Cushing Terrell

PROJECT MANUAL

November 15, 2021

Yellowstone County

SIGN, PUBLIC ADDRESS & SECURITY CAMERA

Billings, Montana

Volume 1 of 1 | Division 26

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TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

DIVISION 01 – DIVISION 26 – NOT USED

DIVISION 27 – COMMUNICATIONS

DIVISION 28 – ELECTRONIC SECURITY AND SAFETY

DIVISION 31 – DIVISION 33 -NOT USED

SECTION 270300 - DEMOLITION/REMODEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes general requirements and methods of execution relating to the Demolition of portions of the electrical system for the Project.

1.2 DEMOLITION/REMODEL WORK

A. The Contractor shall carefully examine the Drawings and Specifications, visit the project site, and make note of all existing conditions, dimensions, and limitations prior to Bid and make allowances thereto.

B. No Change Orders shall be issued due to the Contractor's lack of knowledge of the existing conditions of the Project and of the amount and difficulty of the remodel and/or demolition work necessary for a complete installation of the systems shown.

C. The Contractor shall also notify all corporations, companies, individuals or local authorities owning, or having jurisdiction over existing utilities and services which interfere in any manner with the execution of the Work under this Contract, and shall remove, relocate or protect such utilities or equipment as required by the parties having jurisdiction over same.

D. If existing active or nonactive services (which may not be shown on Plans) are encountered that require relocation or disconnecting, the Electrical Contractor shall make written request for decision on proper handling of the services. The Electrical Contractor shall not proceed with the Work until so authorized by the Architect.

E. When areas of the existing buildings are adjacent to the area of construction in which work is going on and are occupied, then this Contractor shall arrange the Work so as to reduce to a minimum the periods of interruption or outages in the various services.

F. Not less than one week before any system is to be put out of service, the Contractor shall notify and coordinate with other trades and the Owner of such necessity including the extent of the Work to be done during the outage, possible length of time required for that phase of the Work, and the desired time at which the outage is to begin.

G. Balance additional loads to existing circuitry between phases. Furnish a revised, typed panel directory on existing panelboards where circuitry is changed.

H. Carefully lay out all work in advance to minimize cutting, channeling, or drilling. Where necessary, all cutting and patching shall be done in a manner approved by the Architect. Do not endanger the stability of the structure. Restore any damaged surfaces to original conditions. Contractor at fault to assume all costs.

I. Remove or relocate existing conduits, wires, equipment, devices, or fixtures indicated on Drawings and as required by remodel operations. Where the reuse of existing conduits, wires, devices, or fixture is permitted, verify that wiring is continuous. Existing outlets or junction boxes shall not be rendered inaccessible by structural changes made to the building. Where existing walls are being furred out or refinished, extend existing outlets and devices to new surface as required.

J. Existing equipment which is indicated as being removed and not indicated for re-use shall be disposed of unless stated otherwise. Remove and dispose of any material, except fluorescent lamps and ballasts. Contractor shall be responsible for disposal of all removed lamps and ballasts. Ballasts may contain PCB's and shall be disposed of according to environmental regulations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 260300

SECTION 270500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and all Division 26.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 QUALITY ASSURANCE

A. Comply with latest adopted IBC Codes, NFPA Codes, Elevator Codes, ANSI, UL, ADAAG, and applicable Local and State Codes. Also comply with Utility Company regulations, industry standards and Construction Documents.

B. Work shall be done by only trained, licensed and experienced workmen familiar with the requirements.

C. All microprocessor based equipment and software with equipment shall utilize 4 digits for the year part of all dates. A two -digit date shall be an option for only for printing at Owner's preference.

1.4 EXTENT OF DRAWINGS / SPECIFICATION

A. Drawings indicate intent and general layout of electrical systems for the Project. Drawings are partly diagrammatic and do not indicate all fittings and accessories which may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.

1.5 PRIOR APPROVALS

A. All products submitted for prior approval shall be received by the Engineer 10 business days prior to Bid. Supply technical data, photometrics and dimensional Drawings showing that substitutes are equal to product specified. Faxed prior approvals will not be accepted.

1.6 DISCREPANCIES

A. Prior to submitting Bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification. The more stringent provisions shall take precedence where codes, Specifications and Drawings differ with one another. The Contractor shall Bid the more expensive requirement, unless discrepancy is addressed by Addendum prior to Bid.

1.7 TEMPORARY LIGHTING/POWER

A. Provide temporary electrical power and lighting for all trades that require service during the course of this Project. Provide temporary service and distribution as required. Comply with the NEC and OSHA requirements. Energy Costs by General Contractor.

1.8 SHOP DRAWING SUBMITTALS

A. General: Follow the procedures specified in Division 01 Section "Submittal Procedures." Submit for final and official approval through the General Contractor.

B. Provide the number of electrical related Shop Drawings, product data, and samples submitted, to allow for required distribution plus one copy of each submittal required, which will be retained by the Electrical Consulting Engineer.

1. Engineer - 1 copy.
2. General Contractor - 2 copies.
3. Subcontractor - Copies as required.

C. All Shop Drawings shall be bound in PDF format. Provide title sheet for each Specification Section indicating the Specification number and name. Copies of price list sheets not acceptable.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.

C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.

E. Coordinate connecting electrical service to components furnished under other Sections.

F. Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Coordinate requirements for access panels and doors where electrical items requiring access are concealed by finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

1.10 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements in Division 01 Section "Closeout Procedures." In addition to the requirements specified in Division 01, indicate the following installed conditions:

1. Actual location of all electrical service gear/feeders, panel/motor/special equipment feeders, all major underground or under slab conduits, all conduit stubs for future use, any change in branch circuitry from Drawings, key junction boxes and pull boxes not indicated on Drawings, any control locations or indicator lights not shown on Drawings.
2. Addendum items, Change Order items and all changes made to Drawings from Bidding phase through to Project completion.
3. Actual equipment and materials installed. Where manufacturer and catalog number are indicated on Drawings, generally or in fixture or equipment schedules, change to reflect actual products installed.
4. Change service panel and branch panel breaker locations and schedules to reflect actual installed conditions.

1.11 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 01 Section "Closeout Procedures." In addition to the requirements specified in Division 01. Assemble O & M Manuals as follows:

1. Compile Operating and Maintenance Manuals for the low voltage systems and equipment. The manuals shall be provided to the Architect for approval complete and at one time, prior to requesting final payment. Partial or separate data will be returned for completion.
2. Manuals shall be assembled in three-ring binders. Binders shall be 3-inch-thick or less and have slip sleeve jacket on binder side and front. More than one binder shall be used for each set of data if required to prevent overfilling of one binder. All information shall be arranged in Sections and each Section shall have a blank buff colored, heavy paper divider with a protruding tab clearly labeled. Sections shall be arranged in the same order that the equipment is listed in the Specification and each Specification Section shall have a separate tab. Shop Drawings which are larger than 8-1/2-inch by 11 inch shall be individually folded so they are 8-1/2-inch by 11 inch or less and inserted behind the appropriate tab.
3. Tabs shall be labeled and arranged as follows:

    a. Index: Furnish under the first tab an index of Sections listing name of Section and Specification numbers.
    b. Equipment Manufacturers: Furnish under the second tab a complete typed list of equipment suppliers and manufacturers representative including type of

equipment, name, address and phone number. The company listed here should be the one which could furnish replacement parts and offer technical information about the equipment.

c. Product Literature: Each tab, starting with the third shall contain the name of a Specification Section. Behind each tab shall be the previously submitted and approved Shop Drawing, factory published operation and maintenance instructions and parts lists. Also include description of function, normal operating characteristics and limitations, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions. Servicing instructions and lubrication charts and schedules.

4. Upon completion and approval of the booklets, one copy shall be given to the Architect, and two to the Owner. Using the booklet, the Electrical Contractor shall explain in detail and instruct the Owner's operating personnel in the correct operation and maintenance of the equipment.

1.12 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

END OF SECTION 260500

SECTION 276000 – PA AUDIO SYSTMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination, provision, installation, inspection, testing, instruction, and warranties of a high-quality Sound System. The scope of work is replacement of the existing sound system speakers in the arena.

B. All materials, equipment, transport and labor necessary to accomplish this and have a complete and working system.

C. Each of the following:

1. Required licenses and permits including payment of charges and fees.
2. Verification of dimensions and conditions at the job site.
3. Provision of submittal information.
4. Installation in accordance with the contract documents, manufacturer's recommendations, applicable codes and authority having jurisdiction.
5. Documented sound system tests and adjustments.
6. Instruction of operating personnel.
7. Provision of manuals.
8. Maintenance services and warranty.

1.2 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below

1. National Electric Code (NEC)
2. National Electrical Manufacturer’s Association (NEMA)
3. American National Safety Institute (ANSI).
4. Underwriters Laboratories (UL).
5. American Society of Testing and Materials (ASTM).
6. Electronics Industries Association (E.I.A).
7. Davis and Davis, Sound System Engineering (2nd Edition), Howard W. Sams, 1987.
8. Giddings, Audio System - Design and Installation, (ASDI) Howard W. Sams, 1990.
9. ANSI/TIA/EIA-568-A-Commercial Building Telecommunications Cabling Standard. (October 1995).
10. Building Industry Consulting Service International (BICSI). 11. ANSI S4.48-1992.

1.3 RESPONSIBILITY AND RELATED WORK

A. Electrical.

1. Power is provided for this work at locations shown on the electrical riser diagram and or other drawings/information in electrical drawings and specifications. Power will be terminated to a panel within or near the equipment enclosure. The contractor shall be responsible for termination and distribution of electrical power from the panel to the

equipment as required. Power for this equipment to be served from the emergency power system to support emergency messaging in the event of a power failure. The selected location will be connected to a UPS system.

2. A ground point will be provided in each equipment room or enclosure electrical panel. The contractor shall be responsible for connecting ground point to all equipment in accordance with NEC Code, local codes and standards specified herein.

B. Related Specification Sections:

1. Division 26: Electrical.

1.4 SYSTEM DESCRIPTION AND REQUIREMENTS

A. The following is intended to provide an overview of the existing Sound System. The scope of this project is replacement of the existing speakers in the arena.

1. The AV Control Room will house a new digital mixing console along with program sources and patch panels. In addition, other signal processing units, a portion of the digital audio processing system and the system control computers and associated network switches will be located and operated from this room. Input panels on the arena floor provide for direct connection to the system through multiple input receptacles and tie lines. Other audio tie lines from other areas of the building will terminate in the AV control room racks. The console will be configured to send and receive multiple stereo pairs of AES/EBU digital signals. All microphone and line level cabling will meet AES/EBU digital audio performance standards.
2. The main amplifier racks are located outside of the AV control room and will house the digital signal processing and power amplifiers for the primary bowl loudspeaker system. Each amplifier input module will receive the audio signal directly the digital signal processor. Each amplifier will be connected to a localized audio system data network for monitoring and control.
3. The general loudspeaker configuration is to have main full range and low frequency loudspeakers (also referred to as the MAIN loudspeaker system) flanking the upper circumference of the center hung scoreboard, and supplemented with “fill” or “delay” speakers for the upper level seating, and loudspeakers under the center hung scoreboard to fill court or ice. The bottom elevation of the scoreboard circumference loudspeakers are typically about 56-feet off the arena floor.
4. Four main clusters will be comprised of high output coaxial horn-loaded mid-high and low frequency loudspeakers. The mid-high cabinets are designed for very high directivity across their bandwidth and low distortion reproduction at the specified continuous SPL, and physically oriented to minimize destructive interference and optimize coverage. Tightly packed subwoofers comprise the top of each cluster and manage the very low frequencies.
5. Two additional high output coaxial horn-loaded mid-high and low frequency loudspeakers will be located at the stage (south) end of the arena. These loudspeakers will be used during conference style events to provide coverage to the front portion of the floor seating. The South facing main cluster will be turned off in this application and the configuration will be controlled by the system presets.
6. As an aid to the fire alarm system, the main seating bowl will receive warning signals and announcements from the main fire command center. The audio signal for this emergency override condition will insert into the digital audio processing system. The emergency

audio signal will be automatically routed to the system by closures received from the fire system connected to the digital audio processing system. The fire alarm system automated message will be signal activated by the alarm and the paging microphone in the fire command center will take priority over the automated message. During an emergency with the fire alarm, all systems other than those that cover the main bowl shall mute. To minimize the load on the emergency generator during a fire alarm condition, engage a high-pass filter at 250 Hz on the entire arena bowl loudspeaker system.

7. Assistive Listening System: A wireless RF hearing assistance system will be provided for the seating bowl as well as the press level and interview room systems. All system to operate on compatible frequencies and will operate on FCC approved frequencies.
8. Production Intercom System: The system will be cable and connector panels located throughout the event and catwalk levels and will include hard patch capabilities to allow the cabling system to be used independently of the installed head-end. Power supply to be provided by the owner.

1.5 QUALITY ASSURANCE

A. The Sound System Contractor shall be experienced in the provision of systems similar in complexity to those required for this project and meet the following requirements:

1. The primary business of contractor shall be the installation of sound and video systems.
2. No less than five years' experience with equipment and systems of the specified types.
3. Demonstrate experience with at least two projects of this type comparable scale within the last three years involving large scale reinforcement audio systems.
4. Be a franchised dealer and service facility for the major products furnished.
5. Maintain a fully staffed and equipped service facility with full time field technicians. It is recommended that the installation team members have following NICET or National Systems Contractors Association (NSCA) certifications.

    a. Project Manager: NICET Level III or R-ESI Integrator Certification.
    b. Field Supervisor: NICET Levell II or C-EST Technician Certification.
    c. Crew Lead: NICET Level I or C-SI Installer Certification.

6. At the request of the Owner, the Contractor shall demonstrate that he has:

    a. Adequate plant and equipment to complete the work.
    b. Adequate staff with commensurate technical experience.

B. Any other contractor who intends to bid this work as the prime contractor and does not meet the required qualifications shall employ the services of a single "Sound System Contractor" who does meet the requirements noted above and is approved by the Owner. This "Sound System Contractor" shall:

1. Furnish the equipment.
2. Shop fabricate the equipment racks and subassemblies.
3. Make audio, speaker and control connections to equipment racks, each piece of equipment, and connection panels.
4. Continuously supervise the installation and connections of cable and equipment.

C. Work shall be in compliance with the applicable standards listed above and all governing codes and regulations of the authorities having jurisdiction and the Contract Documents.

1. Drawings and specification requirements shall govern where they exceed Code and Regulation requirements.
2. Where requirements between governing Codes and Regulations vary, the more restrictive provision shall apply.
3. Nothing in the Contract Documents shall be construed as authority or permission to disregard or violate legal requirements.

D. Coordinate exact location and installation of equipment, power, conduit, and raceway systems with the Architect.

1.6 SUBMITTALS

A. Comply with the general terms and conditions–Project Submittal Procedures.

B. Electronic files of audio or audio visual (AV) contract documents shall not be distributed for use in generating submittal documents with the exception of architectural backgrounds. Contractor to cover all costs for the processing and transfer of these files.

C. Supplementary submittal requirements:

1. Complete schedule of submittals.
2. Chronological schedule of Work in bar chart form.
3. Provide a list of and manufacturer’s data sheet on product to be incorporated within the Work. Organize data sheets in specification order.

    a. Separate major grouping with labeled binder tabs.
    b. Bind contents in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes if necessary.

4. Functional diagrams and description of all parts of the system installation.
5. Shop Drawings:

    a. Schematic: Detailed wiring diagrams showing interconnection of components and products, wiring and cabling diagrams depicting cable types and cable designators, and device designators. Provide connector designations and terminal strip identification, along with color codes for cables connecting to these devices. Give each component a unique designator and use this designator consistently throughout the project.

6. Coordination Drawings:

    a. Prepare and submit a set of coordination drawings showing major elements, components, and devices of the sound system in relationship with other building components. Prepare drawings to an accurate scale of 1/8”=1’-0” or larger on suitable sized media.
    b. Prepare floor plans, reflected ceiling plans, elevations, sections, and details to conclusively coordinate and integrate all equipment. Indicate locations where

space is limited, and where sequencing and coordination of installations is of importance to the efficient flow of the work including but not necessarily limited to the following:

1) Equipment housings
2) Ceiling and wall mounted devices
3) Raceways
4) Cabling

7. Equipment housing: Location of equipment in racks, consoles position on tables or counters. Details to include dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
8. Patch panel layouts and labeling strips, including color schemes.
9. Full fabrication details of custom enclosure and millwork indicating size, material, finish and openings required for equipment and enclosures.
10. Structural rigging and mounting details:

    a. Structural rigging and mounting details of all loudspeakers suspended from or mounted to the building structure: These drawings will identify all types of hardware, fittings and materials to be used. Detail the product manufacture, part numbers and load capacity of the hardware, fittings and materials selected. All loudspeaker structural rigging and mounting detail drawings shall be signed and sealed by a professional engineer licensed to practice in the State of Montana and will include a copy of the design calculations.
    b. The signed and sealed drawings noted above to include the following:

        1) Attachment method to building or scoreboard structure for suspended loudspeakers or mounting brackets.
        2) Any secondary steel required for attachment to the building or scoreboard structure.
        3) All fittings, hardware, materials, and cable used for suspended loudspeakers.
        4) All custom brackets, mounts, suspension grids or trusses and loudspeaker cabinet frames or brackets not supplied by the manufacturer of the specific loudspeaker to be mounted or suspended.

11. Fabricated Plates and Panels: Provide complete drawings on custom fabricated plates or panels. Drawings shall include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.
12. Labeling: Equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and designator schedule.
13. Schedules: Wiring schedule showing source and destination of wiring and indicating which wiring is in conduit. Junction box schedule showing type of box, size, mounting and location. Include this information with remainder of wiring diagrams.

D. Submittal format:

1. Floor plan drawings executed at an appropriate scale, not less than 1/8” = 1’-0”.
2. Detail drawings executed at an appropriate scale, not less than 3/8” = 1’-0”.
3. Plate and panel drawings executed at an appropriate scale, not less than 1/2” = 1”.

4. Rack, enclosure, and millwork detail drawings executed at an appropriate scale, not less than 1” = 1’- 0”.
5. Separate major grouping with labeled binder tabs.
6. Bind contents in titled three ring D style binders sized for 150 per cent of the material. Maximum size: three-inch spine. Use multiple volumes if necessary.

