

DESIGN-BUILD STATEMENT of WORK

Repair Maintenance Hangar 456

Project Number: EEPZ 10-1001

Columbus AFB, Mississippi

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Prepared by
CAFB 14 CES/CENM

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ACRONYMS, ABBREVIATIONS & DEFINITIONS

A	Amps	gpm	gallons per minute
AASHTO	American Association of Highway and Transportation Officials	GB	Gypsum Board
AF	Air Force	Hazmat	Hazardous Materials
AFF	Above Finish Floor	HMW	Hazardous Material or Waste
AFI	Air Force Instruction	HTW	Hazardous and Toxic Waste
AFM	Air Force Manual	HVAC	Heating, Ventilating and Air Conditioning
AHU	Air Handling Unit	ICC	International Code Council
AIA	American Institute of Architects	IFC	International Fire Code
ATFP	Anti-terrorism/Force Protection	IFGC	International Fuel Gas Code
AWS	American <i>Welding</i> Society	IPCEA	Insulated Power Cable Engineer's Association
BCE	Base Civil Engineer	IRC	International Residential Code
BMP	Best Management Plan	ISA	Instrument Society of America
C	Centigrade	LAN	Local Area Network
C&G	Curb and Gutter	LEED	Leadership Energy & Environmental Design
CAD	Computer Assisted (or Aided) Design	MAJCOM	Major Command
CAFB	Columbus Air Force Base	MCA	Military Construction Army
CAS	Charles A Simko	MCASES	Micro Computer-Aided Cost Estimating System
CATV	Cable Television	MIL-HDBK	Military Handbook
CCTV	Closed Circuit Television	MT	MILCON Transformation
CDs	Construction Documents	NICET	National Institute for Certification in Engineering Technologies
CD-ROM	Compact Disk - Read Only Memory	NPDES	National Pollutant Discharge Elimination System
CEPM	Civil Engineering Project Manager	NTP	Notice to Proceed
CES	Civil Engineering Squadron	oc	On Center
cfm	cubic feet per minute	O&M	Operation and Maintenance
CFR	Code of Federal Regulations	OSP	Originally Specified Product
cfs	cubic feet per second	PDF	Portable Document Format
CMI	14CES Construction Manager Inspector	PE	Professional Engineer
CO	Contracting Officer	Ph	Phase (electrical)
COR	Contracting Officer Representative	PIV	Post Indicator Valve
Comm	Communications	PM	Project Manager
CPM	Contractor's Project Manager	psi	pounds per square inch
CSS	Contractor's Site Superintendent	PVC	Polyvinyl Chloride
DDC	Direct Digital Controls	QCP	Quality Control Plan
DM	Design Manual	RA	Registered Architect
DoD	Department of Defense	RFP	Request for Proposal
DP	Design Professional	SOW	Statement of Work
DPM	Design Project Manager	SS	Stainless Steel
EIA	Electronic Industries Alliance	STC	Sound Transmission Class
EM	Engineering Manual	TI	Technical Instruction
EMCS	Emergency Management & Control System	TL	Technical Letter
EMI	Electromagnetic Interference	TM	Technical Manual
EPA	Environmental Protection Agency	TRACE	Trane Air Conditioning Economics
ETL	Engineering Technical Letter	UG	Troglodyte Declarative
FAR	Federal Acquisition Regulation	UMCS	Utility Monitor and Control Systems
FCU	Fan Coil Unit	USACE	United States Army Corps of Engineers
FFE	Furniture, Fixtures and Equipment	USDOT	United States Department of Transportation
FM	Factory Mutual	UFAS	Uniform Federal Accessibility Standards
fps	feet per second	VAV	Variable Air Volume
ft.	foot or feet	VRF	Variable Refrigerant Flow
FY	Fiscal Year	V	Volts
GFCI	Government Furnished Contractor Installed	W	Watts
GFGI	Government Furnished Gov't Installed	WAN	Wide Area Network

Additional Acronyms and Abbreviations may be found in the "Standards & References" (S&R) section.

ACRONYMS, ABBREVIATIONS & DEFINITIONS

DEFINITIONS of BASIC TERMS and LANGUAGE USE

The following table provides many of the meanings of words or phrases commonly used in this document.

All directive, informative, etc. statements are directed to the Contractor even if the term “contractor” or the contractor name is not included (e.g. “Provide a nail.” is equivalent to “The contractor shall provide a nail.” And “remove” is equivalent to “The Contractor shall remove”). Also, the Contractor shall ably and competently execute all directives including all directly or indirectly related tasks required to safely and legally perform the directive (e.g. “remove debris from CAFB” includes “safe and legal removal, disposal and obtaining all necessary permits, etc.)	
A device, equipment or system referred to in the singular (e.g. “the pump”, or “the ____ system”) includes all related devices, elements and components required to Provide (see below in this table) that device, equipment, or system.	
<i>The Term</i>	<i>Shall Mean (*=Shall in Addition Mean)</i>
Approved (by CAFB)	*without waiving or suspending the full force of Contractor obligation to fulfill the CDs
Architect of Record	Architect DP.
Aspect	Distinct feature or element of the project
CAFB	Government contracting Authority on Columbus Air Force Base
Construction Documents	Drawings, specifications and their references including all Design Criteria and Design & Construction Requirements for this Project.
Contractor	The Design-Build entity holding a current Government contract including all personnel in direct or indirect employ of same entity servicing same contract including partners, consultants, subcontractors, suppliers, and manufacturers.
Design Professional	(Abbreviated: DP) Professionals including Architects, Engineers and Landscape Architects licensed to practice in one or more states of the U.S.
Day	Calendar day unless noted otherwise.
DP	Licensed Design Professional fully responsible for all professional design on this project. Engineer DP
For example (e.g.)	One among many possible examples
General Office area(s)	Office and administration area(s)
Government	Columbus Air Force Base Contracting Officer
Including [Includes]	Including, but not limited to [Includes, but is not limited to]
Provide	Furnish and install complete, functional, and ready for use without added government action
Provision	Furnishing & installation complete, functional, and ready for use without added government action
Will, must, shall	& similar <i>Terms</i> are mandatory directives whereby ‘ <i>Term</i> ’ = ‘ <i>Term + to CAFB satisfaction</i> ’
Work	The whole or any part, product, system or subsystem of this project
Replace	Demolish and dispose of existing element. Provide new element of equal or greater value.
Review	Review and, if and when acceptable to the government, approval
Subcontractor	Subcontractor and all personnel in Subcontractor’s direct or indirect employ on any given Project including suppliers and manufacturers

End of Acronyms, Abbreviations & Definitions

PROJECT SUMMARY

- A. This Statement of Work (SOW) describes the renovation and *Repair Maintenance Hangar-456* project located on Imes Street northeast of Hangar 450 and abutting an addition (between hangars 450 and 456) hereafter named Building 450A. The completed project will be a facility for maintenance and repair of T-6 aircraft at Columbus AFB, MS. The design and construction work is composed of the following parts:
- B. Hangar Work: Remove all existing walls, roof, lighting, mechanical and plumbing systems leaving only the existing structural steel frame, concrete slab and foundations in place. Prime and repaint the existing structural frame. Provide existing structure with new exterior walls, roof and openings including new hangar doors. Provide new HVAC systems and a new high-expansion foam fire suppression system. Provide new electric power, lighting and distribution systems. Provide a UPS to enable (all) hangar door operation during a power outage. Provide new above-slab plumbing. The new large hangar space will be able to house 10 aircraft at a time. Other new interior spaces include: an addition to the Northwest corner to include the fire suppression system and a storage room. The existing “wing” extending from the northwest building face shall enclose electrical and mechanical rooms, a communications room, two storage rooms and office spaces as described.
- C. Office and Locker Spaces: Provide a Conference and Training Room in the existing “wing”. Provide a new addition to support administration, training, operations, and planning, house a staff of not less than 15 and provide spaces including the following: three offices; a covered entry door; an entry and reception area; a locker room; men’s room, women’s room and janitor closet; space for an administrative assistant; and a storage closet. Provide the new addition with new HVAC, plumbing, and electric power, lighting and distribution.
- D. Equal or Exceed: The recently completed renovation and repair of Hangar 450 shall be the prototype for the design and construction of Hangar 456. The completed renovation and repair of Hangar 456 shall equal or exceed the design and construction quality of Hangar 450. Examples of “base-line” quality established in Hangar 450 and to be equaled or exceeded in Hangar 456 include:
- 1) The height and type (Columbus Blaze) of face brick around base of Hangar 456 shall match that of Hangar 450. The type and quality of brickwork and joints shall meet or exceed that of building 450. The cast-stone brick-cap and drip-edge of hangar 450 shall be matched or exceeded in hangar 456.
 - 2) Wall and roof panels of Hangar 456 shall match the profiles, insulation value and color of respective Hangar 450 panels.
 - 3) Hangar 450 establishes the minimum standard of paint quality and color scheme for Hangar 456 steel structure and interior CMU walls. Hangar 450 sets the minimum standard for the quality and colors of all new floor finish materials (including the hangar bay floor).
 - 4) The cost effectiveness and performance of all mechanical and plumbing systems in Hangar 456 shall meet or exceed those in Hangar 450.
 - 5) Ordinary electrical power receptacles (110V) and distribution in Hangar 456 shall closely match those in Hangar 450. The 456 hangar bay shall have not less than the same number of Aircraft Maintenance Power Stations in the same locations as in Hangar 450. Each of these power stations includes the following receptacles: 480V 60A 3-phase; 480V 30A 3-phase; 208V 30A 3-phase twist-lock; and an ordinary 120V duplex. Part numbers of special receptacles shall match those in Hangar 450.
 - 6) Hangar 456 lighting fixtures, quality and lumens shall closely match that in Hangar 450.
- E. Construction flaws and deficiencies in Hangar 450 (and its addition) shall not be present in the construction of Hangar 456. Incorporate into Hangar 456 corrections of all flaws and deficiencies in design, construction, and detailing extant at Hangar 450. Hangar 450 deficiencies not to be duplicated in Hangar 456 include:
- 1) High Expansion Foam Fire Suppression System (HEFFSS) shall include requirements of ETL 02-15.
 - 2) Permanent signs displaying complete HEFFSS system operating instructions shall be mechanically fastened to walls near any and all HEFFSS equipment throughout the hangar. Instructions shall be appropriate and

clear for those HEFFSS system components near the posted signs. Posters shall be plastic or metal with permanently affixed or painted letters. A duplicate set of posters, customized as necessary for hangar 450, shall be created and installed near all hangar 450 HEFFSS equipment. Separate design drawings of all HEFFSS posters and signs shall be developed and submitted for review and approval by CAFB.

- 3) Several brick veneer wall weep wicks at Hangar 450 were located below grade or below new concrete slabs. This should not occur at Hangar 456.
- 4) Wall separating Conference/Training Room and Corridor from Electrical/Mechanical and Comm. Rooms shall extend from slab to underside of roof panel. This wall shall have an STC rating of not less than 55.
- 5) Exceptions to Hangar 450 include any designated in this SOW as a whole and in general those necessary to accommodate differences from Hangar 450 in site, utilities, foundations, slab and structural steel frame. Other differences include:
 - 6) Hangar 456 door panels shall be “fabric” like that of Hangar 450, but upper panels of 456 hangar doors shall be translucent. The lower fabric panel of 456 hangar doors shall match the color of the 450 hangar door and shall match the height of the face brick.
 - 7) Durable finishes shall be used to extend the useful life of the new Administrative Area (rooms 101-111). All floors except offices and conference/training room shall be porcelain tile. All walls in men’s and women’s restrooms shall be porcelain tile.

OBJECTIVE

The objective of this solicitation is to obtain a fully functional, operational and easily maintainable facility that conforms to the basic dimensions and configurations presented in the SOW and related concept drawings.

The Contractor shall coordinate between all professional disciplines and construction trades to fulfill the requirements of this contract and to provide a complete, integrated, and functional design.

All project design, Construction Documents and construction shall comply with this SOW including all related drawings, specifications, appendices and requirements. Design and technical criteria contained and cited in this SOW establish minimum standards for design and construction quality. The Contractor shall comply with all applicable design and construction criteria using industry standard best practices and materials. The materials selected shall be high quality, durable and easily maintained. Adjustments and enhancements to the SOW floor and site plans are permitted to accommodate actual design and construction conditions, however no deviations from the criteria shall be permitted without prior written approval from the Contracting Officer. All questions or problems encountered by the Contractor in following criteria shall be promptly submitted with recommendations to the Contracting Officer for review.

The SOW documents do not present or solve any building code or life safety problems. The DPs of Record have full responsibility to design and direct construction to comply with building codes and life safety codes those.

Architectural detail, materials and finishes are paramount to the success of this project. Specify and provide exterior products, materials and finishes that are as identical to those of Hangar 450 as practicable.

End of Project Summary and Objective

DESIGN-BUILD REQUIREMENTS

1. STANDARDS and REFERENCES (S&R)

All design shall be developed by Design Professionals (DPs) according to all federal and state standards, codes, laws, and related publications. Each DP shall use their knowledge, judgment and exercise of professional best practice to determine the applicability to this project of the whole or any part of each S&R or publication. Each DP shall become knowledgeable of and thereby design according to all applicable information and directives contained in the S&R and related publications including those here listed. Unless directed otherwise in writing by the government, DPs shall use the latest versions of these S&R which include all applicable publications of all government and private organizations including the following:

- 1) --This item not used.--
- 2) UFGS, *Unified Facilities Guide Specifications* (www.wbdg.org)
- 3) UFC, *Unified Facilities Criteria*
- 4) FED-STD, *Federal Standard(s)*
- 5) JAFAN, *Joint Air Force, Army, Navy Manuals*
- 6) IBC, *International Building Codes*
- 7) ASCE, *American Society of Civil Engineers*
- 8) AISC, *American Institute of Steel Construction*
- 9) AISI, *American Iron and Steel Institute, Cold Formed Steel Design Manual*
- 10) AITC, *American Institute of Timber Construction, Timber Construction Manual*
- 11) ACI, *American Concrete Institute*
- 12) AWS, *American Welding Society, Structural Welding Codes*
- 13) SJI, *Steel Joist Institute, Standard Specifications and Load Tables*
- 14) SDI, *Steel Deck Institute, Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution*
- 15) PCI, *Precast/Prestressed Concrete Institute*
- 16) IMC, *International Mechanical Code*
- 17) Plumbing: UFC 3-420-01 (and IPC, *International Plumbing Code* as referenced). Backflow Prevention: AFI 32-1066 (and UPC, *Uniform Plumbing Code* as referenced).
- 18) MSS, *Manufacturers Standardization Society, of the Valve and Fittings Industry*
- 19) NEC, *National Electrical Code*
- 20) NESC, *National Electrical Safety Code*
- 21) NEMA, *National Electrical Manufacturer's Association*
- 22) NFGC, *National Fuel Gas Code*
- 23) Life Support Code
- 24) NFPA, *National Fire Protection Association (Codes and Standards)*
- 25) NICET, *National Institute for Certification in Engineering Technologies*
- 26) ANSI, *American National Standards Institute*
- 27) ASME, *American Society of Mechanical Engineers*
- 28) ASTM, *American Society for Testing and Materials*
- 29) UL, *Underwriters Laboratories*
- 30) ABA, *Architectural Barriers Act*
- 31) ADAAG, *Americans with Disabilities Act Accessibility Guidelines*
- 32) MIL-HDBK, *Military Handbooks, MIL-HDBK-1190, Facility Planning and Design Guide*
- 33) ASHRAE *American Society of Heating, Refrigeration & Air Conditioning Engineers* (incl. energy efficiency)
- 34) IES, *Illuminating Engineering Society (Lighting Handbook)*
- 35) BLCC/economic analysis
- 36) SMACNA, *Sheet metal & Air Conditioning Contractors National Association*
- 37) NACE, *National Association of Corrosion Engineers International*
- 38) DCID, *Director of Central Intelligence Directives* (6/9, Physical Security Standards for Sensitive Compartmented Information Facilities; 1/21, Physical Security Standards for SCI Facilities)
- 39) EIA, *Electronic Industries Association*

- 40) TIA, *Telecommunications Industries Association*
 - 41) IEEE, *Institute of Electrical and Electronics Engineers*
 - 42) OSHA, *Occupational Safety and Health Administration*, Guidelines and Regulations
 - 43) NPDES, *National Pollutant Discharge Elimination System*, for Construction Activities
 - 44) AETC, *Air Education Training Command*, Relevant Standards
 - 45) Other Applicable AF Manuals, Air Force Instructions (AFI), Standards, Technical Manuals (TMs), Technical Instructions (TIs), Pamphlets, and Engineering Technical Letters (ETLs).
- Use the latest version of all S&R throughout design and construction. Revision of any S&R through design development shall not be cause for renegotiation of this Contract unless Contractor or Government can prove consequential financial loss. After issuance of Notice to Proceed, S&R revisions will not change the CDs.
 - If a disparity is discovered between S&R, SOW, drawings and specifications, it shall be presented to CEPM and Contractor as soon as possible. The DP and the CEPM shall agree to CD revisions that best accommodate the SOW according to Professional Best Practice. Revisions shall be included in the As-Builts.
 - Wherever practicable or when required by government regulation, Contractor shall install energy efficient equipment. "R" or "u" values shall be used for this project.
 - Details omitted from CDs, but necessary for industry best-practice installation and operation, shall guide the work the same as if included in the CDs. Whenever such omissions are discovered, the appropriate Design Professional(s) of Record shall provide the necessary details and include them in the As-Builts.
 - If the National Fire Codes, NFPA Life Safety Codes, IBC, ADA, and UFAS disagree, the UFC shall govern.

2. GEOTECHNICAL and FOUNDATIONS

- A. Capillary Water Barrier: Floor slabs of all buildings shall be underlain by a minimum 4-inch (loose thickness) aggregate capillary barrier.
- B. Existing Subsurface Information: No current geotechnical investigation exists for this site.
- C. Geotechnical Design: Contractor shall be responsible for determination of actual soil conditions present at the site, and design to suit those conditions. Contractor shall investigate the subsurface soil conditions, and ground water table beneath final structure locations, and complete the design for the facility using contractor-developed data. The contractor shall be responsible for obtaining all required drilling permits. **For bidding purposes only, the contractor shall assume the following: Shallow foundation system consisting of spread footings supporting column loads and continuous footings supporting wall loads. Net allowable bearing capacity - 2500 psf. Some undercutting and re-compacting of the foundation soils will be required.** The contractor shall provide a minimum of three (3) borings per building footprint, exact location and number as determined by the Contractor. All borings shall be sampled by a split spoon sampler in accordance with ASTM D-1586, with samples visually classified at 2.5 foot intervals to a depth of 10 feet and at 5 foot intervals thereafter in accordance with the Unified Soil Classification System (ASTM D-2487). The depth to water (if encountered) shall be recorded on the boring logs. Under buildings, borings shall extend to the depth of 50 feet or refusal, and under roads and/or parking areas, to a depth of 10 feet. Soil borings shall be abandoned in accordance with the following:
 - 1) Each boring shall be measured for depth before it is sealed to ensure freedom from obstructions that may interfere with effective sealing operations.
 - 2) Seal all borings by backfilling with concrete, grout, neat cement or a bentonite/cement mixture.
 - 3) All backfill material shall be placed into the borehole from the bottom to the top by pressure grouting with the positive displacement method (tremie method).
 - 4) Each borehole sealed shall be given time allowing backfill material to settle and set. If the backfill material settles 2-feet or more below ground surface (BGS) than the contractor shall place more backfill material, as described above, in the borehole to the top. If the backfill material is less than 2-feet BGS than the contractor may backfill the borehole using properly compacted native material.
 - 5) A measurement of the borehole's theoretical volume, the amount of grout introduced into the borehole and the depth of the top of the grout or cement backfill shall be included in the borehole log.

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The contractor shall obtain soil samples for testing as required for the computation of bearing capacities, settlement calculations, lateral earth pressure calculations, temporary and permanent dewatering designs, etc. A dated drilling log shall be provided for each boring drilled. All borings shall be continuously sampled by a split spoon sampler and standard penetration blow counts recorded. The approximate elevations and locations of borings drilled shall be provided on each boring log. Coordinates shall be in state plane +/- 1-foot horizontal.

