling timeline spreadsheet for all the procedures required for equipment relocation shall be provided to GOAA for approval.
   b. Equipment connectivity and port mapping.
   c. Active components power down procedure.
   d. Connectivity and power disconnect.
   e. Packaging Avaya headend equipment, identification documentation, transportation method, transportation enclosures and materials, moving equipment, labor personnel, clearances, and transportation path.
   f. Racking and stacking.
   g. Power and connectivity patching and cross connecting.
   h. Active components power up procedures and configuring.
   i. Testing procedures.

2. GOAAs Vendor shall be provide insurance documents to GOAA for written approval prior to relocating the Pod FX.
3. Prior to relocating the Pod FX contractor shall survey, measure, schedule elevator controller, dedicated time slot and receive security access and permission.
4. GOAAs Vendor shall coordinate efforts with the contractor, GOAA, security personnel, electrical department, facilities personnel, fire protection monitoring entity and local emergency personnel.
5. GOAAs Vendor shall identify and notify users and monitoring staff of all systems that will or may be affected during relocation.
6. GOAAs Vendor shall have redundant equipment on standby for any system that is being relocated. GOAAs vendor shall replace any system with the redundant hardware if any hardware fails upon start-up.
7. The relocation of the Avaya POD shall be relocated using the minimum requirements:
    a. Enclosure shall meet or exceed the following:
        1) Solid rigged walls, roof and floor with reinforced corners.
        2) Interior walls shall have bracing that will not warp or scratch the Avaya cabinet.
        3) Bolted or fastened joint capable of withstanding a 20lb direct impact without separation.
        4) Exterior panels shall have handles.
    b. Equipment shall be packaged after a (2) hour ~~a~~ cool down period or equipment temperature has reached the ambient room temperature. Contractor shall use a thermal temperature gauge over the length of the cabinet and record time and temperatures.
    c. Avaya POD shall be transported on a separate foundation rated to support 3,000lbs. Wheels or casters shall be rated to support a combined load of 3,000lbs. Avaya POD enclosure shall be strapped to external transport foundation.
    d. The POD shall not be tilted more than 15 degree in any direction. The use of a hand Dolly is prohibited. Contractor shall not slide or use the Avaya POD cabinet wheels to transport.
    e. Avaya POD at no time shall be hoisted manually to clear uneven surface levels. A ramp shall be constructed to transport Avaya Pod across any uneven surfaces.
    f. The transportation vehicle shall have the minimum requirements:
        1) Insured and inspected for commercial usage. All paperwork shall be verified and approved by GOAA with a signed letter of acceptance.
        2) Commercial vehicle with ~~a~~an enclosed body length of 18-26’
        3) Hauling capacity of 15,000 – 52,000 lbs. GVW
        4) Hydraulic lift gate rated at 4,000 lbs. or greater.
        5) Cargo area shall have multiple anchor points throughout the interior of the enclosure.
        Prior to lifting hydraulic liftgate the Pod pallet enclosure shall be lowered ~~on a pallet to~~onto the liftgate to create as much friction as possible. If enclosure foundation is on casters blocking shall be installed so enclosure cannot shift. Enclosure shall be anchored or strapped to lifting platform.

g. GOAAs Vendor shall not relocate the Avaya POD if any such conditions exist: ~~unless otherwise notified~~:
   1) All conditions identified in the above Specification Section 1.2, K are not met.
   2) Wind speed forecast or measured greater than 10mph.
   3) Wet conditions unless written approval is granted by GOAA. If the following conditions apply the following shall be instituted at a minimum:
      a) Slip resistance rated floor covering throughout the entire pathway within the building.
      b) Encase equipment in a waterproof covering. Strap covering to resist wind speeds up to 20mph.

L. The Division 27 integrator 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, crossconnection 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.

8. Code Blue phones within the Garage shall be furnished and installed by the contractor. Contractor shall refer to section 2.4 Hardware Requirements and related Appendix A for garage 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 South Terminal 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.

B. GOAA and GOAAs Vendor shall coordinate voicemail storage requirements. GOAA vendor shall furnish, install and configure a 1TB networked storage scheme for the voicemail system.

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.

B. GOAAs vendor Avaya AOS agreement shall be extended to service the south terminal complex for all operations and maintenance procedures.

1.11 SOFTWARE AGREEMENT

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

B. Under the Avaya AOS document, all software and firmware updates will be included in the extended contract.

1.12 SPARE MATERIAL

A. All spare material shall be furnished by the Authority. 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 programing 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 the parking garage shall be configured to call as follows:
    a. Emergency Button shall call 911 direct.
    b. Assistance Button shall call Parking help desk on the parking levels and plays recording on the RAC levels.

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. Avaya software and firmware updates shall be included under the extended Avaya AOS document.

B. The Contractor shall furnish and install Code Blue control software ToolVox licencing and service maintenance agreement. ToolVox licensing shall be upgraded or purchased to include emergency phones located in the parking garage. 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 ~~9641GS~~ J179 shall be implemented for GOAA office and personnel, furnished by GOAA and installed by the Contractor.

2. Avaya model ~~9608G~~ 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. G-Tel Inmate Phone JP-3500 Armored Analog shall be GOAA furnished, and contractor installed where identified on drawings as courtesy phones.
   a. Owner shall furnish and Contractor shall install the mounting bracket for all G-Tel phones.
   ~~4.~~b. Mounting bracket G-Tel model number WMP-JP.

5. Code Blue CB-2a with IP5000 FP-2 telephone interface. Contractor furnished and installed, refer to Appendix A.

6. Code Blue interior application interfaces shall be IP500 or IP1501.
7. Code Blue exterior applications interfaces shall be CB1 or CB2. Contractor shall coordinate with GOAA for exact part numbers.
8. Code Blue IP1500 exterior push to talk phone. Contractor shall ~~furnished and contractor~~ installed.
9. Krown manufacturing PAYPHONE TTY with Cabinet. Place the public TTY device in a metal cabinet which provides extra protection for the product. The size is 12.5″ x 11.25″ x 2.25″. GOAA furnished and Contractor installed equipment. The TTY Telephone shall be the following:
   a. Krown K-PPTTYC
   b. ADA compliant

~~7.~~B.

8.1. 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 cord from Zone Enclosure to each elevator controller.
      1. Patch cable shall be a RJ45 8 pin connector connected to local gate-way mounted in Zone Enclosure and terminated on a category 6- keystone jack in the elevator controller.

9.1. Krown manufacturing PAYPHONE TTY with Cabinet. Place the public TTY device in a metal cabinet which provides extra protection for the product. The size is 12.5″ x 11.25″ x 2.25″. GOAA furnished and Contractor installed equipment. The TTY Telephone shall be the following:
   a. Krown K-PPTTYC
   b.a. ADA compliant

C. Accessories and Add-on ComponentsAudioCode Gateways
   1. AudioCodes MP114 and MP118 Gateway shall be furnished and installed by the contractor in the nearest Zone Enclosure or IDF tofor the elevator control rooms:
      a. The Contractor shall identify the quantity of elevators managed/controlled by each control room.
      The contractor shall provide the required number of gateways in the Elevator Control room to assure sufficient connectivity.
      Elevator control rooms which manage multiple cars shall have (1) MP114 Gateway per car.

   2. AudioCodes MP11411412 Gateway shall be furnished and installed by the Contractor for analog courtesy phones in the nearest Zone Enclosures or IDF.

B.D. 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. GOAA furnished GOAAs Vendor installed equipment.
   b. Access List, RADIUS Web
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.
   b. Contractors shall include the Door phone Kit
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 ~~BM12~~ J100 expansion module 24 ~~-~~ shall be GOAA furnished GOAA Vendor installed. Expansion ~~-~~module shall have:
   a. ~~12~~ 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. The Contractor, GOAAs Vendor and GOAA shall be responsible for protection of 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 or indicate damage, exposure to dust or moisture shall not be installed and shall be returned to the manufacturer for immediate replacement.
   a. The use of spare parts or the return of defective equipment after 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. The Contractor, GOAAs Vendor and Contractor shall 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 GOAAs contractor and contractor prior to replacement and approved beforehand by the Authority.

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 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.

3.4 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.

3.5 INSTALLATION REQUIREMENTS

A. In addition to all demonstration and training as specified by Division 01, Specification Section 27 05 00 and related Division 27 Specification Sections, system installation shall be provided in accordance with all requirements of this Section.

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 prevent 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.

7. Phones:
   a. AVAYA phones shall be installed at desk and wall phone locations identified in the drawings.
   b. Desk phones shall have the patch cord routed through phone cable pathway allowing the desk phone to sit flush against the surface.
   c. Phones identified to be mounted on the wall brackets shall be installed and cable routed so that the phone bracket is securely attached to the wall plate studs.
   d. Courtesy phones shall be mounted per manufacturing installation requirements.
   e. Jet bridge phones shall be wall mounted at designated area. Contractor shall coordinate with jet bridge contractor for exact location.
8. Gateways:
   a. Gateways shall be mounted in the floor serving MDF, ~~and~~ IDF's and Zone Enclosures unless otherwise noted. ~~.~~
   b. Gateways shall be mounted within a cabinet. Gateways shall be rack mounted where applicable. Gateways that cannot be mounted to cabinet rails shall reside on a cabinet mounted shelf. These gateways shall be consolidated and neatly place on the shelf.

C. Software Installation

1. The GOAAs vendor and 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.
2. The contractor shall be a certified Avaya installer with a minimum of 5 years experienced installing and maintain Avaya equipment.

D. Hardware Installation

1. Final hardware selected and installation of hardware shall be coordinated with the Project Manager. Additionally, the Contractor and GOAAs vendor shall ensure the ventilation requirements for the all hardware components are met.
2. The Contractor and GOAA Vendor 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 and GOAAs vendor 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.

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 the Division 26 contractor, 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 integrator selected equipment shall be the responsibility of this Electrical Contractor to include as part of this project.

1. Avaya’s Pod FX headend shall have two dedicated L6-30 receptacles.
2. 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.
3. 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.

3.8 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. 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 10

APPENDIX A

Code Blue **CB 2-a**

Unit Order Form

DEALER INFORMATION

Dealer:	City:	State:	PO:	Date:
End User (required for valid order): GOAA	City: Orlando	State: FL	Type: Transportation	

STANDARD FEATURES

Basic Unit Configuration	Part #	Price	Add
■ Code Blue 2-a, wall mount enclosure	see below	$1150	$ 1,150
Color and Graphics Options ■ STANDARD (choose below) ☐ CUSTOM (call)	see below	0	$ 0
Finish Color (choose one)			
Standard Color:			
■ 4B Brushed Stainless Steel	see below	$0	$ 0
Optional Colors:			
☐ Safety Blue ☐ Safety Yellow ☐ Safety Red ☐ Gloss White ☐ Bright Silver ☐ Tiger Orange ☐ Midnight Blue			
☐ Gloss Black ☐ Dark Bronze ☐ Cardinal Red ☐ Medium Bronze ☐ British Racing Green	see below	$250	$ 0
☐ Custom Color*	see below	$275	$ 0
*A physical color sample must be sent to Code Blue for matching. It must be painted or professionally printed and be at least 2x2" in size.			
☐ Clear Coat enclosure (painted units only) (recommended for high iron and saltwater regions)	20093	$125	$ 0
Graphics Text (choose one) (2-sided only)			
■ Emergency ☐ Assistance ☐ Help Point ☐ Police ☐ Courtesy ☐ Security ☐ Information ☐ [None]	see below	$0	$ 0
Graphics Color (choose one)			
☐ Reflective White ☐ Reflective Black ■ Reflective Blue ☐ Reflective Red			
☐ Reflective Green ☐ Reflective Yellow ☐ [None]	see below	$0	$ 0
☐ Front Graphics (optional) (text and color will match side graphics)	41360	$30	$ 0

OPTIONAL FEATURES

Faceplate Opening Options	Part #	Price	Add
First Opening (Bottom)			
Speakerphone - IA4100 (analog) ☐ 1 Button (+$925) ☐ 2 Button (+$1025) ☐ 2 Button with Keypad (+$1075)	see below	$ 0	$ 0
Speakerphone - IP5000 (IP) ☐ 1 Button (+$1375) ■ 2 Button (+$1510) ☐ 2 Button with Keypad (+$1560)	see below	$ 1,510	$ 1,510
☐ No Phone - blank Lexan plate (units ordered w/o phone will not contain surge suppression)	see below	$0	$ 0
☐ IP5000 Battery Back-Up	40006	$60	$ 0
☐ Clear Coat faceplate (for additional protection - recommended for high iron and saltwater regions)	41460	$120	$ 0
Main Bezel			
■ PUSH FOR HELP (+$0) (standard) ☐ EMERGENCY (raised letters w/ Braille) (+$10)			
☐ EMERGENCY/EMERGENCIA (raised letters w/ Braille) (+$10) ☐ Custom / Silkscreen (call)	see below	0	$ 0

Power	Part #	Price	Add
☐ Line Power (standard)	see below	+$0	$ 0
■ Power over Ethernet (PoE) Extractor (powers auxiliary Code Blue equipment)	see below	+$195	$ 195

Voltage (Select the voltage that will be available at the installation site)	Part #	Price	Add
■ 24V AC (+$0) (standard) ☐ 120V AC 40VA (+$0) (cannot power accessories)			
☐ 120-240V AC, 277V AC (+$150) (cannot power accessories)	see below	$ 0	$ 0

Mounting Options	Part #	Price	Add
■ Wall Mount (standard)	see below	+$0	$ 0
☐ Pole Mount Hardware Kit (see Parts Order Form, part no. 40133)	40133	+$460	$ 0

NOTES: Banding tool sold separately. See Parts Order Form, part no. 41441.

Product details: www.codeblue.com/2-series

SEE PAGE 2 FOR ADDITIONAL FEATURES AND TOTAL

Code Blue **CB 2-a**

Unit Order Form

OPTIONAL FEATURES - CONT.

Fiber Modules (I pair TX/RX)	Part #	Price	Add
For IP5000 IP Speakerphone			
☐ KBC Fiber (MM/ST) to 10/100Mbps Ethernet media converter w/power supply (Qty. 2)	40042	+$1620	$ 0

Copper - Ethernet Converter	Part #	Price	Add
☐ Ethernet over twisted copper pair modem w/power supply, Evo DSL (Qty. 2)	40044	+$1440	$ 0

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

Unit Part #: 9 A 2 3 K C 4 1 0 0 0

QUANTITY & TOTAL

Prices and specifications subject to change without notice.

Unit Price: $ 2,855.00 X Quantity: 1 = Total Price: (U.S. Dollars – excludes S&H) $ 2,855.00

Code Blue • 259 Hedcor Street • Holland, MI 49423 USA • 800.205.7186 • www.codeblue.com page 2 of 2 OF-218-L

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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 installation of a Wireless Local Area Network System (WLAN) throughout the entire 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 terminal complex which shall receive WLAN coverage include, but are not limited to:

1. Landside Terminal – Arrivals and Departures Curbs
2. Landside Terminal -- Ticketing / Check-in Hall
3. Landside Terminal – International Arrivals Area
4. Landside Terminal – TSA Security Checkpoint
5. Landside Terminal – Domestic Arrivals Bridge
6. Airside Concourse – Gate Holdrooms
7. Airside Concourse – International Arrivals Corridor (Sterile Area and FIS)
8. Ramp Area – All gates, complete tail-forward aircraft coverage
9. All public circulation areas in every portion of the South Terminal Complex

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 Authority's existing Authority Vendor, Aruba, to integrate the South Terminal Complex Bluetooth wayfinding system with the existing system in the North Terminal Complex (NTC). This integration shall result in a seamless wayfinding experience between the NTC and STC.

F. The Contract Drawings are diagrammatic in nature and reflect the design intent and device quantities based on an RF Coverage Model prepared by the OAR. It is the Contractor's responsibility to finalize exact locations and quantities in conjunction with the GOAA Vendor-prepared RF Coverage Model.

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 North Terminal Complex. 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. 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. Refer to specification section 27 10 00 for additional information. Work shall also include all fiber channeling for a complete and operational system.
f. Horizontal Cable: The Contractor shall furnish and install all horizontal cable. This shall include passive optical splitters, and hybrid copper/fiber cabling to support ONTs. . Furnish all patch cables for connection of equipment at WAP locations and in communications spaces (IDFs/MDF) for installation by the GOAA Vendor. Provide patch panel port information to the Authority to perform patching in communications spaces (IDFs/MDF). 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 new 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 Vendor shall be responsible for integration of the WLAN with the South Terminal Complex Local Area Network (LAN) / Passive Optical Network (PON), existing Authority network(s), and connected tele/data systems. Any configuration shall be performed in coordination with, and after approval by the Authority and Owner’s Authorized Representative (OAR).

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.
   c. Specialized Mounts: For all other mounting conditions, construct a mock-up that demonstrates the structural and aesthetic features specified.
3. RF Coverage Modeling

a. Prior to the submission of shop drawings, contractor shall obtain from the Authority's existing Vendor, Aruba, an RF Coverage Model which establishes final WAP installation locations to ensure proper, vendor-certified and approved configuration and performance of the WLAN in accordance with the Vendor's published system and device documentation. All shop drawings shall reflect all WAP locations based on this RF Coverage Model. The RF Coverage Model furnished by the GOAA Vendor shall establish the final design.

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. The Authority shall provide 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. 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 and Authority's existing Vendor, Aruba, to ensure proper, vendor-certified and approved configuration and performance of the WLAN in accordance with the Vendor'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: 802.11ac Wave 2, 802.11n, 802.11g, 802.11a and 802.11b
   b. Dual radios, 2.4GHz and 5GHz frequency bands
   c. Multi-User, Multi-Input Multi-Ouput (MU-MIMO) support
   d. (4) spatial streams
   e. 4x4 MIMO
   f. Maximum concurrent bandwith: 1733Mbps (5GHz), 600Mbps (2.4Ghz)
   g. Maximum connected devices per radio: 255
   h. Maximum number of BSSIDs: 16
   i. Maximum aggregate transmit power: +24dBm (2.4GHz), +24dBm (5GHz)
   j. Integrated Bluetooth Low Energy (BLE) radio

   Indoor Omnidirectional WAPs shall be Aruba AP-325 or most current version, no approved equal.
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-365 or most current version, no approved equal.

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-367 or most current version, no approved equal.

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 equal.

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-BT1 or most current version, no approved equal.
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 Aruba 330 series WAPs
      6) Oberon model 1012-00 or approved equal.
   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 Aruba 330 series WAPs
      6) Oberon model 1077-WA-T or approved equal.
   c. 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.
      ~~6)~~3) Aruba AP-270-MNT-H1 or approved equal.
   ~~c.~~d. 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 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 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 hybrid 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 IDENTEFICATION

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 Contractor shall furnish and install a network of Automated Visual Docking Guidance Systems (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.

C. 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 ~~SITA Airport Management System (AMS)~~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).

D. 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 ~~SITA AMS~~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.

E. 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.~~.~~

F. 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: ~~Not applicable.~~The Authority does not have an existing VDGS and no integration to existing VDGS system is required.
   c. Interfaces: 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.
   d. 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. 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 listed in section 1.1.B for additional information.
   e. Backbone Cable: The contractor shall furnish and install all backbone cable and associated raceways, pathways, boxes, fittings and appurtenances. Refer to specification section 27 10 00 for additional information.
   f. 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.
   g. Field Devices: Contractor shall provide all A-VDGS units, workstations, and other accessories. 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
   ~~e.~~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.

a. ~~Provide evidence that systems with similar aircraft tracking technique are operational at ten (10) or more international airports in North America. Provide evidence that a minimum of five hundred (500) units with similar technique are in operation in North America.~~

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.~~By others.

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:~~for requirements.~~

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

~~a. The system and components shall be Safedock T2 as manufactured by:~~
~~1) ADB/Safegate, or approved equal.~~

2.2 FIELD DEVICES

A. A-VDGS Main Unit shall comply with the following requirements:

1. Stop position range: 2 – 100m (approx. 6– 300ft)
2. Stop position accuracy within +/- 10cm (4 in.)
3. Azimuth guidance accuracy within +/- 20cm (8 in.)

4. Operating Temperature -25ºC to +50ºC
5. Main Unit Enclosure: IP54 Rated
6. Operator's Panel: IP65 Rated
~~7.~~1. ~~Weight: Shall not exceed 300 lbs~~
~~8.~~7. Main Unit shall include an installed video camera which provides for observation of the gate area for operational purposes. Units which already include a camera for the purposes of detecting aircraft shall be acceptable, given that video streams are available for viewing by system operators. Separately-installed cameras shall comply~~ing~~ with the following:
   a. Form Factor: Box
   b. Image Resolution: 1920 (H) x 1080 (V) pixels
   c. Frame Rate: Up to 30 FPS at full resolution
   d. Lens: Varifocal 3mm – 10.5mm, F1.4
   e. Minimum Illumination: 0.4 lux Color, 0.08 lux Black & White
   f. Connectivity: RJ-45 10BASE-T/100BASE-TX, PoE
   g. ONVIF Profile S and Profile G compliant
   h. Operational Environment: 32°F to 122°F @ 20-80% Relative Humidity
   i. Camera shall be Axis M1145-L or approved equal.
   j. Camera shall be listed for use with Main Unit in order to maintain UL and all other applicable listings.

B. GCS System Servers and Workstations

1. Comply with current Authority standards for administrative workstation equipment. These standards are based on application and usage. The Contractor shall submit a request for information (RFI) to the Authority requesting specific and most current server and workstation specification standards.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. The display portion of the main A-VDGS unit shall be capable of displaying alphanumeric and directional arrows, ~~all necessary~~ 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 ~~be aligned for use by the pilots occupying both the left and right seats, and 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 ~~Airport~~ Gentrack/Veovo Airport 20/20 Resource Management System (~~AMS~~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 an administrative software platform referred to as the Gate Control System (GCS) shall provide a means for monitoring and administering the Terminal's A-VDGS units over the Authority's LAN / PON.

1. The GCS shall act as both a service provider for the A-VDGS units and as a gateway to other external systems for exchange of data to be provided by the A-VDGS, or for use 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 (~~SITA AMS~~Gentrack/Veovo RMS):
   a. REST (Representational State Transfer) web services
   b. Application Programming Interface (API)
   ~~a.~~c. The latest Extensible Markup Language (XML) standards over a Message Oriented Middleware (MOM)
   ~~b.~~d. Open Database Connectivity (ODBC) drivers
   ~~c.~~e. Connectors for Major Enterprise Application Integration (EAI) platforms
   ~~d.~~f. IATA/ACI-NA AIDX XML standard method of sending and receiving airline information
   ~~e.~~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 ~~SITA AMS~~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 ~~SITA AMS~~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 ~~alarm~~ supervisory message if PC ~~h~~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

D. The GCS shall be interfaced with the Authority's facilities management system, building management system, and/or SCADA system in order to provide these systems with status and alarm of all A-VDGS units. Obtain interfacing requirements from the Authority and OAR.

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 ~~is~~ 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
   ~~g.~~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 ~~Division~~ 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. 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. Coordinate with Division 26, 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 integrator selected equipment shall be the responsibility of this Contractor to include as part of this project.

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.

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 IDENTEFICATION

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

3.11 MAINTENANCE & SERVICE

A. ~~Refer to Specification Section 27 05 00 for requirements.~~ By others.

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 10 30 – AUTOMATED PASSPORT 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 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 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 Automated Passport Control Kiosk System (APC System).

C. The APC System installed shall meet the requirements presented in this specification as an extension of the existing APC System currently serving the North Terminal Complex (NTC).

D. The installation of the APC System in the South Terminal Complex (STC) 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)).

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. .

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 APC 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, kiosk 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 system to the existing NTC 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 APC System and other related systems.
   d. Network Components: The Authority will furnish and configure all network-related equipment including servers and routers.
   e. Backbone Cable: The Contractor shall provide all backbone cabling and associated raceways/pathways, conduits, boxes, fittings and appurtenances, including fiber channeling to achieve the required connectivity to the NTC. Refer to specification section 27 10 00 for requirements. The APC System shall be connected to a dedicated network which is not part of the PON or Authority network.

f. Horizontal Cable: The Contractor shall provide all horizontal cabling and associated raceways/pathways, conduits, boxes, fittings and appurtenances. Furnish all patch cables for connection of equipment at kiosk locations and in communications spaces (IDFs/MDF) for installation by the GOAA Vendor. Provide patch panel port information to the Authority to perform patching in communications spaces (IDFs/MDF). The APC System will be connected to a dedicated network which is not part of the PON or Authority network. Refer to specification section 27 10 00 for additional information.

g. Field Devices: The Authority will furnish and configure all APC Kiosks and will provide test space. The Authority Vendor shall install the OFE APC Kiosks, associated management software including firmware and software, configurations, interfaces and upgrades.

C. The Contractor shall provide the following services:

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 provide Quality Assurance services to ensure that the portions of the system installed by the Contractor meet or exceed 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 Automated Passport Control: Business Requirements (Version 15, April 2014)

1.5 SYSTEM DESCRIPTION

A. The APC System in the South Terminal Complex (STC) is made up of self-service kiosks (or other CBP approved device) and a site server that provides a real-time interface with the Custom and Border Protection (CBP) APC Service.

B. The APC System functions shall include, at a minimum:

1. Meet the CBP business, technical, and operational requirements
2. Display information and instructions to the traveler(s)
3. Collect the necessary travel information from each traveler
4. Collect biometrics from travelers(s), if relevant
5. Prepare and send the Traveler Validate Request(s)
6. Process vetting results from the Traveler Validate Response message
7. Request and receive the Traveler End message

8. Prepare and print receipts for traveler as specified
9. Record and document session information
10. Request and receive the APC Service System Status message
11. Request and receive the latest flight list information from APC Service

C. The APC System management functions include, at a minimum:

1. SNMP management capability
2. Remote administration and monitoring capabilities
3. Integrated failover application
4. Role-based security permissions/authorization
5. Audit trail capabilities
6. 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 APC 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.

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 Contractor shall be responsible for the testing of all backbone and horizontal cabling.

1.8 DELIVERY, STORAGE, AND HANDLING

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

1.9 RECORD DOCUMENTS

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

B.

1.

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 APC System.

1.12 SPARE MATERIALS

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 additional information.

2.2 MANUFACTURERS

A. Automated Passport Control Kiosks

1. SITA/Visionbox

2.3 SYSTEM REQUIREMENTS

A. Network and Connectivity

1. The Contractor shall coordinate with the Authority and Authority Vendor for the installation of all network components required for the APC System.
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 furnish and install backbone and horizontal cabling infrastructure and fiber channeling in support of the APC System to the existing head end servers in the NTC via a dedicated network which is not part of the PON or Authority network.

2.4 HARDWARE REQUIREMENTS

A. Supporting Infrastructure:

1. Equipment racks (furnished and installed by the Contractor):
   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.
   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 ~~11~~ 10 00 and 27 ~~11~~ 10 05 for additional information.

B. End User Device (Furnished and installed by the Authority Vendor):

1. APC Kiosk minimum requirements are as follows:
   a. 17" touch screen technology
   b. Facial Biometric Camera: Shall be capable of automatic height and camera settings to capture ICAO-compliant facial photographic images of all kiosk users
   c. Dynamic LED Illumination System: fixed LED framework, vertically aligned at each side of the camera and traveler information display, ensures symmetrical illumination
   d. Passport Reader: scans the MRZ data to capture embedded traveler information
   e. Slap Fingerprint Scanner: an integrated FBI-certified 4-finger slap scanner captures biometric data; for use by non-U.S. citizens
   f. Thermal Slip Printer: issues receipt containing CBP referral code
   g. Lockable Maintenance Access Panel
   h. ADA Compliant including a forward-facing headphone jack
2. Each kiosk requires a 120V AC, 20A, 60Hz, grounded outlet. Contractor shall coordinate with electrical power trades to ensure correct power provisions to support the APC 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 APC 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.

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 and the APC 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. 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 kiosk layout.

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 specifically as it related to the Scope as defined in section 1.3 of this specification.

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 10 30

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SECTION 27 10 40 - QUEUE MANAGEMENT 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. A Queue Management System (QMS) shall be installed at the South Terminal Complex Security Screening Checkpoint (SSCP). The system installed shall be manufactured by the Authority's existing vendor, SITA. The QMS shall utilize ~~Bluetooth® and WiFi~~Lidar sensors to track the movement of passengers~~' mobile devices~~ through the security checkpoint and queuing area. Additionally, standard IP ~~and thermal~~ video cameras shall be used to collect image data to further increase the accuracy and functionality of the system. This data shall be processed to produce estimated security screening wait times, which shall then be displayed on LCD/LED monitors mounted above the checkpoint queuing area via the Dynamic Signage system.

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 Queue Management 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 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 Queue Management System from the existing North Terminal Complex.
   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 Queue Management System and other related systems including, but not limited to, the Authority Passive Optical LAN (POL) / Local Area Network (LAN) and all terminal systems which require WLAN 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 Queue Management System ~~system~~ except for passive optical splitters. Refer to Horizontal Cable below. Backbone Cable: The contractor shall furnish and install all backbone cable. Refer to specification section 27 10 00 for additional information.
   e. Horizontal Cable: The contractor shall furnish and install all horizontal cable. This shall include passive optical splitters, hybrid copper/fiber cabling to support ONTs. Contractor shall furnish all patch cables to connect QMS devices and shall install patch cables at outlet locations. Provide patch panel port information to the Authority to perform patching in communications spaces (IDFs/MDF). Refer to specification section 27 10 00 for additional information.
   f. Field Devices: The Authority will furnish and Contractor shall install Sensors, Sensor Mounting brackets, POE Cameras, Camera Mounting Brackets, Management Nodes, POE Splitters, and ~~Location Nodes, Base Stations and~~ Queue Management System cameras.

C. The Authority shall provide all necessary modifications, software upgrades and programming as required to seamlessly integrate the new Queue Management System with the existing system located at the North Terminal Complex. The Queue Management System shall be an extension of the existing system and shall include all work, materials, infrastructure, equipment, software, and programming as required to provide a fully integrated and operational system as herein specified.