1.7 PROJECT CLOSEOUT

A. Comply with the general terms and conditions–Project Closeout Procedures.

B. Supplementary Project Closeout Procedures

1. Provide all close-out documents on a finalized CDR as well as hard copy. The CDR shall be set up using a non-proprietary “PDF” format.
2. Product Data: Product actually incorporated within the Work:

    a. Manufacturer's data for each type of product conforming to the submission format specified herein. Include manufacturer’s serial numbers within the list of product.
    b. For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
    c. Each products Owner/Instruction Manual. Provide high quality copies where necessary, with all text legible and illustrations of equal resolution and sharpness as the original manual. Faxed copies or copies with portions of the information missing or smeared not acceptable.
    d. Manufacturer’s maintenance and care instructions.
    e. Separately bound list by manufacturer and model or part number of product incorporated within the Work arranged in alphanumeric order. when applicable Manufacturer's warranty statements bound separately.

3. Record drawings: Final rendition of Shop Drawings depicting what is actually incorporated within the Work.
4. Test Reports: Recorded findings of Contractor’s Commissioning.
5. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.

    a. Describe the operation of system capabilities.
    b. Assume the intended reader of the manual to be technically inexperienced and unfamiliar with this facility.

6. Service & Maintenance Manual:

    a. Provide an original manufacturer’s copy of the service manual on every piece of equipment for which the manufacturer offers a service manual. On equipment where there is no service manual, provide statement from company indicating manual is not available. Arrange manuals in the same order as the operations manual.
    b. Manufacturer’s maintenance and care instructions.
    c. Maintenance Instructions, including maintenance phone numbers and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.

7. Provide copies of all current versions of the software programs of the various system components on CDR. Include all site files for the system configuration and internal device settings.
8. Any other pertinent data generated during the Project or required for future service.
9. Segregate documents into separate bindings containing data relevant to operational, maintenance and warranty issues. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

1.8 DELIVERY, STORAGE, AND HANDLING

A. To prevent damage or entrance of foreign matter ship product in its original container.

B. Handling and shipping in accordance with manufacturer's recommendation.

C. Provide protective covering during construction to prevent damaging or entrance of foreign matter.

D. Replace at no expense to Owner product damaged during storage, handling or the course of construction.

1.9 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect's Representative in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings show cables, conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site which make it impossible to install work as shown, recommend solutions and submit drawings to the Architect for approval, showing how the work may be installed.

1.10 FINAL OBSERVATIN AND TESTING

A. Upon completion of the installation and contractor commissioning as specified in Part 3, observation and testing shall be performed by the Architect.

B. To assist the Architect, provide a minimum of one (1) person for observation and two (2) persons for testing who are familiar with all aspects of the system.

C. The process of testing the System may necessitate moving and adjusting certain components such as speaker aiming or transformer taps.

D. Testing includes operation of each major system and any other components deemed necessary. Provide required test equipment, tools and materials required to make necessary repairs, corrections or adjustments.

E. The following procedures will be performed on each System by the Architect:

1. Observation of the methods provided to incorporate the System within the facility.
2. Verification of proper operation of all devices.

3. Verification that the equipment has been properly adjusted, balanced, and aligned for optimum quality and meets the manufacturer's published specifications.
4. In the event further adjustment or work becomes evident during testing, the Contractor shall continue his work until the system is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications, the Contractor shall pay for additional time and expenses of the Architect or his representative at the standard rate in effect at that time.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue his work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner, at the standard rate in effect at thattime.

1.11 WARRANTY

A. Warrant labor and product for twelve months following the date of the ticketed event, trouble free operation, or substantial completion, whichever is later.

B. System is to be free of defects and deficiencies, and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge.

C. This warranty shall not void specific warranties issued by the manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.

D. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty four hours.

E. Contractor to provide Owner with the name and telephone number of the person to call for service. This information to be part of Project Record Drawings.

F. Thirty days prior to the end of the warranty period provide a complete checkout of all system components. Repair or replace any defective equipment or transducers discovered during the testing. Correct any defects in wiring or other functional problems reported by Owner. Warranty replacement and service of equipment shall not apply to Owner furnished equipment. Coordinate inspections visit with the Owner.

G. Outdoor mounted speakers shall be warranted by the manufacturer or contractor to withstand the rigors of the environment and perform to the published specifications for at least one year after date of Substantial Completion.

1.12 INSTRUCTION OF OWNER PERSONNEL

A. After final completion, provide instruction to Owner designated personnel on the operation and maintenance of the System.

B. Develop instructional course based on the use of the system and manufacturer's recommendations. Provide a minimum of twenty-four hours of instruction. Arrange course so that operational and maintenance training seminars are separate.

C. Training Submittals:

1. All Operations and Maintenance manuals, as well as as-built drawings must be on site for all sessions of training.
2. Following discussions with Owner, formally submit a Training and Event Attendance submittal two weeks prior to first training. Submittal shall:

a. Include a separate page/entry for every training session.
b. Indicate date, time, and approximate length of training session.
c. Indicate person(s) conducting training.
d. Indicate whether training will be videotaped.
e. Intended curriculum and most appropriate attendees (e.g., engineer, operations, IT, etc.).
f. Include signature and title lines for:

1) Owner acknowledging and accepting training schedule. Include both an accepted and rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
2) Countersigning by trainer indicating that training actually occurred.
3) All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
4) Owner's representative attending training at the end of the session shall initial that:

a) Training Occurred.
b) Training Materials were provided and left with owner.
c) Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
d) Training was generally sufficient for the proposed curriculum.

g. Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.).
h. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.

D. Sound system contractor shall be present at the first six uses of the facility. The contractor shall be on site the day before the event in addition to the day of the event.

1.13 TECHNICAL SYSTEMS SOFTWARE LICENSE

A. Existing.

PART 2 - EQUIPMENT

2.1 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed as a standard of function, performance and quality.

B. Refer to Project General Conditions for equipment substitute procedure.

2.2 GENERAL

A. Product quantity is as required. If a quantity is given, Sound System Installer shall provide at least the given amount. Some product listed under this section may not be required to fulfill the obligations of the work.

B. Product quantity of spare equipment units for products as listed under this section.

C. Equipment and materials shall be new and conform to applicable UL or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.

D. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet published manufacturer's specifications.

E. Audio XLR type connectors not a part of manufactured equipment shall have gold plated contacts. This includes all cable mounted connectors as well as chassis mounted connectors on custom fabricated panels.

F. Remove all manufacturers’ names, logos, or other symbols from speakers or other objects placed in view of the public.

G. All loudspeaker finishes are to be factory applied. Ceiling and wall mounted speaker grilles and enclosures to match the surrounding ceiling or wall color as directed by Architect.

2.3 AMPLIFIERS

A. Power Amplifiers: Power Amplifiers are existing Lab Gruppen C series.

2.4 LOUDSPEAKERS

A. All replacement Loudspeakers shall be compatible with the existing wiring and power amplifier system.

B. Type M1 Speaker – Main Low/Mid/High:

1. Configuration: Three way speaker cabinet.
2. Frequency operating range: 68 Hz to 18 kHz.
3. HF Section: 1.4-inch exit HF driver.
4. MF Section: 8-inch transducer.
5. LF Section: Dual 12-inch transducers.
6. Maximum sustained output level at 1m: 135 dB.

7. Coverage pattern: Nominal 40°x 40°.
8. Provide all necessary mounting hardware, brackets, and rigging to suspend cluster from building structure.
9. Basis of design product: EAW AX344.
10. Equals to Basis of design are acceptable by:

    a. JBL
    b. L-Acoustics
    c. Nexo
    d. RCF
    e. Danley.

C. Type M2 Speaker – Main Low/Mid/High:

1. Configuration: Three way speaker cabinet.
2. Frequency operating range: 68 Hz to 18 kHz.
3. HF Section: 1.4-inch exit HF driver.
4. MF Section: 8-inch transducer.
5. LF Section: Dual 12-inch transducers.
6. Maximum sustained output level at 1m: 135 dB.
7. Coverage pattern: Nominal 60°x 40°.
8. Provide all necessary mounting hardware, brackets, and rigging to suspend cluster from building structure.
9. Basis of product: EAW AX344.
10. Equals to the Basis of design are acceptable by:

    a. JBL
    b. L-Acoustics
    c. Nexo
    d. RCF
    e. Danley

D. Type M3 Speaker – Main Low/Mid/High:

1. Configuration: Three way speaker cabinet.
2. Frequency operating range: 68 Hz to 18 kHz.
3. HF Section: 1.4-inch exit HF driver.
4. MF Section: 8-inch transducer.
5. LF Section: Dual 12-inch transducers.
6. Maximum sustained output level at 1m: 135 dB.
7. Coverage pattern: Nominal 90°x 50°.
8. Provide all necessary mounting hardware, brackets, and rigging to suspend cluster from building structure.
9. Basis of design product: EAW AX396.
10. Equals to the Basis of design are acceptable by:

    a. JBL
    b. L-Acoustics
    c. Nexo
    d. RCF

e. Danley

E. Type M4 Speaker – Main Subwoofer:

1. Configuration: Front loaded, ported cabinet.
2. Frequency response: ±3 dB 38 Hz to 150 Hz.
3. SUB Section: Dual 18-inch transducers.
4. Maximum sustained output level at 1m: 136 dB.
5. Basis of design product: EAW SB538z.
6. Equals of Basis of design are acceptable by:

    a. JBL
    b. L-Acoustics
    c. Nexo
    d. RCF
    e. Danley

F. Type D1 Speaker – Delay Fill 1:

1. Configuration: Three-way speaker cabinet.
2. Frequency operating range: 68 Hz to 18 kHz.
3. HF Section: 1.4-inch exit HF driver.
4. MF Section: 8-inch transducer.
5. LF Section: Dual 12-inch transducers.
6. Maximum sustained output level at 1m: 135 dB.
7. Coverage pattern: Nominal 90°x 50°.
8. Provide all necessary mounting hardware, brackets, and rigging to suspend cluster from building structure.
9. Basis of design product: EAW AX396.
10. Equals to the Basis of design product are acceptable by:

    a. JBL
    b. L-Acoustics
    c. Nexo
    d. RCF
    e. Danley

G. Type D2 Speaker – Delay Fill 2:

1. Configuration: 6-inch coaxial with .75-inch tweeter.
2. Coverage pattern: 100° conical.
3. Sensitivity: 91 dB at 1W/1M.
4. Frequency operating range: 60 Hz to 20 kHz.
5. Transformer: Internal 60 Watt, 70.7 Volt.
6. Provide all necessary mounting hardware, brackets, and tile supports.
7. Paint grille to match surrounding surfaces at the direction of the architect.
8. Basis of Design product: EAW CIS-400.
9. Equals of the Basis of design are acceptable by:

    a. JBL

b. L-Acoustics
c. Nexo
d. RCF
e. Danley

H. Type SB Speaker – Under Scoreboard Speaker:

1. Configuration: two-way cabinet with 12-inch LF and 1.4-inch HF driver. Line Array is acceptable if the performance is equivalent.
2. Cabinet to include passive crossover and be configured in a horizontal orientation.
3. Nominal coverage to be 90° x 90°.
4. Frequency response: ±3 dB 55 Hz to 20 kHz.
5. Maximum sustained output level at 1m: 120 dB.
6. Provide factory finish on speaker and bracket as directed by Architect.
7. Coordinate installation with scoreboard contractor and provide all necessary mounting hardware, U- brackets, supports and any secondary steel required to attach to scoreboard structure.
8. Cabinet to be mounted horizontally.
9. Match existing speaker dispersion pattern.
10. Basis of design product: EAW MK2399.
11. Equals of the basis of design product are acceptable by:

    a. JBL
    b. L-Acoustics
    c. Nexo
    d. RCF
    e. Danley

I. Type L1 Speaker – Exterior Speaker:

1. Configuration: two-way cabinet with 12-inch LF and 1.4-inch HF driver. Line Array is acceptable if the performance is equivalent.
2. Cabinet to include passive crossover and be configured in a horizontal orientation.
3. Nominal coverage to be 60° x 60°.
4. Frequency response: 75 Hz ÷ 20000 Hz (-10dB).
5. Maximum sustained output level at 1m: 134 dB.
6. Provide factory finish on speaker and bracket as directed by Architect.
7. Provide all necessary mounting hardware, U- brackets, supports and any secondary steel required to attach to scoreboard structure.
8. Weatherproof IP 55 enclosure with Aluminum grille with waterproof clothing.
9. Basis of design product: EAW MK2399.
10. Equals of the basis of design product are acceptable by:

    a. JBL
    b. L-Acoustics
    c. Nexo
    d. RCF
    e. Danley

2.5 SPEAKER HARDWARE AND SUPPORT STRUCTURE

A. General:

1. Each cluster section must be secured from a minimum of four points. Configure supports or additional guy-wires to eliminate any side-to-side or front-to-back movement of the cluster due to wind or HVAC air movement.
2. Attachment system to be supplied by vendor whose primary specialty is fabricating support systems for loudspeakers or similar devices over an audience.
3. Provide safety cable on all overhead bracket mounted loudspeakers.
4. Provide auxiliary support steel and hardware required to attach to building structure and design members to have a minimum safety factor of at least 5:1. Reference architectural and structural documentation for details on structural elements.
5. All wire rope used for loudspeaker suspension to have a minimum safety factor of 8:1.
6. Fabricate all components from powder coated steel for maximum resistance to corrosion.
7. All rigging truss modules, slings and hardware to meet a minimum of one of the following standards.

    a. ASME B30.26
    b. ASME B30.9
    c. OSHA 1910.184
    d. OSHA 1926.251
    e. UL 1480 31.3

B. Cluster/Array Truss Module:

1. Provide a modular loudspeaker hardware system as required to mount speakers in the arrangement as shown on the Drawings.
2. Each cluster section must be secured from a minimum of two points.
3. Attachment system to be supplied by vendor whose primary specialty is fabricating support systems for loudspeakers or similar devices over an audience.
4. Provide auxiliary support steel and hardware required to attach to building structure. Reference architectural and structural documentation for details on structural elements.
5. Fabricate all components from powder coated steel for maximum resistance to corrosion.
6. Acceptable manufacturer:

    a. ATM Flyware Custom.
    b. ATM Flyware AFGS Grid.

C. Shoulder Type Machinery Eye Bolts:

1. Forged Steel – Shoulder, Quenched and Tempered.
2. Fatigue rated at 1-1/2 times the Working Load Limit at 20,000 cycles.
3. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
4. Select size of product based working load limits required.
5. Acceptable product:

    a. Crosby Group S-279 / M-279 Series.
    b. Chicago Hardware Company 261 Series.

D. Forged Eye Nuts:

1. Forged Steel – Quenched and Tempered.
2. Tapped with standard UNC class 2 threads after galvanizing.
3. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
4. Select size of product based working load limits required.
5. Acceptable product:

    a. Crosby Group G-400 Series.
    b. Chicago Hardware Company 167 Series.

E. Anchor Shackles:

1. Forged - Quenched and Tempered, with alloy pin.
2. Working Load Limit permanently shown on every shackle.
3. Hot Dip galvanized or Self-Colored.
4. Product to meet the performance requirements of Federal Specification RR-C-271D Type IVA, Grade A, Class1.
5. Select size of product based working load limits required.
6. Provide all screw pin type shackles with mouse wire.
7. Acceptable product:

    a. Crosby Group G-209 / S-209 Series Screw Pin.
    b. Chicago Hardware Company 201 Series.

F. Turnbuckles:

1. Acceptable turnbuckle assembly combinations include: Eye and Eye, Jaw and Jaw, Jaw and Eye.
2. End fittings are Quenched and Tempered, bodies heat treated by normalizing.
3. Hot Dip galvanized.
4. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
5. Product to meet the performance requirements of Federal Specifications FF-T-791b, Type 1 Form 1 - CLASS 4, and ASTM F-1145.
6. Select size of product based working load limits required.
7. All end fittings to be moused to the body with mousing cable.
8. Acceptable product:

    a. Eye and Eye:

        1) Crosby Group HG-226 Series.
        2) Chicago Hardware Company 012/013 Series.

    b. Jaw and Eye:

        1) Crosby Group HG-227 Series.
        2) Chicago Hardware Company 026 Series.

c. Jaw and Jaw:

1) Crosby Group HG-228 Series.
2) Chicago Hardware Company 030/031 Series.

G. Swivel Hoist Ring:

1. All components are Alloy Steel - Quenched and Tempered.
2. Rated at 100% of Working Load Limit at 90° angle.
3. 360 swivel and 180 pivot action.
4. Product to meet or exceed all the requirements of ASME B30.26 including identification, ductility, design factor, proof load and temperature requirements.
5. Bolt specification to be Grade 8 Alloy socket head cap screw to ASTM A 574.
6. Fatigue rated at 1-1/2 times the Working Load Limit at 20,000 cycles.
7. Zinc Plated (Yellow Chromate) finish for increased corrosion protection.
8. Select size of product based working load limits required.
9. Acceptable product:

a. Crosby Group HR-125.
b. Chicago Hardware Company 860 Series.

H. Wire Rope Thimble:

1. Product to meet the performance requirements of Federal Specification FF-T-276b Type II.
2. Hot Dip galvanized.
3. Select size of product based wire rope size required for suspended load.
4. Acceptable product:

a. Crosby Group G-411 Series.
b. Chicago Hardware Company 224/225 Series.

I. Wire Rope:

1. Strands: 7 x 19 Utility Cable.
2. Type: Galvanized.
3. Select size of product based working load limits required.
4. Acceptable product:

a. Wire Rope Corporation of America (WRCA).

J. Wire Rope Sleeves:

1. Type: Copper Duplex.
2. Select size of product based wire rope size required for suspended load.
3. Acceptable product:

a. Wire Rope Corporation of America (WRCA) SW-740 Series.

2.6 CABLES & WIRING (EXISTING)

A. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g., CMR, CMP, etc.)

B. Cable shall carry appropriate fire rating (e.g., CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

C. Where cables are routed through cable tray, provide tray rated cable of equal specification.

D. Where speaker cables are run exposed through a return air plenum, provide plenum rated cable equal specification.

E. Shielded cables located in raceways shall have aluminum foil shield with drain wire.

F. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. Cables from Commscope, Gepco, and West Penn are also acceptable provided they meet the performance specifications of the approved listed cables. If field conditions or actual cable pathway requires riser, tray or plenum cable, provide version of cable that meets required NEC rating. Conduit pathways and raceways shown on the AV drawings have been calculated for appropriate fill based on the diameter and area of the cables listed below. Contractor to verify adequate conduit capacity for alternate cables selected from Commscope, Gepco, and West Penn.