- D. Contractor's Final Geotechnical Report: Contractor shall provide a geotechnical report complete with recommendations specific to the geotechnical design requirements at the site. The report shall be performed under the direction of and signed by a licensed professional geotechnical engineer. The report shall include drilling logs, the results of soils test data if any, and a plan showing the location of each boring as drilled. The Contractor shall use the data from his own investigation to provide bearing capacity analyses, settlement calculations, lateral earth pressure calculations, and temporary and permanent dewatering designs. A copy of the report shall be provided to 14CES Construction Inspectors for review.
- E. The final geotechnical report by the contractor's geotechnical engineer shall include the following:

- 1) Previous Construction Activity: A discussion of previous construction activity should address any existing fills or subsurface openings, if encountered.
- 2) Subsurface Conditions: Subsurface conditions encountered at the site shall be discussed, based upon stratigraphic sequence observed and local geology. Figure(s) shall be provided displaying soil borings and generalized cross section(s). A general description of the engineering properties or parameters determined from the investigation and applied to design recommendations shall be provided. Prevailing groundwater elevations observed and those recommended for design shall be noted.
- 3) Earthwork: Obtain all borrow off site. Disposal of materials will be off site. Contractor shall bear all costs related to and be liable for disposal and borrow operations and materials including hauling.
- 4) Grading Recommendations: Provide grading recommendations taking into consideration the conceptual grading plan for the site. If over-excavation of unsuitable materials and structural backfill appear warranted, provide vertical and horizontal extent of the over-excavation and structural backfill.
- 5) Compaction Requirements: The report should contain general criteria for acceptable fill and borrow material. The report shall contain recommendations for material usage at the site in regard to placement and compaction requirements, as well as any recommended treatment. Compaction criteria, including acceptable gradations, moisture control, compaction effort, and need for proof rolling shall be discussed, including criteria for both granular and cohesive fill, if applicable.
- 6) Foundation Design: The contractor's geotechnical engineer shall provide final recommended foundation type based on local practice, availability to meet schedule and economics, as well as the ability to carry the required loading. All factors of safety used in developing the allowable load capacities shall be outlined in detail.

The contractor's final geotechnical report shall provide net allowable bearing pressures for shallow spread footings at the recommended bearing depths, as appropriate for the site. Note if any overstressing is allowed under short term loading such as wind or seismic. Provide estimated total and differential settlement for foundations using these bearing pressures. Note factors of safety included or recommended. Provide all necessary slab-on-grade design and construction information (e.g. subgrade modulus, subgrade preparation, base course, vapor barrier, etc). Provide recommendations for resistance to lateral loads, such as passive earth pressures and sliding friction for foundation bases. Recommend groundwater level for buoyancy determination and means to resist buoyant forces.

- 7) Pavement Subgrade Recommendations: The final geotechnical report shall contain recommendations for flexible and rigid pavement design(s) including design CBR and modulus of subgrade reaction and the required compaction effort for subgrades. Guidance shall be offered on the types of base course materials available in the area and design strengths.
- 8) Lateral Earth Pressures: Design lateral earth pressures shall be provided for below grade vertical walls both of the flexible and rigid type. It is anticipated that the proposed facilities may require the use of either active or rigid (at-rest) lateral earth pressure values. It is preferred that these earth pressures be

- provided as equivalent fluid pressure values, however, equations may be developed for the same. Any assumptions relating to the construction method or type of backfill shall be outlined in detail, that is granular, cohesive, drained or undrained conditions. Active, passive, and at-rest coefficients used in determining these pressures shall be noted.
- 9) Existing Fill: Report engineering properties of any existing fills in regard to foundation design.
 - 10) Slope and Excavation Stability: Recommend inclines of temporary excavation and permanent slopes. Identify OSHA soil types and excavation-required temporary slopes, sheeting and shoring. No deep structures or significant grading are anticipated. Only trench foundation excavations are anticipated.
 - 11) Seismic Hazards: Provide a Site Class definition for the site per Section 1613.5.2 of the 2006 IBC.
 - 12) Excavation Requirements: Address the excavatability of soils and rock which may be exposed during foundation excavation and site grading. Excavation effort and equipment type depend on excavation size and depth. Thus discuss regarding to project structures and utility trenches.
 - 13) Dewatering: Project dewatering requirements. If temporary construction dewatering is required due to a high water table; present a dewatering plan. The contractor shall be responsible for securing all the required information necessary for the design of the system during the final geotechnical investigation. Dewatering that discharges to surface waters or storm water systems are required to operate under the coverage of a wastewater permit. The Contractor shall obtain the necessary permit for any ground water discharge off site and operate in compliance with the permit.
 - 14) Expansive, Dispersive, Liquefiable or Collapsing Conditions: Evaluation of the expansive (swelling), dispersive, liquefiable, or collapsing nature of subgrade materials shall be made and special design features required to resist or reduce these tendencies shall be incorporated into the foundation design.
 - 15) Evaluation of Karst Potential: An evaluation of the potential of subgrade materials to develop karst features, solution channels or sinkhole formations shall be made and special design features required to resist or reduce these tendencies shall be discussed. The contractor's geotechnical engineer shall define and discuss the relative risk for sinkhole development and/or the presence of voids within the subsurface materials encountered at the Project Site.
 - 16) Corrosion Potential: Include all pH, salinity, and resistivity tests, measurements, etc., required to design corrosion control and grounding systems. Provide all raw field data. Design all required corrosion control and grounding systems. Recommend construction concrete cover and cement type.

3. SITEWORK

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:
 - UFC 3-210-01A, Area Planning, Site Planning, and Design
 - UFC 3-210-06A, Site Planning and Design
 - UFC 3-230-17FA, Drainage in Areas Other Than Airfields
 - UFC 3-250-01FA, Design: Pavement Design for Roads, Streets, Walks and Open Storage Areas
 - UFC 3-250-04FA, Design Standard Practice for Concrete Pavements
 - UFC 3-250-08FA, Standard Practice for Sealing Joints and Cracks in Rigid and Flexible Pavements
 - TM 5-822-2/AFM 88-7 Ch.5 General Provisions & Geometric Design for Roads, Streets, Walks, & Open Storage
 - UFAS, FED-STD-795
 - American Assoc. of Highway & Transportation Officials: A Policy on Geometric Design of Highways & Streets,
 - Manual on Uniform Traffic Control Devices

- B. General Design Requirements:

Site design includes building and site modifications and repair of construction-related damage. Site modifications include access sidewalks, curb-cuts, and equipment screen walls. Damage repair includes that related to moving equipment and materials on and off site. Site design includes the items listed in this

DESIGN BUILD REQUIREMENTS

section. Sitework includes excavation, backfill, grading, and planting necessary to build addition(s) onto and provide new vehicular and pedestrian access to Hangar 456 and its additions.

- 1) Demolition and Removal: The Contractor shall provide surveying as necessary to locate work items prior to initiating demolition work. All demolition of site work shown on the plans is approximate. Demolition limits shall be determined by the contractor. Erosion and sediment control Best Management Practices (BMPs) shall be in place and approved by the Contracting Officer's Representative prior to initiating demolition work. BMPs shall be maintained through the entirety of the project. The demolition plan drawing provided in the SOW presents existing conditions as known. All information shown is from Columbus AFB Base Maps and visual site inspection and shall be verified. All demolition debris shall be removed from the site. Existing site elements damaged or disturbed during construction shall be fully restored or replaced to match the form and function of their pre-construction condition including curb & gutter, sidewalks, grass, trees, shrubs, mulched beds and edging. Contractor shall remove from CAFB all site construction or disturbance debris. The Contractor shall be responsible for all disposal permits and regulation requirements.
- 2) Concrete Containment Area: Existing containment area shall be completely demolished and removed. Contractor shall coordinate with Base Environmental on any issues and remediation needs.

C. Civil Design Requirements:

Sitework includes excavation, backfill, grading, and planting necessary to build addition(s) onto and provide new vehicular and pedestrian access to Hangar 456 and its additions. Site design shall be done by a Civil Engineer DP. Site design shall be based on information from contractor obtained and verified field investigations. Contractor shall obtain a Base digging permit prior to any excavation. Construction activities shall not interrupt pedestrian movement along any existing concrete without prior written approval from the CMI.

- 1) General: A conceptual project site plan has been provided for the Hangar facility. Contractor shall provide a complete set of construction plans and specifications signed and sealed by a civil engineer registered in the state of Mississippi. If not provided, Contractor shall be responsible for the determining the finished floor elevation, and final location of, but not limited to, site grading and drainage, fire/emergency access drives, service and delivery access drives, sidewalks.
- 2) Access Paths and Sidewalks: Provide construction personnel and equipment access paths with prior CMI approval. These paths shall cause minimal disruption to other site and building functions and minimal damage to site or building. Ramps shall be provided for handicapped access, if necessary due to grades. Contractor is responsible for changed sidewalk grades. Sidewalks shall be redesigned and reconstructed to accommodate both existing and new entry doors into the building. Pedestrian sidewalks are required for the proposed facility. A sidewalk shall connect the parking lot to the facility entrance. Sidewalk shall be provided for emergency evacuation. Sidewalk shall be provided for access to exterior mechanical, electrical, communication, and other service rooms. A functional system of walks connecting operational areas, parking areas, streets and other walks as pedestrian traffic demands shall be maintained. Walks subject to use by the physically handicapped meeting accessibility requirements shall be maintained. Minimum walk width of five (5) feet shall be maintained. Walks shall be concrete unless otherwise directed. Rainwater shall not by any means including downspouts and diverters be directed onto or across sidewalks. Steps in walks are not acceptable. The site and facility access for the physically disabled shall be as required by ADA.
- 3) Soil Treatment: Provide all necessary soil treatment for subterranean termite control. Do not disturb existing termite traps or replace immediately if disturbed. Apply soil treatment immediately before any backfilling within or adjacent to the building enclosure. State licensed and certified pest control personnel shall formulate, apply, store and dispose of pesticides.
- 4) Facility Sign: Provide a facility sign to indicate "Building 456" and be approved by the Contracting Officer's Representative
- 5) Pavement Design: New pavement and replacement for damaged pavement Contractor shall be

DESIGN BUILD REQUIREMENTS

designed by a DP to have a design life of more than 20 years. Use the more stringent of CAFB and State DOT standards.

D. Grading:

- 1) Permits: Erosion and sediment control BMP's shall be in place and approved by the Contracting Officer's Representative prior to initiating any work. Dewatering projects that discharge to surface waters or storm water systems are required to operate under the coverage of NPDES and/or similar permits. The Contractor shall obtain the necessary permit(s) for any groundwater discharge off site and shall operate in compliance with the permit.
- 2) Access Drives: Grades for all access drives shall be as outlined in TM 5-822-2 and shall be the responsibility of the Contractor. Centerline grade changes in excess of 1% will be accomplished by means of vertical curves. The length of vertical curves will be determined in accordance with Site Planning and Design. Profiles are mandatory for vertical control of centerline gradients. Drives will be shown by the use of half-plan/half-profile type drawings.
- 3) Walks: The grade of walks shall be the responsibility of the Contractor. Steps in walks are not acceptable. Walks and ramps serving facilities that are to be accessible to and usable by the physically handicapped shall meet all accessibility requirements.
- 4) Finish Grade Contours and Spot Elevations: Contractor shall provide finish grade contours at one foot intervals and spot elevations to construct all site development features to elevations within the above grading criteria and tolerances as specified in the guide specifications. Spot elevations on the drawings should be sufficient so that interpolation between contours is not required for structures, grading or paved areas; some examples are: corners of paved areas, low points, high points, flow lines of swells or ditches, changes in degree of slope and grading at corners of the facility to ensure positive drainage away from the facility. The use of cut or fill symbols in lieu of finish grade contours is not permitted.

4. **UTILITIES**

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:
- UFC 3-230-10A, Water Supply: Water Distribution
 - UFC 3-230-17FA, Drainage in Areas Other than Airfields
 - UFC 3-240-04A, Wastewater Collection
 - UFC 3-240-07FA, Sanitary and Industrial Wastewater Collection: Gravity Sewers and Appearance
 - UFC 3-250-01FA, Design: Pavement Design for Roads, Streets, Walks and Open Storage Areas
 - TM 5-813-1/AFM 88-10 Vol. 1, Water Supply Sources and General Considerations
 - ASTM D2513, Standard Specification for Thermoplastic Gas Pressure Piping Systems
 - ASTM D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
 - ASME B 31.8, Gas Transmission and Distribution Piping Systems
 - NFPA 54, National Fuel Gas Code
 - ANSI: B16.5, Pipe Flanges and Flanged Fittings
- B. General Design Requirements: All utility design shall be done by a Civil Engineer DP and shall be based on information from DP obtained and verified field investigation. Design and provide all utilities required to make all renovated areas functional. Do not open-cut sidewalks or interrupt pedestrian movement along existing sidewalks without prior written approval from the CMI. Minimize the impact on existing facilities of relocation of any utilities or related equipment. The utility design required for this project shall include, but may not necessarily be limited to the items listed within this section.
- C. Demolition and Removal: Government provided documents show locations and sizes of existing structures and utilities. Contractor shall field-verify all government provided documents and also verify locations and sizes of utilities not shown on government documents but pertinent to utilities design. The Contractor shall provide surveying as necessary to locate the utility items prior to initiating demolition work. All demolition of utilities shown on the plans is approximate. Determine limits of demolition to ensure utilities remain

operable during construction. Abandoned or existing utility lines found under the facility footprint or interfere with the project shall be coordinated with the Contracting Officer's Representative. Contractor shall obtain a Base digging permit prior to demolition of any utility or excavation on site. Submit to CEPM for approval from Base Environmental due to monitoring wells near the site. Contractor may use utilities during construction with prior approval from the CO. Erosion and sediment control BMP's shall be in place and approved by the CMI prior to demolition. All demolition debris shall be removed from the site. Contractor shall obtain all disposal permits and comply with all regulations.

D. Utilities

- 1) Layout: Accuracy of government provided documents showing utilities is not guaranteed, but may help Contractor locate existing utilities. Verify all existing utility locations before starting work. Contractor shall coordinate all site work on the project, including utility work. It is the Contractor's responsibility to verify the locations of all existing utilities prior to commencing work. With the exception of main storm drain culverts, placing utilities and culverts under existing roads shall be by jack and bore unless otherwise approved by the CMI. All sanitary sewer, storm water, water supply, gas, and electrical construction shall comply with local and Base requirements. Contractor shall obtain all required Base, City, County and State digging, installation and operation permits prior to any excavation. Obtain CMI approval at least 10-days prior to any utility outages. Obtain CO approval not less than 72-hours prior to any utility outages. Relocate utilities or equipment so as to minimize the impact on existing facilities. No physical connections shall exist between sewer and water supply systems. Unless otherwise required by local utilities:
 - a. Separate sewer and water lines by min. 10 feet horizontally; except if the bottom of the water pipe is min. 12 inches above the top of the sewer; min. horizontal spacing may be six (6) feet.
 - b. Encase a sewer line crossing over a water line in concrete 10 feet on each side of crossing.
 - c. Place pipes at least three (3) feet underground where possible to protect pipe from superimposed live loads of ordinary traffic. Depth may be greater if required by local codes and agencies.
- 2) Connections: Contractor shall provide all utilities; including water, sewer, phone, power, and gas; required to make the hangar fully functional. Pipe water to the HEFFSS in Hangar 456: either from Building 441 (Pump house) or from Hangar 450. Obtain prior CMI approval of all new-to-existing utility connections. If any such connections are later discovered not to have been observed by the CMI, the CMI may require the Contractor at no additional cost to the government to disconnect and reconnect the utility under CMI observation.
- 3) Device Location: Locate backflow prevention valves, post indicator valves, transformers, electric switches, telephone and cable boxes, manholes, etc., to be concealed from building occupants and personnel passing by the site. New utility lines shall not be located within five feet of the footprint of any known future facility.
- 4) Marking Utility Lines: Bury continuous tape 12 inches above all underground utility lines to identify the type of pipe buried beneath. Use tape specifically manufactured for marking underground utilities. Use plastic tape to identify metallic pipe and metallic tape, detectable by electronic instruments, to identify non-metallic pipes.

<u>Tape Color</u>	<u>Utility</u>
Red	Electric
Orange	Telephone, telegraph, television and communications
Blue	Water Systems
Green	Sewer Systems
Yellow	Gas or other dangerous Materials
- 5) Metering: Meter all utilities to each facility. For Government owned utilities, install meters that are wireless data transmission capable as well as have a continuous manual reading option. All meters will be capable of at least hourly data logging and transmission and provide consumption data for gas, water, and electricity. All meters shall be able to communicate with the base utility monitoring control service. Gas and electric meters will also provide demand readings based on consumption over a maximum of any 15 minute period. Configure all meters to transmit at least daily even if no receiver

- for the data is currently available at the time of project acceptance. For privatized utilities, coordinate with the privatization utilities for the proper meter base and meter installation.
- 6) Road Crossings: Roads and driveways shall not be crossed by open cut unless approved by the CI. If the open cut method is performed, one lane of the street shall remain open to traffic at all times. Contractor shall provide steel matting sufficient to carry traffic loading over the excavated area. Utility structures shall be designed to accommodate the traffic loadings for the area in which the structures are placed. Requests for lane closures for open cuts shall be made in writing prior to commencement of work within a number of calendar days to be determined by Base.
 - 7) Excavations: All excavations, trenches, open manholes, etc., will be properly shored, braced, barricaded or guarded. Contractor shall provide barricades and maintain warning lights or other illumination from sunset to sunup at all excavations that are adjacent to pedestrian or vehicle thoroughfares or as directed by the CMI.
 - 8) Safety: Contractor shall enter manholes, tunnels, tanks, or other confined spaces only if compliant with OSHA pre-entry requirements and after obtaining confined space entry permit(s) from the government.
- E. Permits: Permits required include the items listed within this section. Contractor shall obtain and bear all costs of permits required for this project.
- 1) Storm water Management Permit: A storm water Management permit is not required for this project per Mississippi Department of Environmental Quality.
 - 2) Sanitary Sewer Permit: A sanitary Sewer Permit is not required for this project.
 - 3) National Pollutant Discharge Elimination Systems (NPDES) Permit: is not required for this project because the of site disturbance area is less than one acre
 - 4) Drinking Water Permit: A drinking water permit is not required for this project
- F. Storm Drainage System and Management:
- 1) Design: The Contractor shall design and construct additions to the existing storm drainage system as needed. This system shall be designed and constructed to, but may not necessarily be limited to, the items listed within this section. The Contractor shall evaluate the flow of storm water runoff to and from the site and insure that the flow of water will be properly moved from the site to the storm water sewer system. The drainage system shall tie to the existing system along Imes Street.

The storm drainage system pipe shall be designed for the anticipated traffic loadings. Profiles shall be required for the underground storm drainage systems.
 - 2) Layout: Design the drainage system layout to best meet the facility drainage requirements. All low points in grade shall have an inlet as to avoid ponding water. The system shall take into consideration topography, ultimate development of drainage area, possible future extension, outfall locations, and coordination with existing drainage systems and other existing or future underground utilities.
 - 3) Street Drainage: Street drainage shall be accomplished by the use of curb and gutter and curb inlets. Curb gaps will be considered in areas where roadside ditches are used. The center one-third of the street should not convey runoff during the passing of the design storm. Inverted crown sections for the streets shall not be used without prior approval. Curb inlets should not be located in the radius of street intersections, at curb returns, or where pedestrian traffic is most likely to occur.
 - 4) Stormwater Manholes: Storm water manholes shall be provided at junctions of gravity pipes and at each change in pipe direction, size or slope. Manholes shall be located in areas that are readily accessible for operation and maintenance purposes. A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. Manhole covers shall be level with pavement or two (2) inches about grade in grassy areas, and shall be cast iron and have the word "STORM" marked on them. Manhole structure, frames and covers shall meet anticipated vehicle loadings. Contractor shall provide detail to Contracting Officer's Representative for approval.
 - 5) Underground Systems: Profiles of pipes shall show all existing and new underground utility crossings

and pertinent surface features.

- 6) Sizing of Inlets: The design of inlets shall in accordance with “Procedure for Design of Storm Drainage Systems for Other than Airfields” and State DOT Standards, whichever is most stringent.
- 7) Sizing of Pipes: New underground storm drainage pipes shall be sized using the “Procedure for Design of Storm Drainage Systems for Other than Airfields.” The Contractor shall verify that pipes are properly sized for all piping materials included in the project specifications taking into account the coefficient of friction (n) that varies with material type. Separate backwater computations should be performed for each pipe material to ensure that pipe sizes are compatible with material options. Variations in pipe sizes required by such computations shall be indicated on the plans.

G. Waste Water:

- 1) General: The Contractor shall design and construct a new wastewater removal system for the new facility. The wastewater system shall be designed and constructed to, but may not necessarily be limited to, the items listed within this section.