D. The Authority Vendor shall be responsible for integration of the Queue Management System with the South Terminal Complex Local Area Network (LAN) / Passive Optical Network (PON), existing Authority network(s), and connected tele/data systems. Any configuration shall be performed in coordination with, and after approval by the Authority and Owner's Authorized Representative (OAR).

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.

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 be responsible for providing all equipment, devices, system components, final cable terminations, programming, commissioning, and testing of all network communications cabling in accordance with all related Division 27 Specification Sections.

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.

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. The Authority shall furnish all spare parts for the Queue Management System.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

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

1. All products shall be compatible with the QueueAnalyzer product as manufactured by SITA, no approved equal.

2.2 SYSTEM CONFIGURATION REQUIREMENTS

A. All tasks specified within this paragraph shall be performed by the Authority Vendor.

1. Program and configure the QMS to be a seamless extension of the existing system in the North Terminal Complex (NTC). Provide all programming and configuration required to integrate the QMS into the Authority's mobile device application ("mobile app"), allowing passengers to view estimated SSCP wait times from their mobile device.
2. Perform all programming and interfacing to the Dynamic Signage, MUFIDS, and Airport Integrated Data Broker (AIDB) and SITA Airport Management System (AMS) as required to display SSCP estimated wait times on Dynamic Signage monitors located above the SSCP queuing area. Obtain all requirements from the Authority's existing cloud services provider, iinside, for all off-premises data exchange and communication.
3. Perform all network-related work including but not limited to:
   a. All network configuration tasks including, but not limited to, assignment of IP addresses or configuration of DHCP as directed by the Authority and OAR.
   b. Setup of system administrative features such as network management, traffic monitoring, security/firewall settings, and other functions as directed by the Authority and OAR.
   c. Assignment and configuration of Virtual Local Area Networks (VLANs) and/or Virtual Routing and Forwarding (VRF) instances as directed by the Authority and OAR.
4. Contractor shall coordinate with the Authority and Authority Vendor to adjust physical locations of QMS devices to avoid interference and other interactions between the QMS and WLAN that may degrade performance of either system. This scope shall be conducted during acceptance testing by the Authority and Authority Vendor.

2.3 SYSTEM AND SOFTWARE REQUIREMENTS

A. System software shall be furnished by the Authority Vendor and shall be SITA QueueAnalyzer, no approved equal.

2.4 HARDWARE REQUIREMENTS

A. All hardware in this section shall be furnished by the Authority and installed by the Contractor.

B. ~~Wi-Fi Location~~Management Node (Wi-Fi Sensor)

~~1. The Wi-Fi location node shall passively collect unencrypted wi-fi advertisements from Wi-Fi enabled devices within signal range of the node and provide this data to the system to assist in calculating queue wait times.~~

~~2.~~1. The ~~wi-fi location~~management node shall comply with the following requirements:
   a. 2.4GHz radio operating in the 2.412 to 2.462GHz range
   b. 12VDC operating voltage
   c. RJ-45 Network connection
   d. External antenna with 2.50 dBi gain
   e. ~~Wi-fi location note~~Management Node shall be ~~model SLN20~~ as manufactured by iinside or as approved by SITA and the Authority/OAR.

C. Lidar Sensor

1. The Lidar Sensors shall provide lidar based surveillance of the screening area, providing 3D detection data of passengers moving through the screening area. This data, in combination with IP camera image data, shall be used by the QMS to calculate wait times of passengers moving through the SSCP.
2. The Lidar Sensors shall comply with the following requirements:
   a. Class 1 (Eye Safety IEC 60825-1)
   b. 905 nm Wavelength
   c. Minimum range (80% reflectivity): 1m
   d. Maximum Range (80% reflectivity): 150m
   e. Range Accuracy: Less than 3 cm
   f. Angular resolution: 0.03-0.2°
   g. Detection Layers: 8
   h. Field of view
      1) 360° Horizontal
      2) 20° Vertical (+3°/-17°)
   i. Data Output
      1) Point Dimensions
         a) Angle, Distance, Intensity, Synchronized Time Stamps
      2) Output Rate
         a) 420,000 points per second (1 return)
         b) 1.26M points per second (3 returns)
   j. Electrical Data
      1) Operating Voltage: 24V DC
      2) Nominal Power: 18W
   k. Telecommunications Data
      1) 100/1000Mbps Ethernet
   l. Shock and Vibration: ETSI EN 300 019-2-5
   m. Environmental Protection: IP69K
   n. Certifications and Compliance: FDA, FCC, CE, RoHS, WEEE, IEC-60079-15, ASTM G154
   o. Lidar sensor shall be Quanergy M8, as approved by SITA and the Authority/OAR.
3. Lidar Sensor Mounting
   a. Provide ceiling and/or wall/column mounting bracket in accordance with Lidar Sensor manufacturer's recommendations and requirements.

1) The mounting bracket shall be in-kind to other system device mounts to the extent possible, to maintain a uniform, aesthetic presentation of the architecture throughout the building.

e.b. Coordinate the mounting solution with the Authority Vendor prior to issuance of shop drawings for acceptance by the Engineer and OAR.

~~C. Base Station~~

~~1. The base station shall act as a Bluetooth® to IP network bridge for forwarding data collected by Bluetooth® nodes to the QueueAnalyzer system head end.~~

~~2. The base station shall comply with the following requirements:~~

~~a. Bluetooth® 2.0+ EDR Core Specification radio operating in the 2.402GHz to 2.4835GHz frequency range~~

~~b. 3.3VDC operating voltage~~

~~c. RJ-45 network connection~~

~~d. 50-Ohm, linearly polarized External antenna with 2.89dBi gain~~

~~e. Base station shall be model SBS05 as manufactured by iinsider or as approved by SITA and the Authority/OAR.~~

~~D. Bluetooth® Location Node~~

~~1. The Bluetooth® location node shall passively collect unencrypted Bluetooth® advertisements from mobile devices within signal range of the node and provide this data to the Base Station for forwarding to the QueueAnalyzer system.~~

~~2. The Bluetoohth® location node shall comply with the following requirements:~~

~~a. 1-meter location accuracy~~

~~b. Bluetooth® 2.0+ EDR Core Specification radio operating in the 2.402 to 2.4835GHz frequency range~~

~~c. 5-15VDC operating voltage~~

~~d. Embedded dipole chip antenna, 50-ohm impedance, 3W or greater continuous output~~

~~e. Bluetooth® location node shall be model SLN05 as manufactured by iinsider or equal as approved by SITA and the Authority/OAR.~~

~~E.~~D. Mini Indoor PTZ Dome Camera

1. The mini indoor PTZ camera shall comply with the following requirements:
   a. Pan, tilt and zoom capability
   b. Sensor: ¼" progressive scan RGB CMOS
   c. Minimum illumination: 1.4lux @ F1.8
   d. Shutter speed: 1/25000 to 1/6 seconds
   e. PTZ: 25 Preset Positions, 180º pan, 90º tilt, 3x digital zoom
   f. Video compression: H.264 (MPEG-4 Part 10/AVC) – MBR or VBR, M-JPEG
   g. Resolution: 320x180 pixels up to 1280x720 pixel (HDTV)
   h. Frame rate: Up to 25/30fps at 50/60Hz, all resolutions
   i. Multiple video streams
   j. ONVIF Profile S compliant
   k. Supported Network Protocols: IPv4, IPv6, FTP, HTTP, HTTPS, SSL/TLS, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/2/3, DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS, SSH, 802.1X
   l. IP51-rated housing with clear dome and low-profile form factor

2. Camera shall be Axis model M5014 or equal as approved by SITA and the Authority/OAR.

~~F. Thermal Bullet Camera~~

~~1. The thermal bullet camera shall comply with the following requirements:~~
~~a. Image sensor: Sun-safe VOx microbolometer~~
~~b. Resolution: 90º – 480x360 pixels (4:3) or 480x270 pixels (16:9) / 50º – 336x240pixels (4:3) or 336x189 pixels (16:9)~~
~~c. Thermal Field of View: Selectable, 90º or 50º~~
~~d. Video compression: H.264, M-JPEG~~
~~e. Video outputs: IP, MPX, analog~~
~~f. Video Streams: 3 concurrent~~
~~g. ONVIF Profile S Compliant~~
~~h. PoE Class 3 Compliant~~
~~i. Wide Dynamic Range with Digital Detail Enhancement and Automatic Gain Control~~
~~j. IP-66 Rated Housing~~
~~2. Thermal bullet camera shall be FLIR TCX or equal as approved by SITA and the Authority/OAR.~~

PART 3 - EXECUTION

3.1 COORDINATION

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

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 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 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 Authority Vendor shall supply all software and hardware necessary for the systems(s) to function as specified.
3. 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 cabling and connectivity to device locations.
   b. The installation of Category 6 UTP patch cords for interconnection from data jacks to end devices, and from patch panels to switch ports.
   c. The installation of Singlemode Fiber Optic cabling and connectivity as a distribution backbone.
   d. The installation of Singlemode Fiber Optic jumpers for interconnection from panel to interface.
   ~~d.~~ e. The installation of POE splitters required to provide separate power and data signal to the lidar sensors.
4. The Authority Vendor shall prepare the necessary documents required for installing, testing, and bringing the QMS 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 Queue Management System (QMS) shall support the entire SSCP.
6. The contractor shall adjust physical device locations during acceptance testing as directed by the Authority Vendor to provide a level of performance acceptable to the Authority and OAR. The Contractor shall continue to adjust the system until such level of performance is achieved at no additional cost to the project.

3.4 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 removal/relocation of unrelated equipment, 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. In addition to all demonstration and training as specified by Division 01, Specification Section 27 05 00 and related Division 27 Specification Sections, system installation shall be provided in accordance with all requirements of this Section.

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. Software Installation

1. The Contractor shall incorporate Authority Vendor testing of all custom and packaged software in development and production environments into the Construction Schedule to allow timely installation and acceptance testing prior to Substantial Completion.

D. Hardware Installation

1. Final hardware selected and installation of hardware shall be coordinated with the 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.

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. 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. Coordinate with the Division 26 contractor, 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.

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 IDENTEFICATION

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 40

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:
2. AODB Airport Operational Database
3. CUPPS Common Use Passenger Processing System
4. CUSS Common Use Self-Service
5. GIS Geographic Information System
6. HTML5 HyperText Markup Language Version 5
7. ICD Interface Control Document
8. NTC North Terminal Complex
9. OEM Original Equipment Manufacturer
10. PMP Project Management Plan
11. TIL Technology Integration Lab
12. TPM Technical Project Manager
13. UL Underwriters Laboratories
14. 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) 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 to the existing NTC systems. 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 ~~LAN~~ Network (PO~~L~~N) ~~/ Local Area Network (LAN), Airport Integrated Data Broker (AIDB),~~ 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). ~~all other related systems.~~

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; 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 hybrid copper/fiber cabling to support ONTs. Furnish all patch cables for connection of field devices at outlets and in communications spaces (IDFs/MDF) for installation by the ~~GOAA Vendor~~Authority Vendor. Provide patch panel port information to the Authority to perform patching in communications spaces (IDFs/MDF). 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.

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 ~~millwork~~ 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, 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 Common Use System shall be an enterprise-based solution consisting of components that are an extension of the existing North Terminal Complex (NTC) platforms, along with new components, currently not a part of the NTC platforms.

B. The Common Use System shall consist of all ~~cabinetry, millwork~~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. CUSS Kiosks – allows self-service check-in, boarding pass and baggage tag printing functionality for the passenger. ~~-~~CUSS Kiosks will be located ~~at various locations~~in the check-in hall ~~throughout the terminal~~ and be available in free-standing configurations. ~~-~~
3. ~~Common Use Self-Service Bag Recovery Kiosks – allows self-service tracking and locating of checked baggage for the passenger. Self-Service Bag Recovery Kiosks will be located at International and Domestic Baggage Claim.~~
4. ~~Common Use Self-Service Flight Rebooking Kiosks – allows self-service flight rebooking functionality for the passenger in case of Irregular Operations (IROP). Self-Service Flight Rebooking Kiosks will be located at International and Domestic Baggage claim.~~
5. ~~5.~~3. Common Use Self-Service Bag Drop System – allows passengers to fully prepare their baggage for acceptance by their chosen airline. Self-Service Bag Drop Systems will be located in the Check-in Hall. Future phases will include remote locations such as Ground Transportation Facility (GTF), Departures Curb.

~~6.~~4. 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. Future phases may include Automated Boarding Pass validation at the security checkpoint.

~~7.~~5. 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.

~~8.~~6. 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.

~~f.~~g. Passive Optical Network (PON)- Supports network communication and all connected systems throughout the South Terminal Complex (STC).~~Airline Proprietary Reservation System~~

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 configuration 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).
4. ~~The Contractor shall be responsible for coordination with Authority Vendor to establish a secondary, redundant path for cloud connectivity.~~

2.3 HARDWARE REQUIREMENTS

A. Supporting Infrastructure

1. Hardware Structures:
   a. Provide all hardware and case-work 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. Check-in ~~and 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)~~3) ~~Boarding Gate Reader~~
~~5)~~4) Boarding Pass Printer- Model: Custom TK180-metal
~~6)~~5) Baggage Tag Printer- Model: Custom Tk180- metal RFID
~~7)~~6) Magnetic Stripe Reader and Optical Character Reader- Model: Access-IS MSR/OCR315e
~~8)~~7) ~~Optical Character Reader~~Barcode Reader- Model: Honeywell Genesis 7580
~~9)~~8) Scale Device
~~10)~~9) Printer- Model: HP M506

b. Airline Back Office Workstations 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) Printer- Model: HP M506

c. Baggage Service Office Workstations 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) Magnetic Stripe Reader and Optical Character Reader- Model: Access-IS MSR/OCR315e
5) Printer- Model: HP M506

d. 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

e. 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

~~b.~~f. Self-Service Devices will include:
1) Check-in Kiosks~~Bag Drop Kiosks with integrated bag take-away belt~~ are provided as a sole unit. However, the technical features include:
a) PC
b) Smartcard Reader
c) Touch Screen- Multitouch screen
d) OCR Reader
e) Barcode Scanner
f) Device and Top Arch LEDs
g) Printers
~~1)~~
2) ~~Check-in Kiosks, counter-mounted and/or floor-mounte~~Bag Drop Kiosks with integrated take-away belt~~d~~
~~2) c~~

~~c. Additional devices may include:~~
~~1) Automated Boarding Gates~~

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.

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 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. 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 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.

C. The Electronic Gate System installed shall meet the requirements presented in this specification as an extension of the existing Electronic Gate System currently serving the North Terminal Complex (NTC).

D. The installation of the Electronic Gate System in the South Terminal Complex (STC) 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)).

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 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 system to the existing NTC 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 Contractor shall 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. 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.
   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.

C. The Contractor shall provide the following services:

1. In coordination with the Technical Project Manager (TPM), 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 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. In coordination with the Technical Project Manager (TPM), 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. In coordination with the Technical Project Manager (TPM), 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. Owner Approved Equal

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 work station at the gate

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

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.

B. Type B Security Screening Checkpoint 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

C. 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. In coordination with the Technical Project Manager (TPM), 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 and the E-Gate, including the preparation of schedules and plans.
2. In coordination with the TPM, 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. In coordination with the TPM, the Contractor shall coordinate with the Authority and OAR to finalize the Project Management Plan and all associated documents and schedules.
4. In coordination with the TPM, 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.

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 25 16 – INTEGRATED AIRPORT MANAGEMENT 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 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 Data Base
   b. AIDX Aviation Information Data Exchange
   c. BHS Baggage Handling System
   d. GIS Geographic Information System
   e. ICD Interface Control Document
   f. JADS Joint Application Design Sessions
   g. NTC North Terminal Complex
   h. OBIEE Oracle Business Intelligence
   i. OFE Owner Furnished Equipment
   j. SOA Service-Oriented Architecture
   k. TIL Technology Integration Lab

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 intent of this specification is to establish a standard of quality, functions, and features for the installation a fully operative integrated Airport system, herein referred to as the Integrated Airport Management System (IAMS).

C. The IAMS installed shall meet the requirements presented in this specification as an extension of the existing IAMS currently serving the North Terminal Complex (NTC).

D. The installation of the IAMS in the South Terminal Complex (STC) shall include, but not be limited to, raceway, cabling, network 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 IAMS 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.

G. The Authority Vendor shall perform all necessary modifications, software upgrades, integrations to ancillary systems, and programming to extend the existing IAMS platform as required for specific South Terminal Complex (STC) operations currently not performed by the IAMS in its North Terminal Complex (NTC) operations.

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 IAMS.

1. Where listed on the drawing responsibility matrix, the following components shall be defined as follows:
   a. Headend and Software: The Authority will furnish and configure the site server. The Authority Vendor shall install the site server, furnish and install the IAMS software, configurations, interfaces and upgrades.
   b. Integration to Existing System: The Contractor shall provide fiber channeling with all materials required to connect the STC system to the existing NTC 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 IAMS and other related systems including, but not limited to, the Local Area Network (LAN), Airport Integrated Data Broker (AIDB), Airline Feeds, ~~ARINC/ Avinet Mail, Airport Safety and Operations Compliance System (ASOCS),~~ Baggage Handling Systems, Com-Net AirportVision, Electronic Dynamic Signage System, IBM Maximo, IED Paging System, Oasis GIS, ~~Oracle BAM, PASSUR,~~ PROPworks, SITA Checkpoint Wait Time, SITA Common Use Systems and SITA Type B Messages. and V~~O~~oIP.~~shall~~

~~d.~~c. Network Components: Refer to specification section 27 10 05 for requirements. The Authority will furnish and Authority Vendor shall install all Passive Optical Network components required to support the IAMS.

~~e.~~d. Backbone Cable: The Contractor shall provide all backbone cabling and associated raceways/pathways, boxes, fittings and appurtenances. Refer to specification section 27 10 00 for requirements.

~~f.~~e. Horizontal Cable: The Contractor shall provide all horizontal cabling and associated raceways/pathways, boxes, fittings and appurtenances.

~~g.~~f. Field Devices: The Authority will furnish and configure all IAMS workstations. The Contractor shall furnish data patch cables.

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, then 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 9004:2009)

1.5 SYSTEM DESCRIPTION

A. The IAMS shall be an enterprise-based solution consisting of components that are an extension of the existing North Terminal Complex (NTC) airport management platforms, along with new components, currently not a part of the NTC platforms.

B. The IAMS shall include, at a minimum, the following the Core Functionalities, which are generally noted as:

1. Business Rules Base and Allocation optimizer
2. Seasonal Scheduling ~~and Capacity Analyzer~~
3. Resources Assignment
4. Day of Operations tools
5. Arrivals and Departures tools
6. Reporting
7. Billing tools
8. Interfaces with External Systems
9. Audit Trail

C. The IAMS shall be designed using SOA principles and shall provide a real-time interface to the Authority's AIDB architecture and system tools.

1. The system shall have at least the following interfaces via the AIDB:
   ~~a. OBIEE~~
   ~~b. Airport Integrated Data Broker (AIDB)~~
   ~~c.~~a. Airline Feeds (such as FlightView, FlightStats, OAG, etc.)
   ~~d. ARINC/Avinet Mail~~
   ~~e. Airport Safety and Operations Compliance System (ASOCS)~~
   ~~f.~~b. Baggage Handling Systems
   ~~g.~~c. Com-Net AirportVision
   ~~h.~~d. Electronic Dynamic Signage System
   ~~i.~~e. IBM Maximo
   ~~j.~~f. IED Paging System
   ~~k.~~g. Oasis GIS
   ~~l. Oracle BAM~~
   ~~m. PASSUR~~
   ~~n.~~a. ~~PROPworks~~
   ~~o.~~h. SITA Checkpoint Wait Time
   i. SITA Common Use Systems (CUPPS/CUSS)
   j. SITA Type B Messages
   k. VoIP
2. The system shall have a direct interface with the following system:
   ~~p.~~a. PROPworks
   ~~q. VOIPshallOBIEE~~
   ~~PROPworks~~

~~r.~~

D. The Authority Vendor shall define and validate all operational rules, additional interfaces and data requirements with the Authority or OAR, through Joint Application Design (JAD) sessions.

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 IAMS. 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.

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. Risk Management Process

~~3.~~5. Issue Management Process
~~4.~~6. List of Special Tools, Test Equipment and Outside Inventory needed for the project

D. The Contractor shall provide fully coordinated system design documents by the Contractor, Authority and Authority Vendor. The documents shall include, at a minimum, descriptions and drawings for:

1. Diagram of system architecture/workflow, including all electrical and communications connectivity.
2. Design details of the IAMS.
3. System integration document for the IAMS.
4. Design details of the individual systems and modules.
5. Interface Control Document (ICD) defining each system's interface and relationship to the IAMS.
   a. This document shall include interfaces to the NTC.
6. Design detail of core system configuration including servers, services, applications and connectivity.
7. Data Definition Table for each system.
8. Enterprise Systems Architecture & NTC Gap Analysis, describing use of NTC Systems Architecture and gaps with existing NTC installation, with Systems Architecture requirements included in this specification.

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 Authority Vendor provided hardware and software.

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).

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 Visio files, 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 software.

1.11 SOFTWARE AGREEMENT

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

B. Commercial software packages shall have all registration and licensing documentation filed indicating the Authority as owner of the software.

C. Software developed for this project shall be licensed to the Authority. This license shall include all executable, library, object, and source code required to maintain and modify the delivered product.

D. The Authority Vendor shall provide site licenses. If site licenses are not available, provide user licenses for each type of software used in the IAMS.

1.12 SPARE MATERIALS

A. Spare materials required to support the IAMS shall be provided as specified in related specification sections. Refer to Specification 27 05 00 and related specifications 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. Network and Connectivity Requirements

1. The Contractor shall coordinate with the Authority and Authority Vendor for the installation of all network components required for the IAMS.
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 IAMS to the existing head end servers in the NTC.

2.3 HARDWARE REQUIREMENTS

A. Supporting Infrastructure:

1. Equipment racks:
   a. Contractor shall supply and install any additional equipment racks that may be required for equipment installation within the telecommunication rooms. Obtain rack space requirements from the Authority and Authority Vendor.
   b. Contractor shall be required to 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 ~~11~~ 10 00 and 27 ~~11~~ 10 05 for additional information.

2.4 INTERFACING STANDARDS

A. The Authority's Dashboard / Reporting tool shall have access to all relevant data either by direct database or repository access. The System's Database and/or Application shall also support two or more of the following techniques for mutually interacting and information exchange:

1. Open Application-Programming Interfaces (API) for accessing all major or relevant modules of the application (examples include)
   a. RESTful web service -- is based on representational state transfer (REST)
   b. JSON (JavaScript Object Notation) is a lightweight data-interchange format
2. Connectivity by Open DataBase Connectivity (ODBC) drivers or ActiveX Data Objects (ADO) for direct access to the data

3. Connectors for Enterprise Application Integration (EAI) platforms (examples include)
   a. The latest standards of Extensible Markup Language (XML) import/export
   b. Web Service Definition Language (WSDL) services based on Business Process Execution Language (BPEL)
   c. Enterprise Service Bus (ESB) for interaction and communication
4. Other techniques may be acceptable, such as Java DataBase Connector (JDBC) or Java Messaging Service (JMS), with the approval by the Authority

PART 3 - EXECUTION

3.1 COORDINATION

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

B. The IAMS 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 IAMS shall require extensive software programming by the Authority Vendor to incorporate data from other systems including Common Use Systems, Electronic Dynamic Signage, MUFIDS, BHS, VoIP, IBM Maximo, Oasis GIS. 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 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 and the IAMS, 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 Primavera 6.
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 Authority Vendor shall coordinate with the Authority and OAR and the airlines to confirm:
   a. Airline information needed to confirm design of the IAMS.
   b. New systems and technologies are compatible with the NTC operations and functions as required.

c. Installation/phasing plans are consistent with Operations and Airline training and transition to the new IAMS system.

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 install products detailed in the specifications, system requirements, drawings and Contractor designs including those purchased by the Contractor and those provided by other parties.

D. The Authority Vendor shall install all software in development, test, stage and production environments.

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. The 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. Due to the nature of multiple products, suppliers, contractors, installers, software, etc. that is involved in the IAMS solution, there may be conflicts that could occur between the various sources, the Authority and OAR, 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 Contractor shall make its best effort to resolve all conflicts without involving the Authority and OAR, or airlines.
   b. The 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. The 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.

D. All Authority Vendor supplied software and firmware provided as part of all components shall be upgradeable, for improving functionality or debugging, and without cost to the Authority and OAR, during the Warranty period.

1. The Authority Vendor shall test, install and train on all systems, software, and firmware major and minor upgrades during the warranty period without cost to the Authority and OAR.

3.12 FIELD SERVICE

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

B. In coordination with the Contractor, the Authority Vendor shall deliver the System Test Plan to the Authority and OAR and secure approval from the Authority and OAR prior to test initiation.

C. In coordination with the Contractor, the Authority Vendor is responsible for testing end-to-end system integrations with the following systems:

~~a. Airport Integrated Data Broker (AIDB)~~
~~b.~~a. Airline Feeds (such as FlightView, FlightStats, OAG, etc.)
~~c. ARINC/Avinet Mail~~
~~d. Airport Safety and Operations Compliance System (ASOCS)~~
~~e.~~b. Baggage Handling Systems
~~f.~~c. Com-Net AirportVision
~~g.~~d. Electronic Dynamic Signage System
~~h.~~e. IBM Maximo
~~i.~~f. IED Paging System
~~j.~~g. Oasis GIS
h. SITA Checkpoint Wait Time
~~k.~~ VoIP~~Oracle BAM~~
i.
~~l. PASSUR~~
~~m.~~j. PROPworks (direct interface)
~~n.~~k. SITA Checkpoint Wait Time
l. SITA Common Use Systems (CUPPS/CUSS)
~~o.~~m. SITA Type B Messages
~~p. VOIP~~

3.13 TRAINING

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

B. The Authority Vendor shall develop a training plan to include all aspects of training of required users and administrators of the systems.

C. The Authority Vendor shall provide training at the Airport for the following participants:

a. Airline agents
b. Authority Information Technology support representatives
c. Authority Operations – Super Users and General Users
    1) Ticket Counter
    2) Gate Counter
    3) Baggage Input Console
    4) Engaging Maintenance and Support Functions
    5) Business and Properties
    6) Finance

D. The Authority Vendor shall provide documentation which include software error messages, description and troubleshooting guide.

E. Training classes shall be augmented by individual instruction as necessary to fully train the Authority and Airline personnel. Training shall be completed a minimum of two (2) weeks prior to the system becoming operational and utilized by Opertions and Airlines. The training schedule shall be subject to the Authority and OAR review.

3.14 PROJECT CLOSEOUT REQUIREMENTS

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

END OF SECTION 27 25 16

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 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 entire terminal 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. Should the Authority choose to select a different service provider prior to construction, the contractor shall coordinate with the Authority and that provider to define new equipment and supporting infrastructure requirements and furnish/install the required backbone and horizontal cabling. Additionally, the system shall be designed to support the services of a different service provider in the future.

C. 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 TV 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.

D. 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.

E. 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.~~01~~ 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 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; refer to Backbone Cable below.
   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 WLAN 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. 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. Provide patch panel port information to the Authority to perform patching in communications spaces (IDFs/MDF). 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, projectors, projector mounting hardware, projector screens, A/V touchscreen controllers, audio amplifiers, audio speakers, A/V media panels, fiber optic extender receivers, A/V cables and connectors and all appurtenances.

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. 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.

C. The IPTV system receive an initiation signal from the Fire Alarm System (FAS) and playback a preset message on the IPTV displays.

1. The Contractor shall coordinate the interface with the FAS 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-pixlel 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. Display shall be model 55VH7B as manufactured by LG or approved equal.

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. Audio Amplifier

1. Provide Class D metal enclosure audio amplifiers sized to support connected speakers in quantities shown on the contract drawings. The system shall provide clean audio, free from noises such as pops, clicks, hiss/hum and access/disconnect tones at all loudspeakers at all times during operation including standby mode. Amplifiers shall meet the following requirements:
   a. Fanless, convection cooled
   b. Automatic power up and down
   c. Class D amplifier technology with ripple suppression
   d. Bass, treble and input level controls
   e. Rating: UL 2043 plenum rated
   f. Inputs
      1) Signal: (1) balanced/unbalanced stereo/mono and (2) unbalanced stereo/mono
      2) Connectors: 3.5mm 5-pole captive screw connector and 3.5mm mini audio jack, 1 pair female RCA
   g. Outputs
      1) Signal: (1) 70V mono
      2) Connectors: (1) 5mm 4-pole captive screw connector
      3) Power: 60W RMS
      4) Distortion: <0.1% THD at 1kHz, >90dB S/N from 20 Hz to 20kHz
      5) Response: +1 dB/-3dB 80 Hz to 20 kHz at 1W
   h. Control: wired remote mute and volume
   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

E. Audio Speaker

1. Provide a UL listed nominal 4" coaxial ceiling loudspeaker system including backbox, transformer, grille, and related mounting hardware.
   a. Overall Diameter: 10"
   b. Enclosure:
      1) Optimally tuned and ported specifically for the loudspeaker.
      2) Front loading design for below ceiling access.
      3) Provide tile bridge, or plaster ring as required for the ceiling conditions to rigidly hold speaker in ceiling.
      4) Enclosure assembly shall hold grille tight to the ceiling without gaps between the grille and finished ceiling.
   c. Sensitivity: 92 dB at 1m with 1W input power.
   d. Frequency Response: 75Hz to 20kHz (+/- 7 dB)
   e. Dispersion: 120 degrees at 2kHz, -6dB
   f. Rated Power: 25 watts
   g. Transformer
      1) Primary Voltage: 70.7V
      2) Front mounted taps for below ceiling adjustment
      3) Primary taps at: 0.5W, 1W, 2W, 4W
      4) Frequency Response: 60Hz – 12kHz +/- 1dBm
   h. Grille: Round flush mount white finish with minimal flange. Contractor shall coordinate ceiling finishes with the architectural drawings and coordinate the final finish with the Architect.

F. 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

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

~~F.~~G. 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

~~G.~~H. 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

~~H.~~I. 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 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
~~1)~~4) Or approved equal.

~~I.~~J. 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
   ~~1)~~4) Or approved equal.