G. Provide the following:

1. Arena Bowl Low-Z Loudspeaker Cables:

    a. MF/HF Speaker Cables: Belden 5T00UP - 10 gauge twisted pair, jacketed.
    b. LF/Sub Speakers Cables: Belden 5T00UP - 10 gauge twisted pair, jacketed.
    c. Full-Range Speaker Cables: Belden 5T00UP – 10 gauge twisted pair, jacketed.
    d. Amplifier to Rack Room Terminals: Belden 5000UP - 12 gauge twisted pair, jacketed. Distance not to exceed 25 feet.
    e. Drop Cable from [SB] to Scoreboard: Belden 19201 - 12 gauge twisted pair, SO rubber jacketed. Provide with kellum type strain relief at roof and lace bundle to coil within catch basket.

2. 70.7 Volt Loudspeaker Cables:

    a. Homerun to Amplifier Cabling: Belden 5000UP - 12 gauge twisted pair, jacketed.
    b. Speaker to Speaker Cabling: Belden 5100UP - 14 gauge twisted pair, jacketed.

3. Microphone Level Cable: Belden 1800B - Single Pair twisted, 24 gauge, shielded, jacketed with gray jacket. Conductor to conductor cable capacitance to be less than 12 pF/ft.
4. Line Level Cable: Belden 1800B - Single Pair twisted, 24 gauge, shielded, jacketed with violet jacket. Conductor to conductor cable capacitance to be less than 12 pF/ft.
5. Control Cables: Belden 53(**)FE (00)(01)(02)(03)(04)(06)(07) Series - 18 gauge with overall shield and appropriate number of conductors.

6. Ethernet Cable: Belden 1212 - 4 pair, enhanced category 5e.
7. Production Intercom Cable: Belden 8772 – 3-conductor, 20 gauge shielded. Conductor to conductor cable capacitance to be less than 27 pF/ft.
8. Wireless Antenna Cable: Belden 9258 - RG8/X Type, 16 gauge stranded center conductor, 95% braided shield.
9. Assisted Listening System Cable: Belden 8214 – RG8/U Type, 11 gauge stranded center conductor, 97% braided shield.
10. Precision Video Coax Cable: Belden 1505A – RG59/U, 20 gauge solid center conductor, 100% foil shield and 95% braided shield.
11. Digital Audio AES-3id, Conduit Installed: Belden 1694A - RG6/U, 18 gauge solid center conductor, 100% foil shield and 95% braided shield.
12. Digital Audio AES-3id, Racks and Portable: Belden 1505A – RG59/U, 20 gauge solid center conductor, 100% foil shield and 95% braided shield.
13. Word Clock Conduit Installed: Belden 1694A - RG6/U, 18 gauge solid center conductor, 100% foil shield and 95% braided shield.
14. Word Clock, Racks and Portable: Belden 1505A – RG59/U, 20 gauge solid center conductor, 100% foil shield and 95% braided shield.
15. Fiber Optic Cable: Belden B9C007, 6 fiber, 50/125/900 micron, multi-mode breakout.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate work with other trades to avoid causing delays in construction schedule Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

3.2 INSTALLATION

A. Equipment and materials shall be new and conform to applicable UL or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.

B. Regardless of the length or completeness of the descriptive paragraph herein, each device shall meet published manufacturer's specifications.

C. Install mounted equipment with black number 10 button head machine screws with Hex Allen or Square Robinson drive.

D. Paint all ceiling and wall mounted speaker grilles and enclosures to match the surrounding ceiling or wall color as directed by Architect.

E. Mount equipment and enclosures plumb and square. Permanently installed equipment to be to be firmly and safely held in place. Design equipment supports to support loads imposed with a safety factor of at least five. Seismic microphone bracing shall be installed on appropriate equipment where State of Montana codes require such installation.

3.3 SYSTEM CABLING AND WIRING (EXISTING)

A. General:

1. Take precaution to prevent and guard against electromagnetic and electrostatic hum. For line-level audio signals, float cable shield at the output of source device. Shields not connected shall be folded back over cable jacket and covered with heat-shrink tubing. Do not cut off unused shield.
2. Exercise care in cabling and wiring. Damaged cables or wire will not be accepted. Isolate cables and wires of different signal levels. Separate or re-route to reduce channel crosstalk or feedback oscillation in any amplifier section. Keep cabling separated into groups as described in ASDI article 12.3.
3. Make joints and connections with rosin-core solder or with mechanical connectors approved by the Architect's Consultant. Where spade lugs are used, crimp properly with ratchet type tool.
4. Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.
5. Provide splice free wiring and cabling from origination to destination.

B. Housing:

1. Cabling entering equipment housings or splices in junction boxes should connect via connector termination or terminal block equal to Cinch 140 -142 series.
2. Install terminal block fully exposed, labeled, and mounted on 19 mm plywood board painted flat black with fire retarding paint.
3. Install cable and wire neatly tied in manageable bundles with cable lengths cut to minimize excess cable slack while allowing for service and testing. Provide horizontal support bars if cable bundles sag.
4. Neatly bundle excess AC power cable from housing mounted equipment with plastic cable ties.
5. Provide plastic cable ties or lacing twine to bundle cabling and wiring. Electrical tape and adhesive backed cable tie anchors are not acceptable.
6. Install cabling with connections completely visible and labeled.
7. Provide termination resistors of 5 per cent tolerance; fully visible and not concealed within equipment or connectors.

3.4 LOUDSPEAKER SUSPENSION

A. Loudspeakers shall be suspended at the operating position in a safe, secure and permanent manner.

B. The aiming direction of all loudspeakers shall be adjustable by ±15 degrees vertically.

C. All speaker enclosures being flown or suspended to have internal mounting brackets to distribute the load to the other faces of the enclosures. Provide internal bracing on cabinets that do not have factory installed bracing.

D. All speaker enclosures to be rigidly mounted to structure with no visible speaker movement due to wind gusts normally experienced.

E. All speaker enclosures to have permanently attached grilles with no company logos or names visible without prior approval by the Owner.

F. Structural support members to have a safety factor of at least 5. Mounting hardware and wire rope to have a safety factor of 8. All fasteners to be graded and certified for use in the intended applications. Overhead suspension hardware shall comply with ASME B30.20 standards and all

applicable local building and safety codes.

G. Overhead suspension hardware must be of a type that includes product traceability controls.

H. Rigging, mounting and support systems for loudspeakers shall be designed and sealed by a registered professional engineer licensed to practice in the State of Montana. Once the systems are installed, the engineer shall physically inspect the methods and means used to verify compliance with the original design.

I. Paint speakers supports and related hardware as directed by Architect.

J. Unless otherwise noted, speakers mounted to building structure are to be positioned with the long dimension horizontal and the high frequency horn rotated to maintain the wider dispersion in the horizontal plane. Speakers mounted on poles are to be oriented vertically, as shown in the drawings.

3.5 OUTDOOR MOUNTING OF EQUIPMENT

A. Objects mounted outdoors and within the building bowl structure shall be properly treated for exposure to moisture and temperature extremes.

B. Mounting hardware shall be non-corrosive or be coated with a corrosion inhibiting layer.

C. Structural supports for speakers or other equipment shall have inherent corrosion resistance or covered with a corrosion inhibiting layer.

D. Speaker components mounted in exterior environments shall be rigidly connected to the structure to prevent movement caused by wind gusts.

E. Speaker and microphone enclosures to include grille capable of breaking up direct water sprays or rain.

F. Seal all exposed electrical connections on speaker enclosure with waterproof silicone sealant.

G. Treat paper cones of outdoor speakers with silicone based moisture repellent if not factory treated.

H. Provide screened cover over all openings in horn type speakers to keep out birds, insects, or small animals. Screened covering to be stretched with no visible wrinkles.

3.6 CONTRACTOR COMMISSIONING

A. Prior to energizing or testing the system, ensure the following:

1. All product is installed in a proper and safe manner per the manufacturer’s instructions.
2. Insulation and shrink tubing are present where required.
3. Dust, debris, solder splatter, etc. is removed.
4. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
5. All labeling has been provided.
6. Temporary facilities and utilities have been properly disconnected, removed and disposed off-site.
7. All products are neat, clean and unmarred and parts securely attached.

8. All broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded.
9. Electronic devices are properly grounded.

B. Prior to energizing the system, perform the following tests in compliance with applicable EIA standards. Record the results of each test in the Project Record Manual.

1. Test each AC power receptacle with a circuit checker for proper hot, neutral and ground connections.
2. Measure and record the DC resistance between the technical ground in any equipment rack or console and the main building ground. Resistance should be 0.15 ohms or less.
3. Temporarily lift the technical ground from the main electrical ground, measure and record the DC resistance between them. Resistance should be 1000 ohms or greater.
4. Measure the impedance of each speaker line leaving the equipment racks. For full range devices, use a frequency of 1000 Hz and 100Hz, for band limited devices, use a frequency appropriate for the operating range of the transducer. When documenting the results of these tests, include the calculated impedances based on number of units on a line and the size and distance of the run. Correct any field readings that differ more than 20% from the calculated impedances.

C. Speaker Circuit Verification Test.

1. Provide a low level, band limited test signal to each amplifier input.
2. Turn on one channel of Amplifier #1 and verify that the correct speaker or group of speakers is operating. Correct any wiring or other problems found.
3. In a similar manner, check each channel of all remaining amplifiers and their respective speaker circuits.
4. Include the results of the tests in the Project Record Manual.

D. Constant Voltage Speaker Test

1. Play music, pink noise or other distinctive audio signal through each group of constant voltage speakers. Only one amplifier channel should be on at a time.
2. Walk the area covered by the speakers.
3. Verify that each speaker is operating and that there are no significant changes in volume level from one speaker to the next.
4. Verify that the extent of coverage is consistent with the areas indicated on the drawings.

E. Speaker Polarity Verification Test

1. Use an electronic polarity checker, TEF-20, SYSID, SIM II, or other similar device to test each reinforcement speaker. All speakers should have the same relative polarity.
2. Follow manufacturer’s recommendations in conducting the tests.
3. In a similar manner, check all distributed speakers to ensure they have the same polarity.
4. Include the results of the tests in the Project Record Manual.

F. System Gain Adjustment

1. Adjust each active device for proper gain from the console output to the input of the amplifier.
2. Record the output levels of each device in the Project Record Manual.

G. Signal Delay Adjustment

1. Adjust the delay to each subsystem to ensure proper synchronization between the main speakers and delayed speakers.
2. Using a TEF 20, SYSID, Smaart, SIM II, or other acceptable time based measurement system, measure the arrival time of the distant signal and then measure the arrival of the local signal.
3. Based on the arrival times measured, adjust the delay applied to the local speakers to synchronize them with the distant speakers. Repeat the test to verify the delay has been set to within 1 ms of the arrival of the distant signal.
4. Continue to test and adjust each separate subsystem with a dedicated delay channel.
5. Provide hard-copy printout of each delay adjustment showing first the arrival times with no delay set and then the result after the delay has been adjusted. Record the settings of each delay in the Project Record Manual.

H. Active Crossover Network Adjustment

1. Adjust each active crossover to provide the appropriate bandwidth and slope rate for the speaker system it controls.
2. Multiple crossovers controlling speakers in identical areas should be set identically.
3. Record the settings of all the crossovers in the Project Record Manual.

I. Amplifier Level Adjustment - Main Reinforcement System

1. Adjust the gain of each amplifier to provide a consistent and appropriate volume level throughout the facility.
2. Begin by connecting a pink noise source to one input of the mixing console. Adjust the console output to -10 dB on the VU meter.
3. Adjust the appropriate amplifiers to achieve 85 dBA in the area covered by one section speakers. Use a calibrated sound level meter to make the measurement.
4. If the test group of speakers employs an active crossover, use a Ivie IE-30, TEF 20, SYSID, Smaart or SIM II to balance the spectrum by adjusting the amplifier for each band.
5. Once the initial speakers have been properly adjusted, begin adding the speakers in each adjacent areas and repeating the same adjustments.
6. When a given area or seating level has been completed, move to the next lower area and repeat the tests and adjustments for that area.
7. Amplifier settings for speakers covering similar seating areas should have the same gain settings. Investigate and correct any occurrences where an amplifier deviates more than 2 dB from the average.
8. Amplifiers should be set to provide an average of 85 dBA ±1.5 dB throughout each seating section.
9. Record the setting of each amplifier in the Project Record Manual and keep backup copies of the data file on disk.

J. Amplifier Level Adjustment - 70 Volt Systems

1. Adjust the level of 70 volt systems to achieve a volume level appropriate for their location and intended use.
2. After setting the amplifier level for each system, play a pink noise signal over the speakers and walk through each area. Using a sound level meter, identify any areas where the SPL changes by more than 3 dB. Identify the cause of the change and where it is due to mounting height or architectural differences, adjust the transformer taps of the affected speakers to bring the sound level within range. Include any changes on the Record Documents.

K. Headroom Verification Test

1. Once the preceding tests and adjustments have been completed, play a variety of musical programs through the system. Amplifiers should be off for this test.
2. Adjust the console gain to achieve peak output levels of +6 VU on the console meters.
3. Observe if any of the components indicate clipping or less than 3 dB of headroom.
4. Replace the musical program with a steady 1000 Hz sine wave. Connect an oscilloscope or similar device to selected amplifiers in each portion of the reinforcement system.
5. Increase the output level of the console until the signal displayed on the oscilloscope begins to show distortion. Record the dB level of the signal from the console and which component in the chain is creating the distortion in the Project Record Manual.

L. Remote Input Verification Test

1. Using a microphone or portable signal generator, connect to each microphone receptacle throughout the facility.
2. Verify that the receptacle under test appears at the correct position on the patch bay and is operating properly.
3. In a similar manner, check all remote tie lines and media related lines for correct wiring and labeling.

M. System Equalization

1. Using a TEF 20, SYSID, SMAART or a spectrum analyzer with both 1/3 band and narrow band display, equalize all loudspeaker systems to provide a suitable frequency response.

N. Verify system gain and amplifier levels.

1. Provide follow-up refinements to the equalization based on requests from the Owner.
2. When all the above tests have been completed and the system is ready for inspection, formally notify the Architect at least seven working days prior to Acceptance Testing. Include in this notice copies of all data recorded, date each test was completed and the results of each test. All test data shall be available during the inspection process

3.7 TEST EQUIPMENT

A. Furnish the following equipment as requested. Equipment to be available for the entire test period through final system testing.

1. Sound Level Meter : ANSI S1.4-1971 Type SEA with digital or analog display. Meter to provide ranges of 40 to 120 dBA.
2. Impedance Meter - Capable of testing audio lines at three frequencies, minimum, between 250 Hz and 4k Hz. Measurement Range: 1 ohm to 100 kohms.
3. Multimeter-Measurement range, DC to 20kHz, 100 mV to 300V, 10 ma to 10 A.
4. Audio Oscillator: bandwidth 20 Hz to 20k Hz ±1 dB at 0 dBm output. Output to be balanced. Oscillator to include adjustable output level.
5. Dual trace oscilloscope.
6. Ladders and scaffolding necessary to inspect all speakers.
7. Temporary 1000 foot microphone cable for testing purposes.
8. Provide three portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project. Include rechargeable batteries and charger along with holster for wearing on belt. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

END OF SECTION 276000

SECTION 277000 – LED READER BOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. LED message centers.

B. Control software.

1.2 REFERENCES

A. Standard for Electric Signs, UL48, CUL48, UL Energy Efficiency Verified (Green Leaf certification).

B. Standard for Control Centers for Changing Message Type Signs.

C. Federal Communications Commission Part 15 Regulations for A Class devices.

D. National Electric Code.

E. Designed to current UBC or IBC standards.

F. FCC Class A Compliant.

1.3 SUBMITTAL

A. The electronic LED display manufacturer shall provide a complete technical submittal within 60 days of contract award and shall not proceed with LED Matrix manufacture until the submittal is approved.

B. Submit:

1. All LED display manufacturer qualifications, as specified herein.
2. LED display installation drawing.
3. AC Site Power Requirements, including legs and Amps per leg.
4. LED display control software operator’s manual.
5. LED display installation and maintenance manual.

1.4 QUALIFICATIONS

A. LED display manufacturer shall:

1. Have an onsite quality assurance lab to verify product integrity.
2. Have at least (1) Project Manager with PMI certification. Have a minimum of 75 years electrical manufacturing experience and 20 years of LED display manufacturing experience prior to the contract bid date.
3. Have a minimum of 50,000 permanently mounted LED displays in operation for a minimum period of one (1) year prior to the contract bid date.
4. Provide support via domestic, toll-free help desk and an online service knowledge base.
5. Provide proof of liability coverage of $10,000,000 aggregate.

B. Manufacturing experience with the following types electronic signs shall not satisfy the requirements:

1. Matrix displays that show a limited quantity of messages.
2. LCD displays.
3. Back-lit displays.

1.5 WARRANTY

A. Warranty against material defects in material and workmanship for five (5) years from the date of shipment from factory dock.

B. Provide a ten (10) year parts availability guarantee.

C. Replacement parts shipped the same day when requested by 3 p.m. CT.

D. Provide toll-free service coordination.

PART 2 - PRODUCTS

2.1 LED Displays

A. Contractor shall provide LED Displays according to the schedule in section (B) of this part and as indicated on the construction drawings.

1. Contractor shall mount and install each display.

B. LED Display Schedule

AD = Active Dims CD = Cabinet Dims	Lobby	Skybox	Concourse	Mezzanine	Arena Floor
6.32mm 144x192 Matrix AD 3'H x 4'W CD 3'5"H x 4'3"W 120VAC 9A			Two (4) Displays, "V" Mount		
6.32mm 192x288 Matrix AD 4'H x 6'W CD 4'5"H x 6'3"W 120VAC 17A	Four (4) Displays,		One (1) Display, Wall Mount	Twelve (12) Displays, Wall Mount	
6.32mm 144x576 Matrix AD 3'H x 12'W CD 3'5"H x 12'3"W 120VAC 26A		Three (3) Displays, *OPTION 1*			Sixteen (16) Displays,
8.47mm 216x1296 Matrix AD 6'H x 36'W CD 6'5"H x 36'3"W 240VAC 78A		One (1) Display, *OPTION 2*			
8.47mm 108x864 Matrix AD 3'H x 24'W CD 3'5"H x 24'3"W 240VAC 30A					One (1) Display,

a. Each LED Display must also be in conformance with the specifications provided in parts 1.05, 2.01, 2.02, and 2.03.