Contractor shall construct the wastewater system within tolerances of the state and local regulations and shall obtain all required permits for construction. The system shall provide a minimum of one lateral for the new facility with a cleanout provided at the entrance of the lateral to the facility. New sanitary sewer lines shall be laid on adequate slopes in order to obtain the proper cleansing velocities.

- 2) Wastewater Collection and Conveyance System: Shall comply with applicable state and local regulations and shall be compatible with wastewater to be conveyed and the materials specified shall withstand the effects of the wastewater and not deteriorate as a result of pollutants in the wastewater.
- 3) Wastewater Piping: Sanitary Sewer lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests.
- 4) Sanitary Sewer Manholes: Sanitary Sewer Manholes shall be provided at junctions of gravity sewers and at each change in pipe direction, size or slope. Manholes shall be located in areas that are readily accessible for operation and maintenance purposes. A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. Manhole covers shall be level with pavement or two (2) inches above grade in grassy areas and shall be cast iron and have the word “SEWER” marked on them. Manhole structure, frames and covers shall meet anticipated vehicle loadings. Contractor shall provide detail to Contracting Officer’s Representative for approval.
- 5) Connections to Manholes & Lift Stations: Use flexible manhole pipe connectors at all connections to new or existing manholes and/or lift stations. The connectors shall meet ASTM C-923 requirements.

H. Water:

- 1) General: Contractor shall design and build a new water supply and fire protection systems according to requirements including the items listed within this section. Water requirements are, domestic water, and two separate water lines for fire suppression. Fire suppression water for the HEFFSS system shall be conveyed from building 441 to the HEFFSS system in the renovated building. The Fire water for the office areas will be routed water lines in the area.

Provide required water service and distribution lines connected to the existing water mains. Provide water distribution system design according to criteria in this SOW with sufficient flow and pressure for intended uses. Provide water distribution mains and service lines to carry an adequate quantity of water at sufficient pressure for domestic and fire suppression use. It is anticipated that the Contractor will connect the new water lines to the existing water distribution system and that sufficient pressure and quantity are available for domestic and fire protection uses. Contractor shall determine minimum required pressures according to applicable plumbing and fire protection criteria. Facility supply lines shall be sized to meet peak demands.

Contractor shall coordinate construction connections and water meter installations with the CI.

- 2) Meters: Equip potable domestic water service lines with suitable meters. See plumbing section for

- water metering requirements. Metering of fire service and fire suppression water lines is not required.
- 3) Valves: Curb stops or valves shall be installed near the point of connection to the main and on both the inlet and outlet sides of the water meter and backflow preventer. Valve connections shall be as required for the piping in which they are installed. Flanges shall not be buried.
 - 4) Backflow Preventer: Provide a backflow preventer on fire protection and domestic water service lines. The domestic water backflow preventer shall be outside the facility and screened from public view. The fire protection backflow preventer shall be inside the facility. See the Mechanical portion of this specification for all backflow prevention device requirements.
- I. Fire Protection Water:
- 1) General: The site fire protection system shall be designed in accordance with UFC 3-600-01 and ETL 02-15. The Contractor shall connect the fire protection water to the water distribution system at the site. A fire flow test shall be performed by the Contractor on the nearest fire hydrant to the project site. The Contractor shall provide the adequate water flow and pressure for the interior and exterior (hose stream) demand for fire protection of the Hangar Facility. Fire hydrant connection shall be no less than 150 feet from fire/emergency vehicle access points.
 - 2) Fire Hydrants: New hydrants, if required, shall be served by the base domestic water distribution system. The contractor shall provide fire hydrants as required by UFC 3600-01. Fire hydrants shall be compatible with existing equipment in use at the Base. Hydrants shall be painted the installation's standard colors as directed by the Contracting Officer's Representative. Fire hydrants located in areas of vehicular traffic shall be protected by bollards.
- J. Gas System Design: Contractor may use existing gas distribution system including existing meters outside the facility to feed the remodeled hangar and the building addition. No new gas service is needed.

5. LANDSCAPE

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:
- UFC 3-210-05FA, Landscape Design and Planning Criteria
 - ANSI 260.1, American Standard for Nursery Stock,
- B. Demolition & Removal: Erosion and sediment control Best Management Practices (BMP) shall be in place and approved by the CMI before starting demolition. Maintain BMPs for project duration. Remove all demolition debris from the site. All disposal permits and regulation compliance are Contractor responsibility.

Landscape Materials: Areas within construction limits shall present a neat and finished appearance at all times. Contractor shall protect and maintain existing vegetation within the construction site. Replace grass, shrubs or trees damaged or destroyed by construction. Replace damaged grass with sod. Replace shrubs or trees with the same type(s), sizes, quantities and locations as those damaged or destroyed. Replacement vegetation quality shall be as specified by the American Standard for Nursery Stock, ANSI 260.1.

Sod: Turf preparation includes eradication of unwanted vegetation and use of a pre-emergent granular herbicide. Apply fertilizer and other soil amendments (which may include calcium, properly N-P-K rated fertilizer, and magnesium) according to soil test recommendations to provide healthy sod. Provide proper care and watering. Provide roll-type polypropylene weed control fabric that is woven and needle punched. Weed fabric shall be 99% opaque with a minimum weight of 5 ounces per square yard and minimum thickness of 20 mils.

Landscape Plantings: Existing Vegetation: Planting soil shall be 100 percent on-site top soil with 5-10% organic matter with a maximum particle size of 1/4- inch and maximum of 3% retained on a 1/4- inch screen.

6. ARCHITECTURE

- A. DP and References: All architectural design shall be performed by a Registered Architect (RA) according to all applicable Standards and References of this SOW. Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications

including all S&R in section 1.2 above and the following:

- NFPA 10, Standard for Portable Fire Extinguishers
- NFPA 101, Life Safety Code
- NFPA 220, Standard on Types of Building Construction
- TI-800-01, Design Criteria
- MIL-HDBK 1013, Facilities Engineering Design and Construction
- UFC 3-600-01, Fire Protection Engineering For Facilities
- UFC 4-010-01, DoD Minimum Antiterrorism Standards For Buildings
- UFC 4-010-02, DoD Minimum Antiterrorism Standoff Distances for Buildings
- UFC 3-110, Design: Architectural Roofing
- AFI 31-101, Flightline Security Standards
- AFI 32-1084, Standard Facilities Requirements Handbook
- DCID 6/9, Physical Security Standards for Sensitive Compartmentalized Information Facilities
- JAFAN 6/9, Joint Air Force, Army, Navy Manual; Security Standards for SAPF
- Physical Security Standards for SCI Facilities, Director of Central Intelligence Directive 1/21
- UFC 1-200-01 General Building Requirements
- UFC 1-300-07A Design Build Technical Requirements
- UFC 3-120-01 Air Force Sign Standards

B. Exterior:

- 1) Exterior Walls: The wall system for the Hangar 456 shall have a ten foot brick veneer base over structural concrete masonry units with a precast concrete cap. Insulated metal panel siding over steel framing attached to existing steel structure shall extend from the concrete cap to the underside of the roof. Aluminum windows are the fenestration of choice on the office addition.
- 2) Alternate Exterior Walls: Provide a lower wall of ten foot high brick veneer base over structural concrete masonry units. The upper wall area will consist of insulated metal sandwich panel siding over a waterproofing membrane on a metal framing system attached to the existing structure that is adequate to support the exterior skin of the building. The selected metal panel wall system may require additional batt insulation to provide the required R value for the wall system.

No EIFS shall be used on this project. All insulated metal wall and roof panels will be attached to a framing support system attached to the existing structure per the panel manufacturer's installation requirements. All exterior walls must have the required R value.

- 3) Exterior louvers and grilles shall be a 3-coat fluoropolymer coating system on aluminum, sight and rain proof, continuous, horizontal and drainable. Louvers and grilles shall be furnished with factory fabricated insect screens, insulated blank-off panels and frames. Submit available colors for approval.
- 4) The roof of the Facility shall be an approved insulated metal panel roof system with factory finish colors. The roof system shall provide a minimum R-30 insulation value. The roof and insulation system shall be installed to meet FM-I90 and UL-90 uplift requirements. Contractor shall provide CAFB with a 20-year manufacturer and installation warranty on the roof.
- 5) Exterior Doors: Exterior office area doors (main entry and second means of egress) shall be aluminum storefront doors and frames with thermal-break construction. Frames shall be commercial grade aluminum with a 3-coat fluoro-polymer coating system color to match window frame color. All other doors shall include aluminum thresholds and aluminum housed weather seals. Other exterior Doors and frames shall be insulated seamless steel doors set in welded steel frames with a painted finish to match window frames.

Due to the large opening required for the maintenance area, the fabric door may need to be segmented into smaller doors by means of swing up mullions (as done on Hangar 450). Obtain proper installation and requirements from manufacturer. The door will provide aircraft access to each Bay.

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- a. Door Hardware: Exterior door hardware shall be provided for all doors. Hardware components and keying shall meet ADAAG and UFAS requirements for accessibility, and NFPA exiting requirements. All hardware shall be coordinated with the Base and Security representatives.
- b. Keying: Provide locks with key removable type of cores with construction keying capability. Lock cylinders for all lock sets shall be compatible with 7 pin "BEST" locking system. Locks and contractor will provide the cores. The contractor will install lockable "construction cores" to be used during construction. After the building has been accepted by the base, the base lock smith will remove the construction cores and then install the Best, or compatible, cores which have been provided under the construction project contract. All construction cores will be turned over to the Base. The Base will receive (2) keys and (3) blanks per lock. Provide a minimum of 5 spare cores.
- 6) Windows: Window frames in the Repair Maintenance Facility shall be commercial grade aluminum with a 3-coat fluoro-polymer coating system color to match window frame color on the adjacent facilities. Aluminum window units shall comply with paragraph B-3 in Appendix B to UFC 4-010-01.
- 7) Glazing: All exterior glazing for doors and windows shall be blast resistant thermal break frames and laminated, insulated bronze tinted, with low-emissivity (not mirrored) and shall be in accordance with Appendix B to UFC 4-010-01 paragraph B-3.
- C. Interior Construction:
- 1) Interior Walls: Interior walls shall be gypsum board on metal studs extending from slab to 8" above ceilings. Provide fire rated walls according to applicable building codes. Interior walls extending to the underside of the roof shall be designed and constructed in accordance with UL and approved tested systems. These walls shall also allow for structural deflection of any contiguous roof structure. Walls dividing administration areas from the maintenance hangar or mechanical room shall have a minimum STC rating of 55. Provide blocking for wall mounted audio-visual equipment and flat panel displays.
- a. General: All walls to receive mounted items must have blocking to receive anchoring devices capable of sustaining forces anticipated as a result of attaching the item. Wood blocking is not allowed. Grab bars must sustain a pulling force of 350 lbs. exerted in any direction. Provide fire extinguisher cabinets in accordance with UFC 3-600-01 SECTION 4-9 and as required by all other governing codes.
- b. Interior Doors: The interior doors will generally be solid core wood premium grade with steel frames. Door frames shall be hollow metal, welded type. Fire rated doors and frames shall be rated according to the fire rating requirements of the walls in which they occur. All fire rated doors shall be in accordance with the requirements of NFPA 101. All interior doors between the Administration areas and the Maintenance area shall be hollow metal doors with hollow metal frames. Provide acoustical certified door and frame units with sound seals and hardware for acoustically rated walls where indicated, and all walls and doors between the Administration Areas and the maintenance area.
- c. Door Hardware: Interior door hardware shall be provided for all doors. Hardware components and keying shall meet ADAAG and UFAS requirements for accessibility, and NFPA requirements. All hardware shall be coordinated with CAFB and Security representatives.
- d. Keying Requirements: Locks shall have key removable type of cores with construction keying capability. Lock cylinders for all lock sets shall be compatible with 7 pin "BEST" locking system. Locks and cores' will be purchased and installed by the contractor. The contractor will install lockable "construction cores" to be used during construction. After the building has been accepted by the base, the base lock smith will remove the construction cores and then install the Best, or compatible, cores which have been provided under the construction project contract. All construction cores will be turned over to the Base. The Base will receive (2) keys and (3) blanks per lock. Provide a minimum of 5 spare cores, 2 Provide card readers (CR) and X09 combination locks where required for security access.
- 2) Cabinets: Materials and construction of wall and base cabinets and vanity counters shall be according to Architectural Woodwork Institute (AWI) quality standards "AWI Custom Grade" except plywood

- shall be used in lieu of particle board. No particle board shall be used. Provide Solid Surface acrylic countertops with back and end splashes to match. Cabinet fronts shall be hardwood.
- 3) Toilets: Provide ADA compliant toilets as required. All fixtures shall be in accordance with the International Plumbing Code, 2006 edition and as described herein. Provide sound deadened walls around and between toilet rooms.
- a. Toilet Accessories: Toilet accessories shall be furnished as indicated below. All accessories shall be stainless steel commercial grade quality products. Toilet accessories should be coordinated with the facilities janitorial services before purchasing.
- b. Toilet Partitions and Urinal Screens: Partitions, doors and screens shall be solid phenolic with stainless steel fittings and hardware. Toilet partitions shall be floor braced type and doors shall have coat hook on back.. 18" Urinal screens shall be wall mounted.
1. Each toilet stall shall have a toilet tissue holder provided by the government and installed by the contractor: Provide CE six-week advance notice for delivery.
 2. Set lavatories in the solid surface countertop. Soap dispensers shall be provided by the government and installed by the contractor: Provide CE six-week advance notice for delivery.
 3. At countertop sinks, provide a stainless steel framed mirror extending the "full width" of the countertop (+/- 2" to accommodate side fasteners). Contractor shall install government furnished handicapped accessible paper towel dispensers. Provide CE six-week advance notice for delivery.
- 4) Janitor Closets: Janitor Closets shall be equipped with a 24" x 24" floor mounted service sink, shelving, and storage space for a portable mop bucket. All Janitors' Closets shall have one utility rack w/holders for mops and brooms.
- 5) Lockers: Lockers shall be one-person type, 24"w, 24"d, 96"h. Provide metal base, sloped tops and end panels. Door latch shall have an integral hasp for a padlock. Provide as indicated on the drawings.
- 6) Floor Finishes:
- a. Flooring: shall be 12" x 12" x 1/8" through pattern vinyl tile, static dissipative at rooms where required, standard colors. Rubber base, 4" high, straight at carpeted areas and coved at resilient tile, porcelain tile and concrete floors. Stained Concrete: High quality durable, non-slip finish coat, neutral color incorporated in the maintenance area.
 - b. Carpet: Floor finish in the waiting room reception/secretary, corridor areas as well offices will consist of a multi-colored carpet broadloom multi-level loop solution dyed, minimum 26 oz./sq. yd. (without weight of backings). Carpet that meets or exceeds the CRI "Green Label Plus Program" requirements for air quality shall be used. These include regionally produced materials from manufacturers including Shaw, Milliken, Mohawk, Interface, or approved equal which all have "Green Label" products for commercial use.
 - c. Porcelain Tile: shall conform to ANSI A137.1 heavy grade only. Porcelain wall and floor tile patterns shall be appropriate to size and shape of rooms. Light colors shall be used for background colors, and dark colors shall be used as accents.
 - d. Heavy duty Epoxy Coating: The Maintenance Area (Main Hangar space) shall receive a new epoxy coating finish design to withstand the Hangar aircraft traffic. The existing floor is to be cleaned and all loose paint removed. Rough edges shall be feathered in to receive new surface. All prep work to be accomplished per epoxy coating Manufacturer's specifications. Apply new coating per Manufacturer's specifications. Maintenance area is to receive yellow striping and all ground points to be marked, see Architectural floor plans for layout.
- 7) Wall Finishes:
- a. Paint: The contractor shall use "Green Seal Paints & Coatings" with zero VOC's as manufactured by Benjamin Moore, Devco or Sherwin Williams, or equal, for all interior finished surfaces.

- b. Ceramic Tile: Glazed wall tile, matte finish, nominal 6' x 6", standard colors with all available colors and patterns including deep tone colors for accent tile and borders.
- 8) Ceiling Finishes:
- a. Acoustical Tile: Type III or IV, 2' x 2', tegular edge; CAC, 25; light reflectance, 0.75 min.; NRC, 0.70 min. Steel suspension system shall be intermediate-duty, white painted with minimum 1-1/2" high web, 15/16" wide flange.
- b. Gypsum Board: Moisture resistant type in bathrooms and type 'X' for fire-rated partitions.
- c. Exposed Structure: Dry-fog paint.
- D. Functional Requirements: The functional requirements of this project are indicated below and/or on the drawings. Deviations to the orientation, square foot areas, and functional adjacencies must be submitted for approval during the project design phase.

Administrative Addition: The area will include the entry, waiting room, and secretary desk. A Training / Conference / Break Room accommodating up to 12 people will be part of the space program. Locate three offices within the addition. Support areas will include two restrooms, a Locker Room, a Storage Closet, a Janitor Closet, a Mechanical and Electrical Room, and a Communications Room.

- 1) Entry: The entry will be the primary access to the addition of the repair maintenance facility. Display cases will be located in the entry.
- 2) Training Room: will be used for training, and meetings. This room will also be used as the break room.
- 3) Communications Room: Comm. drops shall be extended from this room to each space as needed.

7. STRUCTURAL DESIGN

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:

- ACI 302.1R Guide for Concrete Floor and Slab Construction
- ACI 318-05 American Concrete Institute, Building Code Requirements for Reinforced Concrete
- ACI 530-08 Building Code Requirements for Masonry Structures Specifications and Commentary
- AISC Manual of Steel Construction – Steel Construction Manual
- AISC Design Guide 11: Floor Vibrations Due to Human Activity
- AISI American Iron and Steel Institute, Cold Formed Steel Design Manual
- AISC 341-05 AISC Seismic Design Manual
- ASCE 7-05 American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures.
- ASCE 30-03 Seismic Evaluation of Existing Buildings
- ASCE 41-06 Seismic Rehabilitation of Existing Buildings
- AWS Structural Welding Code: Sheet Steel, ANSI/AWS D1.3; Steel, ANSI-AWS D1.1
- UFC 1-200-01 General Building Requirements
- UFC 3-310-01 Design: Structural Load Data
- UFC 3-310-05A Masonry Structural Design for Buildings
- UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings
- UFC 4-010-02 DoD Minimum Antiterrorism Standoff Distances for Buildings (FOUO)
- UFC 4-020-01FA Security Engineering Project Development (FOUO)

- B. General Requirements:

- 1) The Structural Engineer shall be responsible for the design of the complete structural building system. A complete structural system for the building shall include foundations, walls, roof framing, roof diaphragms, lateral load stability, framing and connection of any architectural features, and the support of mechanical and electrical equipment. In addition, the Structural Engineer is responsible for the design of all lesser related structures such as utility vaults, pits, retaining walls, etc., although they may be shown on other disciplines' drawings. Structural design of the building shall be compatible with the architectural design. Structural design shall be in accordance with the criteria, requirements, and guidance provided in IBC, as modified by UFC 1-200-01, and the following requirements.

- 2) Wood shall not be used for any structural members. Plywood shall not be used for wall sheathing or structural roof sheathing, or floor decking. Tilt-up panels shall not be used. Pre-engineered metal buildings or systems shall not be used.
- 3) Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.
- 4) Variations from level or from slopes specified for roof decks, floors, ceilings, beam soffits, lintels, sills, horizontal grooves, or other conspicuous lines shall be as follows: for overall length of line or surface of 10 feet or less, + 1/8 inch; up to 20 feet, + 1/4 inch; up to 40 feet, + 3/8 inch.
- 5) Where raised or depressed floors are provided, structural slab elevations shall be adjusted so that all finished floor levels are the same.
- 6) Floors shall be designed to prevent excessive vibration. The floor system shall be rated acceptable in accordance with the "AISC Steel Design Guide Series #11: Floor Vibrations Due to Human Activity."

C. Design Loads:

- 1) Load Requirements: Structural designs shall be per the International Building Code and ASCE 7-05, Minimum Design Loads for Buildings and Other Structures, UFC 1-200-01, UFC 3-310-01 and the applicable industry codes for the particular material involved. In the event of conflict, the most stringent criteria shall apply.
- 2) Building Classification: All additions and the existing structure shall be classified as Occupancy Category II per UFC 3-010-01.
- 3) Dead Load: Weight of structure, coverings, access floors, raised floors, ceilings, and permanent contents, plus 5% of steel member weights to account for connections.
- 4) Collateral Load: 5 psf on roof and floors to account for suspended ceiling and misc MPE loads on any building addition.
- 5) Roof Live Load per IBC: 20 psf for ordinary flat, pitched, and covered roofs Table 1607.1, non-reducible per UFC guidelines.
- 6) Live loads, not given: shall be in accordance with Appendix B of UFC 3-310-01.