~~J.~~K. 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
    ~~a.~~ d. Or approved equal.

~~K.~~ L. 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

~~g.~~d. Or approved equal.

~~L.~~M. AV Projectors

1. WUXGA widescreen projection system with 3-chip poly-silicon thin film transistor active matrix imager.
2. Native Pixel Resolution: 1920 x 1080
3. Light Source: solid state laser phosphor
4. Brightness: minimum 8000 lumens
5. Contrast Ratio: 8000:1 with 90% uniformity
6. Lens: Manual focus with 2x zoom, coordinate exact lens with the manufacturer to mount projector as shown on the drawings.
7. Shift and correction: image flip for upside down mounting, optical axis shift +60 percent from center of screen vertical, +/-10 percent from center of screen horizontal, and +/-40 percent keystone correction.
8. Control
   a. Signals: Serial bi-directional RS-232
   b. Connectors: 9-pin male
9. Mounting: Provide all mounting hardware as necessary to mount the projector as shown on the drawings. Refer to Video Projector Mounting Hardware below for additional requirements.
10. Power: 120V, 60Hz, provide 8’ cord.
11. Acceptable Manufacturers
    a. InFocus
    b. Epson
    c. ViewSonic
    ~~a.~~d. Or approved equal.

~~M.~~N. AV Projector Mounting hardware

1. The exact mounting system components shall be coordinated to support the weight of the projector including mounting hardware. Provide the following mounting hardware at each projector location unless otherwise noted on the drawings.
   a. Pipe Mount: nominal 1-1/2” overall diameter projector mounting pipe with 1” field adjustable increments and overall length to mount projector as shown on the drawings. Pipe shall be threaded at both ends and have openings for cable routing. Provide escutcheon ring. Coordinate finish with the architect.
   b. Projector Mount: used to mount and field adjust projector. Provide mounting for exact projector with 3 degree roll, 20 degree pitch and 360 degree yaw. Coordinate weight capacity with exact projector. Mount shall have quick disconnects for relamping and cable management. Coordinate finish with the architect.
   c. Ceiling Mount: mount the projector to a standard T-grid ceiling utilizing a standard pipe mount and enclosure. The enclosure shall be minimum 12” x 23” x 6” UL listed 2034 for air handling space with hinged access, inward facing data and duplex power receptacles. Enclosure shall have tie points to store and support non-plenum rated video, data, and power cords.
2. Acceptable Manufacturers
   a. Chief
   b. Peerless-AV

c. FSR
~~c.~~d. Or approved equal.

~~N.~~O. AV Projection Screens

1. Video Format: nominal 119 inch diagonal, 16:9 HDTV
2. Image Area: nominal 104 inches wide x 58 inches tall
3. The projection surface shall be a recessed ceiling mount with steel enclosure. The screen shall have an integral low voltage motor control and tensioned screen for high quality high resolution image projection. The surface shall be completely free from puckering, sagging, warping, or vibrations from any nearby building ventilation.
4. Surface: High gain pure white matt white with back blacked surface. The surface shall have excellent white uniformity and no color shift from any angle.
   a. On-axis: 1.3
   b. 60 Degrees: 0.8
   c. Half gain angle: none
5. Mounting: Provide all mounting hardware as necessary to mount the screen as shown on the drawings.
6. Control: RS-232 serial low voltage control via AV system
7. Finish: Matte black frame.
8. Acceptable Manufacturers:
   a. Draper
   b. Da-Lite
   c. Elite Screens
   ~~a.~~d. Or approved equal.

~~O.~~P. AV Media Panels

1. Provide a modular media input panel, flush mounted on work surface, with cut-out integrated with millwork contractor. Media input shall have a recessed enclosure with retractors to hide cables while not in use. The input panel shall have a termination on the back for connection to the headend and an HDMI port for connection of an HDMI cable on the user side.
2. Input and connectors: HDMI
3. System shall be rigid and tightly installed.
4. Acceptable Manufacturers:
   a. Extron
   b. Crestron
   c. FSR
   ~~a.~~d. Or approved equal.

~~P.~~Q. AV Matrix Switchers

1. Provide an HDCP compliant AV matrix 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 matrix switch shall include AV control capabilities and be compatible with the specified user control interface.

5. The front panel shall have backlit, lockable buttons for quick input to output selection.
6. Routing: 4 x 4 matrix switching
7. 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
8. Inputs
   a. Audio Video: (4) HDMI
9. Outputs
   a. Audio Video: (4) HDMI
   b. Audio: (4) 3.5mm captive screw locking connector, 5 pole stereo audio breakout audio
10. Control
    a. Signals: bi-directional serial RS-232
11. Mounting: two RU, compatible with EIA 310-D standard, 19-inch wide panel mounting. Include all necessary mounting hardware.
12. Power: 110-120 VAC, 60Hz.
13. Acceptable Manufacturers:
    a. Extron
    b. Crestron
    c. FSR
    ~~a.~~ d. Or approved equal.

~~Q.~~R. AV Touchscreen Controller

1. 10” color touch screen shall be provided at locations shown in the plans. 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
   ~~a.~~d. Or approved equal.

~~R.~~S. 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 equalized 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.

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 hybrid 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.

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.

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 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) 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 to the existing NTC 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 in support of all network systems. 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 hybrid copper/fiber cabling to support ONTs. Furnish all patch cables for connection of equipment at display locations and in communications spaces (IDFs/MDF) for installation by the GOAA Vendor. Provide patch panel port information to the Authority to perform patching in communications spaces (IDFs/MDF). 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, install data patch cables and video patch cables, and configure, program and calibrate the display displays, and update the firmware. The Contractor shall mount the flat panel displays and outdoor LED displays. The Contractor shall furnish data patch cables and video patch cables required for the complete installation of all flat panel displays and outdoor LED displays.
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. For Branding Signage – backwall check-in counters, 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) digital signage platforms, along with new components, currently not a part of the NTC 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. Baggage Information Displays – for displaying flight and baggage information
2. Branding Signage – backwall check-in counters for use by Airlines
3. Branding Signage – backwall reservation counters for use by Rental Car Companies
4. Flight Information Displays – for displaying flight information
5. Gate Information Display – backwall counters for use by Airlines
6. Holdroom Signage – for displaying Airline flight and boarding information, as well as other related content, e.g. weather.
7. Interactive Informational Display – an interactive tool for providing wayfinding services
8. 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 ~~DisplayPort~~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 via Passive Optical Network (PON).
   a. Connectivity to the NTC is required to distribute content files from the primary head-end servers to content servers throughout the STC.

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

1. 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: LG
      2) Model: 55VH7B
      3) Screen Size: 55" class (54.64" diagonal)
      4) Weight (Unpacked): 43.65 lbs.
      5) Overall Dimensions: 47.69” X 26.86” X ~~10.35~~3.41”
   b. Touchscreen Display
      1) Manufacturer: LG
      2) Model: 55WT30MS-B
      3) Screen Size: 55" class (54.64" diagonal)
      4) Weight (Unpacked): 61.7 lbs.
      5) Overall Dimensions: 50.0” X 29.3” X 4.0”
   c. Outdoor LED Video Wall Panel (Curbside)

1) Manufacturer: Daktronics or Approved Equal
2) Model: AF-67xx Series
3) Weight (Unpacked): 235lbs / 107 kg
4) Dimensions: 22”H x 75.2” W x 13.75” D

d. Outdoor Commercial Grade 55” Signage ~~(GTF)~~
1) Manufacturer: SunBrite or Approved Equal
2) Model:SB-S2-55-4K
3) Screen Size: 55” class
4) Weight (Unpacked): 65 lbs.
~~2)~~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.
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
g. Mount shall be Peerless model DST965 or approved equal.

3. "Backwall" Signage: Brackets shall, at a minimum, meet the following requirements:
   a. Hinged, swing-out display mounting frame
   b. Backwall Signage shall be as manufactured by RP Visuals model SA6046P_LG 55VH7B as custom-manufactured for the Authority or approved equal. Coordinate with Authority and OAR for product details. Modifications to mounting products may be required depending on the final selected display product.

D. ~~DisplayPort~~ HDMI Video Signal Cable

1. Extron HDMI Ultra Series or acceptable equivalent
2. Up to 4K @60 Hz (4096x2160), UHD @ 60 Hz (3840x2160), 8 bit color depth, max 18.0 Gbps data rate for cable length up to 12'.
3. Up to 4K @30 Hz (4096x2160), UHD @ 30 Hz (3840x2160), 8 bit color depth, max 10.2 Gbps data rate for cable length up to 15'.
4. Voltage: 30V
5. Pair impedence: 100 ohms +/- 10 ohms
6. Attenuation:
   @ 0.3 – 0.825 GHz: ≤5 dB per 3 m
   @ 0.825 – 2.475 GHz: ≤12 dB per 3 m
   @ 2.475 – 4.125 GHz: ≤20 dB per 3 m
   @ 4.125 – 5.100 GHz: ≤25 dB per 3 m
4. ~~Support DisplayPort 1.2 standard or latest version at time of installation~~
5. ~~Support resolutions up to 4096 x 2160 pixels @ 60 Hz refresh rate for cable lengths up to 12 feet~~
6. ~~Support resolutions up to 4096 x 2160 pixels @ 30 Hz refresh rate for cable lengths up to 25 feet~~
7. ~~Support up to 21.6 Gbps audio and video bandwidth~~
8. ~~Minimum 28 AWG copper conductors with shield and minimum 30 AWG drain wire~~
9. ~~DisplayPort cables shall be as manufactured by Extron or approved equal.~~

PART 3 - EXECUTION

3.1 COORDINATION

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 DSS 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 DSS shall require extensive software programming by the GOAA Vendor to incorporate data from other systems including IAMS, ECS and FAS. Contractor shall coordinate with the GOAA 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 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.

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.

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 42 23 – EXPERIENTIAL MEDIA ENVIRONMENT (EME) - MEDIA FEATURES

PART 1 - GENERAL

1.1 STIPULATIONS

A. Contract Documents including Drawings, Specifications, and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this Section.

B. Related Specification Sections:
1. 05 12 00 Structural Steel Framing
2. 05 50 00 – Metal Fabrications
3. 05 73 13 – Glazed Decorative Metal Railings
4. 06 64 00 – Plastic Paneling
5. 08 84 00 – Plastic Glazing
6. 09 00 01 – Finish Key
7. 09 78 00 – Interior Wall Paneling
8. 09 91 23 – Interior Painting
9. 09 96 00 – High-Performance Coatings
10. 22 11 16 – Domestic Water Piping
11. 22 11 23 – Domestic Water Pumps
12. 22 13 16 – Sanitary Waste and Vent Piping
13. 26 05 00 – Common Work Results for Electrical
14. 26 05 19 – Building Wire and Cable
15. 26 05 26 – Grounding and Bonding
16. 26 05 29 – Hangers and Supports
17. 26 05 33 – Conduit
18. 26 05 34 – Outlet Boxes
19. 26 05 35 – Pull & Junction Boxes
20. 26 05 53 – Identification for Electrical Systems
21. 27 05 00 – Common Work Elements for Communications
22. 27 10 00 – Premise Distribution Systems
23. 27 10 05 – Passive Optical Network
24. 27 10 10 – Voice Over IP Telephone System
25. 27 10 15 – Wireless Local Area Network System
26. 27 51 13 – Emergency Communication System
27. 28 23 00 – Video Surveillance System
28. 28 31 00 – Addressable Fire Detection and Alarm

C. Reference Symbols:
1. Refer to Specification Section 27 05 00 for applicable reference symbols.

D. Abbreviations:
1. Refer to Specification Section 27 05 00 for applicable abbreviations.

E. Definitions: Refer to the requirements of Section 27 05 00 in addition to the following.
1. CDS: The EME Content Delivery System, including video playback servers, generative content servers, video routing equipment, video processing, audio processing, signal distribution, control system, user interface, file storage, and

other equipment for the purpose of delivering media content to the LED features.

2. CDS Designer: Smart Monkeys Inc.
3. EME: The Experiential Media Environment, comprising three architecturally integrated Media Features (The Portal, Moment Vault, Windows on Orlando), a dedicated Content Management System (CMS), including related equipment and work defined herein.
4. EME Designer: Sardi Design, EME Team lead for design and architectural integration.
5. EME Media Feature Contractor: ~~Video Equipment Rentals~~SACO Technologies Inc. (SACO~~VER~~), the LED manufacturer~~-~~ engaged to~~-~~ deliver the EME Media Feature~~-~~.
6. EME Specialized AV Systems Integrator (EME Specialty Integrator): The contractor engaged to provide EME Audio, Video, IT, and all related equipment installation for the EME.
7. EME Fountain Contractor: The contractor engaged ~~to~~ by the EME Media Feature Contractor to provide the Moment Vault fountain and related equipment.
8. EME Team: The team consisting of Burns, MRA International Group, Sardi Design and Smart Monkeys Inc.
9. EME Drawings: The EME Construction Documents.
10. CMAR: Usage of this term in all EME-related specifications and drawings refers to the full scope of the General Contractor (Construction Manager at Risk) for the Project and shall be considered to include all primary building contractors (electrical, mechanical, plumbing, structural, etc) working under the General Contractor.

1.2 SUMMARY

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

B. The Work defined in this Specification Section includes all material, systems, components, and installation requirements of the Media Features which are integral to the South Terminal Complex (STC) Experiential Media Environment (EME) and the related work required for a complete and working installation, in compliance with all codes and regulations of authorities having jurisdiction (AHJ). The EME Media Feature Contractor is responsible for obtaining all approvals and permits required by AHJ. Media Features of the EME shall be engineered to meet the design intent of the EME Drawings.

C. The Work also includes requirements for submittals, quality assurance, product handling, record documents, project conditions, installation, system performance, demonstrations, testing, and certifications for work related to EME Media Features. Refer to additional requirements specified under related trades including the provisions of Section 27 05 00.

D. EME Media Feature Contractor shall be responsible for meeting the design intent through engineering, shop drawings, mock-ups, fabrication, installation and commissioning of the LED displays, structures, architectural finishes and all other elements comprising the EME Media Features as described herein and in related Contract Documents.

1. EME Media Feature Contractor shall be responsible for coordinating the work effort of an approved and qualified Specialized AV Systems Integrator to carry out the scope of work described in Section 27 42 24

2. EME Media Feature Contractor shall be responsible for coordinating the work effort of an approved and qualified Fountain Contractor to carry out the scope of work described in Section 13 12 00.
3. EME Media Feature Contractor shall have the overall responsibility for coordinating all designs, materials, fabrication, equipment and technical support related to the scopes of work described in Sections 27 42 23, 27 42 24 and 13 12 00, and shall ensure the execution of all work required for delivery of fully operational EME Media Features and EME CDS in accordance with all requirements of the Contract Documents, including compliance with all applicable codes and AHJ.

1.3 SCOPE OF WORK

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

B. Refer to drawing sheets MS00.00.03 and MS30.00.03 for the work responsibility matrix for the scope of work required for the EME Media Features, for Airside and Landside respectively.

C. Further to the responsibilities listed on the aforementioned work responsibility matrix drawing and described herein, the following components shall be provided by the EME Media Feature Contractor as described in this specification section unless otherwise noted, and be defined as follows:

1. EME Media Feature Structures: Provide structures, connections, and attachments, including attachments to primary base building structure (primary base building structure by CMAR's building steel contractor). CMAR's building steel contractor shall be responsible for providing attachment points to primary base building structure where such attachment points require welding or drilling into primary base building steel, including the attachment points to the four columns surrounding the Portal; and the two (2) attachment points for the west element of the Moment Vault. CMAR's building steel contractor shall also provide dedicated base building structural components (including plates, headers, and junior beams, as shown on Contract Documents) to allow EME Media Feature to be welded, drilled or otherwise securely supported and affixed without impact to the structural integrity of the STC.

   The EME Media Feature Contractor provide EME Media Feature Primary Structure (EME Primary Structures). These include all tubular structures and tension system (rods and all associated accessories and connections) ('The Portal' feature) as well as concealed trusses and structural members ('Moment Vault' and 'Windows on Orlando' features), suitable for and ready for installation of the integrated LED product solution.
2. EME Architectural: Provide architectural fabrications, including all material and finishes, casings, and similar architectural work, as shown on EME drawings.
3. The Portal interactive photo booth ("Orlando Experience Booth"): Provide interactive photo booth, with structure, finishes, electrical, communications infrastructure, AV, related equipment and work, inclusive of detailed drawings. CMAR to provide base building infrastructure elements (including but not limited to electrical panel boards, electrical conduits, fiber optic cabling, patch panels, and data conduits, together with spare parts for all such components)

as detailed in the EME drawings. CMAR to provide base building infrastructure for future installation of second booth as shown in the EME drawings. Computer software and programming will be provided by a specialized content provider under separate contract (by others).

4. Electrical power: As per EME drawings, provide electrical power distribution including conduits, cabling, and other electrical components required to render EME Media Features fully functional in compliance with design intent and all regulations and/or codes. This includes spare parts. CMAR shall provide base building electrical infrastructure (including but not limited to electrical panel boards, conduits and junction boxes, together with spare parts for same) as detailed in the EME drawings. Refer to EME drawings for demarcation with the building electrical system.
5. Data distribution: As per EME drawings, provide data distribution including cabling and other data distribution components required to render EME Media Features fully functional in compliance with design intent and all regulations and/or codes. This includes spare parts. CMAR to provide base building data infrastructure, (including but not limited to fiber optic cabling, patch panels, and data conduits, together with spare parts for same) as detailed in the EME drawings. Refer to EME drawings for demarcation with the building data system.
6. Integration to EME CDS: Provide all LED processor display programming, configuration, data distributors, and support services required to render the LED processors and displays fully functional, to apply the required pixel mapping, to receive and respond to specified control signals from the EME CDS (by EME Specialty Integrator), to receive and distribute video signals (by EME Specialty Integrator), and such other services as required to integrate the LED displays and supporting technologies with the EME CDS (by EME Specialty Integrator).
7. The following shall be furnished by the Authority. The EME Media Feature Contractor shall install, commission and support Owner-furnished equipment as specified herein and as shown on the drawings.
    a. LED tile, break-in / break-out boxes, cabling: includes LED tiles, break-in/break-out boxes, specialized cables for interconnection of tiles and boxes, and all steel framing, LED aluminum sub-frames, connections, attachments, fittings required to mount the steel framing to the EME primary structure and components required to provide suitable physical support and achieve required functionality of LED displays including the required concave and convex curvatures for EME Media Features within both the Landside Terminal and Airside Concourse, as shown on Drawings and described in this Specification. This further includes all connections, attachments, and fittings required to securely affix the integrated LED product solutions to the EME Primary Structures of each media feature.
        1) This includes spare parts.
    b. LED processors: includes LED processors.
        1) This includes spare parts.
    c. Video servers: includes video servers as described in Specification Section 27 42 24.
        1) This includes spare parts.

1.4 REFERENCES

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

1.5 SYSTEM DESCRIPTION

A. The EME includes three Media Features: two Media Features located in the Airside Concourse and one Media Feature located in the Landside Terminal.
   1. F-1 – Moment Vault located in the Airside Concourse Hub (Palm Court).
   2. F-2 – Windows on Orlando located in the Airside North Concourse.
   3. F-3 – The Portal located in the Landside Terminal.
   ~~3.~~4. F-4 – Windows on Orlando South located in the Airside South Concourse

B. Coordination
   1. Refer to requirements of Section 27 05 00 Common Work Elements for Communications Systems in addition to the requirements included herein.
   2. Coordinate bidding and related procedures as required in the Contract Documents.
   3. Coordinate general requirements related to the EME Media Feature Contractor and related building work. Coordinate miscellaneous steel, metal fabrications, ornamental metal materials, fabrication, and finish requirements with the requirements of related trades provided under Division 5, Metals, Series Specifications; with the intent of ensuring consistency in metal project materials, fabrication, finishes, and erection in the completed work.
   4. Coordinate requirements for power and data to support installation of speakers, monitoring equipment, cameras, interactive sensors and ambient light sensors with the EME Specialty Integrator. Coordination to take place subsequent to the Design Refresh effort (refer to Section 27 42 24) carried out by EME Specialty Integrator, but prior to EME Media Feature construction.
   5. Coordinate all electrical and data raceway spatial requirements and support, including bend radius, stub-up distances and locations, and total bend angles.
   6. Coordinate raceways required as part of this project with all other objects being installed.
   7. Coordinate with the Electrical Contractor and EME Team to recommend appropriate light levels and to limit unwanted lighting of EME Media Features.
   8. Coordinate with the EME Specialized AV Systems Integrator for interface between the EME Media Features and the systems architecture design to support seamless content delivery to the features. The EME Specialized AV Systems Integrator will develop the detailed design of the EME Equipment Room and coordinate the location of, and interface with, EME Media Feature Contractor-provided equipment within equipment rooms and cabinets. Refer to the EME Content Delivery System specifications, section 27 42 24 for additional requirements.
   9. Coordinate with EME Fountain Contractor for integration of Moment Vault fountain as seamless component of Moment Vault media feature.
   10. Coordinate with Contractor, EME Specialized AV Systems Integrator, EME Fountain Contractor and EME Team for the positioning, installation, and commissioning of multimedia technologies within the EME Media Features provided by others under the Scope of Work of Section 27 42 24; which work includes but is not limited to cameras, sensors, speakers, and ancillary components.

11. Coordination with EME Specialized AV Systems Integrator and EME Team for playback specifications and video processing parameters is a requirement of the EME Contract.
12. Coordinate with Contractor, EME Specialized AV Systems Integrator, and EME Team for the positioning, installation and commissioning of The Portal interactive booth and infrastructure for second future booth.
13. Coordinate 3D CAD file formats with Contractor to ensure clarity of communication.
14. Coordinate final SolidWorks models of EME Media Features, inclusive of building context, (see Submittals, below) with Architect, Engineer, EME Fountain Contractor and EME Team to ensure coordinated integration of EME Media Features with base building REVIT model.

C. EME Media Feature Contractor is responsible for reviewing the base building system's design criteria and components and shall design all EME Media Features to operate passively within the base building environmental conditions. Should supplementation of mechanical facility for any element of the EME Media Feature be required, such facility shall be coordinated with the STC Mechanical Contractor.
1. Each EME Media Feature is to be passively ventilated using ambient air unless otherwise indicated or recommended by the EME Media Feature Contractor. Refer to Division 1 General Requirements for project conditions.
2. The EME Media Feature Contractor shall ensure that each EME Media Feature will operate adequately in the environment, and not overheat and fail, and provide delivery of content for a full spectrum of media content.
3. If it is determined that any of the EME Media Features requires supplemental ventilation, EME Media Feature Contractor shall offer mechanical supplementation within the LED product solution, (e.g. pancake fans) prepared by a professional engineer, licensed in the state of Florida, premised on review and acceptance by STC Mechanical Engineer of Record.
4. The building Mechanical Engineer shall provide return air ducting for the Windows on Orlando features, within coordinated distance from each display, and as shown in Contract Documents.
5. EME Media Feature Contractor shall provide all safeguards including but not limited to: temperature sensors, hardware and software solutions, governors; and programming to assure safe shut-down of EME Media Features, and assure that EME Media Features do not overheat and/or malfunction due to heat build-up.

D. Except where otherwise indicated, EME Media Feature Contractor shall paint surfaces visible through any perforated areas, flat black. Finish to be approved by EME Media Feature Designer.

E. The EME Media Feature Contractor is responsible for all equipment beyond the structural, electrical, and IT technology demarcation points indicated on the EME drawings to meet the EME design intent.

F. A head-end EME Content Delivery System (CDS), provided by EME Specialty Integrator, is included in this project. The EME Media Features shall display 4K/UHD-60 10-bit 4:2:2 format video signals from the EME CDS. Refer to Section 27 42 24 Experiential Media Environment – AV Specialty Systems for details.

G. The Authority shall furnish ~~Revolution M8~~SACO NANO 4K LED processors for all EME Media Features (including spares). EME Media Feature Contractor shall rack-

mount and cable LED processors in STC equipment room(s). EME Media Feature Contractor shall configure and program all LED processors as required to support a fully functional EME system. This work shall be coordinated with EME Media Feature Contractor, EME Specialized AV Systems Integrator and EME Team.

H. EME Media Feature Contractor shall be responsible for the following:
   1. Refer to the general requirements of Section 27 05 00 in addition to the following.
   2. Electrical power distribution from EME electrical branch circuit panelboards to EME Media Features, unless otherwise indicated on EME drawings. Refer to EME electrical drawings for specific scope of work delineation, by EME Media Feature, between CMAR and EME Media Feature Contractor.
   3. All cable pathways shall be concealed from public view.
   4. Data distribution for each EME Media Feature, as indicated on EME drawings, which includes fiber optic cable, cable pulling and cable termination where so indicated. Refer to EME drawings for specific scope of work delineation, by EME Media Feature, between CMAR and EME Media Feature Contractor.
   5. All cabling, conduits, trunking and the like within the EME Media Features to make functional displays compliant with all applicable codes and the requirements of all related specification sections, as indicated on the EME drawings. Refer to EME drawings for specific scope of work delineation, by EME Media Feature, between CMAR and EME Media Feature Contractor.
   6. All break-in/break-out boxes within the EME Media Features to make functioning displays.
   7. Cabling shall be plenum rated where required to meet the requirements of codes, specifications and AHJ.
   8. Design of ventilation of the EME Media Feature and confirmation of system performance within the anticipated base building environment. EME Media Feature Contractor has determined that the EME Media Feature can be passively ventilated to maintain operating requirements.
   9. Any connection hardware required to affix the EME Media Feature Contractor’s LED products, beyond that provided as an integrated product solution.
   10. EME Primary Structure and all connections and attachments to base building primary structure.
   11. Where noted on the drawings, the EME Media Feature Contractor shall provide sealed structural engineering drawings for delegated design. The EME Media Feature Contractor may provide alternatives for review and approval by the Authority and EME Team.
   12. Where approved design changes affect the building structural or electrical systems, the EME Media Feature Contractor shall provide updated loads, connection or routing means, and calculations for review and approval by the Authority, EME Team, and building Structural or Electrical Engineer of Record.
   13. All fasteners shall be stainless steel and code compliant. Fasteners shall be concealed to the furthest extent possible. Exposed fasteners shall be tamper proof and must indicated on final shop drawings.
   14. Provide fabrication and erection tolerances of 1/8” in 10’, non-cumulative, for Media Feature LED displays and fabrications.

15. EME Media Feature Contractor shall be responsible for coordination and troubleshooting during installation and commissioning.
16. EME Media Feature Contractor shall be responsible for processor configuration including LED tile mapping.
17. F-1 Moment Vault located within Airside Concourse Hub (Palm Court).
    a. Three curvilinear truss structures, each supporting both interior and exterior LED displays.
    b. Front-serviceable ~~Revolution Display RS3 (3.75~~SACO-M4-RGB-i (4.16mm pixel pitch) all-black LED tiles for all three (3) exterior of feature displays.
    c. Front-serviceable SACO-M2-RGB-i (2.08mm ~~Revolution Display RS1.8 (1.87mm~~ pixel pitch) all-black LED tiles for all three (3) interior of feature displays.
    d. Each of the curvilinear truss structures is located within a surrounding stainless steel water basin, provided by the EME Fountain Contractor and coordinate by the EME Media Feature Contractor, that separates the displays from public access and provides placement positions for cameras, sensors, and speakers.
    e. All LED tiles for this feature shall be treated with water-resistant coating and UV inhibitor.
    f. All other structural components and connections required to fabricate a fully functional media feature.
    g. Water-jet cut metalwork surrounds and panels: EME Media Feature Contractor shall provide coordinated installation including furnishing, fabrication, installation and coordination with related trades
    h. Metal mesh surface at the back of the exposed LEDs as indicated on the drawings.
    i. All exposed LED panel edge trim must be covered with 1/8” steel plate, powder-coated, following the curvature of the LED display.
18. F-2 Windows on Orlando located within the Airside Concourse
    a. Three (3) structures, each supporting a large-scale LED display.
    b. Structure composed of I-beams and hollow structural sections and structural steel members where required and as indicated on the Structural Drawings and Division 5 Structural Steel Series Specifications.
    c. Front-serviceable SACO-M4-RGB-i (4.16mm ~~Revolution Display RS3 (3.75mm~~ pixel pitch) all-black LED tiles for all three (3) displays.
    d. Provide 3M gradient film at the bottom of the facility provided mirrored finish base.
19. F-3 The Portal located within the Landside Terminal
    a. Two (2) spiral tubular truss structures, painted steel, composed and assembled of self-similar modular sweeps as shown on EME assembly drawings, jointly supporting interior concave panels and exterior convex panels and internally enclosing power and communications cabling and raceways.
    b. Tension Rod System is part of the Scope of Work of this Contract. Refer to Drawings and Paragraph 2.8 of this Specifications Section.
    c. Front-serviceable SACO-M4-RGB-i (4.16mm~~Revolution Display RS3 (3.75mm~~ pixel pitch) all-black LED tiles for all interior concave and exterior convex LED displays.
    d. All interior concave and exterior convex non LED metal panels as per final Shop Drawings developed based on MA Design Intent drawings

e. Engaging an approved and qualified vendor to carry out prototyping, mock-up, final design detailing and engineering, fabrication and installation of one interactive photo booth ("Orlando Experience Booth") located below the The Portal at the Departures level of the STC Landside Terminal is part of the Scope of Work of this Contract.
   1) The Orlando Experience booth is a self-contained unit that must be designed for maximum efficiency and flexibility. It shall be equipped with all required electric and data wiring necessary for the full functionality of its intended use. All wiring, electric and data boxes, switches, docking stations, mounting, and all other accessories must comply with all applicable codes.
   2) A carefully defined edge must be established between different materials and surfaces on the Orlando Experience Booth.
   3) Orlando Experience Booth shall be constructed with a concealed fastener system. Any exposed fasteners must be approved on a case-by-case basis, and shall be tamper proof.
   4) All materials used in the booth fabrication must be durable and non-corrosive.
   5) Display and tablet insert openings should have an edge frame of 1/4" thick brushed stainless steel trim extending 2 1/2" back off the face of the display and adjacent surface. Maintain 1/8" gap between the display and tablet to the trim edge.
   6) Tablets and display to be accessed via easy to reach concealed access panel (removal of 1 polycarbonate panel).
   7) All fabricator drawings and samples must be submitted for review and approved by EME team prior to actual fabrication to concur that the design intent has been satisfied.