C. Cabinet Construction

1. Cabinet dimensions shall not exceed the measurements shown in Part 2.01 (B)(a). The front-to-back cabinet depth shall not exceed 5 inches.

2. Maximum display power per face shall not exceed values set forth in Part 2.01 (B)(a) when 100% of the pixels are operating at their maximum possible drive current.
3. Cabinet weight per face shall not exceed 9lbs/sq ft
4. Display shall operate from the following power sources: 120/240 VAC, 60 Hz single-phase, including neutral and earth ground.

    a. All primary power runs to be provided prior to installation by MetraPark.

5. Display shall operate in a minimum ambient temperature range of -40° to +140°F (-40 to +60°C) and to a 95% humidity.
6. Internal display component hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from stainless steel, aluminum, nylon, or other durable corrosion-resistant materials suitable for the signage application.
7. Module components shall be 100% solid-state.
8. Display performance may not cause harmful radio, magnetic or electromagnetic interference. The display must accept any interference received, including interferences that may cause undesired operation.

D. Housing Frame

1. Display materials shall use non-corrosive materials or have a protective coating so they shall be anti-corrosive and not degrade or oxidize.
2. Cabinets must be constructed from extruded aluminum with precision-mitered corners, solid welds, and
3. stainless fasteners.
4. The display shall be front or rear ventilated with adequate ventilation provided by the use of fans.
5. Steel mounting points that can be used for mounting purposes shall be provided with the display and have the ability to be adjusted for alternative mounting methods.
6. Shall include lifting supports which may be removed after installation.

E. Exterior Finish

1. The LED display front-facing cabinet shall be coated with a baked acrylic enamel

F. Front Face Construction

1. To meet the display readability requirements, the front face must be constructed in such a manner that it provides high contrast, low light reflection and durability in all weather and site conditions.
2. Minimum features of front face shall:

    a. Include horizontal louvers over LEDs for contrast enhancement and light shading.
    b. Include vertical light traps to reduce light spill.
    c. Use surface materials in the active LED area, such as metal, plastic, or other face materials, designed for low light reflectivity.

G. Serviceability

1. The display housing shall provide safe and convenient front service access for all modular assemblies, components, wiring, and other materials located within the housing.
2. All internal components shall be removable and replaceable by a single technician with proper tooling.
3. Service access shall be easily obtained by removal of one or more modules in front of the associated internal component and/or rear access panel.
4. Each module should allow easy removal with a latch with positive stops.
5. Displays shall be designed with service features that minimize potential bodily harm.

2.2 Display Components

A. LED display modules shall be constructed for good readability, long life, and ease of service. Each display module shall be constructed as follows:

1. Each module within the product family shall be designed with the same physical footprint of 12” x 12”.
2. All modules and their components shall be fully encapsulated and sealed to meet IP-67 standards.
3. An LED module shall consist of LEDs with all drive electronics mounted on a single Printed Circuit Board (PCB).
4. LEDs shall be auto-inserted in order to maintain quality and uniformity of the LEDs within each LED module.
5. All surface mount LEDs shall be soldered using a reflow process to ensure uniformity, quality, and durability of all solder joints.
6. All PCBs shall be cleaned in a manner so as not to contain more than 2 parts per million contaminants.
7. Module signal and electrical connections shall be of the positive locking and removable type. Removal of a module from the display shall not require a de-soldering operation.
8. All LED display modules in a single display shall be identical in construction and interchangeable throughout the display with the ability to be field calibrated.
9. Modules shall be individually attached to the cabinet frame.
10. Removal of one or more modules shall not affect the display’s structural integrity.
11. The distance from the center of one line or column of pixels to the center of all adjacent lines or columns shall be either 6.35mm or 8.47mm both horizontally and vertically depending on display model.
12. Confines high speed data signals to individual smart LED modules, each with its own microcontroller that runs the LEDs.
13. The display must not send high speed data signals from a receiver card to the module over multi-conductor cables to display an image.
14. The failure of a single pixel, module or power supply shall not cause the failure of any other pixel, module or power supply in the display.
15. All modules shall have no less than a 150° horizontal half-intensity viewing angle.
16. The transition of the viewing intensity shall be consistent throughout the viewing cone.

B. Pixels shall be constructed with 3 in 1 SMD LEDs, and these 3 in 1 SMD LEDs shall conform to the following specifications:

1. LEDs shall be diffused, ultra-bright, solid-state light emitting diodes.
2. Each color of LEDs used in all LED displays provided for this contract shall be from the same bin.
3. LED half-life shall be an estimated minimum of 100,000 hours.
4. Display shall have a minimum intensity of 7,000 nits maximum light output.

C. Power Supply

1. All power supplies shall be regulated, auto-ranging AC to DC power, with protection for the LED pixel, LED display and driver circuitry in the event of power spikes or surges.
2. Each power supply and their connectors shall be fully sealed to protect from corrosive environmental factors meeting IP-67 standards.

D. Internal Wiring

1. Use smart module design to minimize cables needed, reduce potential points of failure and reduce Mean Time Between Failures (MTBF).
2. Cables must be engineered and tested to withstand environmental conditions by using high grade automotive connectors instead of insulation displacement (ribbon-type cables) connectors.
3. Wires shall not make contact with or be bent around sharp metal edges.
4. All wiring shall conform to the National Electric Code.

E. The display shall be protected from electrical spikes and transients.

F. The manufacturer shall provide an earth-ground lug on the display.

2.3 Display Performance

A. Display Capability

1. The LED display shall present messages that are continuous, uniform, and unbroken in appearance.
2. The LED display shall be capable of producing 1.2 quintillion colors.
3. Each display pixel shall be composed of one each – red, green, and blue LEDS configured in a Surface Mount Diode (SMD) pixel package.
4. The display shall be able to display messages composed of any combination of alphanumeric text, punctuation symbols, and graphic images.
5. Live video and message content shall have equal or greater than 30 frames per second (FPS) playback capability.

B. Control and Communications

1. Each single-face display shall be controlled and monitored by its own LED controller.
2. The LED controller shall be able to receive instructions from a host communications system via fiber-optic cable.

    a. All Fiber-optic cable runs from host communications system to LED Displays provided by MetraPark.

b. Fiber-optic cable shall be multi-mode, 62.5 Micron with ST-style connectors.

2.4 Control System

A. System Hardware

1. Hardware should be delivered in a rack mountable computer enclosure not to exceed 4RU in height. Mounting rails should be included.
2. System should not draw more than 250W at 120VAC during normal operation.
3. System should not produce more than 65db at 3 feet when sampled from the front.
4. Power supply should be professional quality and feature a MTBF of at least 100,000 hours. At nominal load power supply should deliver 90% power efficiency. Optionally, system should allow selection of fully redundant power supply.
5. System should have at least Qty 2, RS232 I/O ports.

B. Operating System Requirements

1. Windows 10 IOT LTSC 64-bit
2. Minimum of 16GB RAM
3. Only solid state drives are permitted.
4. Minimum of 900GB SSD capacity configured as a 4 disk RAID 10. Drives should be housed with front serviceable RAID cage with driv

C. Live Video Support

1. System input and output should support 10-bit SD/HD SDI
2. QTY 4, 3G HD-SDI Inputs
3. QTY 2, 3G HD-SDI Outputs with optional Key&Fill
4. 4:2:2 Video Sampling
5. 10-bit Color Precision
6. REC 601 and REC 709 Color Space
7. Auto synchronization to input video format.

D. SDI Output

1. System should support SDI InLine mode, as well as single or dual channel SDI Key&Fill Channels. When u

E. Graphics Output

1. DVI Output should support real-time pixel remapping to control display sin excess of 30,000 pixels.

F. Software Requirements

1. One occurrence of the software should be able to drive full matrix LED Displays as well as fascia ribbon displays.

2. Software should support unlimited number of media buttons and allow user to dynamically unload and load new collections of media items without stopping current media or switching between different modes.
3. System should be able to render Live video, Clips, Graphics and Virtual scoring data on SD or HD SDI, DVI, or a combination of both. SDI output should support separate key and fill SDI outputs.
4. Software should be able to drive any compatible LED screens, LCD Monitors or Video Switchers from any manufacturer with no limiting proprietary technologies.
5. Software should provide native support for multiple video codecs and image formats. At a minimum these should include: Video: MPG1, WMV, Uncompressed AVI, MOV (MPG4), MOV (H.264) and Lagarith. Video alpha transparency should be preserved if transparency is supported by codec. Images: JPG, BMP, PNG with alpha transparency supported. Software should NOT require transcoding or outside conversion prior to importing clips.
6. System should allow manual editing of dynamic text data fields from any web browser enabled device over Ethernet via local area network or internet if desired. Changes to the data variables should not require operator to perform any action and values should change automatically.
7. Software should support external control from third party devices and or software over TCP/IP.
8. Software should support remote buttons allowing content to be triggered from one system to another.
9. Software should support automatic triggering of any media on any desired surface in the event of a fire alarm.
10. Software should support proof of play reporting of clips. Playback reports should be able to be generated from the main server or ANY Windows PC with network connectivity to server.
11. Proof of play report should allow for "Events" to be defined during playback. "Events" are used as markers to encapsulate periods of time for which reports are generated. A report should be able to be generated for any Event and for any media item at any point.
12. Software should support multiple “Profiles” allowing easy transition from one configuration to another. Allowing multi-use venues to easily switch between sports.
13. Software should allow creation of multiple playback canvas areas. Canvas areas should be stackable in 3D Z-Order and support transparency through stacked layers. Canvas areas should within themselves, support Live video, and three distinctly controllable layers for asynchronous playback of content.
14. Software should support at least 2 Real-time data feeds over RS232, RS485 and TCP-IP. Support should be provided for any scoreboard manufacturers and other sources. At a minimum, this should include Watchfire, OES Scoreboard, Daktronics, Fairplay and Spectrum Scoreboards. Statistics from StatCrew as well as any User-Defined XML data source. New data sources should be able to be changed with little effort by user. Close captioning text should also be supported.
15. Software should support Text messaging campaigns and be able to provide anecdotal accounts of more than one event where the system was used successfully to display text messages.
16. Software should support RSS Based Out of Town scores from Stats.com

PART 3 - EXECUTION

3.1 EXAMINATION

A. Mounting structure to be installed by contractor to support desired displays in all locations. Verify that separate conduit is in place for power and data to display, unless fiber is being used. Verify that all control equipment has access to 120/240 VAC.

3.2 INSTALLATION

A. Support structure design depends on the mounting methods, display size, and weight. The structure design is critical and should be done only by a qualified individual. It is the contractor's responsibility to ensure that the structure and mounting hardware are adequate.

B. It is the contractor's responsibility to ensure that the installation meets local standards. The mounting hardware shall be capable of supporting all components to be mounted.

C. All mounted displays must be inspected by a qualified structural engineer.

D. Possible power and signal entrances are designated by etched markings. Separate conduit must be used to route the power, signal in wires, and signal out wires.

   a. All primary power and signal runs to be completed by MetraPark prior to installation

E. Displays must be grounded according to the provisions outlined in Article 250 of the National Electrical Code. The display must be connected to earth-ground. Proper grounding is necessary for reliable equipment operation and protects the equipment from damaging electrical disturbances and lightning.

F. All installations shall conform to Article 600 of the National Electrical Code.

END OF SECTION 277000

SECTION 282100 - VIDEO SECURITY SURVEILLANCE MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. SECURITY CAMERAS

B. NETWORK VIDEO RECORDER

C. SOFTWARE

1.2 REFERENCES

A. Code of Federal Regulations (CFR).

B. Institute of Electrical and Electronics Engineers (IEEE):

1. 802.3 Ethernet Standards.

C. International Electrotechnical Commission (IEC).

D. International Organization for Standardization (ISO):

1. ISO / IEC 10918 - Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
3. ISO / IEC 23008-2 - High Efficiency Coding And Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part 2 (ITU H.265, HEVC).

E. European Standard (EN):

1. EN 50121 - Railway Applications. Electromagnetic Compatibility.
2. EN 50155 - Railway applications - Rolling stock - Electronic equipment.
3. EN 50130-4 - Alarm Systems. Electromagnetic Compatibility. Product Family Standard: Immunity Requirements For Components Of Fire, Intruder, Hold Up, CCTV, Access Control And Social Alarm Systems.
4. CE EN 50581 - Technical Documentation For The Assessment Of Electrical And Electronic Products With Respect To The Restriction Of Hazardous Substances.
5. EN 55022 Class A - Information Technology Equipment - Radio Disturbance Characteristics - Limits And Methods Of Measurement.
6. EN 61000-3-2-A2 - Electromagnetic Compatibility (EMC) - Part 3-2: Limits - Limits For Harmonic Current Emissions (Equipment Input Current: 16 A Per Phase).
7. EN 61000-3-3 - Electromagnetic Compatibility (EMC) - Part 3-3: Limits - Limitation Of Voltage Changes, Voltage Fluctuations And Flicker In Public Low-Voltage Supply Systems, For Equipment With Rated Current less than or equal to 16 A Per Phase And Not Subject To Conditional Connection.

F. European Union Safety Standards (CE).

G. Federal Communications Commission (FCC):

1. FCC Rules and Regulation of Title 47 of CFR Part 15 Subpart B Class A.

H. Open Network Video Interface Forum (ONVIF):

1. ONVIF - Profiles S Specification.

I. Underwriters Laboratories (UL):

1. UL listed.

J. United States Military Standard (MIL-STD):

1. MIL-STD-810F - Environmental Engineering Considerations and Laboratory Tests.

1.3 DEFINITIONS

A. Abbreviations:

1. ARP - Address Resolution Protocol.
2. DHCP - Dynamic Host Configuration Protocol.
3. DNR - Digital Noise Reduction.
4. DDNS - Dynamic Domain Name Server.
5. fps - frames per second.
6. GUI - Graphical User Interface.
7. HDD - Hard Disk Drive.
8. HTTP - Hypertext Transfer Protocol.
9. ICMP - Internet Control Message Protocol.
10. IGMP - Internet Group Management Protocol
11. IP - Internet Protocol.
12. iSCSI - Internet Small Computer System Interface.
13. JBOD - Just a Bunch of Disks.
14. JPEG - Joint Photographic Experts Group.
15. MJPEG - Motion JPEG.
16. MP - Megapixel.
17. MPEG - Moving Pictures Experts Group.
18. NAS - Network Attached Storage.
19. NTP - Network Time Protocol.
20. POS - Point of Sale.
21. PPPoE - Pont to Point Protocol over Ethernet.
22. RAID - Redundant Array of Independent Disks (Drives).
23. RTP - Real-Time Transport Protocol.
24. RTCP - Real-Time Control Protocol.
25. RTSP - Real-Time Streaming Protocol.
26. SMTP - Simple Mail Transfer Protocol.
27. SNMP - Simple Network Management Protocol.
28. SSL - Secure Sockets Layer.
29. TCP - Transmission Control Protocol.
30. UDP - User Datagram Protocol.
31. UPnP - Universal Plug and Play.
32. VMS - Video Management System.
33. PoS - Point of Sales.
34. VA - Video Analytics.
35. PnP - Plug and Play.
36. ARB - Auto Recovery Backup.
37. NVR - Network Video Recorder.
38. RAID - Redundant Array of Independent Disks.

B. Definitions:

1. JBOD: A collection of hard disks that have not been configured to act as a redundant array of independent disks (RAID) array.
2. GOV (Group of Video object planes): A set of video frames for H.264 and H.265 compression, indicating a collection of frames from the initial I-Frame (key frame) to the next I-Frame. GOV consists of 2 kinds of frames: I-Frame and P-Frame.
3. WiseStream: Smart Codec that controls quantization parameter in H.265 and H.264 to efficiently manage bitrate of the video stream and reduce the storage required.
4. Dynamic GOV: Dynamic assignment of GOV length based on the complexity of the scene to efficiently manage bitrate of the video stream and reduce the storage required.
5. Dynamic fps: Dynamic assignment of frames per second based on the complexity of the scene to efficiently manage bitrate of the video stream and reduce the storage required.
6. ARB (Auto Recovery Backup): Automatic backup mechanism that enables WiseNet cameras to store videos on to SD card during failures and stream it to the storage device after recovery.
7. Failover: A feature that automatically switches to a redundant or standby device upon failure or unexpected shutdown of an active device.

1.4 SUBMITTALS

A. Submit under provisions of Section 013000 - Administrative Requirements.

B. Solution Proposal: System Integrator shall submit the Solution Proposal.

C. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Manufacturer's printed or electronic data sheets.
2. Manufacturer's installation and operation manuals.
3. Warranty documentation.

D. Shop Drawings: Include details of construction, interface of equipment, and relationship with adjacent construction.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

B. System Integrator shall provide the following as part of the System Solution:

1. Complete product and technical data specification sheets that include all material and equipment and shall be available freely online.
2. List of all equipment with part numbers, manufacturer, firmware, and assigned IP addresses.
3. Locations and details for all components to be installed under this scope of work.
4. Placement Diagram showing the proposed location of all system hardware devices.
5. System Calculation of all network bandwidth and storage requirements for System Servers to ensure proper planning of computing and networking infrastructure.

C. Installer Qualifications: Minimum 2 year experience installing similar products. Installers shall be trained and authorized by the Manufacturer to install, integrate, test, and commission the system.

1.6 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.9 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.10 WARRANTY

A. The security system VMS software and labor furnished by the System Integrator including wiring, software, hardware and third party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance of the Video Surveillance System.

B. Manufacturer shall provide a limited 3 year warranty for the product to be free of defects in material and workmanship.

C. Software Licensing and Warranty:

1. Software licensing should be on a per device basis (e.g. 1 x license for 1 IP Camera or I/O device) with no base license for additional features or capabilities.
2. The VMS Software should be completely free for live streaming or playback of offline media files (images, videos).
3. Lifetime software upgrades shall be provided by the Manufacturer without cost and without the need for an annual maintenance agreement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of design Manufacturer: Hanwha Techwin.