The following floor areas shall be designed using the stated minimum uniform loads:

Offices, Administrative Areas	60 psf (50 psf + 10 psf partition loading)
Corridors, Assembly Areas	100 psf
Mechanical Areas	125 psf
Light General Storage	125 psf
Server Rooms and Heavy Storage Areas	250 psf

- 7) Wind Loads per IBC and ASCE:
 - Basic wind speed: 90 mph for a three-second gust.
 - Exposure category: C for open terrain with scattered obstructions.
 - Importance factor: 1.0 for Occupancy Category II
 - 8) Seismic Loads per IBC:
 - Spectral response coefficients: $S_S = 25\%g$, $S_1 = 11\%g$
 - Importance factor: 1.0 for Occupancy Category II
 - Site class: Assume-D until a subsurface investigation report is completed
- D. Building Substructure: (Foundations and Floor Slab) The contractor shall be responsible for determination of actual soil conditions present at the site, and design to suit those conditions. It shall be the contractor's responsibility to investigate the subsurface soil conditions, and ground water table beneath final structure locations, and complete the design for the facility using contractor-developed data.

E. Building Superstructure:

- 1) Building Framing: The D/B Contactor's structural engineer must analyze the existing hanger per ASCE 31-03 Seismic Evaluation of Existing Buildings. The structural engineer must also evaluate the existing trusses at the hangar opening to adequately support the new motorized hangar door
- 2) Contractor shall demolish the existing gantry crane beams from the hangar structure.
- 3) The existing hangar's metal siding and roof system shall be removed and replaced with a brick and metal panel façade with a new metal roof. Existing structural system and members must be analyzed with regard to required dead loads and wind pressures acting on new metal panels and roofing system.
- 4) All structural additions adjacent the existing hangar must be designed to be structurally independent per UFC 4-010-01. The allowable separation shall be based on the structures' total story drift per ASCE 7-05 and shall not to be less than 1" minimum.
- 5) Roof System: The roof system on all additions shall consist of a structural metal deck supported by steel joist. The slope of the roof structure shall slope as shown per the architectural drawings.
- 6) Lateral Bracing System: The lateral bracing shall be steel braced frames on the existing hangar and masonry shear walls on the building additions as required and coordinated with architectural requirements and layouts.
- 7) Exterior Walls: Exterior walls of additions shall consist of CMU walls with a brick veneer.

F. Concrete:

- 1) Strength: Specified minimum compressive strength f_c shall be 4000 psi at 28 days for all structural concrete. Slabs-on-grade to receive vehicular traffic shall have a specified minimum flexural strength of 650 psi at 28 days. Reinforcement shall comply with ASTM A615, Grade 60, minimum. Structural plain concrete is not permitted.
- 2) Reinforcing: The reinforcing of concrete stem walls, continuous footings, and tie and bond beams shall be continuous and therefore, typical details showing the arrangement of reinforcing at corners and intersections of these members shall be shown on the drawings.
- 3) Slabs-on-Grade: Building slabs-on-grade shall be placed on a minimum 4-inch capillary water barrier. Building slabs-on-grade with moisture sensitive floor coverings shall be placed on a minimum 10 mil vapor barrier and minimum 4-inch capillary water barrier.

No slab-on-grade shall be less than 4 inches thick. Provide thickened slabs for walls and partitions as required by the geotechnical report. A minimum of 0.18 percent steel area placed 2-inch from the top of slab shall be provided in each direction of slab. Only deformed reinforcing bars shall be used.

Slabs-on-grade shall be placed in lanes. The area bounded by crack control joints shall not exceed 400 square feet and distance between crack control joints shall not exceed 20 feet. Crack control joints may be construction joints, contraction joints, expansion joints, or isolation joints. Reentrant corners in slabs shall be reinforced with two #4 bars, 4 feet long, placed diagonally to the corner. Discontinuous joints shall be reinforced with two #4 bars, 4 feet long, placed opposite the end of the discontinuous joint. No joints shall be located under ceramic tile floors.

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 10 foot straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Bullfloated	1/2 inch
Straightedged	5/16 inch
Float Finish	3/16 inch
Trowel Finish	3/16 inch

Tolerances may also be measured by the F-number system in accordance with Paragraph 4.5.6 and 4.5.6.1 of ACI 117/117R.

- 4) Embeds: Exterior steel embedded in concrete for such purposes as exterior railing, handrails, fence, base plates, anchor bolts, etc. shall be hot-dipped galvanized unless otherwise directed.
- 5) Base Plates: All column base plates and anchor bolts shall be completely encased in concrete. All below grade steel shall be completely encased in concrete or coated with coal-tar epoxy.
- 6) Waterstops: Rubberized, keyed waterstops shall be provided in all construction joints below grade between the exterior and interior of the building.

G. Steel:

- 1) Connections: Shop connections for structural steel shall be welded, and generally field connections shall be made with high strength bolts (ASTM A325) in bearing type connections. All connections shall be designed by the structural engineer of record and detailed on the final plans. Connection angles shall be a minimum 5/16 inch thick and bolts shall be a minimum of 1/2 inch in diameter.
- 2) Cold-Formed Framing: All cold-formed steel framing shall be formed from steel that conforms to the requirements of ASTM A-653, Grade 33 or higher, having a minimum yield of 33 ksi. Minimum uncoated steel thickness (design thickness times 0.95) shall be 0.0329 inch (20 gage). All cold-formed steel framing shall receive a G-60 galvanized coating. All cold-formed steel framing connectors shall receive a G-90 galvanized coating. Cold formed framing units as structural lateral load resisting elements are prohibited.
- 3) Joists: shall be anchored to steel supports by bolting or field welding. Provide steel insert plates in concrete. If top chords are extended, provide required section modulus of extensions on the drawings.
- 4) Bracing: If braced frames are used as all or part of the main lateral force resisting system, the stability of the structural system shall not depend on any single member or connection. Provide redundancy by using bracing members capable of both tension and compression if bracing is placed in a single bay.
- 5) Steel Certificate: If a structural steel frame is provided, the fabricating plant furnishing the structural steel shall be certified under the AISC Certification Program for Conventional Steel Structures.
- 6) Lintels: Masonry steel lintel angles shall have a minimum thickness of 5/16" and shall be G-90 (0.9 oz/ ft²) galvanized.

H. Metal Deck:

- 1) Form Deck: All form deck shall be galvanized steel. Minimum thickness of non-composite steel form deck shall be 26-gage. Minimum thickness of composite steel floor deck shall be 22-gage.
- 2) Roof Deck: Metal roof deck material shall be galvanized steel and have a minimum thickness of (22 gage). A structural metal roof deck shall be provided under all roofs. Where metal deck or form is used, show required section modulus and moment of inertia on drawings. Steel roof and form deck shall have a G-90 galvanized coating.
- 3) Construction: Structural metal roof decks shall be attached to structural supports and to adjoining units using mechanical fasteners, such as screws, powder actuated or pneumatically driven fasteners. Welding shall not be used to attach roof decks.

I. Concrete Masonry Units and Wall Veneer Units:

- 1) Walls: Masonry walls shall be reinforced as required to resist all vertical and horizontal loads. All structural masonry walls (load bearing walls, shear walls, or exterior walls) shall be designed as reinforced masonry, neglecting the tensile strength of masonry. Interior walls shall be constructed with cold-formed (non-load bearing) metal stud partitions and/or reinforced CMU.
- 2) Vertical Reinforcement: Reinforcement shall comply with ASTM A615, Grade 60, minimum. Minimum bar size shall be #4. Three vertical reinforcing bars shall be provided continuously from support to support at each wall corner, one minimum at each side of each opening, at each side of control joints, at ends of walls, and elsewhere in the wall panels at a maximum spacing of 48 inches.
- 3) Horizontal Reinforcement: Horizontal reinforcement in continuous masonry bond beams shall be

- provided continuously at floor and roof levels and at the tops of walls. Horizontal reinforcement ratio shall be at least 0.025%, consisting bond beam reinforcement with maximum spacing of 4 feet. Horizontal reinforcement shall also be provided above and below all wall openings. These bars shall extend a minimum of 48 bar diameters, but not less than 24 inches, past the edges of the opening. For masonry laid in running bond, the minimum horizontal reinforcement shall be two #5 bars per bond beam. Lintel units shall not be used in lieu of bond beam units. Nonstructural masonry walls shall be designed as reinforced masonry.
- 4) Control Joints: Concrete masonry walls shall have vertical control joints as follows:
 - a. Exterior and Interior Walls: 24 feet maximum,
 - b. At changes in wall height or thickness,
 - c. Near wall intersections,
 - d. At points of stress concentration,
 - e. At control joints in foundation walls and in floors that support masonry walls.
 - 5) Inspection: A qualified masonry inspector approved by the CO shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports of the quality of masonry construction to the Quality Control representative.
 - 6) Sample Panels: A sample masonry panel shall be built on the project site where directed. The sample panel shall be constructed after the material samples are approved and prior to starting masonry work. The sample panel shall be not less than 6 feet long by 4 feet high. The panel shall be of typical wall thickness for the construction represented. The panel shall show color range, texture, bond pattern, control and expansion joints, and cleaning of the masonry as required in the work. The panel shall also show cold-formed steel framing, insulation, gypsum wallboard, sheeting, moisture barrier, vapor barrier, veneer anchors, joint reinforcement, steel shelf angles, flashing and weep holes, as applicable. The approved sample panel shall be used as a standard of workmanship required in the actual installation. The sample panel shall be protected from weather and construction operations and shall not be removed until the wall work has been completed and accepted.
- J. Antiterrorism Force Protection:
- 1) General: The structural design shall incorporate applicable requirements of UFC 4-010-01
 - 2) Progressive Collapse: Since the facility will be less than three stories, the design for progressive collapse avoidance is not required. However the structure can be analyzed and designed to limit the effects of local collapse and to prevent or minimize progressive collapse per UFC 4-023-03 Design of Building to Resist Progressive Collapse 25 January 2005
 - 3) Exterior Masonry Walls: Exterior masonry walls shall have both vertical and horizontal reinforcement to meet the requirements of UFC 4-010-01. The vertical reinforcement ratio shall be minimum of 0.05% with maximum spacing of 4 feet on center. Vertical reinforcement is required within 1.3 feet of the wall ends. Horizontal reinforcement ratio shall be at least 0.025%, consisting of joint reinforcement with maximum spacing of 1.3 feet, or bond beam reinforcement with maximum spacing of 4 feet. Horizontal reinforcement is required within 1.3 feet of the top and bottom of the wall.
 - 4) Windows and Glazed Doors: All glazing, including windows and glazed doors, shall meet the requirements of UFC 4-010-01 and the following:
 - a. Supporting Structural Elements: Design supporting structural elements and their connections using their nominal strengths and a design load equal to eight times the glazing resistance determined using ASTM E 1300 in conjunction with ASTM F 2248 based on explosive weight II,

as specified in UFC 4-010-02 (FOUO), at the conventional construction standoff distance of 82 feet. Distribute the design load to the structural elements only from the tributary area of the glazing. It is not necessary to account for reactions from the supporting structural elements in the design of the remainder of the structure.

- b. Submittals: Demonstration that the design of each different size and type of window or glazed door system and their connection to the structure meets the minimum antiterrorism standards contained herein shall be submitted to the government for approval. Demonstration shall be by either Design Analysis or Standard Airblast Test results, as described below:
 - c. Design Analysis Submittals: prepared and signed by a registered professional engineer which shall include calculations verifying the structural performance of each window or glazed door system proposed for use, under the given loads. Window components and anchors to the structure, as determined by the design analysis, shall be reflected in the shop drawings.
 - d. Standard Airblast Test: Standard Airblast Test results may be submitted in lieu of a design analysis to demonstrate conformance with the minimum antiterrorism standards. Standard Airblast Test shall be conducted by arena test or shocktube method in accordance with ASTM F 1642, "Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings (2004)" by an independent testing agency regularly engaged in blast testing. Results shall be included in a test report providing information in accordance with ASTM F 1642, as prepared by the agency performing the test. The test results shall demonstrate the ability of each window or glazing system proposed for use to withstand the Airblast loading parameters and achieve the hazard level rating specified. For proposed systems of the same type as the tested system but of different size, the test results may be accepted provided the proposed window area is within a range of 25% smaller to 10% larger than the tested window. The test shall be performed on the entire proposed window system, which shall include, but not be limited to, the glazing, framing system, operating devices, and all anchorage devices. Anchorage of the window frame or subframe shall replicate the method of installation to be used for the project. The minimum Airblast loading parameters for the test shall be as follows: Peak positive reflected pressure of 5.8 psi and positive phase reflected impulse of 29.7 psi-msec. The hazard rating for the proposed window systems, as determined by the rating criteria of ASTM F 1642, shall not exceed the "Very Low Hazard" rating (i.e. The "No Break", "No Hazard", "Minimal Hazard" and "Very Low Hazard" rating are acceptable. The "Low Hazard" and "High Hazard" ratings are unacceptable.) Results of systems previously tested by test protocols other than ASTM F 1642 may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.
- 8. HEATING, VENTILATING AND AIR CONDITIONING (HVAC)**
- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:
 - UFC 3-410-01FA Design: Heating, Ventilating, and Air Conditioning
 - ANSI Z358.1-2004 American National Standard for Emergency Eyewash and Shower Equipment
 - ASHRAE Handbooks Latest Edition
 - ASHRAE Standard 62.1-2004 Ventilation for Acceptable Indoor Air Quality
 - ASHRAE Standard 90.1-2004 Energy Standard
 - MSS SP 69 Manufacturers Standardization Society of the Valve & Fittings Industry – Pipe Hangers & Supports – Selection & Application
 - NFPA 90A Installation of Air Conditioning and Ventilating Systems
 - NFPA 90B Installation of Warm Air Heating and Air Heating and Air Conditioning Systems.
 - SMACNA Guidelines Sheet Metal and Air-conditioning Contractors' National Association
 - IECC International Energy Conservation Code
 - ETL 04-3 Design Criteria for Prevention of Mold in Air Force Facilities
 - CAFB Mechanical Design Standards (Included in Design-Build Requirements)
 - B. General Design Requirements: HVAC systems shall be designed to the latest industry standards, codes,

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Government regulations, and to the specifications included in this solicitation. Design documents shall be submitted and approved prior to commencing work on the HVAC system. The Contractor shall be responsible for the professional quality and technical accuracy of all HVAC design documents and shall ensure construction meets all requirements of the approved design. Drawings, specifications, and other design documents upon which construction is based shall be coordinated with other disciplines to insure compatibility of all building systems.

Air handling units serving the building spaces shall be located inside 1st floor mechanical room next to the communications room. The layout of the room and equipment shall consider proper maintenance clearances around all equipment including Filter pull space, component maintenance, separation of conditioned and unconditioned areas, and observance of the “dedicated electrical space” around electrical equipment as required by the National Electrical Code. The mechanical system shall include two direct expansion (DX) split system units and all appurtenances required for a properly operating HVAC system. One unit will serve the office area, and the other will specifically serve the classroom/conference room area. The DX units shall each be sized to meet the total cooling load of each space. The layout of these units shall consider proper maintenance clearances around all equipment including filter replacement. Allow a minimum of 18 inches clearance between two adjacent DX air handling units.

Provide infrared gas heaters, min. 3-each overhead HVLS fans (24’ dia. Big-Ass Fans or approved equal) and side wall propeller exhaust fans for temperature control in the hangar bay area. Overhead de-stratification fans will be high Volume, low speed (HVLS) fans. The hangar bay will not require refrigerant based cooling, but will be ventilated in accordance to the UFC 3-410-01FA.

Outside air for ventilation for the office and classroom area shall be drawn in through wall-mounted louvers located a minimum of 10’-0” above finished grade. The outside air shall be ducted to the DX units.

All equipment shall be of the high efficiency type, and shall be Energy Star rated, where applicable. The DX condensing units shall be located in the utility yard.

Provide restroom and break areas with all necessary exhaust systems to meet applicable S&R.

- C. Design Criteria: Heat gain and loss calculations shall be, as a minimum, in accordance with the current edition of the ASHRAE Fundamentals Handbook. Computer generated loads must be submitted with complete input and output summaries during the design process. Load calculation software must be ASHRAE based. The cooling equipment shall be selected based on satisfying both the total and latent calculated loads. System shall be designed, installed, balanced, and adjusted to distribute heating and cooling to all occupied administrative spaces, in proportion to the calculated heat losses/gains in these spaces. HVAC systems shall provide uniform and consistent interior space temperature while using equipment that is energy efficient and easily maintained.

Verify ventilation rates of each space with the referenced publications in this mechanical design section. Conduct air balance calculations for the spaces in the facility to verify total supply air, outdoor air, return air, and exhaust air. The space (airflow) pressure relationships shall be maintained. Administrative areas shall maintain a positive pressure with respect to outdoors and hangar bay area to aid in keeping generated pollutants and hazardous particles from infiltrating the office supply airstream. Total airflow calculations and outside air calculations shall be performed to verify that the administrative area pressure is positive with respect to outdoors and hangar bay area.

1) Design Parameters:

Hangar Bay – Use multiple sidewall exhaust fans in conjunction with overhead large-diameter direct drive High Volume, Low Speed (HVLS) fans (Big Ass Fans, Powerfoil X, Rite Hite or approved equivalent) to provide air movement. Use infrared gas radiant heaters mounted above the hanger bay. The infrared gas heaters will be connected to the EMCS.

Mechanical and Electrical rooms - Ventilated in summer to maintain a maximum of 10 degree difference between the room and outside temperatures.

2) Outside Design Conditions:

Summer Conditions: | **Winter Conditions:** | **Location:** | **Elevation:**

**DESIGN-BUILD
REPAIR MAINTENANCE HANGAR 456**

94°F dry bulb	24°F dry bulb	N. Latitude 33.65°	223 feet above sea level
77°F wet bulb	Wind: N 5.4 mph	W. Longitude 88.45°	
Wind: NNW 6.2 mph			

3) Inside Design Conditions:

General Offices & Classrooms	Hangar Bays	Mechanical & Electrical Rooms	Communication Room
76°F dry bulb (Cooling)	Ambient - (Cooling)	Ambient + 10°F (Cooling)	76°F dry bulb (Cooling)
0-60% Relative Humidity			Independent System
70°F dry bulb (Heating)	70°F dry bulb (Heating)	Ambient – 10°F (Heating)	70°F dry bulb (Heating)
(humidification systems not required)	(humidification systems not required)		(humidification systems not required)

- 4) Ventilation: Outdoor supply rates for occupants shall exceed the minimum requirements of ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality." Mechanical ventilation shall be provided for all normally occupied areas. Interior spaces shall be designed as non-smoking. Exhaust ventilation rates for bathrooms and locker rooms shall meet the requirements of the International Mechanical Code. HVAC related background sound in rooms shall not exceed the ASHRAE Applications Handbook – 2007 "Design Guidelines for HVAC-Related Background Sound in Rooms – Chapter 47, Table 42". Refer to ASHRAE 62.1 for all other ventilation standards. Provide a minimum of two "Emergency Air Distribution Shut-off" buttons which shall each shut-off all sources of ventilation air and exhaust air in the facility to comply with UFC 4-010-01. The shut off buttons shall be located near the mass notification system panels, and shall be coordinated with the user and base personnel. Emergency Air Distribution Shut-off buttons shall be labeled and protected by a cover to prevent accidental initiation and shall be in a controlled accessible locations.

5) Cooling Systems

- a. System Description: Cooling for administrative areas and other areas authorized to have air conditioning shall be provided by DX split system heat pumps. Systems shall have a minimum SEER of 16. The condensing units shall be located in the utility yard on concrete pads in accordance with UFC 4-010-01. The Communications Room shall use a mini-split heat pump.
- b. Sizing Requirements: The capacity of the DX units shall be selected based upon the peak cooling/heating needs of the facility calculated using design parameters stated in C1-C3 above.
- 6) Heating Systems: Heating for the office/classroom area of the building shall be provided by the above mentioned heat pumps, with electric auxiliary/emergency heat. The hanger bay area will have infrared natural gas heating.
- 7) Ductwork: Ducts shall be galvanized steel with G90 coating. Ducts shall be designed, constructed and installed accordance with SMACNA Standards. Provide external FSK foil faced wrap insulation or rigid duct insulation for supply and outside air ducts to provide a U-value less than 0.125 BTU/sq. ft. – °F. Duct systems shall not be installed underground. Flexible ducts shall comply with NFPA 90A and UL 181 and be limited to three foot maximum length and flexible elbows shall be limited to less than 90 degrees total bend. Only one section of flexible duct is allowed for each diffuser. All 90 degree elbows shall be constructed from hard duct. Turning vanes shall be provided in duct changes of direction with non-radius elbows.