20. F-4 Windows on Orlando South located within the Airside South Concourse
   a. Three (3) structures, each supporting a large-scale LED display.
   b. Structure composed of I-beams and hollow structural sections and structural steel members where required and as indicated on the Structural Drawings and Division 5 Structural Steel Series Specifications.
   c. Front-serviceable SACO-M4-RGB-i (4.16mm pixel pitch) all-black LED tiles for all three (3) displays.
   d. Provide 3M gradient film at the bottom of the facility provided mirrored finish base.
   ~~7)~~1)

I. Hurricane Design and Construction Requirements – General Criteria
   1. The support and restraint system for all media systems shall be designed and built by the EME Media Feature Contractor in compliance with all code requirements and AHJ.
   2. Provide support and restraint to maintain the integrity of structural and non-structural components to ensure that they remain safe to the public and functional in the case of hurricane other deflection event. Design and install restraints and anchorage to allow for deflection and deflection movements of the media features and the back-up support structures for the media features.
   3. The connection design shall compensate for the structural deflection by means of industry-approved methods approved on final shop drawings.

4. EME Media Feature Contractor shall be responsible for engineering reflecting the design intent of the work.
5. Submit a coordinated set of anchorage drawings prior to installation, including:
   a. Description, layout, and location of items shall be anchored or braced with anchorage or brace points noted and dimensioned, along with the magnitude and direction of all loads imparted to the base structure for each type of loading.
   b. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
   c. Provide an engineer-stamped set of calculations.
6. Do not fabricate or install media features until the EME Designer, Architect, and Engineer of Record approve submittals and final shop drawings. Coordinate with Contractor and Engineer of Record to determine scope and extent of field quality testing required for the Project.
7. Back-up support structures shall be designed to avoid torsional loads into the primary structure, and shall be subject to review and acceptance by STC Structural Engineer of Record.
8. EME Media Feature Contractor shall furnish the required mechanical fasteners and anchorage of components to their respective structures, components and locations as approved on final shop drawings with calculations provided and signed by an Engineer licensed in the State of Florida.

1.6 SUBMITTALS

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

B. Indication of method of maintenance for each feature is required as part of the Work. Provide details for specific application including plan and elevation views with dimensional information, equipment specifications, and guarding requirements.
   1. Coordinate equipment requirements for maintenance of each feature with Contractor and Authority.

C. Prior to the preparation of Shop Drawings, SolidWorks models of all final EME Media Features shall be provided for review and approval by EME Team. These include Windows on Orlando; Moment Vault inclusive of Fountain; Portal inclusive of columns and overhead building structure; Portal photo booth. Drawings, sections, elevations and details shall be provided to the EME team for confirmation of design intent.
   1. Coordinate with EME Fountain Contractor for submittal. Provide single coordinated submittal.
   2. Approved SolidWorks models will be used to update the base building Revit model; this work shall be coordinated with Architect, Engineer and EME Team.
   3. No Shop Drawings may proceed without formal written approval of the above by Architect, Engineer and EME Team.
   4. Materials to be so provided include but are not limited to the following:
      a. LANDSIDE - THE PORTAL
         1) Remodel Portal 3D model including the facility structure, following the correct geometry as per the sample sweep provided as a sample in

CDs. This shall include column connections, tension rod system, CNC spiral attachments, and LED tile product solution (including sub-frames, connections, attachments, components, and fittings required to assemble the LED tile product solution and attach the solution to the EME Primary Structure).

2) Describe and illustrate method of pulling power (cable) and data (cable) through tubular structure designating pathways and connections to column enclosure
3) Redraw and verify dimensions for the metal panels in conformity with design intent
4) Provide drawings for each of the (4) column attachments. Include details showing specific conditions for each attachment.
5) Describe and illustrate the photo booth, showing materials, detailed method of construction, and integration of technologies.

b. AIRSIDE – MOMENT VAULT
1) Remodel Moment Vault 3D model, including facility structure. This shall include fountain basins with all components; structural connections from the facility, water-jet cut panels; valencia panels, back LED mesh cover; all architectural elements; LED tile product solution (including sub-frames, connections, attachments, components, and fittings required to assemble the LED tile product solution and attach the solution to the EME Primary Structure.
2) Provide (9) nine integrated sections per element (North, South and West) showing all components, including fountains.
3) Provide full 3D and unrolled 2D drawings of water-jet-cut panels including perforated pattern included. Provide method of assembly and integrated drawings showing placement of WJC rolled surface panels in relation to the structure and displays. Detail the individual panels that will be part of the entire structure in all the features.
4) Engineer and detail camera stems and enclosures based on the results of prototyping and evaluation of camera positioning and housing requirements by EME Team

D. Shop Drawings
1. Shop Drawings shall be submitted for review and approval by the OAR, Architect, Engineer and EME Team.
2. Final approval of Shop Drawings will not be provided until fully integrated set of Shop Drawings with fully detailed components are coordinated by EME Media Feature Contractor and submitted as a full package for final release.
a. Moment Vault Shop Drawings to be fully coordinated with EME Fountain Contractor Shop Drawings. Coordinate iterative integrated submittals of Moment Vault Shop Drawings with EME Fountain Contractor.
b. Portal Shop Drawings to include Portal Photo Booth.
3. Shop Drawings to be prepared by the Contractor and/or Fabricator. Repackaged, modified or marked-up design drawings or Construction Documents are not acceptable as Shop Drawings.
4. Shop Drawings to be prepared as fabrication drawings, presented in series, with every part of every component of every feature drawn in true scale. Each EME Media Feature shall be detailed from whole to part and shown in three or

more views (plan, section, elevation, and axonometric views). Drawings so prepared shall include, but are not limited to,

a. EME Primary structure for each Media Feature, inclusive of all components, parts, and members; specific welding details for each part or member; specifications and dimensions for bolts and other fasteners. All fully and detailed fully dimensioned method of attachments of each feature to the building structure.
b. LED tile product solution for each Media Feature, including all sub-frames, connections, attachments, components, fittings and the like required to assemble the LED tile product solution and attach the solution to the EME Primary Structure. Shop Drawings to show details of all base building and other related conditions, size and arrangement of components, including rotation angles between the tiles, fully dimensioned method of attachments of each part of the LED tile system, adjacent construction including EME Fountain, and other pertinent data.

5. Shop Drawings to show finished dimensions and required clearances, radius (for bent and curved members and parts), metal thicknesses and gauges, material finishes, electrical connections, concealed and exposed (if any) mechanical fasteners and attachments together with fastener sizes and types, joint locations, relationship to supports and provisions for the work of related trades and by Owner.
   a. Shop Drawings shall detail each part of each component to show all related and required local structural reinforcement, the part's connection to adjacent part(s), the part's connection to adjacent self-similar part(s) if any, and immediate supporting structure. Drawings shall show each and every attachment between parts.
   b. Exact self-similar components with identical surrounding conditions must be identified with unique call-out numbers. Self-similar components with different surrounding conditions must be detailed and drawn in their entirety as described above.
   c. Include a coordinated submittal of engineered design for EME Media Feature Contractor-provided structures and attachments, for review by the building Structural Engineer of Record. Coordination of submittals with design criteria related to the Work of this Section is a requirement of the EME Contract.
   d. Coordinated submittal of power and data distribution within each EME Media Feature and to demarcation points as indicated on EME drawings for review by the building Electrical Engineer of Record is a requirement of the EME Contract.
   e. Indicate work of related trades including, conduit and wire-way runs through frame structure.
   f. Shop Drawings and calculations shall substantiate structural attachment of the work to the primary in-place structure and structural supports. A structural engineer licensed in the State of Florida shall prepare calculations.
      1) Indicate engineered structural attachments to building steel and substrates.
      2) Indicate weight limits, accessibility, pick-points, and equipment access during installation.

g. Shop Drawings to clearly describe and illustrate methods of access for maintenance and repair for all components of each EME Media Feature.

6. Light Emitting Diodes (LEDs)
   a. Provide physical (width, height, depth) and pixel (width, height) dimensions for each EME Media Feature Contractor LED tile product used in EME Media Features.
   b. Submit technical requirements for each display of each Media Feature:
      1) Display dimensions
      2) Pixel Pitch Required (mm)
      3) Required Brightness (nit)
      4) Minimum Viewing Angle (H / V)
      5) LED type
      6) Max. Power Consumption (W/sq. ft.)
      7) Max. Heat Generation (BTU/sq. ft.)
      8) Max Operating Temperature (F)
      9) Maximum Display Weight
      10) Maximum Cabinet Depth
      11) Connection Type from Processor to Display
      12) Cooling
      13) Processing
      14) Serviceability
   c. If any customization or modification to equipment provided has been carried out, describe and illustrate such customization.

E. Samples
   1. F1 –Moment Vault
      a. Submit all samples to EME Designer for review and approval.
         1) The following to be powder-coated using Silver Metallic paint, Sherwin-Williams Powdura 3000 #PAM8-C000.
            a) Provide two (2) 48” x48" samples of 1/4” bent steel water-jet cut panels with custom-perforated pattern. Coordinate with EME Designer for custom pattern.
            b) Provide four (4) 24”x24” samples of 1/8” custom-stamped steel for end and top covers. Show unstamped, unperforated border. Coordinate with EME Designer for custom pattern.
            c) Provide four (4) 4”x4” samples of 1/8” steel for LED border trim.
         2) Provide four (4) 4”x4” samples of paint finish to be used for EME structural elements. Field sprayed paint over catalyzed polyurethane to match Silver Metallic color and texture from Powdura 3000 #PAM8-C000; Sherwin Williams.
         3) Provide four (4) 8”x8” samples of stainless steel metal mesh; GKD “Omega 1516.” Acceptable manufacturer: GKD-USA, Inc., 825 Chesapeake Drive Cambridge MD, 21613, 800-453-8616

   2. F-2 – Windows on Orlando
      a. Submit all samples to EME Designer for review and approval.
         1) Provide four (4) 18”x6” samples of 3M gradient film, applied over stainless steel mirror finish screen, to EME Designer for approval
         2) Coordinate with Contractor for stainless steel mirror finish sample.
   3. F-3 – The Portal

a. Submit all samples to EME Designer for review and approval.
   1) Provide four (4) 4”x4” samples of front covers for non-LED panel surfaces. Stainless steel, “6-OM,” finish: satin, 1.9mm, gauges: 0.075”/14g over 3/8” bent plywood. Acceptable manufacturer: Rimex Metals (USA) Inc, 2850 Woodbridge Avenue, Edison, NJ 08837, USA, (732)549-3800
   2) Provide four (4) 4”x4” samples of paint finish on 1/8” steel to be used for the LED trim. Finish: powder-coated Silver Metallic paint, Sherwin-Williams Powdura 3000 #PAM8-C000
   3) Provide four (4) 4” diameter x 12” length samples of The Portal EME Primary structure with finish: Silver metallic paint over catalyzed polyurethane (shop sprayed) to match color and texture from Powdura 3000 #PAM8-C000; Sherwin Williams.
   4) Provide four (4) 12” length samples of vertical tension rods with couplings and end fittings. Finish: powder-coated Silver Metallic paint, Sherwin-Williams Powdura 3000 #PAM8-C000
   5) Provide four (4) 12” length samples of lateral stainless steel tension rods, with couplings and end fittings.
   6) Provide four (4) 8”x8” samples of photo booth perforated stainless steel, “Scape,” 32% open, 0.8mm perforated, Seastone finish. Acceptable manufacturer: Forms + Surfaces, 30 Pine St., Pittsburgh, PA 15223, www.forms-surfaces.com.
   7) Provide four (4) 4”x 4” samples of photo booth kickplate, stainless steel level #4, 360 grit, laminated over P.T wood blocking.
   8) Provide four (4) 4”x 4” samples of photo booth green-screen paint on metal finish.
   9) Provide four (4) 12” x 12” samples of photo booth frosted polycarbonate panels (Lexan) 1/2” thick, with 1/4” stainless steel reveal.
   10) Provide four (4) 4” x 4” samples of optically transparent, anti-glare, anti-reflection, photo booth lens protection glass.

4. F-4 – Windows on Orlando South
   a. Submit all samples to EME Designer for review and approval.
      1) Provide four (4) 18”x6” samples of 3M gradient film, applied over stainless steel mirror finish screen, to EME Designer for approval
      ~~10)~~2) Coordinate with Contractor for stainless steel mirror finish sample.

F. Certifications:
   1. Submit certification that work is in compliance with codes and AHJ.
   2. Submit certification that work is in compliance with equipment manufacturer requirements.
   3. Submit certification that materials and assemblies meet the fire ratings where required and as indicated.
   4. Submit certification from equipment manufacturers attesting that their products/assemblies meet or exceed Contract Document requirements and are suitable for the use indicated.
   5. Submit field-testing and inspection certifications including testing for welds, EME features, seismic restraints.

1.7 QUALITY ASSURANCE

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

B. Design and arrangement shown on the EME drawings represent design requirements. Shop drawings shall indicate construction and fabrication details. Engineering is a requirement of the EME Contract as is coordination with Engineers of Record. Under this Contract, final structural calculations shall be prepared and signed by a structural engineer licensed in the State of Florida.
   1. Analyses and member sizes indicated were developed at the level of Construction Documents to validate the feasibility of the design solution. A structural engineer licensed in the State of Florida shall be retained as part of the Work of this Contract to review and determine the required structural supports; and, where required, submit engineering and structural calculations substantiating their Work.
   2. EME Media Feature structures, as well as internal connections and connections related to the mounting of the feature to the primary structure, are part of the Work of this contract; and shall be coordinated with the Structural Engineer of Record.
   3. Conflict in Contract Documents:
      a. Comply with the most stringent requirement where conflicting information is found within Contract Documents including drawings, drawing notes and specifications. Provide notification of conflicting information verbally and in writing.

1.8 DELIVERY, STORAGE AND HANDLING

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

B. Deliver components and assemblies in fully sealed protective cartons identified as to contents. Protect from damage from any source.

C. EME Media Feature Contractor to coordinate storage and delivery of Authority-provided materials with Authority and CMAR.

D. Deliveries shall be coordinated with the CMAR. Each component shall be packaged with information containing its function and location within the system and referencing shop drawing details where needed.

E. Store materials in accordance with EME Media Feature Contractor’s instructions, properly protected from weather and construction activities. Coordinate locations with CMAR. Suitable, and secure where required, storage locations to be provided by CMAR.

F. Handle in a manner to prevent damage to finished surfaces.

G. Coordinate all EME structural work with the building structural contractor for appropriate phasing, staging, and installation prior to construction.

1.9 RECORD DOCUMENTS

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

1.10 OPERATION AND MAINTENANCE

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

B. Provide a detailed plan for service access and maintenance of all EME Media Features. This plan, covering both preventative and reactive maintenance, shall be submitted for review and approval by Owner, OAR and EME Team.

C. EME Media Feature Contractor shall supply standard maintenance agreement(s) for Owner review and acceptance. Such agreement(s) shall include work by all subcontractors.

D. EME Media Feature Contractor shall provide all documentation and training required for Owner operation and maintenance of EME Media Features.

E. Owner responsible for providing suitable maintenance access equipment and its storage within proximity of features.

1.11 SOFTWARE AGREEMENT

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

1.12 SPARE MATERIAL

A. LED tiles: spare LED tiles, of identical make, model and technical specifications as each installed LED product and from the same batch as each installed LED product, shall be provided to the Owner at the time of final acceptance of the project. Spare LED tiles so provided shall represent the equivalent of no less than 4% of the total installed surface area of each LED product type used in all EME Media Features.

B. LED processors: No less than three (3) spare ~~M8~~ SACO NANO 4K LED processors, of identical make, model and technical specifications as those used for the active EME installation, shall be provided to the Owner at the time of final acceptance of the project.

C. LED distro boxes: No less than five (5) spare ~~M8 distro boxes~~SACO Data Extenders, of identical make, model and technical specifications as those used in the active EME installation, shall be provided to the Owner at the time of final acceptance of the project.

D. Cables: Sufficient spare cables for no less than 10 years of normal operations shall be provided to the Owner at the time of final acceptance of the project.

E. All spare material to be appropriately labeled, packaged, and documented in compliance with Owner requirements.

F. EME Media Feature Contractor shall provide storage for spare material in a secure facility within the Orlando area. This storage shall be provided during the entire warranty period at no cost to Owner.

1.13 ENVIRONMENTAL CONDITIONS

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

B. CMAR to ensure that all electronic equipment rooms are clean and dust free prior to installation of any AV electronic equipment.

C. CMAR to ensure that EME Media Feature Contractor has access to dust free and safe installation areas, with permanent power operations.

D. LED tile installation requires a dust free environment. This means no concrete dust, stone polishing dust, drywall dust, etc. Installing in a non-dust free environment with the presence of humidity can cause this dust to turn into a paste which cannot be removed, and will shorten the lifespan and visual quality of the displays.

E. CMAR to ensure that the HVAC system is in operation with filters in place and humidity controlled for installation.

1.14 SYSTEMS WARRANTY

A. EME Media Feature Contractor shall supply standard warranty agreement(s) for Owner review and acceptance. Such agreement(s) shall include work by all subcontractors. This warranty shall provide no less than three (3) years parts and labor at no cost to Owner. At Owner's request EME Media Feature Contractor shall provide an extended warranty agreement(s) for Owner review and acceptance.

1.15 SUPERVISION OF THE WORK

A. EME Media Feature Contractor shall be wholly responsible for supervision of the work.

B. At all times during the installation and commissioning of the EME Media Features, the EME Media Feature Contractor shall have on the site a competent superintendent who is satisfactory to the Contractor, Owner and EME Team.

1.16 OFF SITE MOCK-UPS

A. Mockups are full size physical assemblies, constructed at designated off-site location. Mock-ups shall consist of a section or part of a media feature, demonstrating specific aspects of design intent. Mock-ups shall be constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, material qualities and methods of execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mock-ups shall not be used for final installation, or be used as samples; nor are they to be provided in lieu of sample submittals. Unless otherwise indicated, approved mock-ups will establish the standard by which the Work will be judged.
   1. All Mock-ups to be constructed at an approved facility in the Orlando area; for reviews and approvals by EME Designer, EME Media Feature Contractor, AOR, and Owner; unless otherwise approved by Owner.
      a. Integrated Mock-Up: Mock-up of media feature section. Integrated mock-up consists of multiple products, assemblies and sub-assemblies.
      b. LED Walls: Section of LED display wall used to test content and adjustable aspects of products (such as shaders) at EME Media Feature Contractor facility. LED walls may be used for functional mock-ups,
      c. Test Mockups: Full-size, physical assemblies of section or sub-assembly of feature, suitable for testing and verification of required performance per specified requirements.
      d. Integrated Test Mock-up for Several Mock-ups: The EME Media Feature Contractor may combine an integrated assembly with a test Mock-up for the purpose of cost efficiency and expediency.
   2. Mock-ups may be developed in the following sequence where appropriate and cost effective: Preliminary integrated Mock-ups will be followed up by final integrated Mock-up, followed by Test Mock-up which may if appropriate utilize the EME Media Feature Contractor's LED wall. The diagrams used in this Section are for reference to indicate the scope and portions of the Media Features requiring mock-up. Mock-ups shall be based on the final approved Shop Drawings.

B. Required Mock-ups
   1. F-1 Moment Vault (Airside)

a. Integrated Mock-up detail of the surrounding frame with LED tiles at the base location as indicated below: in Diagram 1A –Moment Vault Plan; Diagram 1B –Moment Vault Section; Diagram 1C – Moment Vault Exterior Elevation; Diagram 1D –Moment Vault Interior Elevation; Diagram 1E – Moment Vault Fountain Detail1F Perforated basin panel detail. Diagrams are illustrative of sections of features to be mocked up for reference only, and must be updated using final approved Shop drawings to demonstrate the following requirements of the design intent:
   1) The transition between each of the materials including the LED panels, the water-jet cut screen and the fountain framework with finishes expected in the completed work.
   2) Attachment of water-jet cut screen to substructure to demonstrate all visible hardware/attachments and internal attachments.
   3) Functional provision for removable stainless steel speaker cover to match approved finish and material samples.
   4) Functional provision for fountain stem supporting the camera and housing the piping with details on the interior side; demonstration of electrical and data routing.
   5) Fountain basin
   6) Front access panel.
   7) Perforated fountain basin panel concealing speaker/sub-woofer
   8) Method of attachment to curved substructure to achieve seamless appearance of LED display
   9) Terminal box attachment to substructure, cable and conduit support, and proposed terminal access method.
   10) Wire management to eliminate visibility of all cables and junction boxes from the exterior side of display.
   11) Electrical power break-out box positioning above EMT conduit outside of view from exterior of display, required conduit fittings within proposed interior space of display, and proposed access method to break-out box. Include raceway between break-out boxes.
   12) Continued operation of LED panel under simulated semi-aquatic environment with identical GFCI upstream breaker and grounding configuration.
   13) Break-in box connection to terminal box.

b. Test Mock-up: After approval, EME Media Feature Contractor to deploy integrated mock-up with section of LED tile or sample LED wall, at its discretion, to demonstrate the following requirements of the design intent:
   1) Seamless appearance of concave and convex LED when displaying test content provided by EME Team.
   2) Operation of the camera (provided by EME Specialty Integrator) and the speaker (provided by EME Specialty Integrator) in the interior side of the mock-up.

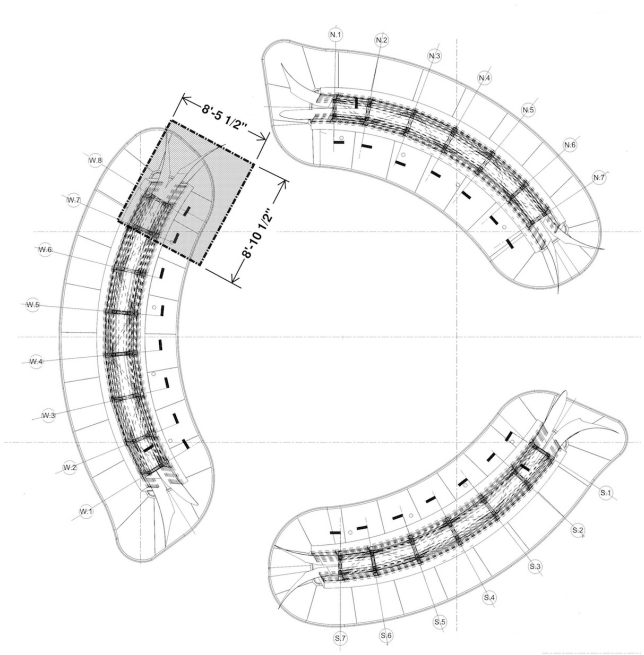

DIAGRAM 1A: F-1 Moment Vault Plan

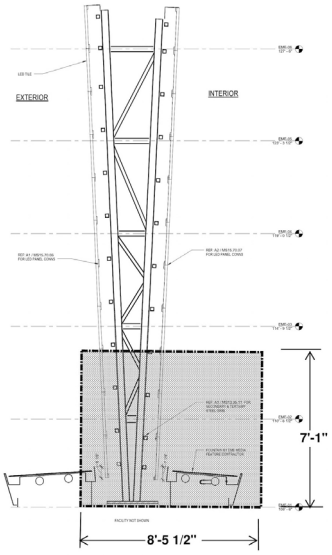

DIAGRAM 1B: F-1 Moment Vault Section

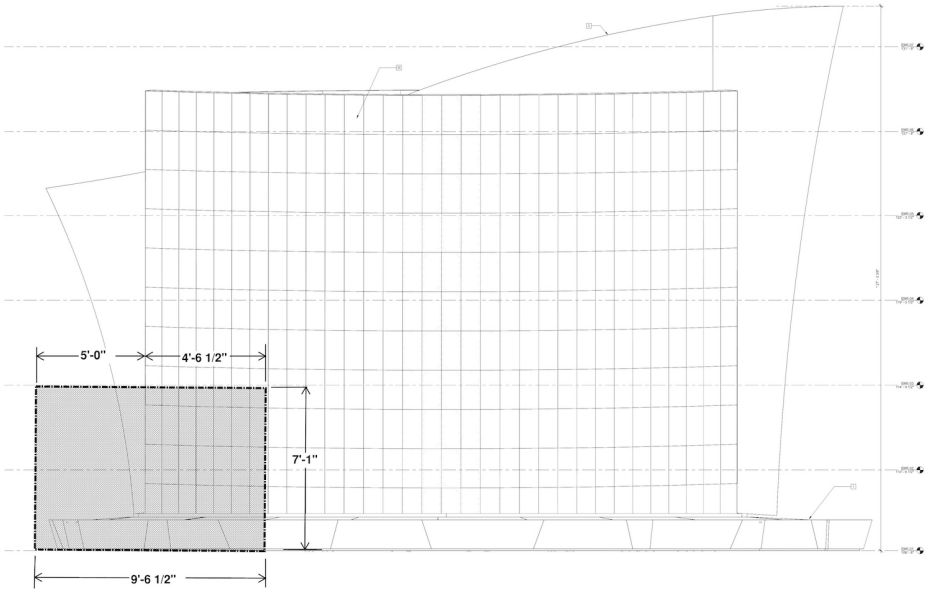

DIAGRAM 1C: F-1 Moment Vault Exterior Elevation

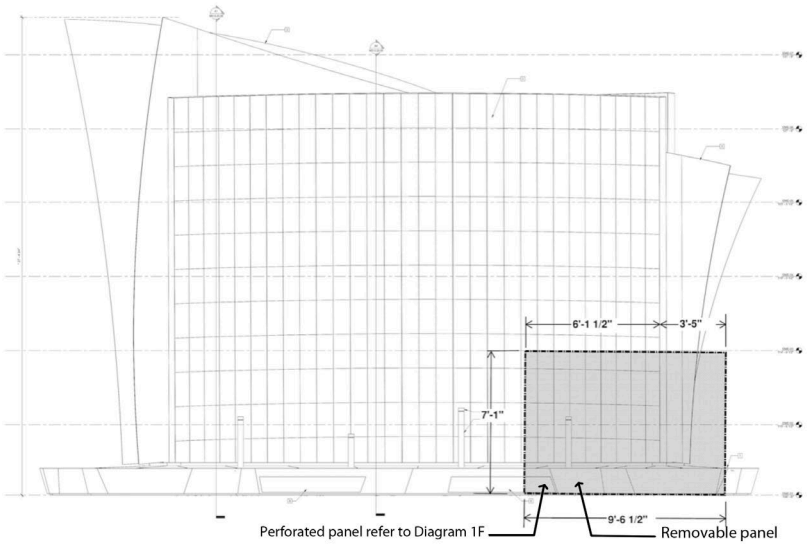

DIAGRAM 1D: F-1 Moment Vault Interior Elevation

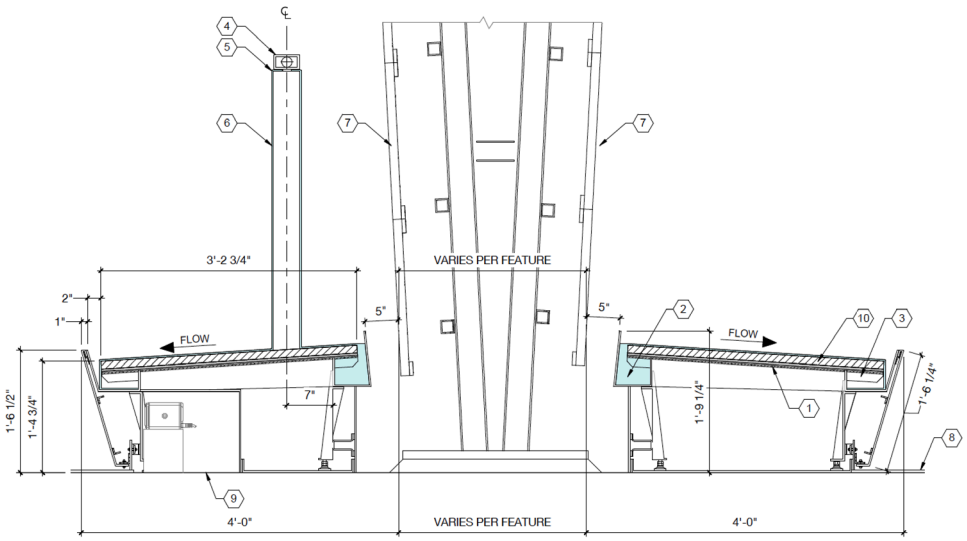

DIAGRAM 1E: F-1 Moment Vault Fountain Detail

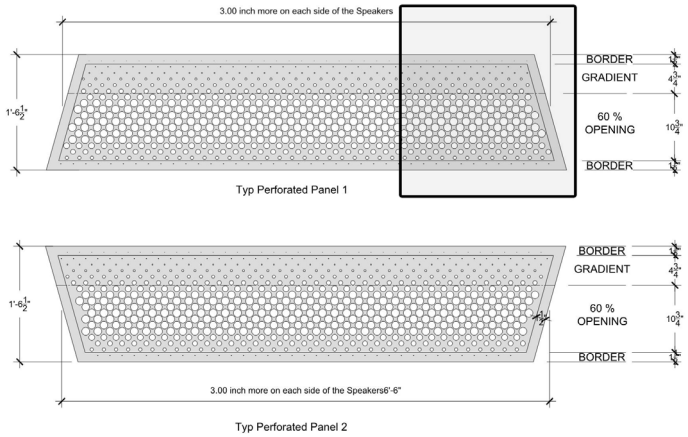

DIAGRAM 1F: F-1 Moment Vault Perforated Panel Detail

2. LED Display Mock-Up
   a. LED wall (~~RS1.8~~SACO-M2-RGB-i LED tile, 4'6”x 8' or larger, final dimensions based on integer multiples of SACO-M2-RGB-i ~~RS1.8~~ LED tile dimensions) shall be provided by the EME Media Feature Contractor for testing typical viewing distances and angles. Based on iterative testing under simulated site lighting conditions, and following review by EME Team, EME Media Feature Contractor shall develop shader design to support optimal viewing of EME Media Feature displays. Shader design must be approved by EME Designer.
   b. LED wall (SACO-M4-RGB-i ~~RS3.75~~ LED tile, 4'6”x 8' or larger, final dimensions based on integer multiples of SACO-M4-RGB-i ~~RS3.75~~ LED tile dimensions) shall be provided by the EME Media Feature Contractor for testing typical viewing distances and angles. Based on iterative testing under simulated site lighting conditions, and following review by EME

Team, EME Media Feature Contractor shall develop shader design to support optimal viewing of EME Media Feature displays. Shader design must be approved by EME Designer.