B. Requests for equal substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 SECURITY CAMERAS

A. SECURITY CAMERA TYPE “SB”.

1. EQUIPMENT

a. Basis of Design: Hanwha Techwin #TNB-9000 with enclosure, lens and mounting hardware. Include HPoe Injector. SUBSTITUTIONS ON LIKE OR BETTER WILL BE CONSIDERED. PLEASE NOTE VARRIATIONS TO ALLOW COMPARISON.

2. GENERAL DESCRIPTION

a. Video Compression and Transmission – The camera shall have the following properties relating to the video signals it produces.

1) H.265, H.264 and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously.

a) H.265 and H.264 – Max.15fps@8K, 20fps@24MP, 30fps@15MP, 60fps@4K

2) The camera shall be able to configure up to 10 independent video stream profiles with differing encoding, quality, frame rate, resolution, and bit rate settings.
3) The camera shall be able to configure various resolution selections.

a) 7680x4320, 7360x4128, 6016x3384, 6016x4008, 5472x3648, 4768x3184,4608x2592, 3840x2160, 1920x1080, 1280x1024, 1280x960, 1280x720, 1024x768,800x600, 800x448, 720x576, 720x480, 640x480, 640x360

4) The camera shall support multicast and unicast video streaming up to 10 users.
5) The camera shall be able to configure Dynamic DNS (DDNS). DDNS shall be provided with no additional cost by the manufacturer.
6) The camera shall provide smart codec (WiseStream II, Dynamic GOV, and Dynamic fps) to efficiently manage bit rate of the video stream and reduce storage while producing video quality that is visually equal to the one without smart codec.

b. Camera – The camera device shall have the following physical and performance properties:

1) Automatic, manual, scheduled day and night operation with infrared cut filter. Images are available in color or black and white.

a) Low light level operation to 0.015Lux (F1.4) in color mode and 0.0015Lux (F1.4) in black and white mode.

2) The camera shall support digital noise reduction using both 2D and 3D noise reduction technology.
3) Configurable 6 privacy masking regions utilizing rectangle

c. Intelligence and Analytics – The camera shall have a suite of integral intelligent operations and analytic functions to include:

1) Motion detection with eight definable detection areas with eight point polygonal zones, and minimum/maximum object size.
2) Motion detection hand-over to PTZ cameras. The camera shall be able to call a preset of PTZ camera when motion event is triggered.
3) Detection of logical events of specified conditions from the camera’s video

a) Tampering
b) Loitering
c) Directional detection
d) Defocus detection
e) (Dis)Appear,
f) Audio detection

g) Motion detection
h) Classified object type : person/face/vehicle/license plate with attributes, Best shot per object
i) Analytics events based on AI engine : object detection, directional detection, Enter/Exit, loitering, virtual line

4) Detection and classification of the following sound.

a) Scream
b) Gunshot
c) Explosion
d) Crashing glass

d. Interoperability – The camera shall be ONVIF Profile S,G and T compliant.

e. The camera shall possess the following further characteristics:

1) Built-in web server, accessed via standard HTML5 browsers including Internet Explorer, Firefox, Chrome & Safari
2) The camera shall provide streaming to multiple smart phones with DDNS provided freely from the manufacturer. In addition, the application shall be available for both iOS and Android, free of charge with search keyword, 'Wisenet Mobile'.
3) Micro SD/SDHC/SDXC memory card with configurable pre-alarm and post-alarm recording intervals
4) NAS recording option with configurable pre-alarm and post-alarm recording intervals
5) Alarms and notifications

a) alarm notification triggers:

1) Alarm input
2) Analytics
3) Network disconnect

b) available notification means upon trigger:

1) File Upload via FTP and E-mail
2) Notification via E-mail
3) Local storage (SD / SDHC / SDXC) or NAS recording at event triggers
4) Alarm output
5) Handover

6) Pixel Counter available in the web viewer.
7) HPoE capable

3. DETAILED SPECIFICATIONS

a. Video

1) Imager

a) Sensor 43.3mm Full-frame CMOS

1) Effective Pixels 7680(H) x 4320(V)

b) Minimum Illumination

1) Color Mode 0.015Lux (1/30sec, F1.4)
2) Black & White Mode 0.0015Lux (1/30sec, F1.4)

c) Video Out (Installation) HDMI: 1080p@30fps

d) The following features with control settings shall be available

1) Camera Title Off / On (Displayed up to 75 characters)
2) Day/Night Setting Auto (ICR)
3) Backlight Compensation (BLC) BLC / DWDR
4) Digital Noise Reduction (DNR) SSNR5
5) Motion Detection Off / On (8ea, 8 points polygonal zones in 8k resolution only)
6) Privacy Masking Off / On (6ea zones of rectangle)- Color: Gray / Green / Red / Blue / Black / White
7) Gain Control Low / Middle / High
8) White Balance ATW / AWC / Manual / Indoor / Outdoor
9) Electronic Shutter Speed

a) Settings Min / Max / Anti-flicker (1/5 ~ 1/12,000sec)

10) Analytics

a) Classified object type. Person/Face/Vehicle/License plate withattributes, BestShot per object.
b) Analytics events based on AI object detection, Directional detection, Enter/Exit, Loitering, Virtual line
c) Analytics events Defocus detection, Motion detection, Appear/Disappear, Tampering, Audio detection, Sound classification(*AI function will be upgraded later)

11) Serial Interface RS-485(Samsung-T, Pelco-D/P)
12) Alarm I/O Input 1ea / Output 1ea
13) Alarm Triggers Alarm Input Video & Audio Analytics, Network Disconnection
14) Alarm Events File Upload via FTP and E-mail, Notification via E-mail, Local storage (SD / SDHC / SDXC) or NAS recording at event triggers, Alarm outputHandover
15) Audio InMic in/Line in(2.5VDC(4mA), Input impedance: 2K Ohm)
16) Audio Out Line out(Max. output level 1Vrms)

e) Lens

1) Field of View Canon 24mm f1.4L, Auto-Iris (EF 24mm f/1.4L II USM) :Horizontal field of view : 8K 62.1°

B. DORI DistanceDetect (167.5ft)Identify — 255.3m (837.7ft)Observe 102.1m (335.1ft)Recognize 51.1m 25.5m (83.8ft)Canon 35mm f1.4L, Auto-Iris (EF 35mm f/1.4L II USM): Horizontal field of view:8K 44.5°

C. DORI DistanceDetect (244.3ft)Identify — 372.3m (1221.6ft)Observe 148.9m (488.6ft)Recognize 74.5m 37.2m (122.2ft)Canon 50mm f1.4, Auto-Iris (EF 50mm f/1.4 USM): Horizontal field of view: 8K 31.6°

D. DORI DistanceDetect (349.0ft)Identify — 531.9m (1745.1ft)Observe 212.8m (698.1ft)Recognize 106.4m 53.2m (174.5ft)Canon 85mm f1.2L, Auto-Iris (EF 85mm f/1.2L II USM) : Horizontal field of view: 8K 19.2°

E. DORI DistanceDetect (593.3ft)Identify — 904.3m (2966.7ft)Observe 361.7m (1186.7ft)Recognize 180.9m 90.4m (296.7ft)Canon 100mm f2.0, Auto-Iris (EF 100mm f/2 USM): Horizontal field of view: 8K 16.1°

F. DORI DistanceDetect — 1063.8m (3490.3ft)Observe 425.5m (1396.1ft)Recognize212.8m (698.1ft)Identify 106.4m (349.0ft)Canon 70-200mm f2.8L, Auto-Iris, Vari Focal (EF 70?200mm f/2.8L USM) : Horizontal field of view: 8K 23.2° ~ 8.3°* When using Canon 70-200mm f2.8L, Auto-Iris, Vari Focal (EF 70?200mm f/2.8L USM) mount lens, housing accessory components must be used.

G. DORI Distance Detect — 744.7m-2127.7m (2443.2ft – 6980.5ft) Observe 297.9m-851.1m (977.3ft – 2792.2ft) Recognize 148.9m-425.5m (488.6ft – 1396.1ft)Identify 74.5m-212.8m (244.3ft – 698.1ft)

1) Focus Control Auto focus
2) Lens Type Canon EF mount Lens
3) Mount Type Canon EF mount
4) Optional Lens Canon 24mm f1.4L, Auto-Iris (EF 24mm f/1.4L II USM)Canon 35mm f1.4L, Auto-Iris (EF 35mm f/1.4L II USM)Canon 50mm f1.4, Auto-Iris (EF 50mm f/1.4 USM)Canon 85mm f1.2L, Auto-Iris (EF 85mm f/1.2L II USM)Canon 100mm f2.0, Auto-Iris (EF 100mm f/2 USM)Canon 70-200mm f2.8L, Auto-Iris, Vari Focal (EF 70?200mm f/2.8L USM)

2) Video Streams

a) The camera shall be able to produce 10 video profiles, each of which may have the following properties

1) Encoding Type

a) H.265
b) H.264
c) MJPEG

2) Resolution 7680x4320, 7360x4128, 6016x3384, 6016x4008, 5472x3648, 4768x3184, 4608x2592, 3840x2160, 1920x1080, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360
3) Maximum Framerate

a) H.265/H.264: 8K @ Max. 15fps (Mode 0) : Available in Dec.

2019

b) H.265/H.264: 24MP @ Max. 20fps (Mode 1) : Available in Mar. 2020
c) H.265/H.264: 15MP @ Max. 30fps (Mode 2) : Available in Mar. 2020
d) H.265/H.264: 4K @ Max. 60fps (Mode 3) : Available in Mar. 2020

4) Smart Codec WiseStreamII, Dynamic GOV, Dynamic fps
5) Bitrate Control Method H.265 / H.264: CBR or VBRMJPEG: VBR

3) Number of Multi-Streaming Profiles 3 maximum
4) Simultaneous Users (Total) 10 maximum (Unicast)
5) Storage and Recording

a) The camera shall have an onboard SD card storage

1) Card Type Micro SD/SDHC/SDXC
2) Capacity 256GB (1slot)
3) Video or images content on the card shall have the ability to be downloaded to a selected destination

6) Audio Compression G.711 u-law /G.726 SelectableG.726(ADPCM) 8KHz, G.711 8KHzG.726: 16Kbps, 24Kbps, 32Kbps, 40KbpsAAC-LC: 48Kbps at 16KHz

7) Interoperability – Video streams shall be capable of supporting ONVIF Profile S / G /T

8) Still Image – The camera shall support image screenshot and export

b. Network

1) Connectivity – RJ-45(10/100/1000 BASE-T), SFP slot(100/1000Mbps)
2) ProtocolIPv4, IPv6, TCP/IP, UDP/IP, RTP(UDP), RTP(TCP), RTCP,RTSP, NTP, HTTP, HTTPS,SSL/TLS, DHCP, FTP, SMTP, ICMP, IGMP, SNMPv1/v2c/v3(MIB-2), ARP, DNS,DDNS, QoS, UPnP, Bonjour, LLDP
3) DDNS – The camera shall support DDNS services offered by the manufacturer and others publicly available service offerings

1. QoS – Layer 3 DSCP
2. Security Feature

a. User password protection
b. The device shall not provide a manufacture default password. Default password change shall be required to access the camera.
c. A minimal level of password complexity shall be required by the camera.
d. The camera shall not have a manufacture back-door password.
e. The manufacturer shall provide a tool that provides the ability to make password changes to multiple cameras at the same time.
f. IP address filtering – List of allowed or blocked IP addresses
g. HTTPS(SSL) login authentication
h. HTTPS(SSL) secured communication
i. Digest login authentication
j. User access log
k. 802.1x authentication

3. Discovery – The manufacturer shall offer a discovery program to identify all devices of them on the network.
4. Configuration – The manufacturer shall offer a configuration program that remotely allows users to change settings on multiple cameras simultaneously.
5. Firmware upgrade – The manufacturer shall offer a program capable of upgrading multiple cameras at the same time (not requiring access to individual cameras).
6. Camera backup setting – The manufacturer shall provide a program that provides the ability to save multiple camera settings to a file and restore these camera settings if needed.
7. Reporting – The manufacturer shall provide a tool that can generate a report including thumbnail view, MAC address, IP address, serial number and other camera settings.

2. Electrical

1. Power

a. Input Voltage / Current HPoE(IEEE802.3bt, Class5), 12VDC
b. Power Consumption PoE: Max 30W, typical 20W, 12VDC: Max 26W, typical 18W

3. Mechanical And Environmental

1. Material: Black, Aluminum
2. Dimensions (W x H x D) : 120(W)x118.1(H)x179(D)mm
3. Weight: 2.1Kg(4.55 lb)
4. Temperature

a. Operating: 0°C ~ +45°C(32°F ~ +122°F) / Less than 90% RH
b. Storage / Humidity: -40°C ~ +65°C(-40°F ~ +149°F) / Less than 90% RH

5. Certification: EMC

H. SECURITY CAMERA TYPE “A”

1. EQUIPMENT

a. Basis of Design: Hanwha Techwin #XND-6081RV with mounting hardware. SUBSTITUTIONS ON LIKE OR BETTER WILL BE CONSIDERED. PLEASE NOTE VARRIATIONS TO ALLOW COMPARISON.

2. GENERAL DESCRIPTION

a. Video Compression and Transmission – The camera shall have the following properties relating to the video signals it produces.

1) H.265, H.264 and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously.

a) H.265 and H.264 – maximum of 60fps at all resolution
b) MJPEG – maximum of 30fps

2) The camera shall be able to configure up to 10 independent video stream profiles

with differing encoding, quality, frame rate, resolution, and bit rate settings.

3) The camera shall be able to configure various resolution selections.

   a) 16:9 aspect ratio : 1920 x 1080, 1280 x 720, 800 x 448, 640 x 360
   b) 4:3 aspect ratio : 1280 x 960, 1024 x 768, 800 x 600, 640 x 480, 320 x 240,
   c) 5:4 aspect ratio : 1280 x 1024, 720 x 576,
   d) 3:2 aspect ratio : 720 x 480

4) The camera shall support unicast video streaming up to 20 users.
5) The camera shall support multicast video streaming
6) The camera shall be able to configure Dynamic DNS (DDNS). DDNS shall be provided with no additional cost by the manufacturer.
7) The camera shall provide WiseStream II, Dynamic GOV and Dynamic fps to efficiently manage bit rate of the video stream and reduce storage.

b. Camera – The camera device shall have the following physical and performance properties:

1) IK10 rated for protection against impacts.
2) True day/night operation with removable IR cut filter

   a) Low light level operation to 0.015 lux at F1.4 in color mode and 0.0015 lux at F1.4 in black and white mode.

3) The camera shall be able to produce clear images in highly contrast scenes with multi-exposure wide dynamic range up to 150dB.
4) The camera shall support digital noise reduction using both 2D and 3D noise reduction technology.
5) The camera shall be able to configure 32 privacy masking areas with polygons.
6) The camera shall have the defog feature to remove fogginess of scene which can be triggered automatically from the fog detection event.
7) The camera shall provide video display on smart phone (iPhone, Android) to adjust viewing angle, rotation and focus.

c. Intelligence and Analytics – The camera shall have a suite of intelligent analytic functions.

1) Motion detection with 8 definable detection areas with 8 point polygonal zones, and minimum/maximum object size.
2) Detection of logical events of specified conditions from the camera's video

   a) Tampering, Loitering, Directional Detection, Virtual Line, Enter/Exit, (Dis)Appear
   b) Defocus Detection, Fog Detection, Shock Detection
   c) Motion Detection, Digital Auto Tracking, Face Detection
   d) Audio Detection, Sound Classification
   e) Audio playback on event

3) Detection and classification of the following sound.

   a) Scream
   b) Gunshot
   c) Explosion
   d) Crashing glass

d. Interoperability – The camera shall be ONVIF Profile S and G compliant.

e. The camera shall possess the following further characteristics:

1) Built-in web server, accessed via non-plugin browsers including Google Chrome, IE11, MS Edge, Mozilla Firefox and Apple Safari.
2) Micro SD/SDHC/SDXC memory card with configurable pre-alarm and post-alarm recording intervals
3) NAS recording option with configurable pre-alarm and post-alarm recording intervals
4) Alarms and notifications

a) alarm notification triggers:

1) Alarm input
2) Motion detection
3) Video & Audio analytics
4) Network disconnect

b) available notification means upon trigger:

1) File Upload via FTP and E-mail
2) Notification via E-mail
3) Local storage (SD / SDHC / SDXC) or NAS recording at event triggers
4) External output

5) Pixel Counter available in the web viewer.
6) PoE capable including heater by PoE
7) IP52, IK10

3. DETAILED SPECIFICATIONS

a. Video

1)	Imaging device	1/2.8" 2MP CMOS
2)	Image Pixels	Total: 1,945(H) x 1,109(V), effective: 1,945(H) x 1,097(V)
3)	Scanning	Progressive
4)	Minimum Illumination (IR LED on)	Color: 0.015Lux (F1.4, 1/30sec), B/W: 0 Lux
5)	S/N Ratio	50dB

b. Lens:

1)	Focal length	2.8~12mm(4.3x) motorized varifocal
2)	Max. Aperture Ratio	F1.4(Wide)~3.6(Tele)
3)	Field of View	[Wide] H: 119.5˚, V: 62.8°, D: 142.1°[Tele] H: 27.9˚, V: 15.7°, D: 32.0°
4)	Min. Object Distance	0.5m (1.64ft)
5)	Focus Control	Simple focus/Manual (Remote control via network)
6)	Lens Type	DC Auto Iris, P-Iris
7)	Mount Type	Board-in Type

c. Pan & Tilt & Rotate

1)	1. PTR Range	0˚~360˚ / -45˚~85˚ / 0˚~355˚

d. IR Viewable Length — 50m (164.04ft)

e. Operational Functions

1)	Camera Title	Off / On (Displayed up to 85 characters)
	a) W/W	English / Numeric / Special characters
	b) China	English / Chinese / Numeric / Special characters
	c) Common	Multi-line (Max. 5), Color (Grey/Green/Red/Blue/Black/White),Transparency, Auto scale by resolution
2)	Day/Night Setting	Auto (ICR) / Color / B/W / External / Schedule
3)	Backlight Compensation	Off / BLC / HLC / WDR
4)	WDR	150dB
5)	Contrast Enhancement	Off / On (SSDR)
6)	Digital Noise Reduction	Off / On (SSNR5 : 2D+3D Noise filter)
7)	Digital Image Stabilization	Off / On (built-in Gyro sensor)
8)	Defog	Off / Manual / Auto
9)	Motion Detection	Off / On (8ea, 8-point polygonal), Handover
10)	Privacy Masking	Off / On (32 zones, polygonal)- Color: Grey / Green / Red / Blue / Black / White- Mosaic
11)	Gain Control	Off / Low / Middle / High
12)	White Balance	ATW / AWC / Manual / Indoor / Outdoor(Including Mercury and Sodium)
13)	Electronic Shutter Speed	Min / Max / Anti-flicker (2 ~ 1/12,000sec)
14)	Digital Zoom	24x
15)	Digital PTZ	Support (Preset, Group)
16)	Image Rotation	Flip: Off / On Mirror: Off / On Hallway view: 0˚ / 90˚ / 270˚
17)	Alarm I/O	Input 1ea / Output 1ea
18)	Alarm Triggers	Alarm Input, Motion Detection, Video & Audio Analytics, Network Disconnection
19)	Alarm Events	File Upload via FTP and E-mail, Notification via E-mail, SD/SDHC/SDXC or NAS recording at event triggers, Alarm output, Handover, Audio playback
20)	Pixel Counter	Support
21)	Storage	Micro SD/SDHC/SDXC 512GB (256GB x 2 slots) , NAS support
22)	Intelligent Analytics	Tampering, Loitering, Directional Detection, Defocus Detection, Fog Detection, Virtual Line, Enter/Exit, (Dis)Appear, Audio Detection, Face Detection, Motion Detection, Digital Auto Tracking, Sound classification (Scream/Gunshot/Explosion/Crashing glass)Shock detection, Heatmap, People counting, Queue management, Audio Playback

		on event
23)	Video Out (Installation)	USB: Micro USB type B, 1280 x 720

f. Video Streams

1)	Video compression	H.265, H.264, MJPEG
2)	Resolution	1920 x 1080, 1280 x 1024, 1280 x 960, 1280 x 720, 1024 x 768, 800 x 600, 800 x 448, 720 x 576, 720 x 480, 640 x 480, 640 x 360, 320 x 240
3)	Maximum Framerate	
a) H.265 / H.264		Max. 60fps at all resolutions
b) MJPEG		Max. 30fps
4)	Smart Codec	Manual Mode (area-based : 5EA)
5)	WiseStream II	Support
6)	Bitrate Control Method	H.265 / H.264: CBR or VBRMJPEG: VBR
7)	Streaming Capability	Multiple streaming (Up to 10 profiles)
8)	Streaming method	Unicast / Multicast
9)	Simultaneous Users	20 maximum (Unicast)
10)	Profile set	Max. 10 ea
11)	Interoperability	ONVIF Profile S / G, SUNAPI, Open Platform

g. Audio

1)	Audio In	Built in Mic / Line-in / External Mic(2.5VDC/4Ma supply)(Input impedance: approx. 2K Ohm)
2)	Audio Out	Line out (3.5mm stereo mini jack)
3)	Audio Compression	G.711 / G.726 / AAC Selectable, G.711 u-law: 8KHz,G.726 (ADPCM): 16 / 24 / 32 / 40Kbps at 8KHz,AAC-LC: 48Kbps at 8 / 16 / 32 / 48KHz
4)	Communication	Bi-directional (2-Way)

h. Network

1) Connectivity – 10/100 Base-T Ethernet via RJ-45 connector
2) Protocol

a) IP v4 / v6, TCP, UDP

1. Configuration: DHCP, LLDP
2. Web service: HTTP, HTTPS
3. Network Service: ARP, Bonjour, DNS, ICMP, NTP, PIM-SM, SNMP v1/2c/3 – MIB-2, UPnP
4. Media: RTP, RTCP, RTSP
5. Multicast: IGMP
6. Notifications: FTP, SMTP
7. Remote Access: PPPoE

6. DDNS – The camera shall support DDNS services offered by the manufacturer and others publicly available service offerings

7. QoS – Layer 3 DSCP
8. Security Feature

    1. User password protection
    2. The device shall not provide a manufacture default password. Default password change shall be required to access the camera.
    3. A minimal level of password complexity shall be required by the camera.
    4. The camera shall not have a manufacture back-door password.
    5. The manufacturer shall provide a tool that provides the ability to make password changes to multiple cameras at the same time.
    6. IP address filtering – List of allowed or blocked IP addresses
    7. HTTPS(SSL) login authentication
    8. HTTPS(SSL) secured communication
    9. Digest login authentication
    10. User access log
    11. 802.1x authentication

9. Discovery – The manufacturer shall offer a discovery program to identify all devices of them on the network.
10. Configuration – The manufacturer shall offer a configuration program that remotely allows users to change settings on multiple cameras simultaneously.
11. Firmware upgrade – The manufacturer shall offer a program capable of upgrading multiple cameras at the same time (not requiring access to individual cameras).
12. Camera backup setting – The manufacturer shall provide a program that provides the ability to save multiple camera settings to a file and restore these camera settings if needed.
13. Reporting – The manufacturer shall provide a tool that can generate a report including thumbnail view, MAC address, IP address, serial number and other camera settings.

4. Electrical
    1. Power

        a. Input Voltage / Current PoE (IEEE 802.3af), DC 12V±10%
        b. Power Consumption: Max 12.95W (PoE), Max 10.8W (DC 12V)

5. Mechanical And Environmental
    1. Color/Material: White / Aluminum
    2. Dimensions (W x H): Ø160 x H125mm (6.30" x 4.92")
    3. Weight: 1.45 kg (3.20 lb.)
    4. Mount type: Surface
    5. Temperature

        a. Operating: -25°C ~ +60°C (-13°F ~ +140°F)
        b. Storage: -50°C ~ +60°C (-58°F ~ +140°F)

    6. Humidity Less than 90% RH
    7. Ingression Protection: IP52
    8. Vandal Resistance: IK10

I. SECURITY CAMERA TYPE “B”.

1. EQUIPMENT

a. Basis of Design: Hanwha Techwin #XNP-6120H with mounting hardware. SUBSTITUTIONS ON LIKE OR BETTER WILL BE CONSIDERED. PLEASE NOTE VARIATIONS TO ALLOW COMPARISON.

2. GENERAL DESCRIPTION

a. Video Compression and Transmission – The camera shall have the following properties relating to the video signals it produces.

1) H.265, H.264 and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously.

a) H.265 and H.264 – maximum of 60 fps at all resolution
b) MJPEG – maximum of 30 fps

2) The camera shall be able to configure up to 10 independent video stream profiles with differing encoding, quality, frame rate, resolution, and bit rate settings.
3) The camera shall be able to configure various resolution selections.

a) 1920 x 1080, 1280 x 1024, 1280 x 960, 1280 x 720, 1024 x 768, 800 x 600,800 x 448, 720 x 576, 720 x 480, 640 x 480, 640 x 360, 320 x 240

4) The camera shall be able to stream at least 10 independent video stream types using unicast protocol.
5) The camera shall support multicast and unicast video streaming.
6) The camera shall be able to configure Dynamic DNS (DDNS). DDNS shall be provided with no additional cost by the manufacturer.
7) The camera shall provide smart codec (WiseStream, Dynamic GOV, and Dynamic fps) to efficiently manage bit rate of the video stream and reduce storage while producing video quality that is visually equal to the one without smart codec.

b. Camera – The camera device shall have the following physical and performance properties:

1) It shall provide Wi-Fi interface which can stream video to a smart phone for installation purposes. The smart phone application shall be available in iOS and Android for free of charge with search keyword, ‘Wisenet Installation’. Moreover, the smart phone application shall also provide PTZ maneuver to help installers configure view of the PTZ dome camera. Wi-Fi dongle is required for Wi-Fi connection.
2) The camera shall be able to produce clear images in highly contrast scenes with multi-exposure wide dynamic range up to 150dB.
3) The camera shall have enhanced Digital Image Stabilization (DIS) with built-in gyro sensor. The gyro sensor greatly reduces false alarm triggered by scene changes.
4) Automated, manual, scheduled, or externally triggered day and night operation with infrared cut filter. Images are available in color or black and white.

a) Low light level operation to 0.03 lux (F1.6, 1/30sec) in color mode and 0.003 (F1.6, 1/30sec) lux in black and white mode.

5) The camera shall support digital noise reduction using both 2D and 3D noise

reduction technology.

6) Configurable 24 privacy masking regions utilizing a rectangle.
7) Defog feature to remove fogginess of scene.
8) The camera shall support bi-directional audio.
9) The PTZ dome camera shall have azimuth feature to display compass points on the screen. The available points are following.

    a) East, West, South, North, Northeast, Southeast, Northwest, Southwest

c. Intelligence and Analytics – The camera shall have a suite of integral intelligent operations and analytic functions to include:

    1) Motion detection with eight definable detection areas with rectangular zones, and minimum/maximum object size.
    2) Detection of logical events of specified conditions from the camera's video

        a) Tampering
        b) Loitering
        c) Directional Detection
        d) Fog Detection
        e) Virtual Line
        f) Enter/Exit,
        g) (Dis) Appear
        h) Audio Detection
        i) Face Detection
        j) Motion Detection

    3) Detection and classification of the following sound

        a) Scream
        b) Gunshot
        c) Explosion
        d) Crashing glass

d. Interoperability – The camera shall be ONVIF Profile S and G compliant. Moreover, it shall allow users to install third party applications from the manufacturer's partners through Open Platform and the list of available applications and partners shall be available from the manufacturer's homepage.

e. The camera shall possess the following further characteristics:

    1) Built-in web server, accessed via standard browsers including Internet Explorer, Firefox, Chrome & Safari.

    2) The camera shall provide streaming to multiple smart phones with DDNS provided freely from the manufacturer. In addition, the application shall be available for both iOS and Adroid, free of charge with search keyword, 'Wisenet Mobile'.

    3) Micro SD/SDHC/SDXC memory card with configurable pre-alarm and post-alarm recording intervals

    4) NAS recording option with configurable pre-alarm and post-alarm recording intervals

5) Alarms and notifications

a) alarm notification triggers:

1) Alarm input
2) Motion detection
3) Video & Audio analytics
4) Network disconnect

b) available notification means upon trigger:

1) File Upload Via FTP and E-mail
2) Notification Via E-mail, TCP and HTTP
3) Local storage (SD / SDHC / SDXC) or NAS recording at event triggers
4) External output
5) Presets

6) Pixel Counter available in the web viewer.

3. DETAILED SPECIFICATIONS

a. Video

1) Imager

a) Sensor: 1/2.8" 2.16MP CMOS

1) Pixels per sensor: 1945 (H) x 1109 (V) total; 1945 (H) x 1097 (V) effective.
2) Scanning: progressive

b) Minimum illumination

1) Color mode: 0.03Lux (F1.6, 1/30sec)
2) Black & white mode: 0.003Lux (F1.6, 1/30sec)

c) S/N Ratio : 50dB
d) Video Out (Installation) CVBS: 1.0 Vpp / 75Ω composite, 720 x 480(N), 702 x 576(P)USB: Micro USB Type B, 1280 x 720 for Installation
e) The following features with control settings shall be available:

1) Camera Title Off / On (Displayed up to 85 characters per line)

a) W/W: English / Numeric / Special characters
b) China: English / Numeric / Special / Chinese characters
c) Common: Multi-line (Max.5), Color (Grey/Green/Red/Blue/Black/White),Transparency, Auto scale by resolution

2) Day/night setting: Auto (ICR) / Color / B/W / Schedule
3) Backlight compensation (BLC):Off / BLC / HLC / WDR
4) WDR150dB
5) Contrast Enhancement Off / On (Samsung Super Dynamic Range)

6) Digital Noise Reduction (DNR):Off / On (Samsung Super Noise Reduction V)2D + 3D Noise Filter
7) Digital Image Stabilization Off / On (Built-in gyro sensor)
8) Defog Off / Auto / Manual
9) Motion Detection Off / On (8ea, polygonal zones)
10) Privacy Masking Off / On (24ea, polygonal zones)- Color: Gray/Green/Red/Blue/Black/White- Mosaic- Zoom ratio option for mask mode
11) Gain Control Off / Low / Middle / High
12) White Balance ATW / AWC / Manual / Indoor / Outdoor Mercury / Sodium
13) Electronic shutter speed:

a) Settings: min, max, anti-flicker (2 ~ 1/12,000sec)

14) Digital Zoom 32x
15) Image flip: Off / On
16) Image mirror: Off / On
17) Alarm I/O Input 1ea / Output 1ea
18) Alarm Triggers Alarm Input, Motion detection, Video & Audio analytics, Network disconnect
19) Alarm Events File Upload Via FTP and E-mail Notification Via E-mail, TCP and HTTP Local storage (SD / SDHC / SDXC) or NAS recording at event triggers External output, PTZ Preset
20) Pixel Counter Available in the web viewer.

f) Lens: 5.2 ~ 62.4mm (12x)

1) Max. Aperture Ratio F1.6 (Wide) ~ F3.0 (Tele)
2) Angle of view: H: 54.58° (Wide) ~ 5.30° (Tele) / V: 32.19° (Wide) ~ 3.00° (Tele)
3) Min. Object Distance 1.5m (4.92ft) (Wide), 2.1m (6.89ft) (Tele)
4) Focus Control Auto / Manual / One shot AF
5) Lens Type DC Auto Iris
6) Mount Type Board-in Type

g) Pan/Tilt

1) Pan 360°
2) Tilt 190° (-5° ~ 185°)
3) Pan Speed Preset 350°/sec, Manual: 0.024°/sec ~ 200°/sec
4) Tilt Speed Preset 350°/sec, Manual: 0.024°/sec ~ 200°/sec
5) Sequence Preset (300ea), Swing, Group (6ea), Trace, Tour, Auto Run, Schedule
6) Preset Accuracy ±0.2˚
7) Azimuth Yes (E / W / S / N / NE / SE / NW / SW OSD)
8) Auto Tracking Off / On

2) Video Streams

a) The camera shall be able to produce 10 video profiles, each of which may have the following properties:

1) Encoding type:

a) H.265
b) H.264
c) MJPEG

2) Resolution: 1920 x 1080, 1280 x 1024, 1280 x 960, 1280 x 720, 1024 x 768, 800 x 600, 800 x 448, 720 x 576, 720 x 480, 640 x 480, 640 x 360, 320 x 240

3) Maximum frame rate

a) H.265 and H.264: Max. 60 fps at all resolutions
b) MJPEG: Max. 30 fps

4) Smart Codec: Area Based, WiseStreamII, Dynamic GOV, Dynamic fps.

5) Bit rate control method:

a) H.265 and H.264 target bitrate level control constant bit rate (CBR) or variable bit rate (VBR)
b) MJPEG target bitrate level control variable bit rate (VBR)

3) Number of multi-streaming profiles: 10 maximum
4) Simultaneous users (total): 20 maximum (unicast)
5) Storage and Recording

a) The camera shall have onboard SD card storage

1) Card type: Micro SD/SDHC/SDXC
2) Capacity: 512 GB (2 slots available for continuous recording from 1st to 2nd.)
3) Image content on the card shall have the ability to be downloaded to a selected destination.

b) NAS

6) Interoperability - Video streams shall be capable of supporting ONVIF protocol, profiles S and G.
7) Single Images - The camera shall support image screenshot and export.
8) The camera shall support open platform to allow users to install third party applications.

b. Network

1) Connectivity: 10/100 Base-T Ethernet via RJ-45 connector
2) Protocols supported:

a) Transmission Control Protocol (TCP), Internet Protocol (IP) v4 and v6, User Datagram Protocol (UDP)
b) Configuration: Dynamic Host Configuration Protocol (DHCP)
c) Web services: Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS)
d) Network services: Address Resolution Protocol (ARP), Bonjour, Domain Name System (DNS), Internet Control Message Protocol (ICMP), Network Time Protocol (NTP), Protocol Independent Multicast-Sparse Mode (PIM-SM), Simple Network Management Protocol (SNMP v1/2c/3 – MIB-2),

Universal Plug and Play (UPnP)

e) Media: Real-Time Transport Protocol (RTP), Real-Time Control Protocol, Real-Time Streaming Protocol (RTSP)
f) Multicast: Internet Group Management Protocol (IGMP)
g) Notifications: File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP).
h) Remote Access: Point-to-Point Protocol over Ethernet) (PPPoE)

9. DDNS – The camera shall support DDNS services offered by the Manufacturer and other publicly available service offerings.

10. Quality of Service (QoS) – Layer 3 DSCP

11. Security features:

1. User password protection
2. IP address filtering - list of allowed or blocked IP addresses
3. HTTPS(SSL) login authentication
4. HTTPS(SSL) secured communications
5. Digest login authentication
6. User access log
7. 802.1x authentication

12. Discovery - Manufacturer shall offer a discovery program to identify all devices of his manufacture on the network.

13. Configuration – Manufacturer shall offer a configuration program that remotely allows users to change settings on multiple cameras simultaneously.

14. The camera shall support audio in as well as audio out. The detailed specification of audio in and out is following.

1. Audio in Selectable (Mic IN / Line IN), Supply voltage : 2.5VDC (4mA)
2. Audio out Line out (3.5mm mono jack), Max output level : 1 Vrms
3. Audio Compression G.711 u-law /G.726 Selectable, G.726 (ADPCM) 8KHz.

6. Electrical

1. Power

a. Input Voltage / Current 12V DC, PoE
b. Power Consumption: Max. 12W

7. Mechanical And Environmental

1. Material: Aluminum
2. Dimensions (W x H): Ø168.0 x 161.5mm (Ø6.61" x 6.36")
3. Weight: 1.9 Kg (4.19lb)
4. Temperature:

a. Operating: -30° C to 55° C (-22° F to 131° F)
b. Storage: -30° C to 60° C (-22° F to 140° F)

5. Humidity: 0 ~ 90%, non-condensing
6. Ingress Protection / Vandal Resistance
    a. IP66
    b. IK10

I. SECURITY CAMERA TYPE “C” AND “D”.

1. EQUIPMENT

a. Basis of Design: Hanwha Techwin #XNP-9300RW. Include HPoe Injector. For type “C” include #SBP-156WMW wall mount bracket and mounting hardware. For type “D” include #SBP-156LMW parapet mounting bracket and mounting hardware. SUBSTITUTIONS ON LIKE OR BETTER WILL BE CONSIDERED. PLEASE NOTE VARRIATIONS TO ALLOW COMPARISON.