Bends in rigid ductwork shall have a minimum radius to diameter ratio of 1.5. Fit each duct branch with a manual balancing damper. Locate all ductwork above slab, supported from roof structures. Duct return-air to unit from return ducts routed into return air plenum space. Ceiling return air plenums can be used for administration or support areas. Mechanical or Electrical rooms shall not be used as return air plenums. Duct return shall maintain NC-25 requirements at rooms for general occupancy space. Test ductwork according to SMACNA 10. Total duct leakage shall meet the requirements specified in IECC 2009. Provide access to all devices or areas that may require periodic

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- inspection, including but not limited to balancing devices, motor operated dampers, flow measuring stations, smoke/fire dampers, etc. Provide permanent test ports in ductwork at balancing test points and DDC sensor locations. Provide manual balancing dampers at each take-off to a diffuser, register, or grille, located as far away from the air outlet as practical.
- Provide minimum size 8 inch x 8 inch access doors in ducts to allow access to fire dampers, coils, dampers and other items requiring service.
- Internal duct insulation shall not be allowed.
- Provide fire dampers for all rated walls, chase walls and corridors as required by the IBC.
- The following materials shall be used:
- | Ductwork | System Material |
|----------|---|
| Supply | Galvanized Steel – Insulated |
| Return | Galvanized Steel – no insulation (unless routed through unconditioned spaces) |
- a. Ductwork Accessories: Provide manual volume dampers in each branch take-off to control air quantity. Dampers shall conform to SMACNA Duct Construction Standards. Provide out-of-airstream, dynamic rated fire dampers per UL 555 where required. Provide smoke dampers rated per UL 555S where required by International Building Code. Provide outdoor air intake and exhaust louvers of aluminum designed to prevent the entry of rain or snow. Louvers shall be designed to meet the wind load rating for the building as indicated in the structural chapter. Intake plenums shall have bottom panel sloped towards the louver opening to drain any water that comes through the louver. Intakes shall be a minimum of 25 feet from the nearest exhaust outlet and exterior mechanical equipment. Provide bird-screens at all louvers. Provide a low-leakage motorized damper at each outside air intake.
- b. Diffusers, Registers and Grilles: Diffusers, registers and grilles shall be selected as appropriate for the application and should be consistent throughout the building. Select to ensure noise levels remain below specified criteria and Air Diffusion Performance Index (ADPI) of 0.80 or greater. Perforated diffusers will not be acceptable. Ductwork behind registers and grilles shall not be visible or the ductwork shall be painted black. All diffusers and grilles shall be aluminum to prevent corrosion and shall be painted to match interior. Provide lay-in type supply diffusers in all rooms with ceiling served by air handling units. Each room will require a lay-in return air grille open to the plenum ceiling with the exception of the restrooms, locker rooms, and janitor's closets.
- 8) Toilet Exhaust System Requirements: Rooms shall be exhausted via an inline exhaust fan with heavy gauge backdraft damper. Exhaust fans shall be V-belt driven by belt drives sized for 150% of design power requirement. Provide adjustable sheaves for fans up to 5 hp. Small fans not available with V-belt drive may be directly driven. Motor selection shall permit non-overloading operation at all conditions. All fans shall be provided with vibration isolators to decouple the motor assembly from the fan housing. Suspend fans with vibration isolators from building structure. Fans shall be AMCA 210 certified, with AMCA seal. Fan bearings shall have a minimum average life of 200,000 hours at design operating conditions. As far as practicable, locate fans such that they are readily accessible for maintenance.
- 9) Filtration Rates: All areas – MERV 8.
- 10) Exhaust Rates: See ASHRAE 62.1, Table 6-4.
- 11) Miscellaneous Loads (values are minimum loads):
Design Lighting Loads shall comply with ASHRAE 90.1, EPCACT 2005, and applicable UFGS and UFC. Verify actual loads with existing conditions and user requirements.
- | | Admin/Office | Hangar Bay Area | Classrooms/Conference |
|-----------|------------------------|-----------------|-----------------------|
| Personnel | 143 square feet/person | 20 people | 20 people per room |
- 12) Energy Conservation: Mechanical system designs shall comply with UFC 3-400-01. The design shall make use of the latest technology to provide equipment with the highest efficiency possible without compromising maintainability. The design shall comply with 10 CFR 435, "Energy Conservation Voluntary Performance Standards for New Commercial and High Rise Residential Buildings; Mandatory for New Federal Buildings".

- 13) Permitting: The Contractor shall be responsible for all applicable environmental permitting and testing concerning the mechanical systems, diesel generator set, including coordination of the permitting with the Contracting Officers Representative.
- 14) Miscellaneous Information:
 - a. Refrigerant Ozone Depletion Factor: 0.05 or Lower R-134a or 407c
 - b. Seismic Design: See Structural Section
 - c. Outside Air Criteria: Designed to ASHRAE Standard 62.1-2004 requirements
- 15) Energy Values:
 - a. Natural gas 1020 BTUH per cu. ft.
 - b. Electricity 3,413 BTU per Kilowatt Hour

D. General HVAC Equipment:

- 1) Material and Equipment: All materials and equipment shall be new and free from defects. Materials and equipment shall be proven to be satisfactory in commercial or industrial use for 2 years prior to the bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2-year period. All materials in the same category shall be the product of a single manufacturer (i.e., fans, gate valves, globe valves, sprinkler heads, etc.). All equipment shall be located to allow a minimum of 3 feet of clearance around all access/service panels. Clearance around electrical and electrical panels shall be provided in accordance with the National Electrical Code (NEC). Access panels designed for removal and/or replacement of parts, which require greater than 3 feet for this activity, shall be provided with sufficient clearance to remove the largest and/or longest part of the assemblage. All access panels shall be appropriately labeled with stencils, or a minimum of 3 inch tall letters. Building mechanical equipment shall be held in place with anchor bolts set in "green" concrete and held in place by plywood templates until the concrete has cured. Housekeeping pads shall be provided for all other floor mounted mechanical equipment. Contractor shall provide all safety equipment required to operate and install the equipment. Air handling units, fan coil units, or other pieces of air conditioning equipment producing condensate, shall be provided with stainless steel or aluminum drip pans (insulated where required, such as in non-conditioned spaces, to prevent sweating) under the coils, with piping routed to floor drains. Piping shall include p-traps and cleanouts. Provide secondary containment for units suspended above ceilings and/or equipment, for overflow of condensate with leak detection alarms to notify maintenance personnel of potential clogs. All exterior mechanical equipment shall have painted finishes that pass a salt-spray test conducted per ASTM B117 for duration of at least 1000 hours.
- 2) Maintainability: System maintainability is a critical, but often overlooked, aspect of a facility. The contractor shall provide for maintenance of all items in this facility. This shall be coordinated with all systems (it is unacceptable planning to install lights, then block access to them with pipes and conduit). System maintainability has three broad categories. The design analysis and O&M manuals shall address the features/procedures described below in detail.
 - a. Routine Maintenance (filters, lights, lubrication, inspection, etc.): This requires the most frequent and easiest access. The need for portable or fixed ladders (no more than 10 ft) should be minimized and, where needed, ensure that space is available to use them properly.
 - b. Component Replacement (coils, fans, motors, etc.): This requires less frequent access, but when the need arises, this work must be done quickly and efficiently, since normally this has the greatest impact on the user. Everything needed to perform these tasks shall be provided (work platforms, equipment access hatches/panels, hoists, cranes, etc.).
 - c. Equipment Replacement (air handling unit, switchgear, condensers, etc.): This occurs very seldom so permanent equipment to support these tasks is not required. However, equipment replacement must be accommodated and the facility shall include items such as removable wall sections, access routes, etc. to allow replacement with the least amount of collateral damage.

- d. Maintenance Features / Procedures: Ensure that all equipment, including filters, controls, control valves, backflow preventers, and coils are easily accessible and have ample room for servicing, inspection, and cleaning. Isolation valves shall be provided for each terminal unit, zone, branch, long runs, etc. as necessary for proper isolation and maintenance.

Contractor shall ensure all maintenance and repairs can be performed safely and efficiently without the need for extensive material handling or access equipment (e.g. A-frames or ladders).

Locate all controls, sensors, and other items requiring regular service such that they may be maintained from floor level when possible. If not accessible from floor level, then provide permanent maintenance access.

Ensuring maintainability requires careful coordination of piping, conduit, etc., to avoid blocking access by cranes, hoists, ladders, etc. The contractor shall make this a priority, recognizing that this will generally result in longer runs of pipe/conduit.

All above ceiling utilities (cable trays, ductwork, junction boxes, utility piping, etc.) shall be accessible for a worker to reach two sides plus the service side with a minimum 3 feet of clearance (greater if required for component maintenance/disassembly).

Provide permanent maintenance access for all suspended mechanical equipment. Refer to the Architectural section for requirements. Provide catwalks for all roof-suspended equipment requiring servicing in the hangar bay.

- 3) Operation and Maintenance Manual: Operations and Maintenance Manuals – Contractor shall provide Operation Manuals, Maintenance Manuals and spare parts inventory lists for each piece of mechanical equipment. Contractor shall furnish control diagrams as part of as-built documentation. Refer to Section 01012 for requirements.
- 4) Training: Contractor shall provide operator training for all systems for which an operation and/or maintenance manual is provided. In addition, the contractor shall provide video tapes of the training sessions. Refer to Section 01012 for additional requirements.
- 5) Spare Parts: Contractor shall replace all filters in all systems at building occupancy by the user, plus one additional set of replacement filters for all systems. Contractor shall provide replacements for a minimum of 10% of all belts, pulleys, flush valves, sprinkler heads, and bearings in all sizes provided.
- 6) Routing: Routing of piping and ductwork in exposed locations shall be parallel or perpendicular to the building structure. Do not install any HVAC or plumbing piping inside the block cores of exterior concrete masonry unit (CMU) walls. Install all piping in furred walls or in pipe chases.

E. General Requirements:

- 1) Test and Balance: The design shall include testing, balancing, and adjusting of all HVAC systems. Reports of all tests shall be submitted for approval to the Construction Inspector.
- 2) O & M Manuals: Operation and Maintenance Manuals for all components of the HVAC systems shall be required by the design. Manuals shall be submitted for approval 60 days prior to the scheduled completion date for the project. The design shall include requirements for a minimum of 8-hours to train operating personnel in the operation and maintenance of the complete HVAC system. Framed instructions, control drawings, and system diagrams shall be in place prior to the start of training.
- 3) Identification: All piping, plumbing, fire protection and HVAC systems shall be clearly marked for identification with permanent color coded markers. Identification scheme shall be per ASME A13.1. Pipes and ducts shall be labeled at each valve or damper, control device, tee and elbow and also regular interval not greater than 20 feet between markers. Valves shall be tagged and a laminated valve schedule shall be mounted in the mechanical room. Every fire protection valve shall be marked as normally opened or closed.
- 4) Valves: Provide valves on supplies to equipment and fixtures. Valves 2 inches and smaller shall be

bronze with threaded bodies for pipe and solder type connections for tubing. Valves 2-1/2 inches and larger shall have flanged bodies and bronze trim. Valves shall conform to the following standards:

<u>Description</u>	<u>Standard</u>
Butterfly Valves	MSS-SP-67
Cast-Iron Gate Valves	MSS SP-70
Cast-Iron Swing Check Valves	MSS SP-71
Ball Valves, Threaded, Socket-Welding, Solder Joint and Flared ends	MSS SP-110
Cast-Iron Plug Valves	MSS SP-78
Bronze Gate, Globe, Angle and Check Valves	MSS SP-80
Steel Valves, Socket-Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves	MSS SP-85
Vacuum Relief Valves	ANSI Z21.22
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018

- 5) Hangers and Supports: Hangers and supports shall be factory fabricated according to MSS SP-58. A licensed engineer shall design all hanger and supports for the project. Lateral supports shall be provided to prevent piping and ductwork from swaying.
- 6) Mechanical Vibration Control: All vibrating equipment shall be isolated with vibration isolators and flexible connections according to UFC 3-450-01 standards.
- 7) Sound Criteria: Each room shall be designed to be less than the maximum allowable room criteria (RC) levels per ASHRAE Fundamentals Handbook 2005, Chapter 7.
- 8) Motors: Single-phase, fractional-horsepower, alternating-current motors shall be premium efficiency types, corresponding to the applications listed in NEMA MG 11. Polyphase motors shall be selected based on high-efficiency characteristics relative to the applications as listed in NEMA MG 10. Additionally, all polyphase squirrel-cage medium-induction motors with continuous ratings shall meet or exceed energy efficient ratings in accordance with Table 12-10 of NEMA MG 1. Motors used with variable speed drives shall be rated for variable speed drive service.
- 9) Metering: Gas and Potable Water: Potable water and gas meters (see the Electrical section for electric meters) shall comply with UFGS – 26 27 13.10 30, 33 57 13.00 30, and 33 12 33.00 30.

F. Control System:

- 1) General: Provide a Johnson Controls TEC2102-3 N2 Networkable/Programmable thermostat and interface with existing EMCS in Building 385. Ensure controls for the infrared heaters are also connected to the EMCS at Building 385.
- 2) Design: The facility mechanical systems shall be designed and controlled with the consideration that maintenance personnel shall not be readily available to address operational problems in a timely manner. To this end, the controls shall provide for automatic restart of all equipment after interruptions except in the case of safety code requirements for a manual restart.

Provide one laptop computer that can be used as a field interface device to monitor, control, and reset any applicable point for any control device. Provide a copy of the control system supplier operating software and control system technical manuals to the Contracting Officer.

The air handling control systems shall allow for a complete shutdown of all air moving equipment and closing of all the outside air.

For Force Protection issues, consider the following:

- a. Outdoor air intakes must be at least 10 feet above the ground.
- b. There must be at least two emergency shutoff buttons in the HVAC control system that can immediately shut down air distribution throughout the building.

9. PLUMBING

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:

- ANSI Z358.1 American National Standard for Emergency Eyewash and Shower Equipment
- UFC 3-420-01 Plumbing Systems
- CAFB Mechanical Design Standards (Included in Design-Build Requirements)

- B. General Design Requirements:

All water piping subject to freezing shall be completely capable of draining and suitably protected. Water piping shall be provided with pressure regulator set at 50 psi. A gas fired water heater will be used for hot water demand. Floor drains shall be provided in janitor closets, mechanical rooms, and restrooms and any other locations as conditions require. Mechanical room floor drain piping shall be 3-inch min. For all traps with trap primers. Water coolers shall be provided in locations as indicated on Architectural drawings.

Plumbing system shall be designed and installed according to the Plumbing Codes listed in the Standards & References. Inspection and testing of the plumbing system shall be performed as prescribed in the IPC. The plumbing system shall conform with the applicable rules of the International Building Code, governing venting of plumbing fixtures, sizing of waste, vents, drains, and water systems. A reduced pressure zone type backflow preventer shall be provided and located in an accessible vault outside the building. Fixture count shall be as required by International Building Code. All piping shall be labeled, color coded, titled, and indicate direction of flow. All shutoff/isolation valves and water hammer arresters shall be accessible from the floor level and be labeled. If installed above hard ceilings, access doors shall be provided.

All piping shall be concealed, properly supported with allowances for expansion and contraction. Interior water distribution piping shall not be buried under concrete floors. All piping systems shall be drainable. Interior hot and cold water piping systems shall be insulated. Water piping systems (including sprinkler piping) shall not be routed or located where subjected to freezing and shall be located within the insulated building envelope. Heat tracing (to prevent freezing) of interior piping systems shall not be allowed. Individual shutoff or stop valves shall be provided on water supply lines to all plumbing fixtures. Isolation shutoff valves shall be provided for each toilet room group to allow isolation shutoff for maintenance purposes while continuing service to the remainder of the restrooms. Consolidate fixture vents through one common vent whenever possible. All vent penetrations through the roof shall be made through a roof jack designed for use with the roofing system furnished and color-matched to the roof. Aboveground piping shall run parallel with the lines of the building.

Provide one exterior freeze-proof wall hydrant every 150 feet around the entire facility.

Provide a compressed air system for the tool air requirements in the hangar bay maintenance area.

Provide natural gas connections for the infrared gas heaters in the hangar bay area.

Provide an emergency shower and eyewash station in the hangar bay area.

All sewer lines shall be provided with exterior clean-out.

- C. Domestic Hot and Cold Water Systems: Design Criteria: Provide domestic water for the facility by tying into existing underground domestic water system and routing a new main domestic water supply line into the building. Provide an outdoor reduced pressure backflow preventer and water meter at the domestic water entrance. A packaged, skid-mounted duplex domestic water booster pump system with VFD is required for this facility. Domestic cold water shall then be distributed throughout the facility to serve the various plumbing fixtures defined herein.

Domestic hot water shall be provided via an electric resistance water heater to serve the building. Shut-off valves shall be installed in the supplies to each fixture. Shut-off valves shall be installed in branch lines to each toilet room and other area(s) with more than two fixtures. Water hammer arresters shall be installed on branch lines to absorb hydrostatic shock pressures that may occur in piping.

- D. Sanitary Drainage, Waste and Vent Systems: Design Criteria: The sanitary system shall collect waste from plumbing fixtures in toilet rooms, service sinks, floor drains and other fixtures that discharge to the sanitary sewer and transport the wastes to the base-wide sanitary sewer system. The system shall be designed and sized in accordance with the requirements of the International Plumbing and Building Code. Each fixture

trap shall be vented and connected to common vents, which extend and terminate above the roof not less than 15 feet from outside air intakes.

- E. Natural Gas Systems: Natural Gas shall be connected to the existing underground gas system, and shall be routed to a new gas meter and pressure reducing station located adjacent to the building.

Provide natural gas to natural gas infrared heaters in the hanger bay area. Concealed piping or piping which is not easily accessible shall have welded connections. Gas line connections to each item of equipment shall have a shut off valve, dirt leg, and pressure regulator. Piping within building shall be low pressure piping (less than 2 psig).

- F. Plumbing Fixtures: Provide industrial grade water conservation fixtures complete with fittings and trim. Fixtures shall be and comply with the Energy Policy Act of 2005 and the International Plumbing Code. All shutoff valves shall be metal construction. Plastic valves are not acceptable. All fixtures, fittings, and trim in a project shall be from the same manufacturer and shall have the same finish. Fixtures for use by the physically handicapped shall conform to ANSI A117.1. Plumbing fixtures and specialties shall be supplied in sufficient quantity to meet or exceed the requirement of the Code. Wall hydrants, hose bibbs, spigots and service sinks shall have integral vacuum breakers. Floor drains shall be cast iron with deep trap and automatic primer. Use square type drain in areas to receive tile. Fixture descriptions shall be as described by the American Society of Mechanical Engineers, ASME A112.19. See architectural drawings for quantity of lavatories, water closets, urinals, mop sinks, and electric water coolers.
- G. Compressed Air System: Provide a new compressed air system in the mechanical room that serves the hangar bay. Design this system to supply a total of seven drops with hose reels. Locate five drops at maintenance use-points and the other two on either end of the hangar bay. The estimated load on each drop is 15 scfm at 80-125 psi. Provide a duplex compressor package; complete with dryer, after-cooler, and receiver tank.

10. FIRE PROTECTION

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:

- UFC 3-600-01 Design: Fire Protection Engineering for Facilities General Design Requirements
- ETL 02-15

- B. System Description: Provide an HEFFSS system in the hangar bay area and an automatic wet pipe sprinkler system throughout the new office area of the Hangar. All systems shall be electronically supervised with tamper switches on all major valves and provide a signal to the fire department.

The foam storage and water quantities are based on the size of the hangar. Refer to \1\ ITG FY05-01 /1/ for redundant foam storage, pumps, and other fire protection requirements. The wet pipe sprinkler system will be provided a separate supervised flow switch for each floor. Signal shall be compatible with the present equipment of the fire department and designed in accordance with applicable NFPA codes. Sprinkler heads shall be centered in the ceiling tile.

- C. Design: Design of sprinkled facilities shall be in accordance with UFC 3-600-01, except where NFPA 13 criteria have been substituted and as specified hereinafter. All contract requirements of UFC 3-600-01 that exceed the minimum requirements of NFPA 13 shall be incorporated into the design. The Contractor's design shall be prepared and sealed by a registered Fire Protection Engineer or a registered Professional Engineer with a fire protection background and who has had at least five years experience in fire protection/detection design. Qualifications shall be submitted to the CO for approval.