3. F-2 Windows on Orlando (North Concourse)
   a. Integrated Mock-up detail of the surrounding frame with LED tiles at the base location as indicated below: Diagram 2A – Windows on Orlando Plan; Diagram 2B –Windows on Orlando Section; Diagram 2C – Windows on Orlando Elevation; Diagram 2D – Viewing Angles. Diagrams are illustrative of sections of features to be mocked up for reference only, and must be updated using final approved Shop drawings to demonstrate the following requirements of the design intent:
      1) Fit and transition between the LED display, base cover, and stainless steel mirror surface reveal, from both side reveal and bottom. Simulate architectural finishes. Simulate wall and floor to demonstrate fit and transition. Application of 3M film options on bottom mirrored surface
      2) Attachment of LED display to substructure.
      3) Terminal box attachment to substructure, cable and conduit support, and proposed terminal access method.
      4) Wire management between break-in box, terminal box, and electrical break-out box.
      5) Electrical power break-out box positioning above EMT conduit entering from space below, and proposed access method to break-out box. Provide conduit fittings adequate for the conduits fed, Include raceway between break-out boxes.
   b. Use Integrated Mock-Up for testing viewing points and angles of ~~3.75~~4.16 mm product from typical passenger vantage points based on Diagram 2D.
      1) Evaluate viewing angles at key vantage points with test content provided by EME Team indicated on Diagram 2-D.
      2) Evaluate color blending (absence of pixelization) at distances representative of passenger departure and arrival transition zones with content provided by EME Team.

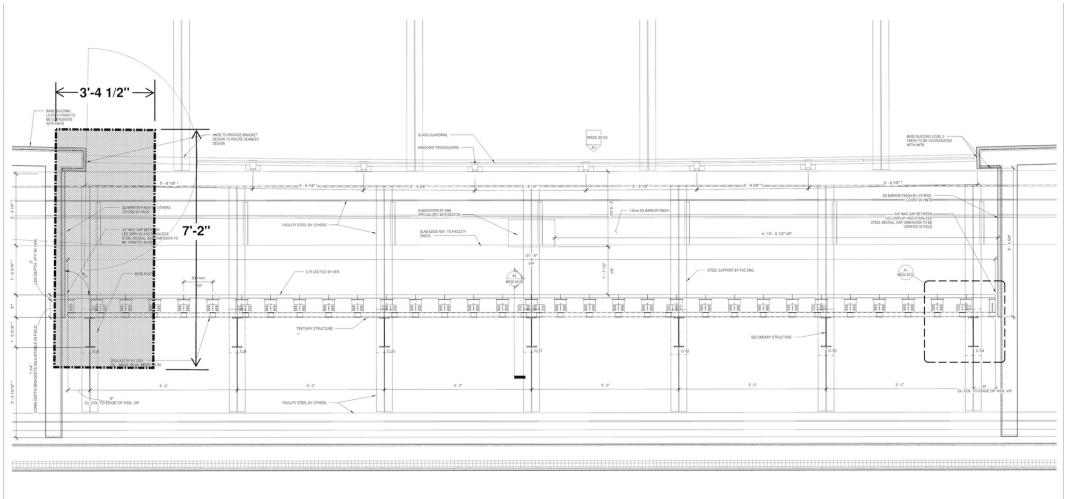

DIAGRAM 2A: F-2 Windows on Orlando Plan

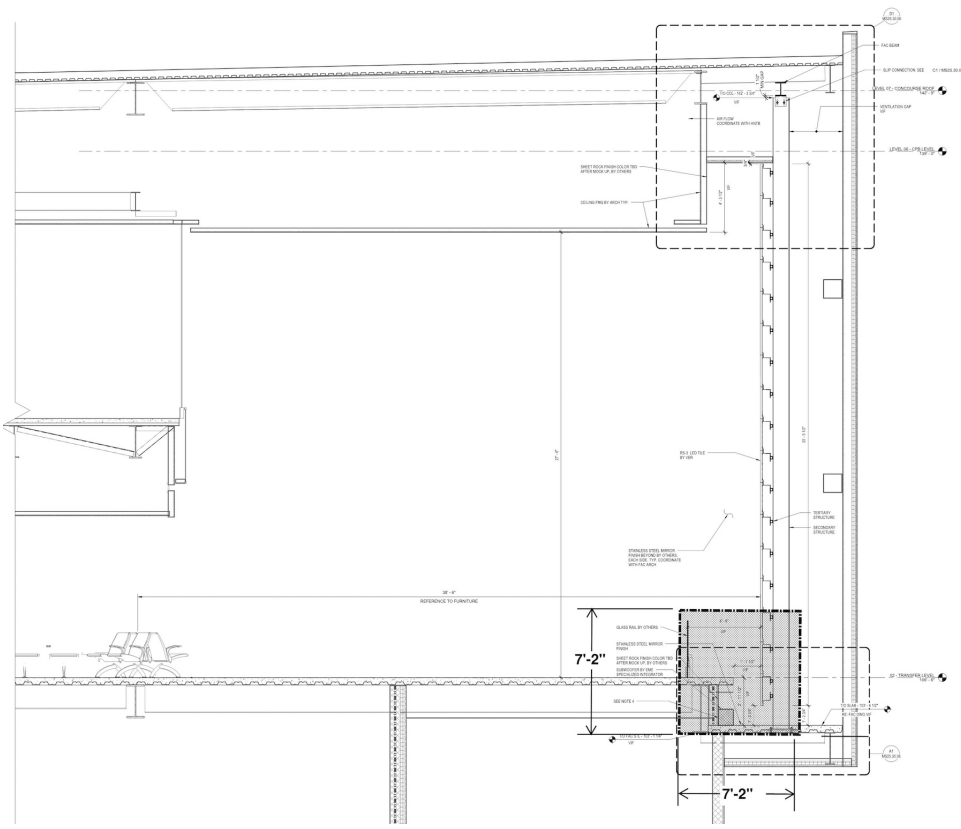

DIAGRAM 2B: F-2 Windows on Orlando Section

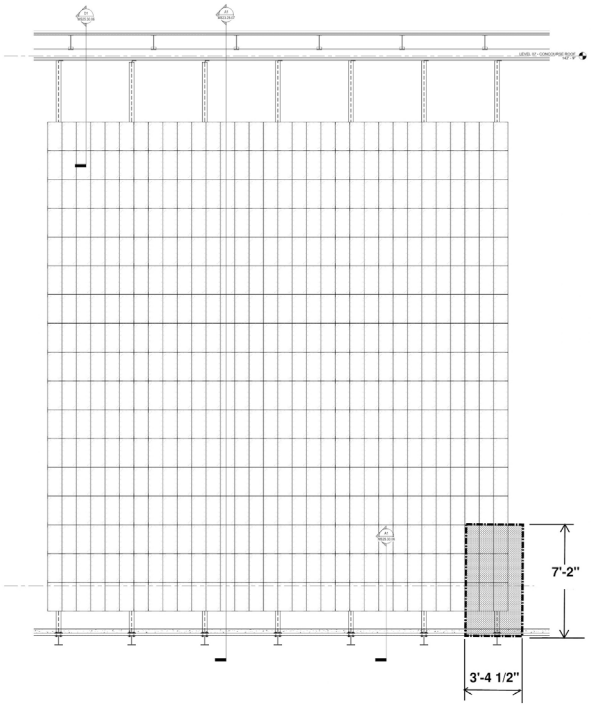

DIAGRAM 2C: F-2 Windows on Orlando Elevation

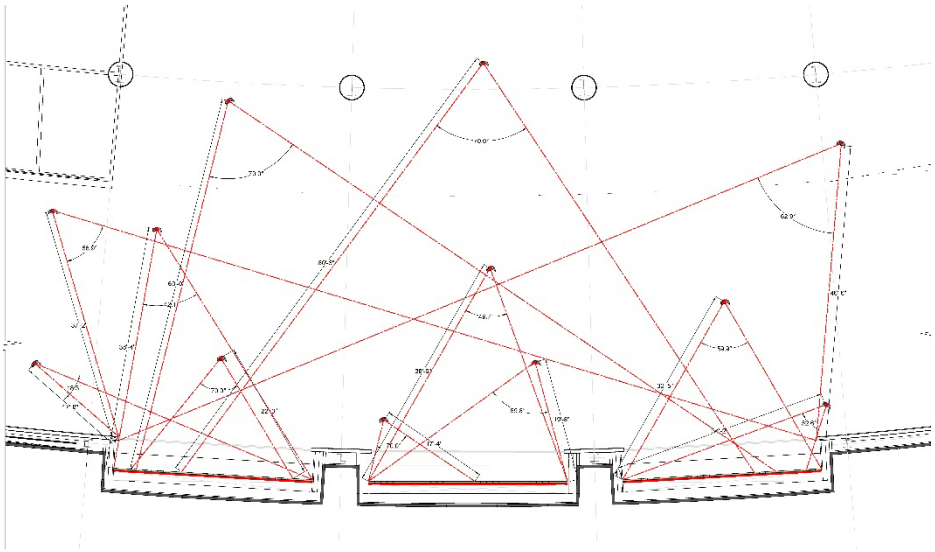

DIAGRAM 2D: F-2 Windows on Orlando Viewing Angles

4. F-3 The Portal – Landside Terminal
   a. Integrated Mock-up detail(s) of the 3.75 mm LED displays 12I (interior) and 12E (exterior), approximately 8’ x 4’ W, mounted on tubular truss as indicated below: Diagram 3A – The Portal Plan; Diagram 3B – The Portal Section; Diagram 3C – The Portal Exterior Elevation; Diagram 3D – The Portal Interior Elevation. The mock-up shall be rigged to allow hoisting to 12 feet above ground plane. Diagrams are illustrative of sections of features to be mocked up for reference only, and must be updated using final approved Shop drawings to demonstrate the following requirements of the design intent:
      1) Materials comprising the enclosure including the steel edge provide a clean fit and meet the design intent.
      2) Section between the convex LED display and concave metal panel, including the steel edge of the displays, sub-frames, and all visible hardware viewed from the side and below, meets the design intent.
      3) Attachment of LED displays to the truss including all visible hardware/attachments and internal attachments.
      4) Electrical distribution system, including junction boxes, access for cable pulls, structural reinforcements and any other component.
      5) Tension rod system attachment point and structural reinforcements.
      6) Paint color and finish of the steel members to meet design intent.
      7) Smooth welds.
      8) Attachment of tubes to enclosure meets design intent.
      9) Terminal box attachment to substructure, cable and conduit support, and proposed terminal access method.
      10) Wire management between break-in box, terminal box, and wiring entrance to display.
      11) Electrical and data wiring transition from structural steel tubing into display, taking consideration of insulation integrity and fiber bend radius.

12) Conduit support method inside of structural steel tubing

b. Test Mock up: After approval, EME Media Feature Contractor as Design Build-Primary Contractor with its subcontractors shall deploy integrated Mock up with section of LED tile or sample LED wall (below) at its discretion; to demonstrate design intent requirements in accordance with the following:

1) Demonstrate that there are no noticeable seams in the concave LED and convex LED using test content (provided by EME Team).

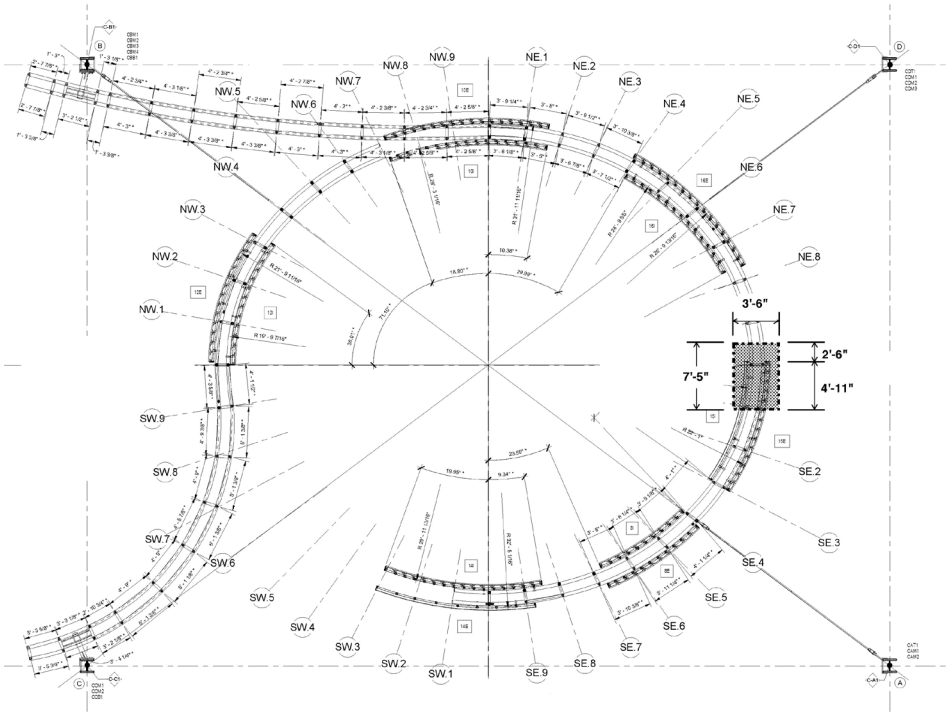

DIAGRAM 3A: F-3 The Portal Plan

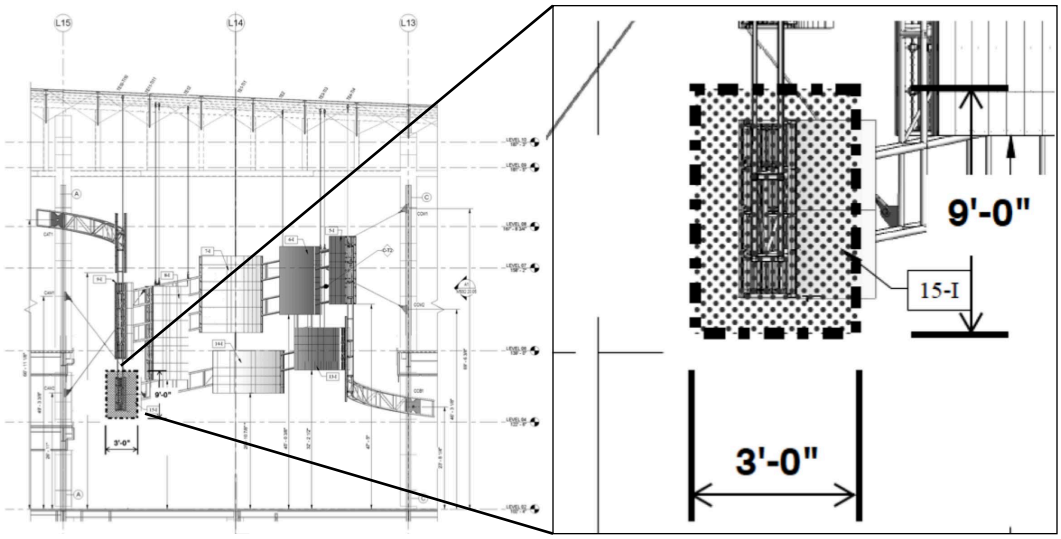

DIAGRAM 3B: F-3 The Portal Section

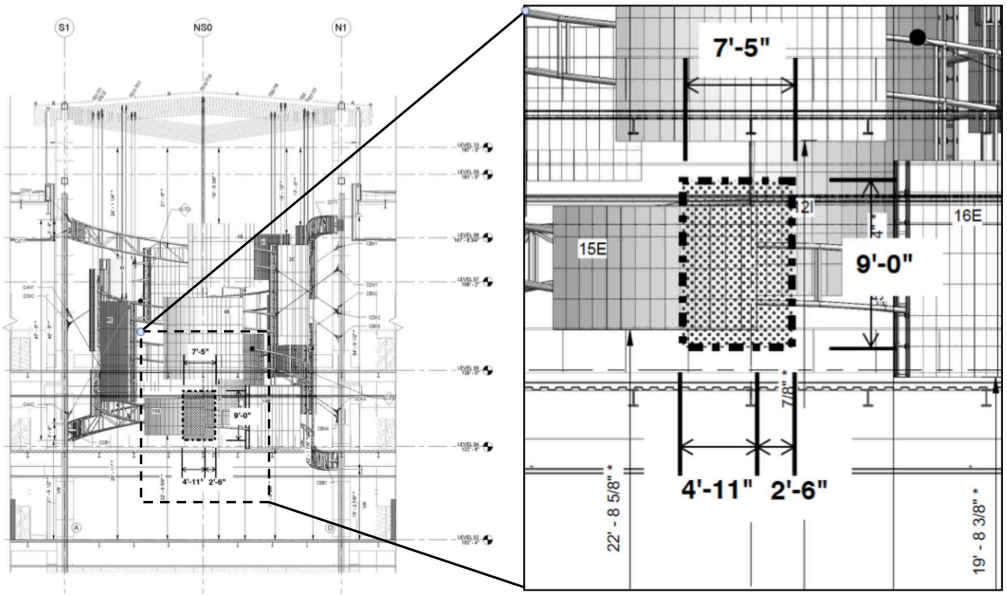

DIAGRAM 3C: F-3 The Portal Exterior Elevation

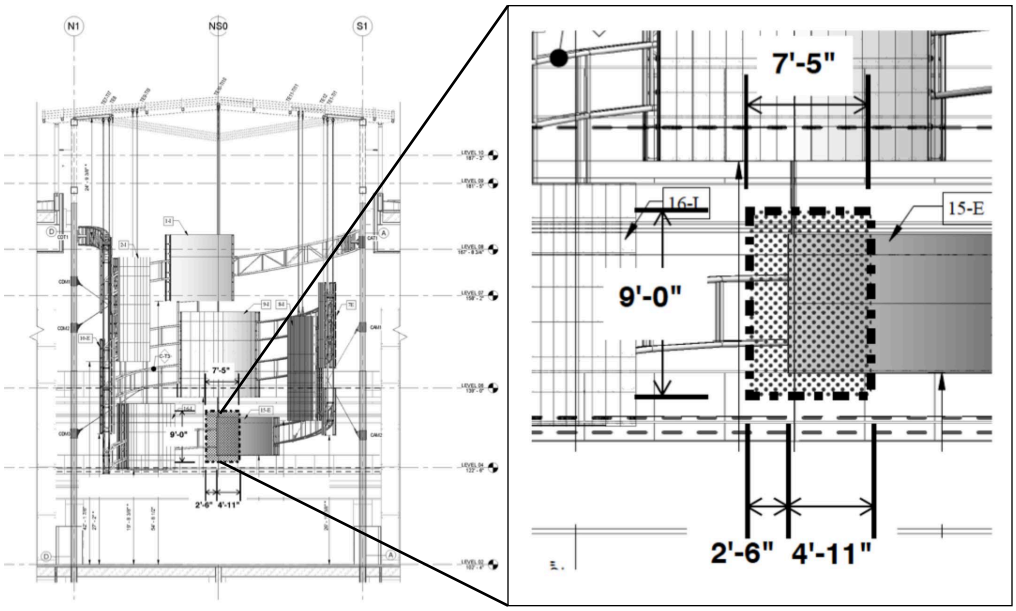

DIAGRAM 3D: F-3 The Portal Interior Elevation

c. Integrated Mock-ups of joints: The EME Media Feature Contractor shall also provide detailed Mock-ups of the following connections:
   1) Pin connection detail that shall be used to carry the electric/data feeds from the primary structure (column) The Portal truss; as illustrated below
   2) Electrical distribution, including any reinforcements, junction boxes, cable pull boxes and any other elements of the electrical distribution solution.
   3) Verification of pathways from the column, to the junction box on the rail, to the rail.

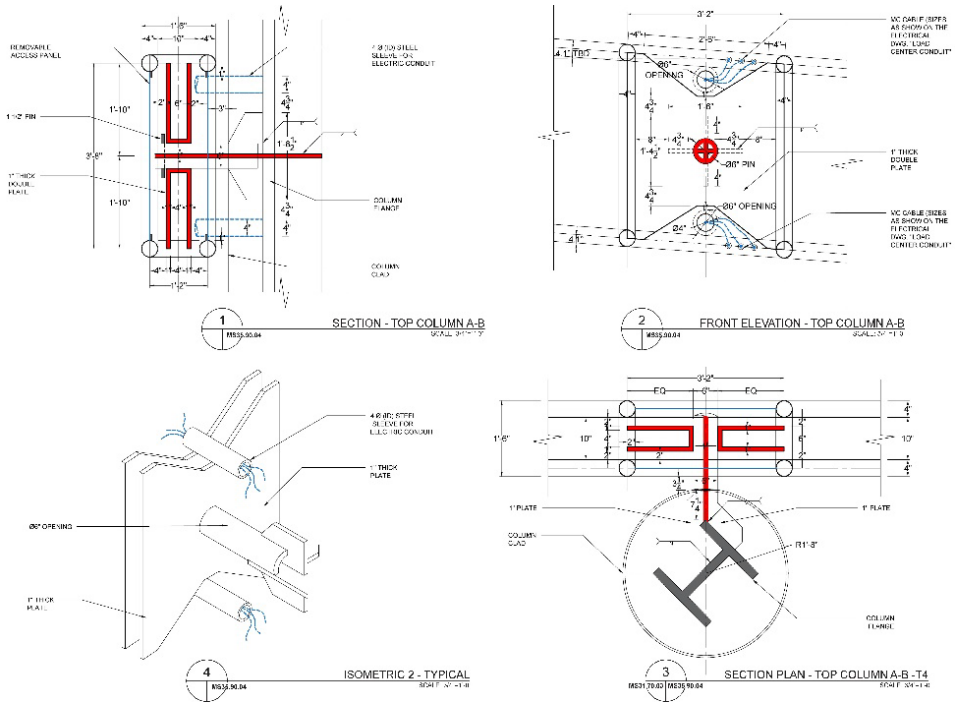

DIAGRAM 3E: F-3 The Portal Pin Detail

d. Orlando Experience Booth: EME Media Feature Contractor shall oversee a qualified vendor who shall produce a fully functional mock-up of the interactive booth for testing purposes.
   1) Integrated mock-up: EME Media Feature Contractor vendor shall provide a full-scale interactive station mock-up (incorporating functional photo capture camera, protective glass, and interface device, provided by EME Specialized AV Systems Integrator) to test ergonomics, usability, camera positioning, camera integration, interface device positioning, interface device integration, lighting positioning, lighting integration and such other aspects of the booth as relate to the interactive experience. This mock-up shall be used to develop final positions for interactive elements. Final design drawings shall be prepared by EME Media Feature Contractor vendor incorporating comments on this mock-up.
   2) Mock-up: EME Media Feature Contractor vendor shall provide a portion of the interactive booth that shows key fabrication details, materials and quality of workmanship in construction

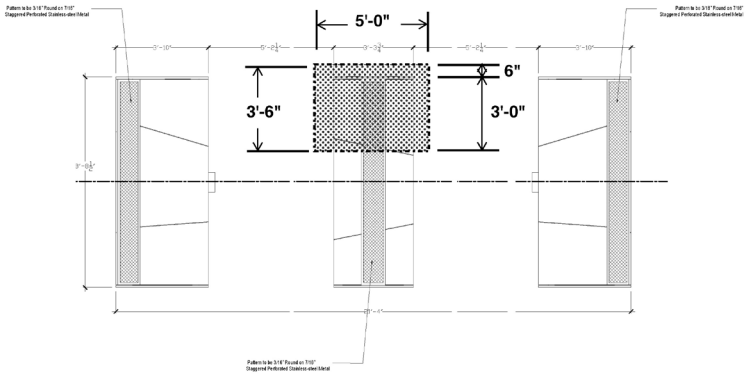

DIAGRAM 3F: F-3 The Portal Photo Booth Plan

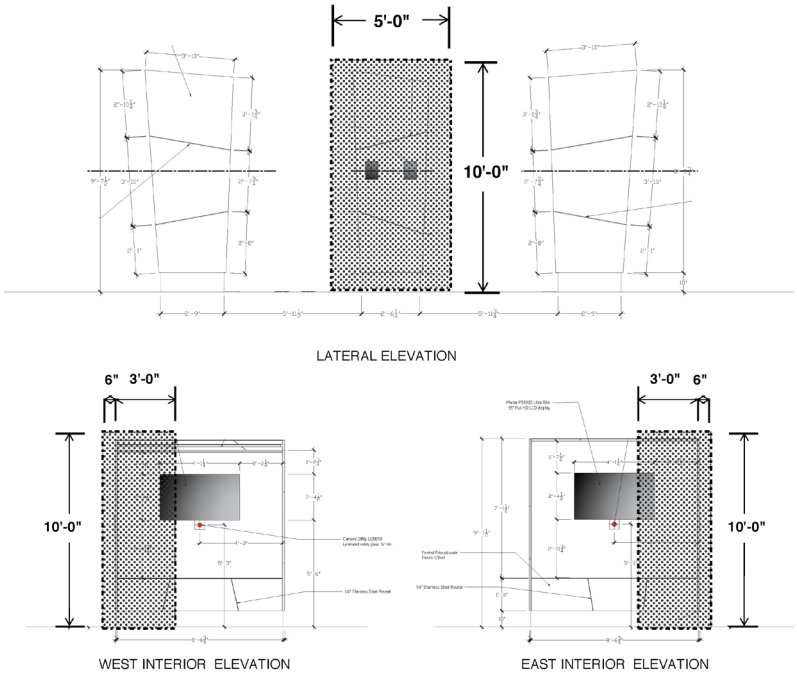

DIAGRAM 3G: F-3 The Portal Photo Booth Elevations

PART 2 - PRODUCTS.

2.1 MANUFACTURED PRODUCTS

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

B. Acceptable Manufacturer:
   1. Company shall be able to provide a turnkey delivery of complex LED features with exposed, architectural frames, and surrounds.
   2. Company shall have sufficient manufacturing volume to support scope and level of quality of the Project.

3. Company shall have ability to provide a North America-based stock of applicable parts sufficient to replace any malfunctioning tiles and equipment within 24 hours.
4. Company shall have a “black” LED product in the applicable pitch range.
5. Company shall have ability to provide a North America-based stock of applicable parts sufficient to replace any malfunctioning tiles and equipment within 24 hours.
6. Company’s applicable SACO-M4-RGB-i 4.16~~RS3.75~~ mm LED product shall meet the 2,000 NIT brightness requirements.
7. Company’s applicable SACO-M2-RGB-i 2.08~~RS1.8~~ mm LED product shall meet the 1,000 NIT brightness requirements.
8. Company’s applicable system shall have ability to support a single-mode fiber connection between display and processor (9/125µm Single mode (SMF) OS2, ST-ST terminated, UPC polish).
9. Company’s applicable products shall employ diodes manufactured by Avago, Cree, Nichia, or Osram; or an alternate diode with equal or superior performance and quality control
10. Company’s product shall have ability to be calibrated on location, and in the installed position.
11. Company shall have LED tiles that are front serviceable.
12. Company shall manufacture 4K processors that can accept an external sync signal to ensure seamless playback of multiple video streams on a single feature surface.
13. Company shall have the ability to provide a high-resolution LED product that can meet the power, weight and thermal output requirements specified for each EME Media Feature, including supporting frame, all attachments, wire and other required components necessary to complete the features.
14. Company shall be responsible for the work in its entirety and shall subcontract and be responsible for related work comprising the EME.

2.2 BASIS OF DESIGN

A. Basis-of-Design – Product: Subject to compliance with requirements, provide product by the referenced EME Media Feature Contractor and its subcontractors specified herein or approved equal.

2.3 LEDS, LED PROCESSORS, AND RELATED EQUIPMENT

A. LEDs
1. Refer to EME Media Feature specific requirements, below.

B. LED Processors
1. All LED processors and distribution (“distro”) boxes shall be the most recent generation of the “SACO NANO 4K~~Revolution Display M8~~” family available on the market at the time of procurement. No substitutions will be accepted.
2. EME Media Feature Contractor’s LED processor units must accept 4K/UHD-60 video input signals
3. EME Media Feature Contractor’s LED processor units must support tri-level genlock synchronization signal input. When synchronized, multiple units must individually accept 4K/UHD-60 video input signals and collectively be capable of outputting signals to LED displays of total resolution greater than 4K (3840 x 2160) without tearing, sync loss (both horizontal and vertical sync will be

maintained), distortion, or change in color, brightness, or shape of media displayed on feature.

2.4 MATERIALS AND FABRICATION REQUIREMENTS – GENERAL

A. Refer to and coordinate with the applicable requirements of the related trades and Specifications Sections relative to the Orlando International Airport South Terminal C Phase 1 (WS110).

B. Metals – General: Provide materials, which exhibit surface flatness, smooth and free from blemishes where exposed to view in finished units.
   1. Exposed to view surfaces, which exhibit pitting, seam marks, roller marks, "oil canning", stains, discolorations or other imperfections are not acceptable.

C. Stainless Steel
   1. Exposed to view surfaces, which exhibit pitting, seam marks, roller marks, "oil canning", stains, discolorations or other imperfections are not acceptable.
   2. Tubing: as indicated on the EME drawings.
   3. Bars, Shapes, Plates and Moldings: As indicated on the EME drawings.
   4. Finish: Ornamental Grade, AISI No. 4 except where otherwise indicated.

D. Steel, carbon: Concealed supports only.
   1. Structural Shapes: As indicated on the EME drawings.
   2. Plates (for forming or bending cold): As indicated on the EME drawings.
   3. Steel Sheets: As indicated on the EME drawings.
   4. Shop prime with rust inhibitive primer, compatible and as recommended with feature paint finish.
   5. Shop paint all features unless otherwise indicated.

E. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of the metal shall be welded and with AWS standards; and as required for color match, strength, and compatibility of the fabricated items. Provide electrode type and strength as indicated.

F. Fasteners: Furnish basic metal and alloy, matching finished color and texture as the metal being fastened, unless otherwise indicated. Provide concealed fasteners for interconnection of decorative formed metal components to the furthest extent possible. Provide high strength bolts as indicated.
   1. Where exposed fasteners are acceptable to the Designer, provide countersunk, tamper proof flat-head screws for exposed fasteners, unless otherwise indicated.
   2. Use of metals that are corrosive or incompatible with materials shall be joined is unacceptable.

G. Anchors and Inserts: Furnish inserts and anchoring devices for use in the attachment of decorative formed metal items to required substrates; as indicated on final shop drawings.

H. Shop form metalwork to the required shapes and sizes, with true curves, lines, and angles. Provide necessary rabbets, lugs and brackets for assembly of units. Use concealed fasteners wherever possible; exposed fasteners shall occur only where permitted by EME Designer. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated or required for structural performance.

I. Joints

1. Locate joints where indicated on Drawings. Where not indicated, joints shall be subject to review and acceptance of the EME Team, and Structural Engineer of Record, on final shop drawings.
2. Make connections with joints capable of developing full strength, flush unless otherwise indicated.
3. Fabricate connections to allow for thermal movement of metal, at locations and by methods approved by EME Team, and Structural Engineer of Record, on final shop drawings.
4. Joints shall be mitered, welded, and ground smooth unless otherwise noted.

J. Welding: Comply with American Welding Society (AWS) for recommended shop welding and brazing practices.
1. Welds shall be continuous, except where spot welding is specifically permitted.
2. Provide welds behind finished surfaces without distortion or discoloration of exposed side.
3. Undercut metal edges where welds are required shall be ground flush.
4. Clean exposed welded joints of welding flux, dress smooth exposed and contact surfaces and finish to match adjacent specified metal finish.
5. Field Testing and Inspection: Refer to and coordinate with Division 1 General Requirements including Section 01 45 00, Quality Control. Refer to Part 3 of this Section. Provide inspection as indicated on EME Structural Drawings.

K. Bolts and Screws
1. Make threaded connections tight with threads entirely concealed; use lock nuts.
2. Bolts and screw heads, where shown on final shop drawings shall be exposed to view, shall be flat and countersunk.
3. Cut off projecting ends of exposed bolts and screws flush with nuts of adjacent metal.

L. Cutting
1. Cut metal by sawing, shearing or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges.
2. Make cuts accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces or metals.
3. Drill or cleanly punch holes (do not burn), so that holes will be accurate, clean, neat and sharp without deforming adjacent surfaces or metals.
4. Supplementary Parts: Provide as necessary to complete each item or work, even though such supplementary parts are not shown or specified.

M. Shop Finishing
1. Metals: Comply with NAAMM "Metal Finishes Manual" except as otherwise indicated.
   a. Provide colors and finishes to match Project Mock-Up and Project Samples.
2. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.

N. Structural Steel Fabrication - Coordination Requirements for Moment Vault and Windows
1. Design components and field connections required for erection to permit easy assembly.

2. Assemble items in the factory to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
3. Use connections that maintain structural value of joined pieces.
4. Fabricate framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location.
5. Bolted connections: All bolted connections shall be tested and inspected as indicated on EME Structural Drawings.
6. Welded connections: In addition to visual inspection, factory-welded connections shall be tested and inspected according to acceptable inspection procedures, as indicated on EME Structural Drawings.
7. Factory fabricate framing components to indicated size and section, with anchor plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
8. Make factory connections by welding or by using high-strength bolts as indicated on EME Structural Drawings.
9. Tack weld or bolt clips to frames for attaching EME secondary framing and LED Panels connectors.
10. Mill joints to a tight, hairline fit. Cope or miter corner joints.
11. Finish exposed surfaces to smooth, sharp, well-defined lines.
12. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness
13. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and finishing.
14. Prevent weld show-through on exposed steel surfaces.
15. Grind butt welds flush.
16. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.
17. Reinforce Sections to resist handling, transportation, and erection stresses.
18. Painted Structures will be shop primed, shop finished, powder-coated, unless otherwise indicated.
19. Field weld must be limited.

2.5 F-1 – MOMENT VAULT

A. Technical Requirements - EXTERIOR

CATEGORY	SPECIFICATION
1. Feature Display Dimensions	Refer to EME drawings.
2. LED product/Pixel Pitch Required (mm)	~~Revolution Displays RS3~~SACO M4-RGB-i, 4.16~~3.75~~mm pixel pitch. No substitutions
3. Diode manufacturer	Nichia or approved equivalent
4. Service Access	Front
5. Required Brightness (exterior displays)	2000 nits or more
6. Viewing Angle (degrees H / V)	160 /140
7. LED Type	3-in-1 SMD All Black
8. Max. power consumption (kW/sq.ft)	0.078~~6~~
9. Avg. power consumption (kW/sq.ft)	0.0018~~4~~ based on 20% APL + black-out power
10. Max. heat generation (KBTU/hr/sq.ft)	0.26~~405~~
11. Avg. heat generation (kBTU/hr/sq.ft)	0.006~~248~~ based on 20% APL + black-out power
12. Weight / tile (with integrated frame)	Maximum 11.5 lbs
13. Weight / tile with cables	Maximum 6.3 lbs / sq ft
14. Pixel dimensions	~~80~~ 72 x ~~160~~ 144 / tile
15. Pixel density	~~6606~~ 5353.95 pixels / sq ft
16. Tile dimensions (LxHxD)	11.~~81~~ 79 in x 23.6~~32~~ in x ~~2.983~~ in
17. Max. tile depth with cables	3" or less
18. Connection type, processor-display	~~50~~9/125µm ~~single~~ multi-mode (M~~S~~MF) OM3~~S2~~, LC-LC Duplex~~ST-ST terminated~~, UPC polish
19. Cooling	Passive
20. Contrast	5000:1 or better

CATEGORY	SPECIFICATION
21. AC power In	110W-240VAC (50/60Hz)
22. Power/Data daisy chain	14 panels max @208-240VAC; 31 panels max per data chain
23. Power/Data In/Loop	~~Revolution~~SACO MSeries ~~Display Hybrid~~
24. Processing	~~M8~~ SACO V-Stream Platform
25. Certifications	ETL or TUV~~, FCC, CE~~, RoHS
26. Minimum lifespan (hrs)	15~~0~~0,000
27. Operating Temperature	0°C to ~~40~~65°C
28. Image refresh rate	~~Variable/programmable;~~ 120~~9~~20-5400Hz adjustable~~minimum~~
29. IP Rating	IP34 (Parylene coating will be quoted separately)

B. Technical Requirements - INTERIOR

CATEGORY	SPECIFICATION
1. Feature Display Dimensions	Refer to EME drawings.
2. LED product/Pixel Pitch Required (mm)	~~Revolution Displays RS1.8~~SACO M2-RGB-i, 2.08~~1.87~~mm pixel pitch. No substitutions
3. Diode manufacturer	Nichia or approved equivalent
4. Service Access	Front
5. Required Brightness (interior displays)	1000 nits
6. Viewing Angle (degrees H / V)	160 /140
7. LED Type	3-in-1 SMD All Black
8. Max. power consumption (kW/sq.ft)	0.066
9. Avg. power consumption (kW/sq.ft)	0.00154 based on 20% APL + black-out power
10. Max. heat generation (KBTU/hr/sq.ft)	0.22~~05~~

CATEGORY	SPECIFICATION
11. Avg. heat generation (kBTU/hr/sq.ft)	0.005248 based on 20% APL + black-out power
12. Weight / tile (with integrated frame)	Maximum 11.5 lbs
13. Weight / tile with cables	Maximum 6.3 lbs / sq ft
14. Pixel dimensions	~~160~~ 144 x ~~320~~ 288 / tile
15. Pixel density	~~26426~~ 21515.82 pixels / sq ft
16. Tile dimensions (LxHxD)	11.7981 in x 23.632 in x ~~2.983~~ in
17. Max. tile depth with cables	3" or less
18. Connection type, processor-display	509/125µm ~~Single~~ Multi-mode (MSMF) OM3~~S2~~, LC-LC Duplex~~ST-ST terminated~~, UPC polish
19. Cooling	Passive
20. Contrast	5000:1 or better
21. AC power In	110W-240VAC (50/60Hz)
22. Power/Data daisy chain	12 panels max @208-240VAC; 7 panels max per data chain
23. Power/Data In/Loop	~~Revolution Display Hybrid~~SACO MSeries
24. Processing	~~M8~~ SACO V-Stream Platform
25. Certifications	ETL~~, FCC, CE,~~ or TUV, RoHS
26. Minimum lifespan (hrs)	150,000
27. Operating Temperature	0°C to ~~40~~65°C
28. Image refresh rate	~~Variable/programmable;~~ 19200-5400Hz adjustable ~~minimum~~
29. IP Rating	IP34 (Parylene coating will be quoted separately)

C. EME Media Feature Contractor Requirements

1. Any required fiber optic converters and/or distribution boxes to be securely and accessibly mounted behind displays by EME Media Feature Contractor. It is EME Media Feature Contractor's responsibility to bring cabling from the demarcation points to the converters/distribution boxes and from the converters/distribution boxes to displays.
2. EME Media Feature Contractor shall coordinate accommodation of specified cameras and sensors provided by EME Specialized AV Systems Integrator
3. EME Media Feature Contractor shall seamlessly marry video signals on this feature with no tearing, sync loss, or change in color, brightness, or shape of media being displayed.
4. LED tiles shall be front serviceable for maintenance.

5. EME Media Feature Contractor shall coordinate installation of speakers and subwoofers (provided by EME Specialized AV Systems Integrator) at lower exterior face of the interior water basins.

D. F-1 Moment Vault Materials and Finishes
1. Water-jet cut panels
   a. 1/4" custom-perforated, bent steel panels, powder-coated with Silver Metallic paint, Sherwin- Williams Powdura 3000 #PAM8-C000
   b. Color, pattern and finish to be approved by EME Designer.
2. LED panel trim
   a. 1/8” steel, powder-coated with Silver Metallic paint, Sherwin- Williams Powdura 3000 #PAM8-C000
3. Metal mesh
   a. Stainless steel fabric, “Omega 1516”
   b. Acceptable manufacturer GKD-USA, Inc.
4. Finish for all visible structural elements
   a. Silver metallic paint over catalyzed polyurethane (shop/field sprayed) to match color and texture from Powdura 3000 #PAM8-C000; Sherwin Williams.

2.6 F-2 WINDOWS ON ORLANDO

A. Technical Requirements

CATEGORY	SPECIFICATION
1. Feature Display Dimensions	Refer to EME drawings.
2. LED product/Pixel Pitch Required (mm)	~~Revolution~~ SACO M4-RGB-i~~Displays RS3~~, 4.16~~3.75~~mm pixel pitch. No substitutions
3. Diode manufacturer	Nichia or approved equivalent
4. Service Access	Front
5. Required Brightness (exterior displays)	2000 nits or more
6. Viewing Angle (degrees H / V)	160 /140
7. LED Type	3-in-1 SMD All Black
8. Max. power consumption (kW/sq.ft)	0.00~~6~~78
9. Avg. power consumption (kW/sq.ft)	~~0.0014~~0.0018 based on 20% APL + black-out power
10. Max. heat generation (KBTU/hr/sq.ft)	0.~~205~~264
11. Avg. heat generation (kBTU/hr/sq.ft)	~~0.0048~~ 0.0062 based on 20% APL + black-out power

CATEGORY	SPECIFICATION
12. Weight / tile (with integrated frame)	Maximum 11.5 lbs
13. Weight / tile with cables	Maximum 6.3 lbs / sq ft
14. Pixel dimensions	~~80~~ 72 x ~~160~~ 144 / tile
15. Pixel density	~~6606~~ 5353.95 pixels / sq ft
16. Tile dimensions (LxHxD)	~~11.81~~11.79 in x ~~23.62~~23.63 in x ~~2.98~~ 3 in
17. Max. tile depth with cables	3" or less
18. Connection type, processor-display	50~~9~~/125µm ~~Single~~ Multi-mode (M~~S~~MF) OM3~~S2~~, ~~ST-ST~~LC-LC Duplex ~~terminated~~, UPC polish
19. Cooling	See Mechanical Section above.
20. Contrast	5000:1 or better
21. AC power In	110W-240VAC (50/60Hz)
22. Power/Data daisy chain	14 panels max @208-240VAC; 31 panels max per data chain
23. Power/Data In/Loop	~~Revolution Display Hybrid~~SACO MSeries
24. Processing	~~M8~~ SACO V-Stream Platform
25. Certifications	ETL~~, FCC, CE,~~or TUV, RoHS
26. Minimum lifespan (hrs)	15~~0~~0,000
27. Operating Temperature	0°C to ~~40~~65°C
28. Image refresh rate	~~Variable/programmable; 1920Hz minimum~~1200-5400Hz adjustable
29. IP Rating	IP30

B. EME Media Feature Contractor Requirements
   1. Any required fiber optic converters and/or distribution boxes to be securely and accessibly mounted behind displays by EME Media Feature Contractor. It is EME Media Feature Contractor's responsibility to bring cabling from the

demarcation points to the converters/distribution boxes and from the converters/distribution boxes to displays.

2. EME Media Feature Contractor will seamlessly marry multiple video signals on this feature with no tearing, sync loss, or change in color, brightness, or shape of media being displayed.
3. LED tiles will be front serviceable for maintenance.
4. Structure / Steel Components: Refer to Appendix A and Appendix B

C. F-2 Windows on Orlando Finishes
   1. Panels
      a. Gradient diffusion film applied over mirrored surround (by Contractor)
         1) Coordinate film selection and application with Contractor and EME Designer.
      b. Acceptable Manufacturer: 3M

2.7 F-3 THE PORTAL

A. Technical Requirements

CATEGORY	SPECIFICATION
1. Feature Display Dimensions	Refer to table below. EME Media Feature Manufacturer is required to approximate these dimensions to the degree possible.
2. LED product/Pixel Pitch Required (mm)	SACO-M4-RGB-i, 4.00~~Revolution Displays RS3, 3.75~~mm pixel pitch. No substitutions
3. Diode manufacturer	Nichia or approved equivalent
4. Service Access	Front
5. Required Brightness (exterior displays)	2000 nits or more
6. Viewing Angle (degrees H / V)	160 /140
7. LED Type	3-in-1 SMD All Black
8. Max. power consumption (kW/sq.ft)	0.~~06~~078
9. Avg. power consumption (kW/sq.ft)	0.~~0014~~ 0018 based on 20% APL + black-out power
10. Max. heat generation (KBTU/hr/sq.ft)	0.~~205~~264
11. Avg. heat generation (kBTU/hr/sq.ft)	0.~~0048~~ 0062 based on 20% APL + black-out power
12. Weight / tile (with integrated frame)	Maximum 11.5 lbs

CATEGORY	SPECIFICATION
13. Weight / tile with cables	Maximum 6.3 lbs / sq ft
14. Pixel dimensions	~~80~~ 72 x ~~160~~ 144 / tile
15. Pixel density	~~6606~~ 5353.95 pixels / sq ft
16. Tile dimensions (LxHxD)	~~11.81~~11.79 in x ~~23.62~~23.63 in x ~~2.983~~ in
17. Max. tile depth with cables	3" or less
18. Connection type, processor-display	~~9~~50/125µm ~~single~~ multi mode (~~SMF~~MMF) ~~OS2~~OM3, ~~ST-ST~~LC-LC terminated, UPC polish
19. Cooling	Passive
20. Contrast	5000:1 or better
21. AC power In	110W-240VAC (50/60Hz)
22. Power/Data daisy chain	14 panels max @208-240VAC; 31 panels max per data chain
23. Power/Data In/Loop	SACO MSeries~~Revolution Display Hybrid~~
24. Processing	SACO V-Stream~~M8~~ Platform
25. Certifications	ETL, ~~FCC, CE~~, or TUV, RoHS
26. Minimum lifespan (hrs)	~~100~~150,000
27. Operating Temperature	0°C to ~~40~~65°C
28. Image refresh rate	~~Variable/programmable; 1920Hz minimum~~1200-5400Hz adjustable
29. IP Rating	IP30

B. The Portal Display Dimensions (all dimensions in feet)

LED EXTERIOR CONCAVE		
Type.	Width	Height
1E	14.76	13.78
2E	12.79	21.65
3E	12.79	15.75
4E	15.75	9.84
5E	14.76	15.75
6E		
7E	14.76	17.72
8E	10.83	21.65
9E	17.72	17.72
10E	16.73	19.68
11E		
12E	13.78	19.68
13E	17.72	9.84
14E		
15E	13.78	7.87
16E	15.75	13.78

LED INTERIOR CONVEX		
Type.	Width	Height
1I		
2I	11.81	21.65
3I	11.81	15.75
4I	13.78	9.84
5I	12.79	15.75
6I		
7I	13.78	17.72
8I	9.84	21.65
9I	15.75	17.72
10I	15.75	19.68
11I		
12I	12.79	19.68
13I	15.75	9.84
14I	14.76	9.84
15I		
16I	13.78	13.78

C. EME Media Feature Contractor Requirements
1. EME Media Feature Contractor to coordinate with EME Specialty Integrator to place light sensor for automatic brightness adjustments of displays.
2. Any required fiber optic converters and/or distribution boxes to be securely and accessibly mounted behind displays by EME Media Feature Contractor. It is EME Media Feature Contractor's responsibility to bring cabling from the demarcation points to the converters/distribution boxes and from the converters/distribution boxes to displays.
3. EME Media Feature Contractor will seamlessly marry video signals on this feature with no tearing, sync loss, or change in color, brightness, or shape of media being displayed.
4. LED tiles will be front serviceable for maintenance.

D. F-3 The Portal Finishes
1. Finish for all visible structural elements
   a. Silver metallic paint over catalyzed polyurethane (shop sprayed) to match color and texture from Powdura 3000 #PAM8-C000; Sherwin Williams.
2. Front covers for non-LED display surfaces
   a. Stainless steel, "6-OM," Finish: Satin, 1.9mm, Gauges: 0.075"/14g over 3/8" bent plywood. Refer to specification Section 09 78 00 for approved installation and mounting method. Manufacturer: Rimex Metals (USA) Inc, 2850 Woodbridge Avenue, Edison, NJ 08837, USA, +1-(732)549-3800.
3. LED Panel Trim
   a. 1/8" steel, powder coated with Silver Metallic paint, Powdura 3000 #PAM8-C000; Sherwin Williams.
4. Orlando Experience Booth finishes
   a. Frosted polycarbonate panels (Lexan), 1/2" thick. Polycarbonate panels shall be frameless and mounted using 1 3/8" brushed stainless steel

standoffs by CRL or approved equal. Standoffs to be placed in aligned geometric configuration
1) Panels to be trimmed in stainless steel at all edges, 1/4" wide gap to be maintained between the panels and the trim strip.
2) Polycarbonate panels on same plane to have 1/4" stainless steel trim strip divider.

b. Stainless steel mesh used as shown on Orlando Experience Booth drawings. Pattern to be 3/16" round on 7/16" staggered perforated stainless steel metal, satin finish. Acceptable manufacturers: McNichols, Forms + Surfaces, or approved equivalent. Perforated stainless steel panels to be inset into polished ½" stainless steel frames. Perforated panels up to 18" must be minimum 12-gauge.

c. Photo backdrop material must have solid backing such as formed plywood, or other approved material.

d. Toe kickplate must be heavy gauge stainless steel, with brushed finish, level #4, 360 grit, laminated over P.T. wood blocking.

e. Camera glass protection must be laminated safety glass with suitable optical properties, ½" min.

f. Trim must be coordinated. Stainless steel (#8 finish) to be used at all outside corners and as a transition between changes in materials. Stainless steel corner guards to be ¼" in width. Transition strips shall be ½" wide at changes in material other than where polycarbonate panel meets other polycarbonate panel on same plane.

2.8 F-4 WINDOWS ON ORLANDO SOUTH

A. Technical Requirements

CATEGORY	SPECIFICATION
1. Feature Display Dimensions	Refer to EME drawings.
2. LED product/Pixel Pitch Required (mm)	SACO M4-RGB-i, 4.16mm pixel pitch. No substitutions
3. Diode manufacturer	Nichia or approved equivalent
4. Service Access	Front
5. Required Brightness (exterior displays)	2000 nits or more
6. Viewing Angle (degrees H / V)	160 /140
7. LED Type	3-in-1 SMD All Black
8. Max. power consumption (kW/sq.ft)	0.078
9. Avg. power consumption (kW/sq.ft)	0.0018 based on 20% APL + black-out power
10. Max. heat generation (KBTU/hr/sq.ft)	0.264

CATEGORY	SPECIFICATION
11. Avg. heat generation (kBTU/hr/sq.ft)	0.0062 based on 20% APL + black-out power
12. Weight / tile (with integrated frame)	Maximum 11.5 lbs
13. Weight / tile with cables	Maximum 6.3 lbs / sq ft
14. Pixel dimensions	72 x 144 / tile
15. Pixel density	5353.95 pixels / sq ft
16. Tile dimensions (LxHxD)	11.79 in x 23.63 in x 3 in
17. Max. tile depth with cables	3" or less
18. Connection type, processor-display	50/125µm Multi-mode (MMF) OM3, LC-LC Duplex, UPC polish
19. Cooling	See Mechanical Section above.
20. Contrast	5000:1 or better
21. AC power In	110W-240VAC (50/60Hz)
22. Power/Data daisy chain	14 panels max @208-240VAC; 31 panels max per data chain
23. Power/Data In/Loop	SACO MSeries
24. Processing	SACO V-Stream Platform
25. Certifications	ETL or TUV, RoHS
26. Minimum lifespan (hrs)	150,000
27. Operating Temperature	0°C to 65°C
28. Image refresh rate	1200-5400Hz adjustable
29. IP Rating	IP30

B. EME Media Feature Contractor Requirements

1. Any required fiber optic converters and/or distribution boxes to be securely and accessibly mounted behind displays by EME Media Feature Contractor. It is EME Media Feature Contractor's responsibility to bring cabling from the

demarcation points to the converters/distribution boxes and from the converters/distribution boxes to displays.

2. EME Media Feature Contractor will seamlessly marry multiple video signals on this feature with no tearing, sync loss, or change in color, brightness, or shape of media being displayed.
3. LED tiles will be front serviceable for maintenance.
4. Structure / Steel Components: Refer to Appendix A and Appendix B

C. F-4 Windows on Orlando South Finishes
1. Panels
a. Gradient diffusion film applied over mirrored surround (by Contractor)
1) Coordinate film selection and application with Contractor and EME Designer.
b. Acceptable Manufacturer: 3M

2.9

~~2.8~~2.10 TENSION ROD SYSTEM

A. Provide complete tension rod system consisting of tension rod fork connectors, locking nuts, pins, isolation bushes, couplings and all other required components, including all necessary take-up couplers.

B. Intersecting couplers shall be used where applicable.

C. Rod system: (TriPyramid) A03 High Strength Stainless Steel Rod, with its associated accessories; inclusive of the following:
1. B210 Adjustable Jaw Assemblies for High Strength Headed Rod.
2. B205 Fixed Jaw Assemblies for High Strength Headed Rod.
3. B101-20 Threaded Nose for Headed Rod.
4. B200 Eye Assemblies for High Strength Headed Rod.

D. Other systems may be submitted, subject to review and acceptance:
1. Ronsten ARS2-S40 Stainless Steel Rod System (satin polished finish).
2. Ronsten ARS4-520 Carbon Steel Rod System (grit blast and prime painted for finish painting by others).
3. Pfifer Type 860 and 860X tension rod system (grit blast and prime painted for finish painting by others).

E. Provide signed and sealed drawing and calculations for rods and connectors. Alternatively, provide proof of load testing by a third-party testing agency to the following loads per 2014 FBC Section 1710.3.1. Measure and record deflection at 25%, 50%, 75%, and 100% of proof load. Maintain load at 100% level for specified amount of time specified in FBC. Measure and record deflection again prior to beginning unloading. Measure and record deflection at 75%, 50%, 25%, and 0% proof load levels during unloading. Acceptability to be determined as noted in reference FBC section. Provide final report to EME Structural Engineer of Record and to VER.
1. Vertical rod assembly proof load: 30 KIPS
2. Lateral rod assembly proof load: 20 KIPS

F. All Vertical Rods shall be painted to match The Portal color and paint material. All lateral rods shall be stainless steel.

PART 3 - EXECUTION

3.1 COORDINATION

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 EME Feature Contractor will examine areas and conditions under which components comprising the work and notify the Contractor, Architect and EME Team in writing, of those conditions which are, in the EME Media Feature Contractor's opinion, potentially detrimental to proper completion of the Work. The EME Media Feature Contractor shall not proceed with the Work until unsatisfactory conditions have been corrected.

C. Specific items of examination shall include, but shall not necessarily be limited to, the following:
   1. Structural connections to Primary Structure – Division 5 Structural Steel Specifications Series and Structural Drawings provided by others.
   2. Conditions of site.
   3. Power provisions as described on EME drawings and provided by others.
   4. Data provisions as described on EME drawings and provided by others.
   5. All points of interface with existing building systems and components including but not limited to: structural; electrical; mechanical; and architectural systems and components provided by others

D. The EME Media Features include hardware provided by the Authority and Authority Vendor in addition to items provided under this Contract. EME Media Feature 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.

E. Project Management.
   1. EME Media Feature Contractor shall provide comprehensive project management services for the coordination of its team members and coordination with the Authority, Authority Vendors, EME Specialized AV Systems Integrator and EME Fountain Contractor throughout the term of the project.
   2. Provide regular progress and problem resolution reporting.

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. Install components, including all hardware, software, connectors, etc., as required to comply with manufacturer's recommendations, applicable codes and reference standards, best practice, and final shop drawings.

C. Coordinate installation of supports with existing primary structural connections inclusive of bracing and supports. After installation, verify that supports, components, and housing/structures comprising the Work are installed properly.

D. Coordinate setting drawings, diagrams, templates, instructions, and directions for installing anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors that are shall be embedded in substrate construction. Coordinate delivery of such items to Project site. Fit exposed connections accurately together to form tight, hairline joints.

E. Perform cutting, drilling, and fitting required for installing the support structure. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free from support structure.

F. Do not weld, cut, or abrade surfaces of components that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.

G. Field Welding: Comply with the following requirements:
1. Field weld shall be limited to where indicated on the EME drawings and approved shop drawings.
2. Comply with all applicable codes, regulations and requirements of the Project.
3. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
4. Obtain fusion without undercut or overlap.
5. Remove welding flux immediately.
6. All points of interface with existing building systems and components including but not limited to structural, electrical, mechanical, data, and architectural systems and components.
7. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
8. Fully coordinate the means of attachment to the support structure.
9. Supports attachment to primary supports and structure in place.
10. Protect adjacent surfaces at all times.

H. CMAR responsible for welding and drilling of all connection points to base building steel for the Portal feature at the four column attachments, in addition to providing two base plates with associated anchor bolts for the Moment Vault west feature.

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. 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. Inspections and testing requirements.
   1. Submit field-testing protocol for review of Owner, Contractor, EME Team and Engineer of Record, listing each test in order. Where operating tests are required, test the work as it progresses.
   2. Preliminary tests shall be satisfied before applying to the EME Team for official tests.
   3. Tests shall be in the manner specified for the different branches of the work. Each test shall be made on the entire system for which such test is required, wherever practical. In case it is necessary to test portions of the work independently do so without extra compensation. The tests will be conducted in the presence of the EME Team unless otherwise notified. Should defects appear, such defects will be corrected and the test repeated until the installation is acceptable to the Architect/EME Team. Work shall not be covered or enclosed before it has been tested and approved.
   4. Performance Verification Testing as described in Specification Section 27 05 00 to include:
      a. Performance Verification Testing of each EME Media Feature following installation and commissioning.
      b. Performance Verification Testing of the entire EME system, including EME Media Features, EME CDS (by others) and EME Multimedia Content (by others) following installation and commissioning of all EME Media Features, EME CDS (by others) and EME Multimedia Content (by others).

C. During installation, commissioning and testing of EME CDS (by others) and EME Multimedia Content (by others), ensure correct operation of EME Media Features and correct any deficiencies.

D. Institute protective measures and other precautions required to ensure that EME will be without damage or deterioration at time of Substantial Completion.

E. Adjacent surfaces shall be left in a clean condition.

3.13 TRAINING

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

3.14 PROJECT CLOSEOUT REQUIREMENTS

A. In addition to all final close requirements as specified by Division 01, Specification Section 270500, the Contractor shall comply with all requirements of this Section.

B. Refer to and coordinate with final closeout procedures for the Orlando International Airport Terminal C Phase 2 for the following:

1. Photographic documentation for submitting final completion construction photographic documentation.
2. Execution for progress cleaning of Project site.
3. EME Contract closeout procedures for administrative and procedural requirements.
4. Operation and maintenance data for operation and maintenance manual requirements.
5. Project Record Documents for submitting EME Contract Documents including Project Drawings, Project Specifications, included final submittals.
6. Demonstration and training for requirements for instructing Owner personnel.

END OF SECTION 27 42 23

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SECTION 27 42 24 –
EXPERIENTIAL MEDIA ENVIRONMENT (EME) AV SPECIALTY SYSTEMS

PART 1 - GENERAL

1.1 STIPULATIONS

A. Contract Documents including Drawings, Specifications, and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections and stipulated Specification Sections shall apply to this Section.