2. GENERAL DESCRIPTION

a. Video Compression and Transmission – The camera shall have the following properties relating to the video signals it produces.

1) H.265, H.264 and MJPEG compression, each derived from a dedicated encoder and capable of being streamed independently and simultaneously.

a) H.265 and H.264 – maximum of 30/25FPS(60Hz/50Hz) at all resolution
b) MJPEG – maximum of 30/25FPS(60Hz/50Hz)

2) The camera shall be able to configure up to 10 independent video stream profiles with differing encoding, quality, frame rate, resolution, and bit rate settings.
3) The camera shall be able to configure various resolution selections.

a) 16:9 aspect ratio : 3840x2160, 2592x1464, 1920x1080, 1280x720, 800x448, 640x360
b) 4:3 aspect ratio : 2592x1944, 1600x1200, 1280x960, 1024x768, 800x600, 640x480, 320x240
c) 5:4 aspect ratio : 1280x1024, 720x576
d) 3:2 aspect ratio : 720x480

4) The camera shall support unicast video streaming up to 20 users.
5) The camera shall support multicast video streaming up to 10 profiles.
6) The camera shall be able to configure Dynamic DNS (DDNS). DDNS shall be provided with no additional cost by the manufacturer.
7) The camera shall provide WiseStream II, Dynamic GOV and Dynamic FPS to efficiently manage bit rate of the video stream and reduce storage.

b. Camera – The camera device shall have the following physical and performance properties:

1) Built-in wiper is for get rid of water or dust initially
2) IK10 rated for protection against impacts for camera body.
3) True day/night operation with scheduling and options for external devices.

a) Low light level operation to 0.1 lux at F1.6 in color mode and 0 lux in black and white mode with IR illumination on.

4) The camera shall be able to produce clear images in highly contrast scenes with multi-exposure wide dynamic range.
5) The camera shall support digital noise reduction using both 2D and 3D noise reduction technology.
6) The camera shall be able to configure 32 privacy masking areas with polygonal zones.
7) The camera shall have the defog feature to remove fogginess of scene which can be triggered automatically from the fog detection event.
8) The camera shall provide video display on smart phone (iPhone, Android) to adjust viewing angle, rotation and focus.

c. Intelligence and Analytics – The camera shall have a suite of intelligent analytic functions.

1) Motion detection with 8 definable detection areas with 8 point polygonal zones, and minimum/maximum object size.
2) Detection of logical events of specified conditions from the camera's video

a) Directional detection
b) Fog detection
c) Face detection
d) Motion detection
e) Appear/Disappear
f) Enter/Exit
g) Loitering
h) Tampering
i) Virtual line
j) Shock detection
k) Audio detection with NW I/O Box (External Device)
l) Sound classification with NW I/O Box (External Device)

3) Detection and classification with NW I/O Box of the following sound.

a) Scream
b) Gunshot
c) Explosion
d) Crashing glass

d. Interoperability – The camera shall be ONVIF Profile S / G and T compliant.

e. The camera shall possess the following further characteristics:

1) Built-in web server, accessed via non-plugin browsers including Google Chrome, IE11, MS Edge, Mozilla Firefox and Apple Safari.
2) The camera shall provide streaming to multiple smart phones with DDNS provided freely from the manufacturer. In addition, the application shall be available for both iOS and Adroid, free of charge with search keyword, 'Wisenet Mobile'.
3) Micro SD/SDHC/SDXC memory card with configurable pre-alarm and post-alarm recording intervals
4) NAS recording option with configurable pre-alarm and post-alarm recording intervals
5) Alarms and notifications

a) Alarm notification triggers:

1) Analytics
2) Network disconnect
3) Alarm input with NW I/O Box

b) Available notification means upon trigger:

1) File Upload via FTP and E-mail
2) Notification via E-mail
3) Local storage (SD / SDHC / SDXC) or NAS recording at event triggers
4) Alarm output with NW I/O Box
5) PTZ preset
6) Handover

6) Pixel Counter available in the web viewer.
7) HPoE capable
8) IP66, IK10, NEMA4X
9) This device has been verified using STP cable. The use of appropriate GND grounding and STP cable is recommended to effectively protect your product and property from transient voltage, thunder stroke, communication interruption.

J. Decoding performance in web viewer depends on CPU/GPU performance of user

1. DETAILED SPECIFICATIONS

a. Video

1)	Imaging device	1/2.8" CMOS
2)	Scanning	Progressive
3)	Minimum Illumination	Color: 0.1Lux (F1.6, 1/30sec), B/W: 0Lux(IR LED On)

b. Lens

1)	Focal length	5~150mm(30x) zoom
2)	Max. Aperture Ratio	F1.6(Wide) - F4.56(Tele)
3)	Field of View	H: 57.42°(Wide)~2.19°(Tele)V: 33.54°(Wide)~1.25°(Tele)
4)	Min. Object Distance	3m(9.84ft)
5)	Focus Control	Oneshot AF, Focus save
6)	Lens Type	DC auto iris

c. PTR

1)	PAN	360° Endless
2)	PAN Speed	Max. 500°/sec, Manual: 0.024°/sec~250°/sec
3)	TILT	110° (-20°~90°)
4)	TILT Speed	Max. 350°/sec, Manual: 0.024°/sec~250°/sec
5)	Sequence	Preset(300ea), Swing, Group(6ea), Trace, Tour, Auto Run, Schedule
6)	Preset Accuracy	±0.1°, Pan/Tilt correction

d. Operational Functions

1)	IR Viewable Length	200m(656.17ft)

2)	Camera Title		Off / On (Displayed up to 85 characters)
	a)	W/W	English / Numeric / Special characters
	b)	China	English / Chinese / Numeric / Special characters
	c)	Common	Multi-line (Max. 5), Color (Grey/Green/Red/Blue/Black/White), Transparency, Auto scale by resolution
	d)	Image	BMP 20x20 pixel
3)	Day/Night Setting		Auto (ICR) / Color / B/W / External / Schedule
4)	Backlight Compensation		Off / BLC / HLC / WDR
5)	WDR		extreme WDR
6)	Contrast Enhancement		SSDR
7)	Digital Noise Reduction (DNR)		Support (SSNR V)
8)	Digital Image Stabilization (DIS)		Support (built-in gyro sensor)
9)	Defog		Support
10)	Motion Detection		Off / On (8ea, 8-point polygonal)
11)	Privacy Masking		Off / On (32 zones, rectangular)- Color: Grey/ Green / Red / Blue / Black / White- Mosaic
12)	Gain Control		Support
13)	White Balance		ATW / AWC / Manual / Indoor / Outdoor
14)	Electronic Shutter Speed		Min / Max / Anti-flicker (2 ~ 1/12,000sec)
15)	Image Rotation		Flip: Off / On Mirror: Off / On
16)	Alarm I/O		Support with external NW I/O Box
17)	Alarm Triggers		Alarm Input(with NW I/O Box), Analytics, Network Disconnection
18)	Alarm Events		File Upload via FTP and E-mail, Notification via E-mail, SD/SDHC/SDXC or NAS recording at event triggers, Alarm output with NW I/O Box, Handover, PTZ preset
19)	Pixel Counter		Support
20)	Storage		Micro SD/SDHC/SDXC 1TB (2 slots x 500GB)
21)	Analytics		Directional detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line, Shock detection Audio detection with NW I/O Box, Sound classification with NW I/O Box)
22)	Memory		4GB RAM, 512MB Flash

e. Video Streams

1)	Video compression		H.265, H.264, MJPEG
2)	Resolution		3840x2160, 2592x1944, 2592x1464, 1920x1080, 1600x1200, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360, 320x240
3)	Maximum Framerate		
	a)	H.265 / H.264	H.265/H.264: Max. 30FPS/25FPS(60Hz/50Hz)
	b)	MJPEG	Max. 30/25FPS(60Hz/50Hz)

4)	Smart Codec	Manual Mode (area-based : 5EA)
5)	WiseStream II	Support
6)	Bitrate Control Method	H.265 / H.264: CBR or VBRMJPEG: VBR
7)	Streaming Capability	Multiple streaming (Up to 10 profiles)
8)	Streaming method	Unicast / Multicast
9)	Simultaneous Users	20 maximum (Unicast)
10)	Profile set	Max. 10 ea
11)	Interoperability	ONVIF Profile S / G / T, SUNAPI(HTTP API), Open Platform

f. Network

1) Connectivity – Metal Shielded RJ-45(10/100/1000BASE-T)
2) Protocol

a) IP v4 / v6, TCP, UDP
b) Configuration: DHCP, LLDP
c) Web service: HTTP, HTTPS
d) Network Service: ARP, Bonjour, DNS, ICMP, NTP, PIM-SM, SNMP v1/2c/3 – MIB-2, UPnP
e) Media: RTP, RTCP, RTSP
f) Unicaset: SRTP
g) Multicast: IGMP, PIM-SM
h) Notifications: FTP, SMTP

3) DDNS – The camera shall support DDNS services offered by the manufacturer and others publicly available service offerings
4) QoS – Layer 3 DSCP
5) Security Feature

1. User password protection
2. The device shall not provide a manufacture default password. Default password change shall be required to access the camera.
3. A minimal level of password complexity shall be required by the camera.
4. The camera shall not have a manufacture back-door password.
5. The manufacturer shall provide a tool that provides the ability to make password changes to multiple cameras at the same time.
6. IP address filtering – List of allowed or blocked IP addresses
7. HTTPS(SSL/TLS) login authentication
8. HTTPS(SSL/TLS) secured communication
9. Digest login authentication
10. User access log
11. 802.1X Authentication(EAP-TLS, EAP-LEAP)
12. Device Certificate(Hanwha Techwin Root CA)

7. Discovery – The manufacturer shall offer a discovery program to identify all devices of them on the network.
8. Configuration – The manufacturer shall offer a configuration program that remotely allows users to change settings on multiple cameras simultaneously.
9. Firmware upgrade – The manufacturer shall offer a program capable of upgrading multiple cameras at the same time (not requiring access to individual cameras).

10. Camera backup setting – The manufacturer shall provide a program that provides the ability to save multiple camera settings to a file and restore these camera settings if needed.
11. Reporting – The manufacturer shall provide a tool that can generate a report including thumbnail view, MAC address, IP address, serial number and other camera settings.

8. Electrical

1. Power

a. Input Voltage / Current HPoE (IEEE802.3bt, Class6, Type3)
b. Power Consumption: HPoE (Camera only): Max 42W, typical 20W

9. Mechanical And Environmental

1. Color/Material: White, Black / Aluminum and Polycarbonate
2. RAL Code: White: RAL9003
3. Dimensions (W x H): Ø184.9x318.8mm(7.28x12.55")
4. Weight: 5.4Kg(11.90lb)
5. Temperature

a. Operating Normal: -40°C~+55°(-40°F ~ +131°F)
b. Storage: -50°C~+60°C (-58°F~+140°F)

6. Humidity

a. Operating Less than 95% RH (non-condensing)
b. Storage Less than 90% RH (non-condensing)

7. Ingression Protection: IP66, NEMA4X
8. Vandal Resistance: IK10

10. DORI

1.	Detect (25PPM/ 8PPF)	Wide: 140.2m(460.0ft) / Tele: 4018.1m(13182.6ft)
2.	Observe (63PPM/ 19PPF)	Wide: 62.5m(184.0ft) / Tele: 1607.2m(5273.1ft)
3.	Recognize (125PPM/ 38PPF)	Wide: 28.0m(92.0ft) / Tele: 803.6m(2636.5ft)
4.	Identify (250PPM/ 76PPF)	Wide: 14.0m(46.0ft) / Tele: 401.8m(1318.3ft)

2.3 NETWORK VIDEO RECORDER

A. WISENET #WRR-P-S202X1-108TB pre-configured for RAID6, supports RAID 0,1,5,6,10 configurations. SUBSTITUTIONS ON LIKE OR BETTER WILL BE CONSIDERED. PLEASE NOTE VARIATIONS TO ALLOW COMPARISON.

2.4 SOFTWARE

A. WISENET WAVE VMS. SUBSTITUTIONS ON LIKE OR BETTER WILL BE CONSIDERED. PLEASE NOTE VARIATIONS TO ALLOW COMPARISON.

2.5 VMS Overview

1. VMS Software Components

a. The System shall be comprised of four (4) applications which work together seamlessly.

1) Cloud - a cloud application that enables simple remote connectivity, viewing, and management of an unlimited number of systems and users.
2) Server - a media server responsible for discovering, connecting to, and managing system users, devices, and associated data.
3) Desktop - a desktop application capable of acting as a stand-alone media player or as a client application for connecting to and managing systems.
4) Mobile - a mobile application for iOS and Android devices that allows users to connect to, view, search, and control IP cameras over Wifi or Data networks.

2. VMS Developer & Integration Tools

a. The VMS shall have built-in developer tools which are accessible from any System Server's Web Admin Interface (compatible with all major browsers) and should include, at a minimum:

1) A Generic Events Generator - a tool which helps build HTTP Generic Event calls, a method of sending events from 3rd party systems to the VMS, which can be used to trigger system actions in the VMS.
2) Server API – SUNAPI implementation that gives developers the ability to access every system feature available.
3) API Change Log - list of breaking changes in API from version to version
4) Video Source Integration SDK - provides the ability to integrate virtually any live or recorded video source (IP Cameras, NVRs, DVRs, etc) into the VMS with methods for discovering, displaying, analyzing and recording video, as well as integrating device I/O ports and related motion detection information.
5) Storage SDK - provides the ability to integrate potential storage into System. It allows developers to read from or write to any storage location: local, remote, and even cloud one. Creating a storage plugin requires implementing standard functions such as: I/O stream, if file exist, delete file, list of files in the folder, etc. Storage SDK also contains an example for using an FTP server as a storage location.

3. VMS System Architecture

a. The VMS shall have a Server Hive Architecture wherein:

1) All servers in a system are equal and synchronize system databases in real-time
2) A user can connect to any system server to see and manage the entire system
3) Servers support automatic camera failover to ensure limited loss of video recording in the event of hardware or network failure.
4) Servers will use a SQLite - a free database technology - included in the installation package

b. The VMS shall support one-click system wide updates.

1) System Administrators shall be able to upgrade an entire system via a single button in the Desktop Application.
2) System Administrators shall be able to upgrade on demand to the latest release or specific builds with specific functionality or bug fixes
3) System Administrators shall be able to apply an OTA (over-the-air) update

4) System Administrators shall be able to generate a URL to download a portable system- specific update package in .zip file format which can be used to update servers without an active Internet connection.

c. The VMS will use secure technologies for inter-application communication and security.

1) OpenSSL for network connections - deprecated and insecure protocols and use only TLS v1+.
2) Server to Client (Mobile, Desktop, Web) Communications – Option to force encryption between Client and Server for API data.
3) Option to force HTTPS video traffic encryption between Client and Server.
4) HTTPS Email notification - TLS / SSL - TLS is the default option for Email Server communications.
5) Salted/Hashed Passwords - Local Credentials will be protected using a salted MD5 hash, Cloud Credentials should use a complex multi-level hash

d. The VMS will not require any licenses to increase the number of supported devices, users, or servers.
e. The system shall support scaling to support the maximum recommended system sizes shown below. The system shall support exceeding these recommended maximums by consulting with engineering support.

1) The system shall support a maximum of 100 Servers in a system.
2) The system shall support a maximum of 10,000 resources in a system.
3) The system shall support a maximum of 1,000 concurrent users in a system.

4. - VMS Server Application

B. Supported Operating Systems. The VMS Server application shall be able to run on any of the following operating systems.

1. Operating System Versions: Microsoft Windows 7,8,8.1,9, 10. Windows Server 2012, 2012 R2, 2016 (Long-term servicing channel) 1607. Windows 10 Enterprise Ubuntu Linux Ubuntu 16.04 LTS: "Xenial Xerus"Ubuntu 18.04 LTSNVIDIA Jetson Support NVIDIA Tx1 and Tx2.

C. Minimum Compatible Computing Hardware

1. The VMS Server application will be capable of operating on any hardware able to run a compatible operating system.
2. The VMS Server will be capable of recording 128 dual-streaming IP cameras (256 streams) on a single core of an Intel Core i3 processor.

D. Initial Installation & Setup

1. The VMS Server application installer should not exceed 100 MB (megabytes).
2. The VMS Server application should be a publicly available, free download.
3. The VMS Server application should require no prerequisite proprietary or 3rd party software and database technologies during installation.
4. The VMS Server installation process should require no user input once initiated
5. After installation is complete the VMS server setup process will allow system administrators to create a new system or to merge newly installed server(s) with existing systems.

E. Features

1. The VMS Server Application shall automatically discover, stream, and record any ONVIF Profile S IP camera located on the same subnet as the server application.
2. The VMS Server Application shall manually discover, stream, and record RTSP, HTTP, or UDP (multicast, unicast) streams.
3. The VMS Server application shall support up to 1000 concurrent TCP connections
4. The VMS Server application shall record and stream video of any resolution and frame rate, limited only by hardware.
5. The VMS Server application shall support automatic camera failover without any additional licenses. 6. The VMS Server application will support an unlimited number of users and custom user roles

F. The VMS Server application shall support any type of storage medium - HDD's, SSD's, SD cards, DAS, NAS, or other network-attached storage devices or locations.

G. The VMS Server application shall support LDAP / Active Directory / Open LDAP integration for user login credential management

H. The VMS Server application shall record and stream H.264, H.265, and MJPEG streams

I. The VMS Server application shall record and stream AAC, PCM (Mu-Law, A-law), g726, and MP3 audio

J. The VMS Server application shall transcode streams on demand for delivery to 3rd party systems or devices in H.265, H.264, MJPEG or WebM codecs.

K. The VMS Server application shall be able to provide pass-through high or low-res HLS streams from connected devices.

L. The VMS Server application shall store archive indices in the same location as recorded video files

M. The VMS Server application shall allow system administrators to recover archives from any storage medium using a re-index archive feature.

N. The VMS Server application will contain a boolean events engine allowing operators to program and trigger system actions based on system, connected device, or HTTP events sent from 3rd party system or device.