In communications rooms, all sprinkler heads shall be protected from damage with wire guards. No water piping shall be allowed to be routed above equipment, and any equipment located above or in these rooms shall have a drip pan hung below the pipe throughout the space.

Submit the input data for the computer program used to design the sprinkler system to the CO. It shall be compatible with FPE software or provide software used by Contractor if not compatible with FPE.

The Contractor shall provide the adequate water flow and pressure for the interior and exterior (hose stream) demand for fire protection. The minimum residual pressure for outside fire protection (hose stream demand) is 20 psi. The water distribution system providing water for interior and exterior fire protection shall be designed in accordance with UNIFIED FACILITIES CRITERIA (UFC 3-600-01) and NFPA 24, Private Fire Service Mains and Their Appurtenances.

- D. Fire Extinguisher Cabinets: All fire extinguishers shall be in fire extinguisher cabinets. Contractor shall provide type 4A60BC fire extinguishers. Location shall be in accordance with NFPA code.

The fire mains shall be designed to supply the quantities and at sufficient pressures for the fire protection system required by Paragraph "Fire Protection" of this document. The hose stream demand shall be as shown in Table 4-1 of UFC 3-600-01. The minimum pressure requirement for the sprinkler system shall be determined during design. The sprinkler system shall be connected to the potable water system.

- E. Site Specific Requirements for Fire Protection Water: Contractor shall connect fire protection water to the existing water distribution system at the site for the wet sprinkler system. Contractor shall gather hydrant flow test data to see if the existing lines can deliver water of sufficient quantity and pressure to the fire suppression system without the need for a fire pump.

The HEFFSS system shall tie into the existing fire pump house (Building 441). This will require the Contractor to provide isolation control valves and an updated control system to allow for individual control depending on which building is calling for fire suppression. The disposal of HEFFSS is dependent upon the water treatment facilities that would treat the effluent from the discharge site. Depending upon the facility's location, HEFFSS may require onsite containment. Verify HEFFSS containment requirements with the appropriate facility environmental engineer.

The Contractor shall be responsible for conducting a new hydrant flow test in accordance with NFPA 291 prior to the first interim design submission. The flow test shall be conducted under the direct on-site supervision by the contractor's Fire Protection Engineer of Record.

11. ELECTRICAL SYSTEMS

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:
- NFPA 70 Electrical Code
 - NFPA 72 Fire Alarm Code
 - NFPA 101 Life Safety Code
 - NFPA 780 Standard for the Installation of Lightning Protection Systems
 - TI 800-01 Design Criteria
 - UFC 3-520-01 Interior Electrical Systems
 - UFC 3-530-01 Interior and Exterior Lighting and Controls
 - All other applicable UFC's
 - MIL-HDBK 419A Military Handbook Grounding, Bonding and Shielding for Electronic Equipments and Facilities
 - Columbus AFB Design Standard (including Division 16 and telecommunications and fire alarm)
- B. General: The electrical requirements of this section encompass the transmission, distribution, and transformation of electrical power to the building from the existing 13.2kV-480/277V, three phase, four wire pad mounted transformer and throughout the facilities. A complete and operable electrical system shall be provided to the CAFB Repair Hanger Bldg 456. The nominal voltage levels used shall be 13.2kV (15kV), 480/277V, and 208/120V, at 60 Hz. Circuits shall be sized to limit voltage drops as further described in this section.

The scope of work for this project is provided here. The following paragraphs dictate the design criteria that shall be included in the contractor's design documents.

Demolition of the entire existing secondary electrical system beginning at the secondary side of the existing 500kVA pad mounted transformer is required. Some of the existing electrical equipment is salvageable, however. See drawings for information on what equipment shall be salvaged and what equipment may be salvaged at the contractor's option.

The design-build contractor is required to visit the site prior to finishing the design of the new electrical systems. He should ascertain all necessary information in order to prepare a complete electrical design. This includes, but is not limited to, information regarding the communications systems such as the types and sizes of cables that enter the building.

C. Contractor Qualifications:

- 1) General Design: Electrical design shall be performed by a registered professional engineer.
- 2) Electrical Wiring: Only certified journeymen electricians or apprentices under the direct supervision of journeymen shall be permitted to install, alter, or repair electrical systems.

D. Design Requirements:

- 1) General: Electrical system layouts shall be generally diagrammatic and unless specifically required, the location of outlets and equipment shall be approximate. The exact location of outlets, lighting fixtures, equipment and wiring shall be governed by structural conditions and obstructions, and shall be repositioned as required during construction at no additional cost to the Government. Where outlets or connections must be at specific locations, provide details and exact measurements. Provide design and coordination to prevent interference between piping, architectural, and structural work.
- 2) Riser Diagrams: Riser and one-line diagrams shall show vertical and electrical relationships and therefore need not include all required equipment, devices, and accessories. Riser diagrams shall indicate all switchboards, transformers, motor control centers, panelboards and other electrical distribution equipment. Motor control centers (MCC) shall have additional one-line diagrams to indicate MCC bus ampacity, short circuit rating, voltage, circuit identification, starter type, starter size, feeder size, local motor disconnect if required, and motor horsepower. Switchboards shall be represented either in one-line diagram format or schedule format.

Switchboard main and feeder breaker trip settings and frame sizes shall be indicated. Riser diagrams shall be included for all signal level systems. The riser diagram shall indicate individual devices with symbols indicating room location and special required feature of the device (i.e. mounting location). A suggestive electrical riser diagram is shown in the electrical drawings. In no way must the design-build contractor construct the interior distribution system based on it. The design-build contractor is required to design and construct an electrical system that will support the demands of the renovated hangar and within the criteria as stipulated in the following paragraphs.

- 3) Schedules: Provide panelboard, switchboard, and motor control center schedules on the electrical drawings. The schedules shall include all circuit identification and connected load per phase. Connected load shall be totaled and demand factor calculated. Show branch circuit size on the schedule. Panelboard information shall include bus ampacity, interrupting current rating, voltage, source fed from, location, pole quantity, panelboard type (main lug only vs. main circuit breaker), main circuit breaker size (if applicable), branch overcurrent protection device size, and branch circuit breaker pole quantity. If applicable, include service entrance rating and show if panelboard has 200% neutral. Include MCC bus ampacity, short circuit rating, voltage, circuit identification, starter type, starter size, feeder size, local motor disconnect if required, and motor horsepower on Motor Control Center (MCC) schedules. Show switchboard main and feeder breaker trip settings and frame sizes on the schedule. The Contractor shall provide a lighting fixture schedule in the drawing package.
- 4) Equipment Ratings: Equipment interrupting ratings shall be shown on the contract documents based upon equipment characteristics and impedance values expected. If actual installed equipment deviates from these characteristics or has lower impedance, the Contractor shall increase the interrupting capacities of all items on the load side of the deviant equipment in direct proportion to the changed characteristics at no additional cost to the Government. Interrupting capacities shall not be reduced to values less than those required by the contract documents.

DESIGN BUILD REQUIREMENTS

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- 5) Details: Provide details to fully show the Contractors intent to satisfy specification requirements and to aid in the building of the facility. Details shall include the following, but not be limited to interior lighting and equipment mounting such as panel-boards and receptacles not mounted directly to walls.
- 6) Control Diagrams: Provide control diagrams to show how a system is to be controlled and interfaced with other systems. The diagrams shall indicate that wiring which is field-wired from the device and those wires internal to the device. Control diagrams shall include the following, but not be limited to:
- Lighting contactor with Hand-Off-Auto and photocell.
 - Occupancy Sensor wiring interface to transformer relays, light switches, different voltage connection to one sensor as required, line, phase and neutral wires.
 - Mechanical equipment motor starters with Hand-Off-Auto and BAS interface. Include fire alarm device interface for equipment shutdown.
- E. Short Circuit Analysis:
- 1) General: Short circuit analysis shall be performed electrical distribution system from the load side of the existing 500kVA, 4%Z pad mounted transformer with infinite primary bus and shall be included in the Electrical Design narrative. Coordination and protective device study shall be provided showing devices and settings. A fault-impedance diagram, a load flow analysis or study, a short-circuit analysis or study, and a power system coordination study shall be prepared to demonstrate that protective system devices have been properly calibrated, adjusted, set and tested. This data, including complete descriptive and technical data of all protective devices and diagrams required to ensure complete coordination, shall be prepared in conformance with industry practices, standards, or other technical data approved by the Contracting Officer. It shall also be submitted for approval of the CO. The Contractor shall coordinate with the CO for short circuit current availability at the site at the start of the electrical distribution design.
- 2) Fault-Impedance Diagram: Diagram shall be prepared to reflect the system impedance of power sources available to supply the building or facility, and the impedance of the new power system components for the facility. The fault-impedance diagram shall show as minimum, fault locations for each voltage transformation and at each power distribution bus. The short circuit current available at each fault location shall be shown in tabular form on the diagram for a bolted line-to-line fault and a line-to-ground fault.
- 3) Protective Devices: The time-current characteristics, features, and nameplate data for each existing protective device, including fuses, circuit breakers and protective relays shall be determined and documented when necessary to ensure coordination between existing and new protective devices. New protective devices proposed, including devices with fixed or adjustable time-current characteristics and features, shall demonstrate proper coordination with existing devices and new and related devices.
- 4) Power System Coordination Study: The study shall include all data related to existing and new protective devices proposed as such data relates to the nameplate data, time-current characteristics and the fixed or adjustable features of the existing or new protective devices. These data shall include:
- The time-current characteristic curves published by the manufacturer of the protective devices or equipment having adjustable time-current characteristics.
 - Data published by circuit breaker or protective relay manufacturers, which contain installation, operation and maintenance instructions for calibration, adjustment, setting and testing of the specific protective devices.
 - Composite time-current characteristics curves for primary, secondary and other related devices, as required to ensure coordinated power systems protection between existing and new protective devices or equipment.
- 5) Circuit Protective Devices: The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they shall function properly prior to the initial energizing of the new power system under actual operating conditions.
- F. Temporary Power: Provide temporary connection and distribution of existing power as required to build the project. Provide temporary electrical service in the design package. All temporary wiring shall comply with

NFPA70. All temporary receptacles shall be Ground-Fault Circuit Interrupter (GFCI) protected.

- G. Secondary Service: Underground service lateral to the Facility and/or facilities, shall extend to the electrical room from the transformer via concrete-encased duct bank. The service lateral conductors shall be sized to carry 125% of the transformer full load current, as a minimum. The quantity and size of conduits shall be in accordance with the NEC. As a minimum, one spare service lateral conduit shall be provided. The service main distribution switchboard or panelboard to this facility shall be 480Y/277 volt, 3 phase, 4 wire. Panelboard and switchboard protective devices shall be molded case circuit breakers with thermal magnetic trip units. The surge protective devices (transient voltage surge suppression (TVSS)) shall be provided for all phases and the neutral at all switchboards and panelboard. The TVSS shall be UL listed. The main circuit breaker in the Service Entrance Switchboard or service entrance rated distribution panelboard shall be molded case type with adjustable instantaneous trip. Circuit breakers rated 480Y/277-Volts and have a thermal rating greater than 100 amp shall be provided with electronic trip units. All disconnect switches shall be heavy-duty type. Provide ground fault protection per NEC 240.13. Power panels rated at 208Y/120V shall be located throughout the facility to serve loads and each panelboard shall be provided with 25% spare, 20A single pole circuit breakers or equivalent number of spaces. All the circuit conductors shall be copper with THHN/THWN insulation. The minimum conductor size shall be 12 AWG.

- 1) Metering: Power shall be metered with a Schlumberger Vectron SVX metering system or approved equal. The meter shall be mounted directly to the existing 500kVA pad mounted transformer. Coordinate with base electrical staff that this meter can communicate with the new CAFB remote meter reading system prior to the final design. Provide all equipment that is necessary so this meter can communicate with the base remote meter reading system.
- 2) Grounding: Grounding systems for this facility shall include the electrical system service entrance ground, equipment grounding, and other auxiliary systems grounding such that all systems and components maintain low potential differences. Copper ground conductors from the main communications room backboard to the main electrical service ground shall also be provided. Facility grounding system shall have a resistance of 10 ohms or less to earth. Facility grounding system shall be tested and verified to achieve the required system resistance. All ground rods shall be copper-clad steel, 3/4 inch diameter and 10 feet in length, sectional type.

The building counterpoise system shall consist of a 2/0 AWG bare copper conductor buried minimum 30-inches below grade, between 3 to 5 feet from the building foundation unless otherwise noted on the drawings, around the building perimeter. Ground rods shall be installed at 30-foot maximum intervals around the perimeter of the building as shown on the drawings. At the corners of the facility, at least four ground test wells shall be installed around the facility. The metal building structure shall be bonded at each corner with a 2/0 AWG bare copper conductor from the building steel to the counterpoise. All connections below grade shall be made using exothermic weld or irreversible high-compression fittings listed for the purpose.

A ground busbar shall be provided in the electrical and telecommunications rooms. The bus bar shall consist of a wall mounted 4-inch wide x 12-inch long copper busbar (with Lexan cover with standoff bushings) for connecting communications equipment and connected to building counterpoise with 2/0 AWG copper ground conductor.

The facility telecommunications spaces shall be provided with bonding busbar and bonding conductors in accordance with TIA/EIA – 607. The Main Distribution Frame room shall be provided with Telecommunications Main Grounding Busbar (TMGB). TMGB shall be connected to building counterpoise 2/0 AWG copper conductor.

- 3) Lighting Design and Fixtures: The lighting design for both interior and exterior lighting shall be in accordance with UFC 3-530-01, Interior and Exterior Lighting and Controls. Lighting design shall incorporate the latest techniques of energy savings applied to lighting systems. For energy-efficient interior lighting schemes, lighting systems shall be designed to allow reduction of lighting levels by appropriately banking lighting circuits or providing separate switching of inner and outer lamps in 3 or 4 tube fluorescent fixtures. Consideration should also be given for any task lighting that could possibly reduce the overhead lighting requirements.
- 4) Interior Lighting: Interior lighting shall be generally fluorescent with energy saving lamps and

ballasts. Programmed start ballasts shall be used for all light fixtures controlled by occupancy sensors.

Offices, conference rooms, corridors, and class rooms shall use 2' x 4' recessed fluorescent, acrylic lensed troffers with two, three or four lamps. Conference room lighting shall be controlled by multi level switching for two separate illumination levels.

Mechanical rooms, electrical rooms, communications rooms, and janitor's closets shall use industrial type pendant or chain hung fixtures with 10% up-light and wire-guards.

The hangar shall be illuminated with 2'x4' T5HO fluorescent high bays. The fixtures shall be mounted to structure or fastened to Unistrut between structural trusses. Some of these light fixtures (10% - 15% of the total amount of fixtures) shall be on twenty-four hours as safety night lights.

Lighting levels and color shall be in accordance with criteria listed below. The IES Lighting Handbook, and UFC 3-530-01AN; where conflicts exist, except where specifically specified otherwise herein, UFC 3-530-01AN shall govern, see table below for recommended lighting levels. Complete lighting calculations for each room shall be provided in the Electrical Design Narrative. A tabulation consisting of room number, room description, illumination level, drawing designation, voltage, basis of design, and lighting detail sheet number shall be provided with the design narrative.

Lighting Levels

Room Type	Foot-Candles (fc)
Reception	10 fc
Corridors/Lockers	10 fc
Individual Offices	30fc/50fc (Note 1)
Open Offices	30fc/50fc (Note 1)
Conference Room	50fc (Note 2)
Hangar Maintenance Area	50fc
Break Rooms	30 fc
Office Support Areas	30fc/50fc (Note 1)
Storage Room	10 fc
Mechanical/Electrical/Janitor	30 fc
Restroom	5 fc
LAN/Server, Comm Rooms	50 fc
Exterior	5 fc – Entrances; .5 fc - Walkways

Note 1: Provide 30fc for ambient lights, with 50fc achieved with task lighting.

Note 2: Provide multi-level selective switching type luminaries for energy saving.

Fluorescent lamps shall have a color temperature of 4100 Kelvin and a minimum of 75 CRI rating. All fluorescent fixtures shall be specified with electronic ballasts with high power factor (greater than .9) and low harmonic distortion (less than 10%). Provide all rooms except for the hangar maintenance area with occupancy sensors.

The hangar maintenance area shall be circuited via a traditional lighting contactor. The lighting contactor shall be controlled with a switch and time clock. This facility is normally occupied from 0500 to 2300 hours each day. Automatic shut-off of the space is required per ASHRAE 90.1—the time clock shall control the automatic shut off. Switches and/or mushroom type pushbuttons shall be installed in strategic locations throughout the facility in order to override the time clock as allowed by ASHRAE 90.1. In addition to these requirements, daylight harvesting must be incorporated into the lighting control design for this space. Install photocells in appropriate locations in order to switch light fixtures off during periods where daylight harvesting can be achieved to reach 50 fc. At the contractor's option he may choose to use an automatic lighting control system for this. The benefits of an automatic lighting control system as well as a complete understanding of how to maintain and operate the system must be submitted by the Design Professional to CEPM. The lighting design must be approved in writing by the CEPM.

DESIGN BUILD REQUIREMENTS

- 5) Emergency and Exit Lighting: Emergency and Exit lighting shall be provided in accordance with NFPA 101 and ETL 94-5. All electrical rooms, communication rooms, mechanical rooms, toilets, showers, corridors, and other interior rooms where sudden loss of light could present problems shall be equipped with emergency lighting fixtures. Emergency units shall be provided in all of the aforementioned spaces. For emergency egress lighting in the maintenance area, emergency units shall be provided around the perimeter where required to illuminate the path of egress. In order to properly illuminate the path of egress in the center areas of the maintenance area, emergency battery back-up ballasts may be used in the general fluorescent lighting fixtures. Emergency fixtures and emergency battery back-up ballasts shall be connected to lighting circuits in the area, ahead of any local switching. LED exit signs (green), with backup battery, shall be used. Emergency ballasts and emergency units shall be of the self-diagnostic type.
- 6) Exterior Illumination: Lighting levels shall be in accordance with the Illuminating Engineering Society (IES) Lighting Handbook and UFC 3-530-01AN; where conflicts exist, UFC 3-530-01AN shall govern. Exterior lighting shall include facility entrances/exits, parking lot lighting, walkway lighting, lighting around the perimeter of the building and utility yard lighting. All building mounted exterior lighting over personnel and egress doors shall use compact fluorescent luminaries and shall have an emergency battery back-up ballast. Exterior building mounted lighting for illuminating the concrete apron at the main airplane hangar door shall use metal halide lamps. All exterior lighting shall have the capability to be controlled both manually and automatically by a photocell installed in series with a programmable timer (photocell "on" timer "off").
- 7) Secondary Power: In general: provide power to Hangar 456 at 480Y/277V, 3 phase, 4 wire; and provide power at 480V, 3 phase for large motors, 400Hz inverter, airplane service receptacles, exhaust fans, and other large loads. Lighting loads shall use 277V power to the maximum extent possible. Convenience outlets, small split system air conditioning systems, and other small electrical loads shall be supplied power via 480 – 208Y/120V, Delta – Wye, 3 phase dry-type transformers.
- 8) Loads: Evaluate loads at each bus location in kilowatts or kilovolt-amperes and the load types analyzed for system design considerations. Limit voltage drop to not more than the following percentages: 2% for the secondary lateral service, 2% for feeders, and 3% for branch circuits at the farthest distance. Ensure that large motors and compressors do not create electrical flicker throughout the facility. All voltage drop calculations shall be included in the Electrical Design Narrative.
- 9) Transformer, 600-Volt or Less Primary: Transformers shall be general-purpose, dry-type, self-cooled, and ventilated conforming to NEMA ST-20 and UL-506. Transformers shall be provided in NEMA 1 enclosure. Provide aluminum or copper primary and secondary windings. All transformers shall have two windings per phase. Provide primary windings with a minimum of 4 full-capacity taps; two 2-1/2% increments above full-rated voltage and two 2-1/2% increments below full-rated voltage for de-energized tap-changing operation. Configure 3-phase transformers with delta-wye windings.
- Dry-type transformers shall have 220 degree C insulation system for transformers 15 kVA and greater, and shall have 180 degree C insulation system for transformers rated at 10 kVA and less, with temperature rise not exceeding 150 degrees C under full-rated load in maximum ambient temperature of 40 degree C. Transformers of 150 degree C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating.
- 10) Switchboards: If a switchboard is used, it shall conform to UL-891 and NEMA PB 2. Switchboards shall be metal-enclosed, freestanding general-purpose type and shall be installed to provide front and/or rear access. Busses shall be copper. Assembly shall be approximately 90-inches high. The withstand rating and interrupting capacity of the switchboards and circuit breakers shall be based on the maximum fault current available. The main circuit breaker shall be molded-case with an adjustable instantaneous trip setting. Feeder circuit breakers shall be stationary, molded-case circuit breakers conforming to NEMA AB 1 and UL 489. Provide ground fault protection per NEC 240.13.
- 11) Panelboards: All panelboards shall have bolt on breakers. Busses shall be copper. Each 480/277 VAC panelboard serving lighting and power loads shall have a $\geq 25\%$ spare load capacity and a $\geq 25\%$ spare breaker capacity. Each panel serving 208/120 VAC loads shall have a $\geq 25\%$ spare load capacity and 25% spare 20/1 breakers. Series ratings on breakers shall not be used for short circuit protection.