B. Related Specification Sections:
1. 13 12 00 – EME Fountains
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
~~26 05 43 – Underground Ducts & Raceways For Electrical Systems~~
9. 26 05 53 – Identification for Electrical Systems
10. 27 05 00 – Common Work Elements for Communications
11. 27 10 00 – Premise Distribution Systems
12. 27 10 05 – Passive Optical Network
13. 27 10 10 – Voice Over IP Telephone System
14. 27 42 23 – EME Media Features
15. 27 51 13 – Emergency Communication System
16. 28 23 00 – Video Surveillance System
17. 28 31 00 – Addressable Fire Detection and Alarm

C. Reference Symbols:
1. Refer to Specification Section 27 05 00 for applicable reference symbols.

D. Abbreviations:
1. Refer to Specification Sections 27 05 00, 27 42 23 and 13 12 00 for applicable abbreviations in addition to the following.
a. EME Experiential Media Environment
b. CDS Content Delivery System
c. CMS Content Management System
d. EER EME Equipment Room
e. SAN Storage Area Network
f. FAT Factory Acceptance Test

E. Definitions: Refer to Specification Sections 27 05 00, 27 42 23 and 13 12 00 in addition to the following.
1. CDS: The Content Delivery System, including video playback servers, generative content servers, video routing equipment, video processing, audio processing, signal distribution, control system, user interface, file storage, and

other equipment for the purpose of delivering media content to the LED features.

2. CDS Designer: Smart Monkeys Inc.
3. EME: The Experiential Media Environment, comprising three architecturally integrated Media Features (The Portal, Moment Vault, Windows on Orlando), a dedicated Content Management System (CMS), a Content Delivery System (CDS), including related equipment and work defined herein.
4. EME Media Feature Contractor: ~~VER~~SACO, the LED manufacturer contracted to deliver fully functional EME Media Features.
5. EME Specialized AV Systems Integrator (Specialty Integrator): The contractor performing EME Audio, Video, IT, and all related equipment installation for the CDS and EME system.
6. EME Team: The EME design team, consisting of Burns, MRA International Group, Sardi Design, and Smart Monkeys Inc.
7. CMAR: Usage of this term in all EME-related specifications and drawings refers to the full scope of the General Contractor (Construction Manager at Risk) for the Project and shall be considered to include all primary building contractors (electrical, mechanical, plumbing, structural, etc.) working under the General Contractor.

1.2 SUMMARY

A. Refer to Specification Sections 27 05 00, 27 42 23 and 13 12 00 in addition to the following.

B. The Work defined in this Specification Section includes all material, systems, components, and installation requirements of the CDS which are integral to the South Terminal Complex (STC) Experiential Media Environment (EME) Content Delivery System (CDS) and the related work required for a complete and working installation, in compliance with all codes and regulations of authorities having jurisdiction (AHJ). The EME Specialized AV Systems Integrator is responsible for obtaining all approvals and permits required by AHJ. The EME CDS shall be engineered to meet the design intent of the CDS Design Development Contract Documents.

C. The CDS shall include all system components as required to meet all functional, operational, performance, and redundancy requirements necessary to deliver a fully integrated and operational system in accordance with the contract documents and the CDS Design Development Contract Documents.

D. The Work also includes requirements for submittals, quality assurance, product handling, record documents, project conditions, installation, system performance, demonstrations, testing, and certifications for work related to the CDS. Refer to additional requirements specified under related trades including the provisions of Section 27 05 00.

E. Specialty Integrator shall possess applicable experience and qualifications which show competency in engineering and installing large, extensive, complex video processing and delivery systems, and shall have proven successful performance of installations of similarly-sized past projects.

F. Specialty Integrator shall be responsible for the work in its entirety and shall not subcontract work to other parties.

G. Project Management
   1. Specialty Integrator shall provide comprehensive project management services for the coordination of its team members during the term of the project.
   2. Specialty Integrator shall submit a project schedule adhering to the contracted delivery schedule, that defines the completion milestones, reviews, approvals, and related items.

H. Specialty Integrator is responsible for providing Quality Assurance to ensure that the installed system meets or exceeds every standard set forth in these specifications and the CDS Design Development Contract Documents.

I. Specialty Integrator shall be responsible for meeting the design intent through engineering, shop drawings, mock-ups, fabrication, installation and commissioning of all elements comprising the CDS as described herein and in related Contract Documents. It is the responsibility of the Specialty Integrator to insure that the installed system meets or exceeds the performance, specification, feature set, and functionality set forth in the design.

J. The CDS and related work described in this section is integral to the related work described in Section 27 42 23 Experiential Media Environment – Media Features. Specialty Contractor shall coordinate work across all disciplines to provide seamless and complete integration into the EME work as described in the Contract Documents.

1.3 SCOPE OF WORK

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

B. Refer to drawing sheet T0.00.01 for the work responsibility matrix for the scope of work required for the CDS integration.

C. Where listed on the responsibility matrix and described herein, the following line components shall be provided by the EME Specialized AV Systems Integrator as described in this specification section unless otherwise noted and be defined as:
   1. Headend and Software: Specialty Integrator shall furnish and install the CDS equipment, software, licenses, cabinet cabling, converters, and components as required by the CDS Design Development Contract Documents except for any equipment specifically noted as furnished by the Authority. In such case, Authority-furnished equipment included in the CDS design shall be installed and integrated by Specialty Integrator.
   2. Equipment Cabinets: CMAR shall coordinate and furnish equipment cabinets to Specialty Integrator for off-site CDS fabrication and execution of FAT. Refer to CDS Design Development Contract Documents for requirements. Specialty Integrator to coordinate and install cabinets on site in accordance with the CMAR.
   3. Interfaces: Specialty Integrator shall provide and install all system interfaces including, but not limited to, hardware, software, wiring, interface devices, as required to communicate with other systems, including, but not limited to,

GOAA Local Area Network (LAN), Emergency Systems, Fire Alarm Systems, Public Paging, and Lighting System.

4. Network: The CDS network shall be provided as part of the GOAA Local Area Network, and shall not be part of Specialty Integrator equipment provision or installation.
   a. Specialty Integrator shall coordinate with the Authority and CDS Designer for all network requirements for data and communications on the GOAA LAN prior to construction.
5. Horizontal Cable: Specialty Integrator shall furnish and install all low voltage cabling and pathways to AV field devices such as cameras and sensors for interactive elements, speakers, light sensors, and other wired field devices. Specialty Integrator shall furnish and install all low voltage cable and wiring within the EME Equipment Room and applicable cable and wiring in the Video Control Room.
6. Field Devices: Specialty Integrator shall furnish and install all CDS field devices including, but not limited to, sensors, cameras, fiber converters, speakers, transducers, patch cables, mounting brackets, power supplies as required.
7. CCTV: CMAR shall furnish, configure and commission CCTV cameras, designated viewing workstations and software for the purposes of monitoring the EME features. Camera positions and viewpoints shall be reviewed and approved by EME Team. Specialty Integrator shall provide necessary brackets, fasteners, and mounting adapters and securely install the cameras (furnished by CMAR) and all cabling to The Portal feature only, as these specific cameras are located on The Portal structure itself. Cameras for the Moment Vault and Windows on Orlando, and all other CCTV equipment shall be installed by CMAR's CCTV Contractor.
8. Video Servers: Authority-furnished video servers included in the CDS design shall be installed and integrated by Specialty Integrator.

1.4 REFERENCES

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

B. If conflicts exist between referenced requirements, Specialty Integrator shall bring those to the immediate attention of the EME Media Feature Contractor, CDS Designer and EME Team prior to work. Where conflicts exist, comply with requirements in the following order: 1) Requirements contained within this section, 2) Specifications Section 27 05 00 and 3) Contract Documents.
   1. Where the Contract Documents mandate a greater requirement or performance than those specified by the referenced codes and standards, the greater requirement shall be the governing design application.

C. The EME CDS Construction Documents include this Specification Section and the EME Drawings in addition to the following attachments.
   1. SN160-X201-AVC-DD-V~~1.3~~3.1: Design Development Drawing Package
   2. SN160-X204-AVC-DD-V~~1.3~~3.1: CDS Equipment List / ROM
   3. SN160-X205-AVC-DD-V~~1.3~~3.1: CDS Design Development Narrative
   4. SN160-X206-AVC-DD-V~~1.3~~3.1: CDS Network Schedule
   5. SN160-X209-AVC-DD-V~~1.3~~3.1: CDS Equipment Data Sheets

6. Q-LAN Notes v5.1: Q-LAN Network Requirements

D. Industry Practice standards are minimum installation requirements for this system.

1.5 SYSTEM DESCRIPTION

A. The Experiential Media Environment (EME) Content Delivery System (CDS) is the media sourcing, processing, routing, distribution, delivery and control system for the EME features.

B. Coordination
1. Refer to requirements of Section 27 05 00 Common Work Elements for Communications Systems in addition to the requirements included herein.
2. Coordinate with CDS Designer for the Design Refresh work. During Design Refresh, CDS Designer will verify that specified equipment continues to represent best value and optimal functionality, and will present alternatives where appropriate. Incorporate any changes or updates to the design prior to preparing engineered shop drawings. CDS Designer will issue revisions to the EME CDS Construction Documents where applicable.
3. Coordinate location of power and data requirements and installation of speakers, monitoring equipment, cameras, interactive sensors and ambient light sensors with EME Media Feature Contractor and EME Fountain Contractor.
4. Coordinate with Contractor, EME Media Feature Contractor, EME Fountain Contractor and EME Team for the positioning, installation, and commissioning of multimedia technologies within the EME Media Features; which work includes but is not limited to cameras, sensors, speakers, and ancillary components.
5. Coordinate with EME Media Feature Contractor, EME Fountain Contractor and EME Team for EME Media Feature mock-ups. Provide cameras, sensors and speakers to EME Media Feature Contractor for mock-ups. Refer to Specification Section 27 42 23 for details of mock-ups.
6. Coordinate with EME Media Feature Contractor for interface between the EME Media Features and the systems architecture design to support seamless content delivery to the features.
7. Coordinate with EME Media Feature Contractor and EME Team for playback specifications, video processing parameters and LED processor configuration.
8. Coordinate with EME Media Feature Contractor and Authority for rack-mounting and cabling of LED processors (furnished by Authority) in STC Equipment Rooms.
9. Coordinate with Contractor, EME Media Feature Contractor, and EME Team for the positioning, installation and commissioning of The Portal interactive booths.
10. Coordinate with CMAR for provision and delivery of CDS equipment cabinets to be provided for off-site rack fabrication and FAT testing.
11. Coordinate with Authority for provision and delivery of Video Servers (furnished by Authority) to be provided for off-site rack fabrication and FAT testing.
12. Coordinate with CDS Designer for CDS Pre-Programming work to be carried out by CDS Designer during FAT testing.

13. Coordinate with CDS Designer for final CDS on-site programming work to be carried out by CDS Designer prior to Performance Verification Testing of the entire EME system.
14. Coordinate schedule for startup of systems with EME Media Feature Contractor, EME Fountain Contractor and EME Content Provider to ensure proper sequencing.
15. Coordinate with CDS Designer, EME Team and EME Media Feature Contractor for Performance Verification Testing.
16. Coordinate final documentation with CDS Designer, EME Media Feature Contractor and EME Team to ensure consistency and coherence.

C. The CDS shall consist of all equipment required for a fully functioning system based on the CDS Design Development package, including, but not limited to, the devices, equipment, software, and other items specifically identified in the CDS Design documents. Refer to the CDS Design Development Contract Documents for further details.

D. The CDS has been designed with attention to performance specifications, compatibility of equipment, available technology, and budgetary considerations. Specialty Integrator shall not replace, substitute, alter, or eliminate any devices specified in the design without review and approval of CDS Designer and the Authority.

E. Specialty Integrator shall install CDS equipment cabinets (provided by CMAR) in the EME Equipment Room and field equipment rooms, including the cabinets designated as spare or for future use.

F. Confidence monitoring of EME features shall be performed using facility CCTV system provided by CCTV contractor. CCTV devices reflected in the CDS Design Development package are for reference purposes. Specialty Integrator shall coordinate with the CCTV Contractor for required field of views, workstation locations, and similar for EME confidence monitoring.

G. Specialty Integrator shall install relevant CDS equipment in the Video Streaming Room, coordinating installation and equipment placement with Contractor. Specialty Integrator shall provide all mounts required for functional positioning of CDS equipment on Contractor-provided furniture and/or facility surfaces. Specialty Integrator shall provide all cabling and cable management required for connection to facility infrastructure.

1.6 SUBMITTALS

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

B. Qualifications. Submit qualifications including but not limited to:
1. Three to five examples of projects, which are equal or greater in scale and complexity. For each, include contact information for a person of responsible charge who can confirm the systems integration requirements and performance of the work.
2. Demonstrated experience with at least three major public works projects and public contracts

3. Submit evidence of technical experience and capabilities in the following areas:
   a. Large scale public assembly, entertainment complex and public environments media features utilizing LED multimedia systems
   b. Integration and configuration of video wall technology and LED manufacturer's processors
   c. Frame accurate, synchronized, multi-channel display systems
   d. Control system integration including media playback systems, show control, and other custom applications
   e. Capability to provide construction level designs of complex system integration environments including:
      1) Complete equipment specifications; design criteria for power and heat loads, mounting details, and signal distribution
      2) Coordination with engineers of record for design of building system interfaces
      3) Coordination with Owner and Owner's Contractor for bid and procurement of equipment
      4) Integration, testing, and commissioning of systems of similar complexity
4. A technical resume of experience for the Project Manager and On-Site Installation Foreman who will be assigned to this project

C. Shop Drawings.
1. The work shown in the Contract Drawings is diagrammatic in nature and the Specialty Integrator is responsible for establishing final equipment arrangements and locations. This includes racks, consoles, equipment mounts, and appurtenances required for existing and new equipment, installed, moved, or relocated.
2. Shop Drawings shall show spacing to accommodate other related trades or systems as well as locations and arrangement of CDS devices and components, including equipment enclosure elevations.
3. Shop Drawings shall show all fabrication and mounting details required for attachments, including materials, dimensions, attachment methods, and power and data provisions.
4. Provide complete network requirements for data and communication including port counts, port assignments, device list, IP address requirements, VLAN configurations, QoS and other management requirements.
5. Drawings to be prepared by Specialty Integrator include, but are not limited to:
   a. Fabrication drawings.
   b. Block diagrams for equipment and systems.
   c. Complete signal flow line drawings detailing all signal paths, equipment connections, cabling, and terminations.
   d. Wiring diagrams for equipment and systems.
   e. Equipment and cabling labeling list.

D. Equipment Submittals
1. The complete product submittal including all parts, equipment, materials, and related accessories described in the Section shall be submitted in the same package as the shop drawings.

E. All engineering documents and Shop Drawings shall be reviewed and approved by the EME Team and CDS Designer prior to procurement and fabrication.

F. Commissioning Plan. Coordinate commissioning schedule with EME Media Feature Contractor and EME Fountain Contractor. Prior to the start of commissioning, schedule shall be submitted to EME Team and CDS Designer for review and approval.

G. Integration Plan. Coordinate integration schedule and plan with EME Media Feature Contractor, EME Fountain Contractor and EME Content Provider. Prior to the start of integration, schedule shall be submitted to EME Team and CDS Designer for review and approval.

H. Testing Plan. Coordinate testing schedule and plan with EME Media Feature Contractor and EME Fountain Contractor. Prior to testing taking place, schedule shall be submitted to EME Team and CDS Designer for review and approval

1.7 QUALITY ASSURANCE

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

B. The CDS Design Development Contract Documents reflect design intent of a working system. The Specialty Integrator shall reflect final engineering in shop drawings indicating construction and fabrication details, signal diagrams indicating cable types and protocols, as well as coordination with Engineers of Record.

C. Qualified Personnel
1. Specialty Integrator shall demonstrate record of financial stability and business operation for 10 years and ability to meet the insurance and bonding requirements
2. Specialty Integrator shall possess a minimum of 7 years of experience.
3. Specialty Integrator shall possess experience performing project management and coordination duties on new construction projects with a multidisciplinary team.
4. Specialty Integrator shall be proficient in and have experience delivering extensive electronic project documentation including as-built drawings, standard operating procedures, troubleshooting strategies, training materials, and operation and technical equipment manuals.
5. Specialty Integrator shall be capable of providing warranty and support services including ability to respond within 12 hours to phone or email support requests, maintain an office or technician support service center within 100 miles of project site, and provide preventive maintenance services at appropriate and regularly scheduled intervals.

1.8 DELIVERY, STORAGE AND HANDLING

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

1.9 RECORD DOCUMENTS

A. In addition to the following requirements, refer to Specification Section 27 05 00 for requirements.

B. As-Built Documentation

1. Provide the Authority with detailed As-Built documentation defining the CDS and related information.
2. As-Built documentation shall include finalized equipment locations, line drawings, 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. The level of detail defined in these As-Built documents shall be suitable to allow any appropriately skilled third party to support the CDS maintenance requirements as well as support future integration and expansion of the CDS.
4. Acceptance of As-Built documentation shall be part of final system acceptance process and may be subject to a cost retainage.

1.10 OPERATION AND MAINTENANCE

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

B. O & M Manuals shall be provided in accordance with the requirements described in Specification Section ~~29~~ 27 10 00 Premise Distribution Systems, Paragraph 1.10, OPERATION AND MAINTENANCE. .

1.11 SOFTWARE AGREEMENT

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

1.12 SPARE MATERIAL

A. In addition to the requirements in this section, refer to Specification Section 27 05 00 for requirements.

B. All extra material to be appropriately labeled, packaged, and documented in compliance with Owner requirements.

1.13 ENVIRONMENTAL CONDITIONS

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

1.14 SYSTEMS WARRANTY

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 in addition to the following requirements.

B. The CDS has been designed with attention to unique performance specifications, compatibility of equipment, available technology, and budgetary considerations. Specialty Integrator shall not replace, substitute, alter, or eliminate any devices specified in the design without review and approval of CDS Designer and EME Team.

2.2 SYSTEM REQUIREMENTS

A. Refer to above section 1.4, References for detailed requirements.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate with EME Team, EME Media Feature Contractor and EME Fountain Contractor for project schedule.

B. In addition to all requirements in the Specification Section 27 05 00 and all related specification sections, Specialty Integrator shall also conform to all requirements in this section.

C. Specialty Integrator will examine areas and conditions of components comprising the work and notify the EME Media Feature Contractor, in writing, of those conditions which are, in the Specialty Integrator's opinion, potentially detrimental to proper completion of the Work. Specialty Integrator shall not proceed with the Work until unsatisfactory conditions have been corrected.

D. The EME CDS includes hardware provided by the Authority and Authority Vendor in addition to items provided under this Contract. Specialty Integrator 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 EME CDS shall require extensive software programming and configuration by the CDS Designer. Specialty Integrator shall coordinate with the CDS Designer to provide sufficient time for such programming to be completed prior to project completion in accordance with the Project Schedule.

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 in addition to the following requirements.

1. The Specialty Integrator shall supply all software and hardware necessary for the system to function and perform as specified.

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. 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 listed below.

B. Inspections and testing requirements.
   1. Submit field-testing protocol for review by the Authority, Contractor, EME Team and Engineer of Record, listing each test in order. Where operating tests are required, test the work as it progresses.
   2. Preliminary tests shall be satisfied before applying to the Authority, EME Team and EME Designer for official tests.
   3. Tests shall be in the manner specified for the different branches of the work. Each test shall be made on the entire system for which such test is required, wherever practical. In case it is necessary to test portions of the work independently do so without extra compensation. The tests will be conducted in the presence of the CDS Designer unless otherwise notified. Should defects appear, such defects will be corrected and the test repeated until the installation is acceptable to the Engineer/CDS Designer. Work shall not be covered or enclosed before it has been tested and approved.
   4. Factory Acceptance Testing as described in Specification Section 27 05 00 to include:
      a. Testing to be carried out in the Orlando region. Location to be coordinated with EME Media Feature Contractor.
      b. CDS Factory Acceptance Testing to be coordinated with CDS Designer.
      c. Coordinate CDS Designer Pre-Programming work with Specialty Integrator preparatory work for Factory Acceptance Testing.
   5. Performance Verification Testing as described in Specification Section 27 05 00 to include:
      a. Performance Verification Testing of the EME CDS.
      b. Performance Verification Testing of the entire EME system, including EME Media Features (by others), EME and EME Multimedia Content (by others) following installation and commissioning of all EME Media Features (by others), EME CDS, and EME Multimedia Content (by others).

C. During commissioning and testing of EME Media Features (by others) and EME Multimedia Content (by others), ensure correct operation of EME CDS and correct any deficiencies.

D. Institute protective measures and other precautions required to ensure that EME CDS will be without damage or deterioration at time of Substantial Completion.

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.

3.15 ATTACHMENTS

A. SN160-X201-AVC-DD-V~~1.3~~3.1: CDS Design Development Drawing Package
B. SN160-X204-AVC-DD-V~~1.3~~3.1: CDS Equipment List / ROM
C. SN160-X205-AVC-DD-V~~1.3~~3.1: CDS Design Development Narrative
D. SN160-X206-AVC-DD-V~~1.3~~3.1: CDS Network Schedule
E. SN160-X209-AVC-DD-V~~1.3~~3.1: CDS Equipment Data Sheets
F. Q-LAN Notes v5.1: Q-LAN Network Requirements

END OF SECTION 27 42 24

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 APM / 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 in the APM / ITF 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.

~~I.~~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. (10) of each style Mic stations
6. Ceiling Speakers
   a. (25) Type 00
   b. (25) Type 01
   c. (10) Type 02
7. Wall Speakers
   a. (25) Type 01
   b. (5) Type 05
   c. (5) 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 50 additional audible notification 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 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.

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. Provide with Globalcom ACS software

B. Provide GCK – Advanced notification software

C. 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.
~~1.~~2. Contractor shall provide additional ACS's with backup as required to support total device counts per manufacture recommendation.
~~2.~~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.
~~3.~~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.
~~4.~~5. The ACS shall include internal support for (8) logic inputs, (8) relay outputs, and (2) balanced audio inputs.
~~5.~~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.
~~6.~~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.
~~7.~~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.

~~8.~~9. The ACS shall support CobraNet® and Dante™ Audio-over-Ethernet protocols with VoIP, RTP, and RTCP.

~~9.~~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.

~~10.~~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.

~~11.~~12. The ACS shall fit into 1 RU of 19" rack space and weigh 3.0 kg.

~~12.~~13. The ACS shall be safety listed to UL Standard 60950.

~~13.~~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.

~~14.~~15. Basis of Design: IED Globalcom.IP Model - IP116

2.6 INPUT/OUTPUT MODULES

~~A. Multifunction Interface~~

~~1. Provided where shown on plans~~
~~2. Interface shall have the connections for up to 16 Ambient Sensors, 8 Relay outputs, and 8 Digital I/O Points.~~
~~3. Interface shall be provided with 48v power supply~~
~~4. Communication shall be via RJ-45 LAN connection.~~
~~5. Shall be 1RU in size and be rack mounted.~~
~~6. Basis of Design: IED T9040NLR~~

~~B. Ambient Sensor Collector~~

~~1. Provided where shown on plans~~
~~2. Interface shall have the connections for up to 32 Ambient Sensors.~~
~~3. Interface shall be provided with 48v power supply~~
~~4. Communication shall be via RJ-45 LAN connection.~~
~~5. Shall be 1RU in size and be rack mounted.~~

A. ~~Basis of Design: IED T9032NS~~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 ~~Dante™~~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
5. ~~3.6 inch (diagonal) backlit color LCD display for a simple and flexible user interface. The color LCD display is configured using the system software to provide an intuitive human/machine interface (HMI) for making operation-specific announcements using prompts, general purpose announcements, or emergency announcements. The LCD utilizes menus consisting of function buttons, navigation buttons, pop-up windows, and programmable soft keys. The menu-driven soft keys make the system easier to use when initiating announcements or messages, especially when used in conjunction with optional automated announcement system software that prompts the operator to input variables used to create the announcement.~~
6. ~~A full 12 button keypad shall provide for user shortcuts.~~
7. The Digital Communication Station uses a single Ethernet interface for audio and control data. The ~~528~~ station is fully compatible with IEEE 802.3af standard for Power Over Ethernet (PoE), allowing the ~~528~~ 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 ~~2-way style telephone headset~~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. ~~12 Button~~LCD Touch Screen Paging Station: IED ~~IEDA528~~ 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: PARKING GARAGE EXPANSION

A. The following speaker specifications are for equipment installed in the Parking Garage Expansion.

B. Speaker Type 1

1. The speaker assembly shall consist of a 4" magnet speaker complete with a 70.7V/100V internal transformer.
2. The speaker shall be an 4", 8-ohm, cone type with the following specifications:
3. Frequency response shall be 75 to 20,000 Hz.
4. Axial sensitivity shall be 88 dB average at 1m with 1 watt input.
5. Normal wattage rating shall be 25 watts RMS.
6. The speaker shall be equipped with a universal line matching transformer for a 70V output line with taps at 1, 2, 4, 8, & 16 watts.
7. Manufacturer: Atlas Sound FAP42T or approved substitution.

C. Speaker Type 2

1. The speaker assembly shall consist of a 6" magnet speaker complete with a 70.7V/100V internal transformer.
2. The speaker shall be a 4", 8-ohm, cone type with the following specifications:
3. Frequency response shall be 63 to 20,000 Hz.
4. Axial sensitivity shall be 88 dB average at 1m with 1 watt input.
5. Normal wattage rating shall be 50 watts RMS.
6. 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.
7. Manufacturer: Atlas Sound FAP62T or approved substitution.

D. Speaker Type 3

1. The speaker assembly shall consist of a 8" coaxial speaker complete with a 70.7V/100V internal transformer.
2. The speaker shall be an 8", 8-ohm, cone type with the following specifications:
3. Frequency response shall be 68 to 15,000 Hz.
4. Axial sensitivity shall be 92 dB average at 1m with 1 watt input.
5. Normal wattage rating shall be 150 watts RMS.
6. The speaker shall be equipped with a universal line matching transformer for a 70V output line with taps at 7.5, 15, 30, & 60 watts.
7. Manufacturer: Atlas Sound 8CXT60 w/ Q408 enclosure or approved substitution.

E. Speaker Type 4

1. The pendant speaker assembly shall consist of a 8" two-way, high-power, open ceiling, ported 120-watt transformer for 25/70.7/100-volt or voice coil direct.
2. The speaker shall be an 8", 8-ohm, cone type with the following specifications:
3. Frequency response shall be 93 to 22,000 Hz.
4. Axial sensitivity shall be 94 dB average at 1m with 1 watt input.
5. Normal wattage rating shall be 125 watts RMS.
6. The speaker shall be equipped with a universal line matching transformer for a 70V output line with taps at 15, 30, 60, & 120 watts.
7. Manufacturer: Soundtube HP890i or approved substitution.

F. Speaker Type 5

1. The wall mount speaker shall consist of a 5 ¼” two-way loudspeaker, weather resistant.
2. The speaker shall be a 5 ¼”", 8-ohm, cone type with the following specifications:
3. Frequency response shall be 85 to 20,000 Hz.
4. Axial sensitivity shall be 90 dB average at 1m with 1 watt input.
5. Normal wattage rating shall be 100 watts RMS.
6. The speaker shall be equipped with a universal line matching transformer for a 70V output line with taps at 094, 1.9, 3.7, 7.5, 15, & 30 watts.
7. Manufacturer: Atlas Sound SM52t or approved substitution.

G. Speaker Type 6

1. The pendant speaker assembly shall consist of a 12" two-way, high-power, open ceiling, ported 150-watt transformer for 25/70.7/100-volt or voice coil direct.
2. The speaker shall be a 12", 8-ohm, cone type with the following specifications:
3. Frequency response shall be 118 to 16,000 Hz.
4. Axial sensitivity shall be 97 dB average at 1m with 1 watt input.
5. Normal wattage rating shall be 150 watts RMS.
6. The speaker shall be equipped with a universal line matching transformer for a 70V output line with taps at 19, 38, 75, & 150 watts.
7. Manufacturer: Soundtube HP129a or approved substitution.

2.11 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.
1) Basis of Design: Atlas Sound FAP8CXT or approved substitution

3. Ceiling Speaker (Type 2)
a. Systems Shall included 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 a internal transformer with primary voltage of 70.7V with a frequency response range of 33Hz to 21kHz (±2dB) 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 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 (± 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. Mounting: Speaker shall be semi recessed mounted with the Semi-flush adapter plate mounted behind VT Series to cover any recessed 4" SQ x
j. 1 1⁄2" D (102mm x 38mm) outlet box. CRS wall plate is stamped and painted.
k. Color: Shall be Grey
~~1) When mounted in non-public areas color shall be RED.~~
~~2) When Mounted in Public areas 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 foir 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 (±3dB); 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 ~~RED~~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

2.12 HIGH POWERED SPEAKER ARRAY (HPSA)

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
6. lock / accessory power.
7. Enclosure shall be as recommended by manufacturer.
8. Basis of Design: Altronix ACM4CB

2.13 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)

2.122.14 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 programing 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 radium 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 Contactor 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 Specification Sections:

1. 26 05 ~~01~~ 00 – ~~Basic Electrical Requirements~~Common Work Results for Electrical
2. 26 05 19 – ~~Low-Voltage Electrical Power Conductors and Cables~~Building Wire and Cable
3. 26 05 26 – Grounding and Bonding ~~for Electrical Systems~~
4. 26 05 29 – Hangers and Supports ~~for Electrical Systems~~
5. 26 05 33 – Conduit ~~for Electrical Systems~~
~~6. 26 05 33.16 – Boxes for Electrical Systems~~
6. 26 05 34 – Outlet Boxes ~~for Electrical Systems~~
7. 26 05 35 – Pull and Junction Boxes
~~8. 26 05 38 – Floor Boxes~~
~~9.~~8. 26 05 53 – Identification for Electrical Systems
~~10.~~9. 27 05 00 – Common Work Elements for Communications
~~11.~~10. 27 10 00– Premise Distribution Systems
~~12.~~11. 27 10 05 – Passive Optical Network
~~13.~~12. 27 10 10 – Voice Over IP Telephone System
~~14.~~13. 27 10 15 – Wireless Local Area Network System
~~15.~~14. 27 10 20 – Visual Docking Guidance System
~~16.~~15. 27 10 30 – Automated Passport Control System
~~17.~~16. 27 10 40 – Queue Management System
~~18.~~17. 27 20 00 – Common Use Systems
~~19.~~18. 27 25 16 – Integrated Airport Management System
~~20.~~19. 27 41 33 – IP Master Antenna Television System
~~21. 27 42 16 – Multi-User Flight Information Display System~~
~~22.~~20. 27 42 20 – Electronic Dynamic Signage System
~~23.~~21. 27 51 13 – Emergency Communication System
~~24.~~22. 27 53 10 – Distributed Antenna System – Cellular
~~25.~~23. 27 53 50 – Global Positioning System
~~26.~~24. 28 05 00 – Common Work Elements for ESS
~~27.~~25. 28 13 00 – Physical Access Control System
~~28.~~26. 28 16 00 – Intrusion Detection System
~~29.~~27. 28 23 00 – Video Surveillance System
~~30.~~28. 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 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 new terminal and in all applicable private and areas and services 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 preferred 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 Automatic People Mover (APM) and Parking Garage 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. Contractor shall furnish and install all inter-building fiber optic backbone cabling in support of the Cellular DAS. 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. The Landside Civil Contractor is responsible to pull all interbuilding site fiber, provide fusion splicing and testing as shown in the Landside Civil Technology Drawings.
   b. Fusion splices will be required by the Airside Concourse Contractor in the Airside Concourse MDF. The Airside Concourse Contractor shall be responsible to test DAS Fiber from the Airside Concourse IDF rooms to termination point in the North Terminal Complex.
   ~~a.~~c. Fusion splices will be required by the Landside Terminal Contractor in the Landside Terminal MDF. The Landside Terminal Contractor shall be responsible to test DAS Fiber from the Landside IDF rooms to termination point in North Terminal Complex.
~~5.~~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.
~~6.~~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 lighting 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 equal

D. Antennas

1. Andrew
2. MaxRad
3. Cellmax
4. Mars
5. Huber-Shuner

E. Feeder and Distribution Coaxial Cable

1. Andrew, or equal

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 equivalent.