O. The VMS Server application shall be able to send HTTP PUT or GET requests to 3rd party systems or devices.

P. The VMS Server application shall support IPv4 or IPv6 addressing

Q. The VMS Server application shall allow operators to set custom network routing configurations for system servers to optimize network routing and usage.

R. The VMS Server application shall allow operators to monitor the CPU, RAM, NIC, and HDD usage in real time.

S. The VMS Server application shall track all operator actions to allow audits

T. The VMS Server application shall generate automatic crash files every time there is an unexpected crash of the Server application.

U. The VMS Server application shall allow operators to change the size of reserved disk space for storage drives.

V. The VMS Server application shall automatically disable any system drive (drive containing the operating system) in computing hardware with more than one drive to ensure the operating system drive does not become

full.

W. The VMS Server application shall support configuration and events from binary I/O contacts on supported devices - including IP cameras and I/O devices.

X. The VMS Server application shall support sending email notifications via SMTP using TLS, SSL or unsecured connections.

Y. The VMS Server application shall support scheduled backup of recording archives to local, networked, or cloud storage locations.

Z. The VMS Server application shall allow on-demand backup of recording archives to local, networked, or cloud storage locations.

AA. The VMS Server application shall allow concurrent-recording of all connected cameras / streams to two (2) servers in real-time.

BB. The VMS Server application will allow server-side, CPU-based motion analysis for all connected IP cameras with no perceptible increase (<3%) in CPU usage.

CC. The VMS Server application will require no dedicated GPU in order to perform at maximum capacity.

DD. The VMS Server application will have a web administration interface that allows users to view live or recorded video from a single camera at a time in high or low resolutions.

EE. The VMS Server application will have a web administration interface that allows system administrators to view real-time server health monitoring statistics (CPU, NIC, and HDD usage).

FF. The VMS Server application will have a web administration interface that allows operators to cloud merge two systems together or disconnect the VMS Server from the VMS cloud application.

GG. The VMS Server application will have a web administration interface that allows users to view all available servers in the system.

HH. The VMS Server application will have a web administration interface that allows operators to switch between server interfaces.

II. The VMS Server application will have a hidden advanced page that gives system administrators the ability to modify advanced system settings.

JJ. The VMS Server application will support any RAID configuration of storage medium

KK. - VMS Desktop Application

LL. Supported Operating Systems

MM. Operating System Versions: Microsoft Windows 7,8,8.1,9, 10. Windows Server 2012, 2012 R2, 2016 (Long-term servicing channel) 1607. Windows 10 Enterprise Ubuntu Linux Ubuntu 14.04 LTS Ubuntu 16.04 LTS: "Xenial Xerus"Ubuntu 18.04 LTS. Apple/Mac OSX 10.11 “El Capitan”OSX 10.12 “Sierra”OSX 10.13 “High Sierra”

NN. Minimum Hardware Requirements

1. The VMS Desktop application will be capable of operating on any hardware able to run a compatible operating system with a CPU that supports OpenGL 2.1 and Intel HD Graphics 3000 (or higher).

2. The VMS Desktop application shall not require any dedicated graphics drive to work at full capacity (64 streams on a 64 bit OS) and shall use the CPU for all video decoding and rendering.

OO. Installation & Configuration

1. The VMS Client application installer should not exceed 100 MB (megaybytes).
2. The VMS Client application should be a publicly available, free download.
3. The VMS Client application should require no prerequisite proprietary or 3rd party software and database technologies during installation.
4. The VMS Client installation process should require no user input once initiated.

PP. Features

QQ. The VMS Desktop application will have the following basic structure:

1. Navigation Panel - with a main menu button, an interactive cloud-login icon, tabbed layouts, minimize and maximize icons, a contextual help icon, and a close application icon.
2. Resource Panel (Left) - contains all system resources (Servers, Devices, Users, Layouts, Offline files, etc.) with collapsible structure and a keyword search mechanism to allow operators to quickly search for a display live streams / cameras, offline video and image files, or any combination thereof.
3. Notifications Panel (Right) - shows all system or rules-engine generated notifications which can be clicked on to display relevant resource in the Viewing Grid
4. Timeline Panel (Bottom) - allows for navigation and search of recorded video files
5. Viewing Grid (Main Viewing Area) - a flexible adaptive grid interface which allows operators to create and share customized layouts of system resources.

RR. The VMS Desktop application shall allow operators to view and interact with the following types of media:

1. Live Streams: H.265, H.264, MJPEG
2. Offline Media: AVI MKV MP4 MOV TS M2TS MPEG MPG FLV WMV 3GP JPG PNG GIF BMP TIFF
3. I/O Devices: Status and Triggers
4. Servers: Real-Time Server Health Monitoring Status

SS. The VMS Desktop application shall allow the operator to scroll to zoom in to any part of the Viewing Grid.

TT. The VMS Desktop application shall allow operator to drag & drop to reassign cameras from one server to another server.

UU. The VMS Desktop application will have a flexible timeline that allows operators to view the dates of any and all archived video in the System for a specific camera, or groups of cameras.

VV. The VMS Desktop application will allow operators to manually create bookmarks - with a start time, end time, name, description, and tags - for later search. Bookmarks shall also be able to be created using the Rules engine.

WW. The VMS Desktop application shall allow operators to create Soft Triggers - programmable, customizable buttons which sit on top of streams in the Viewing Grid - to trigger any available system action.

XX. The VMS Desktop application shall have icons located on the top of live camera streams which allow operators to dewarp fisheye cameras, control PTZ cameras, apply client-side image enhancement, execute smart motion

search, create zoom windows, rotate items to any orientation, and activate stream or file info.

YY. The VMS Desktop application shall allow operators to create Zoom Windows (up to 63 zoom windows on a single item in a 64 bit OS) - a magnified view of a part of a live stream, recorded videos, or static images.

ZZ. The VMS Desktop application shall allow operators the ability to execute a Smart Motion search by selecting a subset of a live camera stream with results shown in red on the flexible timeline. Smart Motion search should be able to search a year (12 months, 365 days) of archived video in less than one (1) second.

AAA. The VMS Desktop application will allow users to search live cameras by name, manufacturer, IP address, MAC address, and status (e.g. live).

BBB. The VMS Desktop application shall allow operators to search video archives by date and time with a responsive, adaptive timeline.

CCC. The VMS Desktop application will allow operators to customize the background image of the application with supported image types.

DDD. The VMS Desktop application will support digital mapping by allowing operators to add and customize background images - including opacity and number of grid points.

EEE. The VMS Desktop application will utilize adaptive scaling technology to automatically switch between high and low resolution streams during live and recording playback to optimize CPU and network usage.

FFF. The VMS Desktop application will allow operators to log in to the Cloud application in order to quickly connect to any shared system.

GGG. The VMS Desktop application will allow operators to quickly switch between previously connected or cloud-accessible systems using searchable tiles that show system name and status.

HHH. The VMS Desktop application will have a Storage Analytics feature allowing operators to analyze storage capacity of the system based on available drives and real-time and historical bandwidth analysis.

III. The VMS Desktop application will allow management and configuration of all System devices, users, and resources in a single unified interface.

JJJ. The VMS Desktop application will allow fast-forward and fast-reverse of archived video up to 16x normal speed.

KKK. The VMS Desktop application will show operators which system server they are connected to.

LLL. The VMS Desktop application will allow operators to connect to previous versions by automatically downloading and switching to compatible versions.

MMM. The VMS Desktop applications will automatically discover available systems on the same network as the computer running the Desktop application.

NNN. The VMS Desktop application will automatically recover and reconnect to a system in the instance the server the operator is connected to becomes inaccessible for any reason.

OOO. The VMS Desktop application will allow operators to show or hide adaptive thumbnails in the timeline panel.

PPP. The VMS Desktop application will allow operators to synchronize all items on a layout or disable synchronization to view live and recorded video at the same time.

QQQ. The VMS Desktop application will have adaptive settings dialogs, allowing operators to switch dialog

content while the dialog is open by clicking on a resource.

RRR. The VMS Desktop application will allow batch configuration of camera recording schedules, fps, and quality.

SSS. The VMS Desktop application will allow operators to drag and drop multiple system resources onto the Viewing Grid at the same time.

TTT. The VMS Desktop Application will allow administrators to modify time synchronization settings for the system to utilize online resources (NTP servers) or to set a dedicated local time server.

UUU. The VMS Desktop Application will allow system administrators to view a full list of system cameras and devices in a single dialog.

VVV. The VMS Desktop application will allow operators to view, search and export all system events.

WWW. The VMS Desktop application will allow operators to view, search and export all system bookmarks.

XXX. The VMS Desktop application will allow operators to view, search, and export system logs.

YYY. The VMS Desktop application will allow operators to view, search, and export an audit trail of all operator actions and replay related video.

ZZZ. The VMS Desktop application will allow administrators to backup and restore the system database.

AAAA. The VMS Desktop application will allow administrators to create an unlimited number of custom user roles.

BBBB. The VMS Desktop application will allow administrators to create and share lockable layouts.

CCCC. The VMS Desktop application will allow administrators to update layouts in real time.

DDDD. The VMS Desktop application will allow users to record their screen in full resolution and up to 30fps.

EEEE. The VMS Desktop application will allow users to add a local folder to add local files for search and playback.

FFFF. The VMS Desktop application will have a Video Wall mode which will allow operators to control the application remotely.

GGGG. The VMS Desktop application will have a Media Player mode which will allow operators to use the application as a media player.

HHHH. The VMS Desktop application will remember past system connections and user credentials and will allow operators to quickly search for and switch between systems.

IIII. The VMS Desktop application will allow operators to adjust the aspect ratio and streaming quality (high resolution or low resolution) of items displayed on the viewing grid.

JJJJ. The VMS Desktop application will display I/O devices as an individual item on the viewing grid and allow operators to create custom names for inputs and output.

KKKK. The VMS Desktop application will allow users to customize the layout of I/O panels on the item in the viewing grid including indicators for inputs and buttons for outputs.

LLLL. The VMS Desktop application will allow users to de-warp any fisheye lens using automatic calibration or manual calibration without the need for any third (3rd) party SDKs.

MMMM. The VMS Desktop application will allow users to create fully customizable viewing tours which include any combination of live video streams, offline videos, images, websites (or URLs), I/O devices, and Server health monitoring status.

NNNN. The VMS Desktop application will allow system administrators to modify and save a shared layout to affect an instantaneous change to that layout on the VMS Desktop application of any user connected to the system viewing that layout (when the system administrator saves the layout the layout will update in real time for any user viewing that layout).

OOOO. The VMS Desktop application will support two-way audio between operators and supported devices.

PPPP. The VMS Desktop application will support audio alerts as an action that can be played on users' computers or connected system devices.

QQQQ. The VMS Desktop application will support PTZ presets and tours.

RRRR. The VMS Desktop application will support PTZ presets and tours in fisheye cameras using de-warp mode.

SSSS. The VMS Desktop application will allow operators to schedule recording for connected cameras and devices with options to force minimum and maximum storage durations.

TTTT. The VMS Desktop application will allow operators to configure pre and post recording for motion events.

UUUU. The VMS Desktop application will allow operators to optimize camera streaming quality from connected devices automatically using low, medium, high, best quality selectors or manually in the camera.

VVVV. The VMS Desktop application will allow users to export video by selecting an area on the timeline and right clicking to export.

WWWW. The VMS Desktop application will support single video export in .avi, .mp4, or .mkv formats and will offer the option to transcode any client-side effects (image enhancement, de-warping, timestamps) as part of the exported video.

XXXX. The VMS Desktop application will support multi-video export in an executable format to create a fully portable version of the VMS Desktop application including all exported video files.

YYYY. The VMS Desktop application shall have a rapid review export feature which will allow operators to compress any length of video into a short video (e.g. export 8 hours of archives into a 30 second video clip).

ZZZZ. The VMS Desktop application shall allow system administrators to activate or deactivate system licenses on Internet connected systems.

AAAAA. The VMS Desktop application shall allow users to force open an alarm layout triggered by any system or 3rd party event with one or many associated cameras or resources.

BBBBB. The VMS Desktop application will have a hidden configurable method of increasing the amount of items allowed on the viewing grid.

CCCCC. The VMS Desktop application shall allow users to adjust configuration of devices.

DDDDD. The VMS Desktop application shall support keyboard shortcuts to control various interface options including PTZ mode, Smart Search mode, & layout control.

EEEEE. VMS will allow analytics from Wisenet and other supported device with analytics (Axis, DW, Hikvision)

FFFFF. The VMS Desktop application will force users to set an initial password for Wisenet camera upon enrollment, for best cyber security practices.

1. - Mobile Application

GGGGG. Supported Operating Systems

1. Operating System Versions Google Android: Android 8.0, 8.1: “Oreo” Android 9.0 Apple iOS: iOS 11.4, 12.1, 12.2, 12.3

HHHHH. Installation

1. The VMS Mobile application will be available as a free download from Google Play or Apple iTunes stores.

IIIII. Features

1. The VMS Mobile application will automatically discover available Systems on a local area network (LAN).
2. The VMS Mobile application will store past system connections and credentials and will allow users to quickly search for switch between systems.
3. The VMS Mobile application will have adaptive streaming and automatically adjust the stream being displayed based on network speed.
4. The VMS Mobile application will allow users to adjust streaming resolutions manually.
5. The VMS Mobile application will allow users to search for cameras by name.
6. The VMS Mobile application will allow fisheye de-warping of any fisheye lens without the need for any 3rd party SDK.
7. The VMS Mobile application will allow users to view live video from one system.
8. The VMS Mobile application will allow users to log in to the VMS Cloud layer in order to view and access all systems shared with a user.
9. The VMS Mobile application will allow users to control the display of any connected "Lite Clients" in the system.
10. The VMS Mobile application will utilize a custom media player to render and display live thumbnails and video.
11. The VMS Mobile application will allow users to search video using a calendar.
12. The VMS Mobile application will allow users to search video using a flex timeline.
13. The VMS Mobile application will allow “Smart Motion Search” to search archived video by selecting an entire video or specific area.

2.6 VMS Cloud Application

A. Supported Browsers

1. The VMS Cloud application will allow users to log in from any modern web browser (Google Chrome, Mozilla Firefox, Microsoft Edge, Opera, etc.) from any type of device (mobile, pc, etc.)

B. Features

1. The VMS Cloud application will be an optional add-on to the VMS requiring no additional licensing.
2. The VMS Cloud application will allow users to connect an unlimited number of systems to a single user account.
3. The VMS Cloud application will allow system administrators to share access to a system using only an email address.
4. The VMS Cloud application will allow system administrators to assign custom user roles when

sharing system access.

5. The VMS Cloud application will allow users to quickly search for and connect to cloud-connected systems by name.
6. The VMS Cloud application will allow operators to view live or recorded video from one camera at a time on any cloud-connected system.
7. The VMS Cloud application will first attempt a direct connection to system servers using NAT Traversal technology and will be able to proxy traffic to ensure access to a system in the case of ISP or routing issues.
8. The VMS Cloud application will allow an unlimited number of connected users and systems with no additional licensing.
9. The VMS Cloud application will utilize secure networking technologies (OpenSSL, HTTPS) and a complex Salted MD5 hash for any stored passwords.
10. The VMS Cloud application will allow two systems to be merged together to operate as one system without the need for port forwarding or local access.

PART 3 EXECUTION

3.1 PREPARATION

A. System Integrator: Confirm the solution proposal planning and design with the installing contractor.

B. The network design and configuration to be verified for compatibility and performance with the input/output devices.

C. Network Configuration: Tested and qualified by Contractor prior to remote device installation.

D. Equipment to be tested and configured in accordance with instructions provided by the System Integrator prior to installation.

E. All firmware found in products to be the latest and most up-to-date provided by the manufacturer, or of a version as specified by the provider of the Video Management Application (VMA).

F. All equipment requiring users to log on using a password to be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.

G. Confirm hardware will be stored in an environment where temperature and humidity are in the range specified by the Manufacturer.

3.2 VIDEO SURVEILLANCE SYSTEM INSTALLATION, NECESSARY MOUNTING ACCESSORIES, AND PROGRAMMING

A. Provide and install all equipment, software, materials, and labor to include system programming for a completely operational video management system described herein an included on the Project Drawings. These specifications and project drawings are complementary in describing the design intent of the security video management system.

B. Before programming, meet with the project owner to determine system programming parameters, camera mounting location, desired field of view, analytics configuration and other system settings required to meet the owners' needs.

C. Install cameras and other appurtenances level and plumb for a high quality, workman like installation.

D. Provide and install all necessary mounting accessories to include caps, mounts, brackets, pendants, etc. as necessary for the environment to accommodate field of views required by the owner. Please find the

appropriate options here: https://www.hanwhasecurity.com/mount-selector/

E. Install power supplies and other auxiliary components at control stations unless otherwise indicated.

F. If applicable, set PTZ/PTRZ pan unit and pan-and-tilt until stops to suit final camera position and to obtain the field of view required for the camera. Connect all controls and alarms, and adjust.

G. Aim cameras as directed by engineer and/or owner. Optimize system settings both day and night for exact field of view, WDR, Day/Night, analytics, etc.

H. Program camera system head end. Provide unique on-screen camera identification for all cameras with the following nomenclature:

1. Camera title, date, and time
2. Tours and Salvos (if required)
3. On screen display feature tiles.
4. Individual user settings and rights.

I. Program all systems analytics and AI system parameters as directed by the engineer and/or owner.

J. Unique individual user login settings and/or Active Directory integration as required.

3.3 CYBER SECURITY PROTECTION

A. All equipment requiring users to log on using a password to be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed. Contractor shall implement all camera manufacturer's cyber security recommendations and configurations, following industry best practices per the camera manufacturer Cyber Hardening Guide.

B. Document that all cameras do not have a default password.

C. Document that all cameras have the latest firmware installed.

D. Back up all camera settings and provide file to owner.

E. Document that all servers and work stations have current version or Operating System (OS).

F. Document that latest VMS version that is installed on all servers and work stations.

G. Set user permissions and rules in VMS.

3.4 INSTALLATION

A. Install products per manufacturer's recommendations and approved submittals.

1. Comply with documentation provided by the System Integrator to insure all steps have been taken to provide a reliable, easy-to-operate system.

B. Contractor personnel must comply with all applicable state and local licensing requirements.

C. Before permanent installation of the system, the Contractor will test the system in conditions simulating the final installed environment witnessed by the System Integrator. Adjust as required until proper operation is achieved.

END OF SECTION