Only fully rated breakers shall be used. Provide 4 each 1-inch spare conduits from each recessed panelboard to above accessible ceiling space. Provide panelboard directories per NEC.

- 12) Wiring: Wiring shall be copper conductors. All wiring shall be installed in conduit or electrical metallic tubing as allowed by the NEC. Wiring system shall consist of insulated single conductors installed in raceways as follows: Galvanized rigid steel conduit or IMC in concrete, masonry and areas subject to moisture; Electric metallic tubing (EMT) in concealed areas and exposed where not subject to physical damage (hangar); and Plastic conduit (Type 80 PVC) in the ground and below concrete slabs. Wire shall be concealed within the walls in all areas except electrical, mechanical, and communication rooms. Conduit shall be labeled with source and destination. Empty conduit shall have nylon pull rope installed in it with 10 feet of pull rope coiled at each end. A ground conductor shall be installed with all feeders and with all branch circuit wiring to receptacle and equipment. Conductors shall be a minimum size of 12 AWG. UL instruction shall be applied when applying the ampacity tables of NEC. Article 110-3(b) states that "Listed or labeled equipment shall be installed, used, or both, in accordance with any instructions included in the listing or labeling." Since virtually all electrical equipment that meets the approval required by article 110-2 of the NEC is UL listed, the equipment must be installed in accordance with UL instructions. The basic rule of the UL Electrical Construction Materials Directory states that, in general "the termination provisions are based on the use of 60C ampacity for wire sizes No. 14-1 AWG, and 75C ampacity for wire sizes Nos. 1/0 AWG and larger, as specified in Table 310-16 of the NEC." Higher rated conductors than specified may be used if the size is based upon the previous statements. The ampacity deration for number of conductors in raceway and ambient temperature shall be based upon the NEC. The percentage of conductor fill in conduit shall be based upon NEC: one conductor maximum fill of 53 percent; two conductor maximum fill of 31 percent; and, more than two conductors maximum 40% fill.
- 13) Identification: All conductors shall be color-coded; colored tape may be used on conductors #6 and larger at all panelboards, switchboards, motor control centers, terminations and junction boxes. A green equipment grounding conductor shall be installed in each receptacle circuit and where noted. All circuit conductors shall be factory color coded as follows:
- 120 Volt, 2-wire circuit: Grounded Neutral, White; Ungrounded Leg, Black.
 - 208Y/120-volt, 3-phase, 4-wire circuit: Grounded Neutral, White; Phase A, Black; Phase B, Red; Phase C, Blue.
 - 480/277-volt, 3-phase, 4-wire circuit: Grounded Neutral, Gray; Phase A, Brown; Phase B, Orange; Phase C, Yellow.
 - 480-volt, 3-phase, 3-wire circuit; Phase A, Brown; Phase B, Orange; Phase C, Yellow.

Major items of electrical equipment shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Unless otherwise specified, identification nameplates shall be made of laminated plastic with the following layers:

- 208Y/120V equipment: White outer layers and a black core.
- 480Y/277V equipment: Yellow outer layers and a black core.
- 400 Hertz equipment: Orange outer layers and a black core.

Edges shall be chamfered. Plates shall be fastened with round-head drive screws or approved non-adhesive metal fasteners. Provide at a minimum the following equipment with identification nameplates: Switchboards, panelboards, transfer switches, safety switches, transformers, major electrical equipment, special receptacles, and control devices. Label each receptacle with its panelboard-branch circuit number. Letters shall be a minimum of 1/4 inches in height.

Provide a 0.005 inches brightly colored plastic tape not less than 3 inches in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion resistant 12 inch metallic foil core to permit easy location of underground utility. The warning tape shall be placed approximately 12 inch below finished grade levels of duct banks or conduit runs. Warning tape shall identify the services routed in the duct bank or conduit.

- 14) Supports: Securely fasten in place all conduit and boxes by means of clamps, clips, hangers, etc. designed for that purpose; No "Tie-wire" shall be permitted. Install conduit and boxes in a neat,

- workmanlike manner according to local industry standards and acceptable to the CI.
Support conduits within 24 inches of each end of each bend, or each termination, and at intervals along the run that shall maintain true raceway alignment without sag or deformation (minimum 10 feet on center). On exposed raceways, provide supports at a minimum of 6 feet on centers and on each side of each bend. Two hole straps shall be used on flat surface for conduit 1 inch and larger. Do not support conduit by suspended ceiling or suspended ceiling support wires except where allowed by NEC.
- 15) Wiring Devices: All receptacle and switch cover plates shall be nylon, except for plated steel in the hangar. All electrical devices shall be flush mounted except where noted otherwise and in the hangar. Receptacle outlets shall be the same ampere rating as the breakers that feed them to prevent receptacle overload without breaker trip. An electrical outlet shall be provided at each water cooler. Water cooler outlets shall be located behind access covers if applicable.
Provide a minimum of one 120-volt outlet for maintenance within 25 feet of heating, air-conditioning and refrigeration equipment and shall not be connected to the load side of the equipment disconnecting means. This outlet shall be GFCI protected for outdoor and roof-mounted equipment.
Provide a minimum of one general purpose, 120-volt, 20-ampere duplex receptacle outlet per wall in each room. In rooms where walls exceed 10 ft, provide an additional duplex outlet for each additional 10 ft of wall or fraction thereof. Receptacles spacing shall not exceed 10 ft. General-purpose receptacles are in addition to special purpose and dedicated outlets for special equipment. In the hangar, no point along any wall at floor level may be greater than 25 ft from a general purpose duplex receptacle. These receptacles shall be surface mounted in a steel outlet box.
Sinks and countertops shall have one 120-volt GFCI outlet within 3 ft of the outside edge of the basin or edge and be in an adjacent wall or partition. All outlets within 6 ft of the edge of a sink shall be GFCI protected. Additional outlets shall be provided so the quantity is one less than sink quantity.
For the break room counters, at minimum, provide two microwave outlets, and general-purpose outlets as required in section 14.8.13.6 below. There shall be a maximum of two general-purpose outlets located at the countertops per circuit.
Provide dedicated circuits for microwaves, refrigerators, vending machines, copy equipment and laser printers and coordinate the location with the users.
- 16) CATV Equipment: Provide receptacles for wall mounted TV's in all break rooms, conference rooms, class rooms, and each VTC (video teleconferencing) location (as well as a CATV outlet).
- 17) Corridors: Provide a minimum of one general-purpose NEMA 5-20R, duplex receptacle every 30 feet of corridor length with a minimum of one per corridor.
- 18) Special Equipment: The new large fabric door at the hangar maintenance area entrance shall have its controls mounted at eye level. Provide all necessary circuitry for the fabric door as required by the manufacturer. In addition to the manufacturer's required circuitry, provide a circuit that can manually operate the control system from a remote location. This circuit shall be controlled by a keyed switch located at eye level. Coordinate the exact mounting location and control requirements of this remote switch with the CAFB electrical maintenance staff.
Remove existing 400Hz generator and replace with a new 35kW 400Hz Inverter which shall provide power to special receptacles throughout the hangar for servicing aircraft. Locate Inverter in the mechanical / electrical room.
Provide power and communications circuits for a GPS antenna. The antenna and supporting equipment will be provided and installed by the CAFB. The contractor must coordinate the location, electrical, and communications requirements with the CAFB staff and install all power and communications circuits that are required for it.
- 19) 14.8.13.5 GFI Receptacles: In each Janitor's Closet and Toilet Room, provide one Ground Fault Circuit Interrupter (NEMA 5-20R-GFI) ground-fault protected type per space, as a minimum. NEMA 5-20R-GFI ground-fault protected duplex receptacles shall be provided for every 100 feet of exterior wall length. These receptacles shall be provided in weatherproof enclosures with hinged covers and shall be installed at convenient location for general access.
- 20) Spaces with Countertops: One NEMA 5-20R for every 3 feet of countertop but no less than one. Provide GFI protected receptacle when located within 6 feet of plumbing fixtures. These receptacles

- shall contain dedicated circuits for equipment use.
- 21) Raceways and Conduit: Conduit shall be Electrical Metallic Tubing (EMT), Galvanized Rigid Steel (GRS), Intermediate Metallic Conduit (IMC), Schedule 40 PVC, or Type EB PVC. GRS shall be used where exposed in mechanical support spaces below 8 ft above finished floor. EMT shall be used for all 600 V and below power, lighting, and control circuits unless dictated otherwise. No conduit, outlet boxes, or junction boxes shall be installed within 18" of the finished floor in the hangar.
 - 22) Conduit Under Slabs: Schedule 40 PVC conduit may be used under slabs. Provide galvanized rigid steel elbows and risers to penetrate through concrete slab. Conduit in duct banks shall have a minimum of 3 in of concrete in all directions. There shall be a minimum of 2 in of concrete separation between all conduits. All duct banks shall be a minimum of 24 in below grade. All conduit risers from buried conduit or duct banks shall be made with GRS elbows and risers.
 - 23) Conduit in Slabs: Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits at either parallel or 90 degrees to main reinforcing steel. Separate conduits by not less than the outside diameter of the largest conduit to ensure proper concrete bond. The Contracting Officer's Representative must review conduits crossing in slab for proper cover. Embedded conduit outside diameter shall not exceed 1/3 of slab thickness.
 - 24) Flexible Conduit: Flexible metal conduit shall only be used in moveable partitions, from outlet boxes to interior recessed lighting fixtures, and for final 460 mm of connection to motors, transformers, and other equipment requiring adjustment or subject to vibration in dry nonhazardous, interior locations. Liquid-tight flexible conduit may be used in nonhazardous locations (no longer than 460 mm) where subject to movement or vibration and if connections are subject to one or more of the following:
 - Exterior location
 - Moist or humid atmosphere
 - Corrosive atmosphere
 - Subject to water spray or dripping oil, water or grease
 - Motor driving a non-submerged pump
 - 25) Conduit and Raceways: Route conduit to roof mounted equipment beneath the roof structure to a penetration immediately adjacent to the equipment. Where multiple items need to penetrate the roof, minimize penetrations by coordinating with other trades and bundling in prefabricated roof assemblies. Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Wiring above lay-in ceilings is considered exposed (as applied to wiring methods). Exposed raceway shall only be run vertical below 2.7 meters unless noted otherwise or approved by Owner's representative. Metallic raceways outside are to have conduit threads painted with corrosion inhibiting compound before couplings are assembled.
 - 26) Cable Tray: Cable Tray may be used to provide support for communication cables. Provide aluminum ladder type. Indicate tray depth, width and rung spacing on drawings. Provide horizontal and vertical elbows, horizontal and vertical tees, horizontal cross, reducers, expansion joints, bonding jumpers, and supports as required. Cable tray shall not be used to support other items, conduit, cable tray, piping or utilities. Provide support per NEMA standards publication VE 2 – Metal Cable Tray Installation Guidelines. Provide grounding per NEC.
 - 27) Motor and Controllers: Provide NEMA rated motor starters as required for the application. Provide Full-Voltage Non-Reversing (FVNR), Reduced Voltage Autotransformer when motor starting shall cause excessive voltage drop, and Variable Frequency Drives (VFDs) for speed control.
 - 28) VFD Starters: Provide IGBT pulse width modulated design utilizing a three-phase, full-wave, diode bridge. Provide 12-pulse unit. Provide integral main motor circuit protector with AIC RMS Symmetrical rating at rated voltage. Provide three mechanically and electrically interlocked contactors as a bypass for that equipment serving equipment that is critical to facility operation and mission. Provide phase reversal and phase loss relays in accordance with Mechanical Technical Design Criteria.
- H. Lightning Protection: Provide a conventional lightning protection system consisting of sharp-tipped air

terminals, down conductors, and ground rods. Exterior exposed down conductors shall not be allowed. To the extent practicable, the building structural steel shall be interconnected and used as the down conductor(s) according to NFPA 780. Where structural steel column(s) do not exist, an unexposed down conductor shall be installed. All roof conductors shall be exposed except where conductors are in protective sleeves at penetrations, inside walls and under concrete slabs. Structural steel columns used as down conductors shall be bonded to the counterpoise system. The lightning protection system shall be designed according to NFPA 780 and TM 5-811-3 and shall be certified and given a UL Master Label.

12. ELECTRONIC SYSTEMS (Comm Network Design + Provide Cabling & Equipment Support)

Contractor shall **design** Electronic Systems including *Data and Communications (Comm)*, *Security and CATV* to service Hangar-456. Contractor shall **provide all support** to Comm equipment and cabling including power, grounding bus bars, backboards, conduit (all conduit with pull-cords with 6'-coils at each end), cabling backboxes (each with conduit to 6"-above accessible ceiling), junction boxes, in-wall or in-ceiling equipment supports including wall and ceiling reinforcing back-blocking and necessary power and grounding located adjacent to all necessary COM or SIPRNET equipment. Contractor shall via CEPM coordinate with base Comm squadron for locations and quantities of all elements requiring support including jacks, ports, cabling, and equipment. CAFB Comm Squadron (CS) shall, under separate contract, provide cable, cable installation, terminations, testing and certification for Electronic Systems **designed** under this contract. Protect existing underground equipment and cables during construction. Conduit for SIPRNET and non-secure Comm cables shall be separate.

SIPRNET data networks are classified. Telephone and NIPRNET (data) networks are both unclassified. A/V and CATV systems are also unclassified. All these systems together constitute the Comm network.

Design Elements: designated in this section and incorporated in the design shall be shown on the design drawings.

Comm Room: Include local network area server space. Locate as required. Provide all Comm and SIPRNET backboards in each Comm room. Provide on a minimum of two walls in the new Comm room with 4'x8'x1/2" plywood backboards (coated with white fire resistant paint) mounted vertically with bottom edge 6" AFF. Secure backboards to CMU with expansion anchors at not less than 8" o.c. each way; and through GWB to steel studs at not less than 8" o.c. each way. Provide wire management systems on all backboards.

Comm Racks and Cabinets: Show separate floor or wall mounted equipment racks adequately sized for patch panels and wire management to support all jacks and outlets plus 25%-spares. Coordinate with CEPM throughout design submittals and reviews to obtain equipment sizes and locations including Open Frames, Floor Mounted Cabinets, General Use Racks, Distribution Racks, Cable Guides, Special Power and Grounding.

Comm Systems Grounding: Comm systems grounding shall comply with the NEC and TIA J-STd-607-A, *Grounding and Bonding Requirements for Telecommunications*. A TMGB (Telecommunications Main Grounding Bus Bar) is the common central point of connection for Comm systems and equipment located in and served by that Comm room. Tie TGBs and TMGB together with #1/0 grounding conductor. Bond main bus bar to building main electrical service ground with #3/0 AWG insulated (green) copper grounding conductor. Run conductor from bus bar to building service ground in EMT conduit each end of which shall in turn be bonded to the grounding conductor. Do not ground to building structure, conduits, utility pipe, or electrical subpanels in lieu of bonding to building main electrical service ground. All Comm racks, cable trays, etc., shall be grounded with #6 AWG insulated (green) copper grounding conductor to main grounding bus bar.

Comm Special Power: At each Comm rack provide two eight-wire assemblies (boxes) fed by a UPS distribution panel and receiving four simplex outlets, each with a dedicated neutral wire, to the satisfaction of CAFB. Use 10 gauge wiring for all electrical circuits. Mount all outlets above the racks.

- 1) LAN Switch racks shall have two 8-wire boxes with:
 - Two dedicated, 4-wire, 208 VAC 20 Amp (L6-20),
 - One dedicated, 4-wire, 208 VAC 30 Amp (L6-30) and
 - One dedicated, 3-wire, 120 VAC 20 Amp (L5-20) simplex electrical outlets.
- 2) Provide each General Use Rack with 4-dedicated, 3-wire, 120VAC 20A (L5-20) simplex electrical outlets.

- 3) Provide each Comm equipment distribution rack with 4-dedicated, 3-wire, 120 VAC, 20 A (L5-20) simplex electrical outlets.
- 4) Obtain Audio/Video equipment outlet types, and power requirements from manufacturer and model.
- 5) Comm room shall have 120Vac 20A duplex convenience outlets for equipment testing and servicing. Convenience outlets shall be located 18" above the finished floor placed at 6'-0" intervals (EIA/TIA – 569).
- 6) Vertical power strips shall have an amp meter display with twist lock plugs to match the outlets described above and multiple outlets for connecting the telecommunication equipment and accommodating GFGI NEMA 5-20R or IEC C13/C14 within the racks.

Horizontal Distribution System: Provide sleeves through walls as necessary to allow Comm cable to be pulled from the Comm Room to workstation jacks. Provide cable tray, open top hooks, or conduits for homerun distribution from work area outlets to the Comm room for Telephone and NIPRNET cables. SIPRNET cables from communication rooms to shall be in conduits and shall comply with classified network requirement.

Horizontal Outlets:

Typical Work Area Outlet: Provide each work area with one quadraplex backbox with conduit to a point above the nearest accessible ceiling. Hard-walled offices shall have one quadraplex backbox with conduit to a point above the nearest accessible ceiling (=1 jack-set) in each wall for a total of four (4) jack-sets (and 4 backboxes). Provide cable tray or open top hooks from each drop to its homerun to a Comm Room.

Hard-walled (not systems partitioned) offices and conference rooms shall have one full set of jacks in each wall (total, 4 jack sets). Each jack set consists of one faceplate with 2 NIPRNET and 2 Administrative Telephones.

NON-Typical Work Area Outlet:

- 1) **Utility rooms:** Provide Utility rooms like Mechanical, Electrical, elevator equipment room, storage rooms, etc with power outlets, conduit and backboxes to accommodate 2 NIPRNET and 2 administrative telephone outlets. Provide Shower area with conduit and backboxes for one administrative telephone outlet.
- 2) **Misc areas:** All the miscellaneous areas shall have at least one jack-set. Provide the ASFP/IP shared space with four (4) jacks adjacent to a quadraplex power outlet.

Labeling: Provide a labeling system with prior approval of the CAFB Comm Squadron. Label each receptacle and patch panel. Use wrap around labels at each end of all cables. Label all SIPRNET and Comm faceplates, conduit, cable trays and termination boxes at 6' intervals with paint or tape color bands: 1" red or 2" grey.

Security system:

An Electronic Security System includes: an Intrusion Detection System (IDS) and Entry Control System. The system cabling and terminations shall be by the government. Backbox cover plates shall be by Contractor.

A common conduit system for all electronic security systems is allowed. Power outlets for all components of the IDS and Entry Control System shall be connected to the emergency generator. UPS battery backup shall be provided by 14SF. Obtain from CEPM location of Security system generator power for optimum UPS location.

Community Antenna Television (CATV) System:

Provide a CATV system design including enclosures, conduits, junction boxes, cabling and passive devices for 1 GHZ rated high definition TV (HDTV) signal distribution. Include the labeling system in submittal drawings and specifications. CATV transmission media shall be RG-6 coaxial cable min. Homerun cables from all CATV outlets to a CEPM located Comm room. Specify all unused taps with 75 ohm termination resistors. Include in the design hinged NEMA 12 18" x 18" x 6"D wall mounted boxes for all cable terminations.

At minimum, provide CATV outlets in the Conference Room and in the Office.

Audio-Visual (A/V) System:

Contractor shall for A/V equipment including flat-screen TVs and monitors; and Video Teleconferencing Center (VYC) provide supporting infrastructure including: conduits with pull cords from receptacles up to six (6) inches above ceiling, junction boxes, electrical outlets, and blocking to support hanging equipment. All A/V

system cabling, equipment and devices will be Government Furnished Government Installed (GFGI). Provide infrastructure compatible with government equipment to ensure fully functioning system(s). Provide A/V infrastructure and capabilities as CEPM directs during design development.