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 Equal.

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 µm, 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 ± 2.0 Ω
   b. Frequency Band: 1 - 8800 MHz
   c. Peak Power Rating: ≥ 40.0 kW
3. Mechanical Characteristics:
   a. Diameter Over Jacket: ≤ .627 in
   b. Minimum Bending Radius: ≤ 5 in
   c. One Time Minimum Bending Radius: ≤ 3 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 Equal.

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 Equal.

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. Impendence: 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.

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 equal

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. Impendence: 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 equal.

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 UNINTERRUPTIPLE POWER SUPPLIES (UPS)~~

~~A. All DAS equipment shall be connected to a UPS system that will provide a minimum duration of backup power based on a 50% duty cycle as specified within this section.~~

~~B. All DAS electronic equipment shall be connected to emergency power circuits. Coordinate with other trades as required to meet this requirement.~~

~~2.8~~2.7 GENERATOR

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

~~2.9~~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.

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:

~~A.~~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.

~~B.~~C. Install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ~~and shall~~ furnish ~~all~~all- cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

~~C.~~D. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

~~D.~~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.

E.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.

F.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 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. 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.

G.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 00for 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 ~~for requirements~~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.

1.2. 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.

A.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.

B.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.

C.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.

D.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
~~1.~~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.

~~B.~~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.

~~C.~~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.

~~D.~~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.

~~E.~~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.
~~1.~~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

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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 new terminal and in all applicable private and areas and services 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 preferred 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 Automatic People Mover (APM) and Parking Garage 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.

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.
6. Horizontal Cable: Authority Vendor shall furnish and install all ~~pathways,~~ horizontal cabling, termination equipment, communication room fittings, grounding, and labeling included in this specification section. Contractor shall furnish and install all conduit ~~and~~, 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 terminal 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 lighting 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.

l. DAS coverage prediction maps: Authority Vendor shall 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) Cellular DAS antenna. 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.

m. Installation schedule.

C. Submit schedule, agenda, and details of formal training, including a complete set of training materials.

D. 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. Scope: Provide the Authority and (OAR) with three (3) complete hard copies of the drawing books and maintenance and operation manuals on the completed system. Provide three (3) complete soft copies of the above manuals in PDF format on CD. 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.

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 Preferred 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 equal

D. Antennas

1. Andrew
2. MaxRad
3. Cellmax
4. Mars
5. Huber-Shuner

E. Feeder and Distribution Coaxial Cable

1. Andrew, or equal

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: ≥ 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: ≥ 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 Equal.

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 colorcoded 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 µm, 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 ± 2.0 Ω
   b. Frequency Band: 1 - 8800 MHz
   c. Peak Power Rating: ≥ 40.0 kW
3. Mechanical Characteristics:
   a. Diameter Over Jacket: ≤ .627 in
   b. Minimum Bending Radius: ≤ 5 in
   c. One Time Minimum Bending Radius: ≤ 3 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. 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 Equal.

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 Equal.

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. Impendence: 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 equal

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. Impendence: 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): ≥ 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 equal.

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 UNINTERRUPTIPLE POWER SUPPLIES (UPS)~~

~~A. All DAS equipment shall be connected to a UPS system that will provide a minimum duration of backup power based on a 50% duty cycle as specified within this section.~~

~~B. All DAS electronic equipment shall be connected to emergency power circuits. Coordinate with other trades as required to meet this requirement.~~

~~2.8~~2.7 GENERATOR

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

~~2.9~~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.

~~D.~~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:

~~A.~~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.

~~B.~~C. Install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ~~and shall~~ furnish ~~all~~ all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

~~C.~~D. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

~~D.~~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).

~~E.~~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.

~~F.~~G. Adhere to the installation schedule of the general contractor and should attend all construction meetings scheduled by the General Contractor.

~~G.~~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.

~~H.~~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.

~~I.~~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.

~~J.~~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 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. 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.

~~K.~~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:

~~A.~~B. Authority Vendor will be responsible for all maintenance and service of DAS equipment as detailed in this section.

~~B.~~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.

~~C.~~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.

~~D.~~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:

~~A.~~B. Authority Vendor will be responsible for all field services for the DAS system components.

~~B.~~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.

~~C.~~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.

~~D.~~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

~~E.~~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.

~~F.~~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.

~~G.~~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.

~~H.~~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.

~~I.~~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.

~~J.~~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.

~~K.~~L. Provide the AHJ, Authority and OAR the opportunity(s) to participate in any or all of tests.

~~L.~~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.

~~M.~~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.

~~A.~~B. Contractor shall coordinate with Authority Vendor to obtain training materials for the DAS System.

~~B.~~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

SECTION 27 53 10 - DISTRIBUTED ANTENNA SYSTEM 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.

B. Related Specification Sections:

1. 26 05 01 – Basic Electrical Requirements
2. 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
3. 26 05 26 – Grounding and Bonding for Electrical Systems
4. 26 05 29 – Hangers and Supports for Electrical Systems
5. 26 05 33 – Conduit for Electrical Systems
6. 26 05 33.16 – Boxes for Electrical Systems
7. 26 05 34 – Outlet Boxes for Electrical Systems
8. 26 05 38 – Floor Boxes
9. 26 05 53 – Identification for Electrical Systems
10. 27 05 00 – Common Work Elements for Communications
11. 27 10 00– Premise Distribution Systems
12. 27 10 05 – Passive Optical Network
13. 27 10 10 – Voice Over IP Telephone System
14. 27 10 15 – Wireless Local Area Network System
15. 27 10 20 – Visual Docking Guidance System
16. 27 10 30 – Automated Passport Control System
17. 27 10 40 – Queue Management System
18. 27 20 00 – Common Use Systems
19. 27 25 16 – Integrated Airport Management System
20. 27 41 33 – IP Master Antenna Television System
21. 27 42 16 – Multi-User Flight Information Display System
22. 27 42 20 – Electronic Dynamic Signage System
23. 27 51 13 – Emergency Communication System
24. 27 53 10 – Distributed Antenna System
25. 27 53 50 – Global Positioning System
26. 27 53 70 – Parking Count and Guidance System
27. 28 05 00 – Common Work Elements for ESS
28. 28 13 00 – Physical Access Control System
29. 28 16 00 – Intrusion Detection System
30. 28 23 00 – Video Surveillance System
31. 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 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. Channel: A path for an RF transmission between two points
   d. Component: A main system element of the DAS
   e. Contractor: The prime contractor bidding the project
   f. 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 the Facilities Radio System. This system will make use of a collection of omni directional and directional antennas to provide coverage throughout the new terminal and in all applicable private and areas and services passages for ~~public safety~~facilities radio bands and CBP frequencies. 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 preferred 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 Automatic People Mover (APM) and Parking Garage 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 Contractor'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. Code of Federal Regulations (CFR) [Telecommunications] Title 47 Part 90
    e. Code of Federal Regulations (CFR) [Telecommunications] Title 47 Part 15
    f. Wireless Communications Principles and Practice, current edition
    g. 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. requirements Contractor shall furnish and install all fiber optic backbone cabling in support of the DAS. Coordinate system backbone requirements with backbone cable Contractor. The DAS system requires dedicated backbone cabling between headend units and remote end units.
6. Horizontal Cable: Contractor shall furnish and install all horizontal cabling, pathways, termination equipment, communication room fittings, grounding, testing, labeling, and all other work included in this specification section. Horizontal cable includes the segment of the premises distribution system that provides connectivity from communications rooms to field devices. This includes all conduit and coaxial cable to connect to field devices. 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 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.

~~1.4~~1.5 SYSTEM DESCRIPTION

~~A.~~ The Distributed Antenna System specified herein provides coverage throughout the terminal and other public areas for operations radio frequencies and Customs and Border Patrol (CBP) 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 areas providing operations radio coverage while mitigating interference. ~~Provided by Authority DAS Vendor.~~

~~1.5~~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 Ante
4) nna and grounding
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) RF propagation modeling
5) Signal to Noise Interference Ratio (SNIR) Map
6) In-band Interference Analysis
7) Bill-of-Material (BOM)
8) Maintenance Service Contract
9) Statement of Work (SOW): The contractor shall submit a SOW that has been accepted by the customer or customer's designated representative.
10) 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 lighting protection details
3) Cable routing, splitters, couplers and coverage antenna locations
4) Active component locations, layout and configuration

e. Test Reports
1) Field Reports: Submit testing results for all cable runs.
2) Field Reports: Submit OTDR test results for all fiber runs.
3) Operation and Maintenance Data: Submit hardware and software manuals for all Active Components.
4) 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 proposed system. .In addition, coordination must be done with all providers of the Cellular DAS and Public Safety DAS systems 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.

g. DAS coverage prediction maps: Authority Vendor shall 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) Cellular DAS antenna, and Public Safety DAS antenna (if designed separately from the 460 MHz DAS). The coverage prediction maps must ensure the required isolation is achieved to ensure proper operation of all DAS systems. 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).

C. 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 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.

D. 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.

E. 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.

F. 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.

G. Training materials: Submit training materials for review and approval at least two weeks before the start of scheduled training.

~~1.6~~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 ~~contractor~~ 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.

~~1.7~~1.8 DELIVERY STORAGE AND HANDLING

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

~~1.8~~1.9 RECORD DOCUMENTS

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

~~1.9~~1.10 OPERATIONS AND MAINTENANCE

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

~~1.10~~1.11 SOFTWARE AGREEMENT

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

~~1.11~~1.12 ~~EXTRA~~ 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. 460 MHz Facilities Radio/CBP Radio DAS:

1. Unless defined otherwise, the minimum downlink receives signal level for 460 MHz DAS shall be -95 dBm over the coverage area defined within.
2. Unless defined otherwise, the minimum downlink receives signal level for CPB Radio (160-174 MHz) shall be -95 dBm over the coverage area defined within.
~~1.~~3. 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 stated above.
~~2.~~4. Provide an In-band Isolation Analysis that describes the design methods used to avoid downlink and uplink interference.
~~3.~~5. 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.
~~4.~~6. All remote amplifiers shall be powered with a minimum of 30 minutes of backup power in the event of an outage.
~~5.~~7. All active components and UPS units shall be monitored by an SNMP based Network Management system.
~~6.~~8. The DAS should support all facilities radio stakeholders operating at UHF frequencies in the 460 MHz band.

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 equal

D. Antennas

1. Andrew
2. MaxRad
3. Cellmax
4. Mars
5. Huber-Shuner

E. Feeder and Distribution Coaxial Cable

1. Andrew, or equal

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 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 equivalent.

B. Omni-Directional Coverage: Omni-Directional Coverage antennas shall feature a multiband design, accommodating multiple frequency bands in a single small antenna.

1. Facilities Radio/CBP Frequency Bands:
   a. Frequency Band: 400-470 MHz and 160-174 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 Equal.

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 colorcoded 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 µm, 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 ± 2.0 Ω
   b. Frequency Band: 1 - 8800 MHz
   c. Peak Power Rating: ≥ 40.0 kW
3. Mechanical Characteristics:
   a. Diameter Over Jacket: ≤ .627 in
   b. Minimum Bending Radius: ≤ 5 in
   c. One Time Minimum Bending Radius: ≤ 3 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. Facilities Radio Frequency Band: 400-470 MHz
   ~~a.~~b. CBP Radio Frequency Band: 160-174 MHz
   ~~b.~~c. Maximum input power: Minimum 6 dB margin over composite broadband power levels proposed to meet the performance specifications in this Section.
   ~~c.~~d. 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 Equal.

I. When a BDA is required to drive the DAS, the BDA shall be of modular design and use digital filtering to mitigate interference and accommodate multiple services for Facilities Radio.

1. Characteristics:
   a. Operating Temperature Range: -33 °C to +50 °C
   b. Chassis: Shall be of modular design
   c. Filtering: Digital

d. Alarming: Shall support SNMP
e. Mounting Options: shall support rack, wall and pole mounting
f. Facilities Radio Frequency Bands Supported: 380 - 512 MHz LMR
~~f.~~g. CBP Radio Frequency Bands Supported: 160-174 MHz. (Note: This can be accomplished with a separate BDA)

2. Compliance:
   a. FCC: Shall be FCC type certified.
3. Approved Manufacturer: SOLiD/Commscope or Equal.

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. Impendence: 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.
2. Frequency Bands Supported:
   a. Facilities Radio Units: 380 - 512 MHz LMR
   ~~a.~~b. CBP Radio Units: 160 – 174 MHz
3. Approved Manufacturer: SOLiD/Commscope/ or equal

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. Impendence: 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) Facilities Radio Units: 380 - 512 MHz LMR
~~a)~~b) CBP Radio Units: 160 – 174 MHz
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 equal.

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 UNINTERRUPTIPLE POWER SUPPLIES (UPS)

A. All DAS equipment shall be connected to a UPS system that will provide a minimum duration of backup power based on a 50% duty cycle as specified within this section.

B. All DAS electronic equipment shall be connected to emergency power circuits. Coordinate with other trades as required to meet this requirement.

2.8 GENERATOR

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

2.9 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.

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 and 460MHz DAS (potentially combined with the 800 MHz Public Safety system described herein) 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.
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, and all other functional requirements of the various DAS systems are met as specified in the Contract Documents.

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. Install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, and shall furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

C. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

D. 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).

E. Adhere to the installation schedule of the general contractor and should attend all construction meetings scheduled by the General Contractor.

F. 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.

G. 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). Coordination between various DAS Vendors shall be the responsibility of the Contractor.

H. Place materials only in those locations that have been previously approved. Any other locations shall be approved, in writing, by the Authority and OAR.

I. 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 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. 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.

J. 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 1 ½” with long radius sweeps. Junction boxes will 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 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 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.

3.9 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. 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.

B. 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.

C. 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.

D. 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. 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

C. 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.

D. Provide the AHJ, Authority and OAR the opportunity(s) to participate in any or all of tests.

3.13 TRAINING

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

~~A.~~B. Contractor shall coordinate with Authority Vendor to obtain training materials for the DAS system.

3.14 PROJECT CLOSEOUT REQUIREMENTS

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

END OF SECTION 27 53 30

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SECTION 27 53 50 – GLOBAL POSITIONING 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. 26 05 00 – Common Work Results for Electrical
2. 26 05 19 – ~~Low-Voltage Electrical Power Conductors and Cables~~Building Wire and Cable
3. 26 05 26 – Grounding and Bonding ~~for Electrical Systems~~
4. 26 05 29 – Hangers and Supports ~~for Electrical Systems~~
5. 26 05 33 – Conduit
6. 26 05 34 – Outlet Boxes
~~6.~~7. 26 05 35 – Pull and Junction Boxes
~~7.~~8. 26 05 53 – Identification for Electrical Systems
~~8.~~9. 27 05 00 – Common Work Elements for Communications
~~9.~~10. 27 10 00 – Premise Distribution Systems
~~10.~~11. 27 10 10 – Voice Over IP Telephone System
~~11.~~12. 27 10 15 – Wireless Local Area Network System
~~12.~~13. 27 42 20 – Electronic Dynamic Signage System
~~13.~~14. 27 51 13 – Emergency Communication System
~~14.~~15. 27 53 10 – Distributed Antenna System - Cellular
~~15. 27 53 50 – Global Positioning System~~
~~27 53 70 – Parking Count and Guidance System~~
16. 28 05 00 – Common Work Elements for ESS
17. 28 13 00 – Physical Access Control System
18. 28 23 00 – Video Surveillance System
19. 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 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 installation of a Global Positioning System (GPS) in the South Terminal Complex. The GPS will provide satellite signals within selected indoor or obscured areas of the terminal complex which lack clear line-of-sight for satellite reception.

C. GPS “coverage” is defined as communication with a minimum of 5 satellites at any given time. Coverage areas shall include, but are not limited to:

1. Parking Garage – Ground Floor Level / Rental Car Area

D. Furnish and install a GPS repeater system to provide indoor GPS location services capabilities for compatible mobile and in-vehicle devices.

E. The scope of work shall include all work, materials, infrastructure, equipment, software, and programming 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 ease of operation, occupant safety and the protection of equipment as recommended by the Authority and OAR.
2. 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 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 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 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 access points, mounting hardware, components, devices, servers, active 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.

F. The Division 27 contractor shall be responsible for providing all cabling, cable terminations, conduits/raceways, racks, cabinets, programming, commissioning, and testing of all network communications cabling and equipment 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 T0.00.01 for the work responsibility matrix for the scope of work required for the Global Positioning System.

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

1. 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 for the Global Positioning System. Does not apply to the Global Positioning System.
2. Integration to Existing System: Does not apply to the Global Positioning System.
3. Interfaces: Includes all hardware, software, wiring, cabling, programming, interface devices and appurtenances as required for network monitoring functions. Does not apply to the Global Positioning System.
4. Network Switch: GOAA IT will furnish and install all required network switches and other active elements for network connectivity. 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. Does not apply to the Global Positioning System.
5. Backbone Cable: Refer to Specification Section 27 10 00 for additional information.
6. Horizontal Cable: Refer to Specification Section 27 10 00 for additional information. Horizontal cable for the Global Positioning System shall also include all coaxial antenna cable.
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 field devices include antennas, amplifiers, splitters, and other GPS components.

1.4 REFERENCES

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

1.5 SYSTEM DESCRIPTION

A. The Global Positioning System specified herein provides GPS “repeater” connectivity to mobile devices, vehicles, and other devices which have GPS location services capabilities. This GPS system enables communication with satellites where line-of-sight to the satellite constellation is obscured by structural elements of the building being serviced.

1.6 SUBMITTALS

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

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.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

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

2.2 SYSTEM CONFIGURATION REQUIREMENTS

A. Position antennas, adjust amplifiers and calibrate all repeater equipment in order to maintain sufficient effective radiated power (ERP) levels to ensure full functionality of GPS-devices within the area served by the system. Coordinate with the Authority and OAR for all GPS system software requirements.

2.3 HARDWARE REQUIREMENTS

A. GLI Metro KIT or equivalent.

B. Amplifier

1. GPS amplifier shall, at a minimum, meet the following feature requirements:
   a. Automatic signal level control
   b. Troubleshooting functionality to isolate and identify the following conditions:
      1) Oscillation

2) High Gain
3) Low Gain
4) Short/Open Circuit
5) Component failure
6) Loss of satellite communication / insufficient signal strength

c. Input / Output Impedance: 50-ohm
d. Standing Wave Ratio, All Ports: 2:1
e. Bandwidth: 1560-1615MHz (GPS & GLONASS L1), 1170-1310MHz (GPS & GLONASS L1/L2)

2. GPS amplifier shall be GPS Source GLI-METRO RK series or approved qual.

C. Antenna Splitter RMS 18 or equivalent:

1. Splitter shall have the ability to pass:
   a. GPS
   b. Galileo
   c. Amd GLONASS L1/L2
2. Must meet or exceed MIL-STD-810
3. 48V Power supply
4. Frequency Range Min. 1GHz max. 1.8GHz
5. In/Out Impedance Ant: J1-J8 Typ 50 ohms
6. Gain
   a. Standard Ant: Any Port; Unused Ports: 50 ohms Min. 10 Typ. 12 Max 14
   b. Custom Amplified As Specified (XXdB, from 0 to 14Db) Min. X-1dB Typ. X Max. X+1Db
7. Input SWR: All Ports 50 ohms Max 2:1
8. Output SWR : All Ports 50 ohm
9. Noise Figure : Amplified Ant: Any Ports 50 ohms Max. 2.2dB
10. Gain Flatness: Amplified [L1-L2] Ant: Any Ports Unused 50 ohms Max 4dB
11. Amp Balance [J1 – J2] Ant: Any Port: Unused Ports: 50Ω Max 4dB
12. Phase Balance Phase (J1 – J2) Ant: Any Port; Unused Ports: 50Ω Max 1 Degree
13. Group Delay Flatness / Td,max - Td,min; Ant: Any Port 1ns
14. Isolation Amplified
    a. Adjacent Ports: Ant – 50Ω Min. 38dB
    b. Opposite Ports: Ant – 50Ω Min. 44dB
15. Current Max.16mA
16. Draw Current
    a. Pass DC Max 22mA
    b. Powered (Military/Quick Connect) 100mA
17. Max RF Input Amplified
    a. 0dB

D. GPS Passive Splitter MS18 or equivalent

1. Splitter shall have the ability to pass:
   a. GPS
   b. M Code
   c. Galileo
   d. Amd GLONASS L1/L2

2. Must meet or exceed MIL-STD-810
3. 48V Power supply
4. Frequency Range Min. 1GHz max. 1.7GHz
5. Gain
   a. Standard Ant: Any Port; Unused Ports: 50 ohms Min. 14 Typ. 15 Max 16
   b. Custom Amplified As Specified (XXdB, from 0 to 20dB) Min. X-1.5dB Typ. X Max. X+1.5dB
6. Input SWR: All Ports 50 ohms Max 2.0:1
7. Output SWR: All Ports 50 ohm Max. 2.0:1
8. Noise Figure: 15dB Gain Amplified Ant: Any Ports 50 ohms Max. 3.8dB
9. Gain Flatness: Amplified [L1-L2] Ant: Any Ports Unused 50 ohms Max 3dB
10. Amp Balance [J2 – J3] Ant: Any Port: Unused Ports: 50Ω Max 0.5dB
11. Phase Balance Phase (J2 – J3) Ant: Any Port; Unused Ports: 50Ω Max 1 Degree
12. Group Delay Flatness / Td,max - Td,min; Ant: Any Port 1ns
13. Isolation
    a. Normal 15dB Gain Adjacent Ports: Ant – 50Ω Min. 16dB
    b. Normal 15dB Gain Opposite Ports: Ant – 50Ω Min. 22dB
    c. High 7dB Gain Adjacent Ports: Ant – 50Ω Min. 27dB
    d. High 7dB Gain Opposite Ports: Ant – 50Ω Min. 31dB
14. Input IP3 15dB Gain Amplified Ant: Any Port; Unused Ports 50 ohms -22dBm
15. Input P1dB 15dB Gain Amplified Ant: Any Port; Unused Ports 50 ohms -12dBm
16. Current (I internal) Current Consumption 65mA
17. Draw Current
    a. Pass DC Non-Powered Configuration DC Input on J2 250mA
    b. Powered (Military/Quick Connect) 60mA
18. Max RF Input without damage
    a. 30dBm

E. L1 Passive Antenna

1. Frequency Range @50 Ohms Min.1570 Max1580
2. Output Impedance Typ 50 Ohms
3. Gain @50 Ohms Min. 2.5 Max. 3
4. Output SWR @50 Ohms Max 2.5:1
5. Polarization right hand circular
6. Shock 40G
7. Vibration (RMS) 50kHz to 2kHz
8. RF Female connection options:
   a. N
   b. SMA
   c. TNC

F. L1 Active Antenna

1. Frequency Range @50 Ohms Min.1570 Max1580
2. Output Impedance Typ 50 Ohms
3. Gain
   a. Element Typ 3 Max 3.5 Units dBiC
   b. LNA Min. 32 Typ. 33 Max. 35 dB

4. Output SWR 3VDC to 16VDC, Output 50 Ohms Typ. Max 2.5:1
5. Noise Figure 3VDC to 16VDC, Output 50 Ohms Typ, 0.8Typ Max 1dB
6. Dc Input Voltage min 3V-16V Max
7. LNA Current @50 Ohms 5V, Typ 17mA, max 20mA
8. Polarization right hand circular
9. RF Female connection options:
    a. N
    b. SMA
    c. TNC

G. GLI-Metro GPS Smart Controller

1. GPS controller shall, at a minimum, meet the following feature requirements:
2. The controller shall have the ability to measure output power control function and automatically control the gain based on user selection.
3. Receives the L1 and L2 GPS signal.
4. High frequency selectivity
5. Oscillation detection and mitigation
6. Serial Port
7. Input Connector
8. Power Button (Options)
9. User Input Display
10. Transmit and Fault Indicator Lights
11. ERP Signal Level Adjustment
12. Brightness Level Adjustment
13. Output Connector
14. Antenna monitor with alarm
15. Built-in testing feature
16. Power button option
17. Display brightness level adjuster
18. Transmit and fault indicator light
19. Power 16VDC or 110VAC plug power
20. Avoid extreme environmental operating temperature
    a. 65 Celsius (149F) or less
    b. -40 Celsius (-40F)
21. Input dynamic range 115dBm to -85dBm max
22. Output dynamic range of 20dBm to -65dBm max (configuration depended)

H. RF Connector

1. SMA Connector
2. BNC Connector
3. TNC Connector
4. N Connector

I. Surge Suppressor CO-PRO or equivalent

1. GPS Protector
2. Frequency Range 800-2500 MHz
3. Impedance 50 ohms
4. Insertion Loss 0.1dB
5. RF Power (Watts) 2.25 Watts

J. GPS Repeater Mount

1. Provide repeater mounts in accordance with manufacturer's recommendations. Where the repeater manufacturer does not provide a mounting product specifically designed for use with the repeater, provide a mount that supports a minimum of 1.5 times the weight of the device.

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 section.
2. The Contractor shall supply all software and hardware necessary for the systems 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. GPS active and passive antennas, splitters, and amplifiers.
   b. The installation of coaxial cabling to/from all passive/active antennas, amplifiers, splitters, and other GPS equipment.
   c. Lighting protection.
3. The Contractor shall prepare the necessary documents required for installing, testing, and bringing the GPS 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
4. The Contractor shall coordinate with the Authority and OAR to ensure the system meets the requirements. The Contractor shall meet all ADA requirements.

3.4 EQUIPMENT INSTALLATION

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. 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. Final hardware selected and installation of hardware shall be coordinated with the 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.

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 due to Contractor work/equipment.

3.5 COMMUNICATIONS CABLING REQUIREMENTS

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

B. Contractor shall adhere to all manufacturing rules and guidelines for installation and maintenance.

C. LMR-240-DB Outdoor Water-tight

1. Installation Temperature Range -40F/+185F (-40C-+85C)
2. Storage Temperature Range -94F/+185F (-70C-+85C)
3. Operating Temperature Range -40F/+185F (-40C-+85C)
4. Inner Conductor
   a. Solid BC
   b. 0.056in. (1.42mm)
5. Dielectric
   a. Foam PE
   b. 0.150in (3.81mm)
6. Outer Conductor
   a. Aluminum Tape
   b. 0.155in (3.94mm)
7. Overall Braid
   a. Tinned Copper
   b. 1.178in (4.52mm)
8. Jacket outdoor rating
9. Performance Characteristics
   a. Velocity of Propagation
      1) 83
   b. Dielectric Constant

1) 1.42
c. Time Delay
1) nS/ft (nS/m) 1.21
2) Impedance
a) 50 ohms
d. Capacitance
1) pF/ft (pF/m) 24.2
e. Inductance
1) uH/ft (uH/m) 0.060
f. Shielding Effectiveness
1) 90dB
g. DC Resistance
h. Inner Conductor
1) Ohms/1000ft (/km) 3.2
i. Outer Conductor
1) Ohms/1000ft (/km) 3.89
j. Voltage Withstand
1) 1500VDC
k. Jacket Spark
1) 5000V RMS
l. Peak Power
1) 5.6kW

D. LMR400

1. Cable Characteristics
a. Dielelectric Installation
1) FEP
b. Center Conductor Material
1) Copper Clad Aluminum
c. Center Conductor Diameter
1) 0.108in
d. Center Conductor Construction
1) Solid
e. Shield %
1) 100% Foil
2) 88% Braid
2. Performance Characteristics
a. Velocity of Propagation
1) 85%
b. Impedance
1) 50 ohms
c. Nominal Capacitance
1) 23.9
3. Loss @ 50MHz 0.90
4. Loss @ 100MHz 1.2dB
5. Loss @ 400MHz 2.5dB
6. Loss @ 900MHz 3.9dB
7. Loss @ 1000MHz 4.10

E. RG8 Outdoor Rated

1. Cable Characteristics
   a. 10 AWG Solid annealed conductor
   b. Insulation
      1) Cellular fluoropolymer
   c. Installation Temperature
      1) Above +40F
2. Performance
   a. DC Resistance 0.90 ohms @ 1000ft (2.95 ohms/KM)
   b. Shield DCR: 2.92 ohms @ 1000ft (9.58 ohms/KM)
   c. Mutual Capacitance: 24.2 pf/FT / 74.4 pF/M
   d. Impedance: 50 ohms +/-3 ohms
   e. Velocity of Propagation: 83%
   f. Voltage Rating: 300V
   g. Cutoff Frequency: 16.2GHz

3.6 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. Coordinate with the Division 26 contractor, 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.

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 3.15 PROJECT CLOSEOUT REQUIREMENTS

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

END OF SECTION 27 10 15