13. FIRE DETECTION AND ALARM SYSTEMS

- A. Codes and References: Design and construction shall comply with the most current applicable state and federal laws, regulations, codes and government and private publications including all S&R in section 1.2 above and the following:
- NFPA 70, Electrical Code
 - NFPA 72, Fire Alarm Code
 - UFC 3-600-01 Fire Protection Engineering for Facilities
 - ETL 02-15
- B. Qualifications:
- 1) Fire Alarm Design: A Registered Fire Protection Engineer shall be required for the fire alarm and detection design and specifications preparation for this contract.
 - 2) Fire Alarm Installation: The Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system. A NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install fire alarm system conduit. Fire Alarm technicians installing equipment shall be trained in the installation, adjustment, testing, and operation of the equipment provided.
 - 3) Fire Detection and Alarm System: Provide the building with a fire detection and alarm system according to NFPA 72 and UFC 4-021-01. Fire detection and alarm systems shall be designed according to UFC 3-600-01, NFPA 72, NFPA 20 and other applicable NFPA Standards and Codes.

Provide a complete addressable, 4-wire supervised fire alarm and detection system. The complete fire alarm system shall meet requirements of NFPA 72, Table 6.7, Style 4 and Table 6.6.1, Style 7. All fire alarm control panels shall be addressable and have a class "B" (IAW HQ guidance) supervised circuit providing a trouble signal and continues to operate as an alarm circuit after one fault has occurred in the wiring. All zones shall be able to transmit to the watch desk independent of other zones. Multiple zones shall be able to transmit an alarm directly to the fire department and shall not "lock-out" other zones. The hangar maintenance area shall be designated as one zone and the remaining spaces shall be designated as another zone. The hangar maintenance area will have an HEFFSS pre-action system. This preaction system will require the activation of a manual pull station or smoke/heat detector in the hangar maintenance area in order for it to initiate. Line type heat detectors may be used in the hangar maintenance area.

All devices shall be addressable and comply with NFPA requirements.

All alarm and trouble signals shall be transmitted via a Monaco BT-X radio transceiver to the base fire station. The radio transceiver shall be fully compatible with existing central receiving station.

Notification of evacuation of personnel shall be by both audible and visual alarms per NFPA 72. All rooms except private offices shall have at least 1 visual fire alarm. The system shall have tamper switches on all valves that would disable the sprinkler system, and shall transmit all trouble, tamper, and flow alarms to the central station. Upon the detection of flow of water in sprinkler lines, a water gong shall sound and the fire alarm panel shall signal an alarm.

Include smoke detectors in air handling units to comply with NFPA 90A and all air handling units that deliver more than 2000 CFM. Interlock all required HVAC fans and equipment with the fire alarm system panel. All fans (supply and exhaust) within a zone shall de-energize when notified by the fire alarm panel that an alarm conditions exists in that zone.

Manual pull stations for evacuation of personnel and transmission of fire alarms to the Base Fire Department shall be located at each exit and spaced to meet NFPA requirements.

All fire alarm system acceptance tests shall be performed in the presence of the Base Fire Department, to demonstrate operation of all newly installed or relocated fire alarm devices.

- 4) Fire Alarm Main Panel: The panel shall be fully addressable with 80 character programmable alphanumeric displays, capable of handling a minimum of 500 individually identified sensors within the main control panel. The panel shall be modular installed in steel cabinet with hinged door and cylinder lock.
 - a. The fire alarm control panel shall have a dry set of contacts for each zone, trouble dry contacts, and fire alarm dry contacts. Provide spare boards for alarm panels, main board, zone boards, and motherboard. Provide drawings and schematics of fire alarm panels, recommended spare parts list, and special tools/test equipment required.
 - b. Locate the fire alarm control panel in main electrical room and location shall be coordinated with fire department. The fire alarm panel shall be easily accessible by the Fire Department.
 - 5) Remote Annunciator: Provide a remote annunciator with an 80 character alphanumeric display with alarm acknowledge, and alarm silence. Locate the remote annunciator as directed by CAFB Fire Department.
 - 6) Manual Pull Stations: Addressable manual fire alarm stations shall conform to the applicable requirements of UL38. Manual stations shall be connected into signal line circuit. Manual pull station shall be mounted in accordance with ADA requirements. Pull stations shall be double action type and red in color. Stations requiring the breaking of glass or plastic panels for operations are not acceptable.
 - 7) Fire Alarm: Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Locate horns so that they meet the intelligibility per UFC 4-021-01 requirements.
 - 8) Visual Notification Devices: Locate visual devices per NFPA 72 and ADA. Visual devices shall be synchronized when more than one device is located in a common field of view. Provide "Clear color" strobes marked "FIRE" for fire alarm notification.
 - 9) Highly Sensitive Smoke Detector: Highly Sensitive Smoke Detectors shall be provided in all LAN/Server rooms.
 - 10) Smoke Detector: Smoke Detectors shall be provided in all storage rooms, electrical rooms, mechanical rooms, and janitor closets.
- C. Storage Battery: Storage batteries shall be provided. The batteries shall be sized to meet the requirements of NFPA 72. In addition, the batteries shall meet the requirements of UFC-4-021-01.

14. CORROSION CONTROL and CATHODIC PROTECTION

Prevention: Do not install any metal that will be in contact with soil, electrolytes or in continuous contact with water or moisture. Provide corrosion protective coatings for metals in contact with the air. New or replacement under-slab plumbing shall use PVC or Polypropylene (preferred) pipe. Provide proper permanent connections from new pipe to existing steel, cast iron, or ductile iron pipe under floor slabs.

Metallic Pipe: Electrically isolate new metal pipe from existing metal pipe with an insulating flange. Provide new metal pipe passing through concrete slabs, walls, and floors with material between pipe and concrete to provide isolation (e.g. by passing the metallic pipe through a PVC sleeve). Provide insulating flanges in new metal pipelines where they extend above grade or above floor slabs; the flanges are to be located above grade.

Coating: Provide a minimum coating thickness of 40 mils on all underground metal. Provide a bonded coating for all ductile iron and other metallic piping. The use of un-bonded coatings (e.g. PE encasement) is strictly prohibited. List allowable coating types in the applicable specification section. A NACE Certified Coatings Inspector (CCI) shall coordinate with the CPE to assure proper coating systems provide a completely compatible and operable total corrosion control system consisting of both coatings and cathodic protection.

Cathodic: Whenever possible, avoid the use of cathodic protection. As necessary, design, specify, show on drawings and provide cathodic protection systems that do not interfere with existing (single or multiple) cathodic protection systems. Field investigate, and verify the type and locations of existing systems. All Cathodic Protection analysis, design, field work, testing, inspection, and commissioning shall be done by or under direct supervision of a Corrosion Protection Engineer (CPE).

15. CAFB MECHANICAL DESIGN STANDARDS

GENERAL REQUIREMENTS

Any deviation from the CAFB Design Standards must require written consent from the CAFB project manager. In cases where the Statement of Work conflicts with the CAFB Design Standards, the Statement of Work governs.

Mechanical Equipment

- a. Mechanical equipment must be the standard product of a manufacturer regularly engaged in the manufacture of such products and must essentially duplicate items that have been in satisfactory use for at least 2 years. The manufacturer must have the required in-house technical expertise and testing capabilities required to support the operational and performance requirements of the product.
- b. Major mechanical equipment must be factory tested prior to shipping. Testing and compliance must be documented and submitted.
- c. Items recommended in the manufacturer's literature shall be required.
- d. All required items to make the equipment operational and useable must be provided by the equipment manufacturer.
- e. All mechanical equipment must have a 5-year comprehensive warranty. The warranty period on all equipment will begin only after acceptance by CAFB.
- f. All major mechanical equipment must be included into the existing Base EMCS.
- g. All mechanical and electrical equipment and utilities must be concealed, both on the interior and exterior of buildings, except in mechanical rooms.
- h. All equipment must have sufficient room for equipment maintenance.
- i. Mechanical equipment must not be placed in custodial rooms.

Identification

- a. All piping and equipment in mechanical rooms and central plants must be completely painted according to the latest revisions of the "Scheme for the Identification of Piping Systems," ANSI A31.1 and the "Safety Code Color for Marking Physical Hazards," ANSI Z53.1.
- b. All piping in buildings must be identified by means of alphabetical stencils and color codes, showing contents of the piping and the direction of flow. Piping must be identified at 30' intervals, on both sides of penetrations through walls and floors, and at each directional change.
- c. All valves must be identified by number with stamped brass discs secured with non-ferrous beaded chain. A framed valve schedule must be provided in the mechanical room(s).
- d. All motor-driven equipment and HVAC components must be individually numbered on the drawings and have corresponding number plates on the equipment; e.g. for unit heaters, use UH-1, UH-2, etc. even though both units are of the same size and type. All designation must be integrated with and distinguished from any existing designations.
- e. Sprinkler control valves located above suspended ceilings must be marked with a red thumbtack on the ceiling panel.

Utility Service Connections

- a. Domestic and hydronic pipe must be buried to a depth of four feet and no deeper.
- b. Domestic and hydronic pipe must not be installed in or under concrete slabs on grade, except where necessitated by building entrances or under sidewalks.
- c. Directional boring is permissible. Pit bores are prohibited.
- d. All underground piping must have a tracer wire.

Vibration and Sound Isolation

- a. Mechanical equipment, associated piping and ductwork must be mounted on vibration isolators to minimize transmission of vibration and noise to the building. All motors over five horsepower must be solidly attached to a base common with the driven unit to minimize alignment problems.
- b. Balance all rotating equipment both statically and dynamically. The structure supporting the equipment must not have any natural frequencies within plus or minus 20 percent of the normal operating speeds.

- c. While operating, the equipment must not exceed a self-excited radial vibration velocity of 0.10 inch per second or an axial vibration velocity of 0.05 inch per second, when measure with a vibration meter.
- d. Vibration test pickups must be placed on bearing caps in the horizontal, vertical and axial directions. Test pickups may be placed on equipment mounting feet if the bearing caps are concealed.
- e. Walls and floors enclosing mechanical rooms adjacent to occupied spaces must have a sound attenuation factor of 10 decibels or greater, above the determined or probable airborne noise level of the operating equipment. The rating must not be less than STC 55db.

Commissioning and Demonstration of Systems

- a. All mechanical equipment must be commissioned.
- b. During the design phase, mechanical design criteria must be developed in consultation with personnel responsible for the operation and maintenance of the building system(s) being designed.
- c. For renovation projects where ductwork is modified, the Architect/Engineer must identify and location(s) for the contractor to measure airflow(s) prior to any demolition. The contractor must be required to report the identified airflow(s) before commencing any HVAC demolition. The intent of this requirement is to identify existing capacities that may be critical to achieve design and/or code requirements.
- d. During construction special attention must be given to items that cannot be easily corrected after construction completion. This includes but is not limited to locations of plumbing cleanouts, adequate maintenance access for equipment, adequate straight pipe up and down stream of flow meters, proper connection to supply and return piping, and code required clearances above and around electrical panels.
- e. All specified tests will be witnessed by representatives of the appropriate (sub) contractor, equipment manufacturer's representative, Consulting Engineer, Contracting Officer and Construction Manager.
- f. The Architect/Engineer (A/E) through the Construction Manager must schedule all commissioning activities no less than two (2) weeks in advance. The Architect/Engineer must certify and document that all commissioning tests and activities have been successfully completed, and that the HVAC systems are functioning in accordance with the manufacturer's specifications and the contract documents.
- g. Specifications must stipulate that until commissioning is satisfactorily completed: 1.) No heating, ventilation and air conditioning system will be accepted by the owner and 2.) The warranty period on all equipment will begin only after acceptance by the Owner.
- h. All heating, ventilation and air conditioning systems must be commissioned per the following requirements prior to training owner's operations and maintenance personnel:
 - i. Point-To-Point (PTP) tests will be performed on all sensors and outputs prior to testing and balancing and Functional Performance Tests. All damper linkages will be run through their full travel as part of PTP testing. All remote duct and hydronic sensors must be located and tested. All PTP tests on zone controls must be done before ceiling tiles are installed. Graphics, alarms, trends, etc. on the EMCS computers must be verified.
 - ii. All motors must be checked for proper lubrication, drive rotation and belt tension.
 - iii. Functional Performance Tests must be done on all freeze stat controls with fan switch in automatic, hand, and bypass position.
 - iv. Perform witness tests on all devices that require maintenance including but not limited to, filters, dampers and motors, control valves and motors, reheat coils, and condensate drain pans and traps.
 - v. Furred in or enclosed equipment must be inspected before being concealed. All information required for record documents and O&M manuals must be verified.
 - vi. Check cooling coil condensate drain pans and traps for proper drainage. In all AHUs and all fan coil units above ceilings pour a sufficient quantity of water into the drain pan to verify proper drainage.
- i. Back flow preventers must be checked for code compliance and a certification report must be submitted to the Construction Manager. Plumbing cleanouts must be checked for required maintenance access.
- j. Functional operation of Fire Protection Systems will be demonstrated in the presence of responsible Fire Department personnel for accessibility to fire dampers, fire dampers, automatic fire suppression systems and alarm systems.
- k. After commissioning is complete, but prior to beneficial occupancy or substantial completion, the Contractor must provide field training for designated personnel who are responsible for the operation and maintenance of mechanical and HVAC systems. Classroom training can be held prior to commissioning. Field training must include a demonstration of all required maintenance activities and proper operation of

all control sequences. The Architect/Engineer must schedule all training and demonstration activities no less than two (2) weeks in advance.

- I. The following must be completed during the first year of systems operation:
 - i. Capacities of HVAC equipment must be verified during extreme summer and winter conditions.
 - ii. Revenue meters must be recalibrated by a manufacturer's trained and authorized representative 6 and 12 months after initial balancing.

PLUMBING SYSTEMS

Piping

- a. Above-grade sanitary drain, waste and vent (DWV) piping must be either cast iron for low noise applications or Schedule 40 PVC DWV for applications where noise is not a concern.
- b. Below-grade sanitary drain, waste and vent piping and sanitary sewer piping must be Schedule 40 PVC DWV.
- c. Above-grade storm drain piping must be cast iron. Below-grade storm drain piping must be Schedule 40 PVC DWV.
- d. Domestic water piping inside the building must be type "L" hard drawn copper. Domestic water piping below slab must be type "K" soft drawn copper.
- e. Backflow preventers must be installed no more than five feet above the floor and twelve inches from the wall.
- f. Shut-off valves are required on each floor, on take-offs from all vertical risers, and at the connection point of each piece of equipment.
- g. Drain valves must be installed in accessible locations at all low points in the piping system to permit drainage and servicing.

Domestic Water Metering

- a. Water meters installed at each building must be OFCI unless otherwise directed. Meters must be capable of showing cumulative gallons used, and of measuring the maximum and minimum anticipated flow rates. Meters for domestic water must be revenue-grade electromagnetic meters having a maximum inaccuracy of 1% of reading and must be equipped with both a 4-20mA and a scalable contact pulse output.
- b. Separate full-flow bypass loops must be provided around all water meters and PRVs.
- c. Meters must be constructed of materials suitable for domestic water and must have a strainer installed upstream.
- d. Boiler, chiller and cooling tower make-up and blow down must be metered separately.
- e. Irrigation systems must be metered separately. Inline vortex flow meters should be used for irrigation.
- f. Fire protection service must not be delivered through the metered domestic water system.

Fixtures

- a. Water Closets must be 1.28 GPF wall-mounted flush valve type or dual flush type where appropriate.
- b. Urinals must be vitreous china, wall mounted, 0.125 GPF (1 pint) type. Waterless urinals are not permitted.
- c. Wall-hung Lavatories must be white enameled cast iron with self-closing metering type push button faucets and perforated grid strainers. Faucets must have insulated traps on wheelchair lavatories.
- d. Counter-mounted lavatories must be oval enameled cast iron self rimming type with self-closing metering push button type, center set faucets.
- e. Service Sinks must be white enameled cast iron, wall mounted and floor supported by wall outlet cast iron P-trap. Faucets must be copper alloy back mounted combination faucets with vacuum breaker and 3/4 inch external hose threads.

Domestic Water Heaters

- a. Domestic water heaters must be evaluated on life-cycle cost effectiveness. Electric heat-pump, natural gas, instantaneous, solar with storage and solar without storage must be considered.
- b. Integration of domestic water heating with other building energy systems is highly encouraged (WSHP, condensing heating boiler, etc.).
- c. Unless demonstrated not to be cost-effective, water heaters must be electric heat pump type with an energy factor greater than 2.2.

- d. Electric resistance water heaters are not permitted. Electric resistance heating elements in electric heat pump water heaters must be temporarily disabled upon installation.
- e. Natural gas water heaters must be condensing type with an energy factor greater than 0.8.
- f. Domestic hot water recirculation pumps must be connected to the EMCS system and turned off during unoccupied hours.

Electric Water Coolers

- a. Wall mounted recessed, high/low dual bubbler style, air cooled condensing unit with 4.75 gph minimum capacity. Bubblers must be controlled by push bars on each side and in front.

HEATING, VENTILATION AND AIR CONDITIONING (HVAC) DESIGN PARAMETERS

Energy Performance

- a. The minimum energy performance for all new construction must be the minimum required for LEED certification but no more than 14% less than the energy use allowed by the most recent version of ASHRAE 90.1. Calculations supporting energy performance must be performed and submitted using the latest version of DOE-2 energy use and cost analysis software; equivalent energy analysis software can only be used with prior approval. For renovations an energy use analysis based on existing conditions must be performed and benchmarked to historical use as recorded in the Energy and Utilities Department billing database.
- b. The maximum allowable fan energy must be 14% less than the values listed in the most recent version of ASHRAE 90.1.

Air Conditioned Spaces

- a. Unless required by a technical order or the Unified Facilities Criteria, cooling design indoor air dry-bulb temperature must be 76°F. Air conditioning systems must be able to maintain an indoor relative humidity of no more than 60% regardless of the outdoor temperature and humidity, or percentage of outside air. Lower indoor humidity levels must be maintained when justified by project criteria.
- b. Unless required by a technical order or the Unified Facilities Criteria, heating design indoor air dry-bulb temperature must be 70°F. Humidification is not to be provided unless justified by special project criteria.
- c. The 1% outdoor design criterion for CAFB are as follows:

Design Criteria	Design Value	Mean Coincident Values			
				Wind Speed	Prevailing Direction
Dry-Bulb Temperature	94°F	77°F MCWB	110 gr/lb MCHR	6.2 mph	W
Wet-Bulb Temperature	79°F	89°F MCDB	131 gr/lb MCHR	5.4 mph	N/A
Humidity Ratio	137 gr/lb	84°F MCDB	78°F MCWB	3.6 mph	S

- d. Untempered air must not be supplied directly to occupied spaces or into the returns of fan coil units.
- e. Constant volume systems must only be used where required by program or where variable volume air control is impractical. Constant volume systems must have a means to pre-cool and dehumidify outside air before being mixed with the return air. A chilled water coil, heat recovery device or other method approved by CAFB project manager may be used.
- f. Spaces that require a continuous and constant supply of outside air must have a heat recovery system. The system must be selected for a payback of no more than 10 years. Desiccant-coated heat recovery devices are acceptable and encouraged.
- g. VAV systems that simply reduce outside airflow in proportion to supply airflow must not be used. Spaces of different uses (such as offices and classrooms) may only be served by the same AHU if CO₂ sensors or other approved controls are provided in adequate quantity and location to ensure code required outside air to all spaces.

- h. Individual offices must have means of ensuring acceptable temperature control (user adjustable thermostat and control device, appropriate zoning or other designed means).
- i. AHUs must have manual override to run unit with high outside airflow (for venting odors from new carpet/furniture, floods, etc.)
- j. Freeze protection must be provided on all air handling units. Freeze stats must stop the supply fan, close the outside damper, and open the heating coil valve. Where DDC is used, the freeze stat controls must be completely independent of the DDC system.

Plans and Specifications

- a. Sequence of operations must be on the control drawings. Specifications must require that the Contractor permanently mount a copy near the equipment.
- b. Air handling unit (AHU) points list, airflow schematic, and sequence of operations must be on the same sheet. AHU schedule, with gallons per minute, and detail must be on the same sheet, unless space prohibits.
- c. An air-side one-line diagram must be provided to show the air balance for each room served by the system.
- d. Pump(s) point list, pump flow diagram, and sequence of operations must be on the same sheet. Pump schedule and detail must also be on this sheet, unless space prohibits.
- e. Building plans must have chilled water, hot water/steam, and airflow schematics. Designs for renovation projects must update the building schematics.

MECHANICAL EQUIPMENT LOCATION

Mechanical Rooms

- a. The Architect/Engineer must, in the earliest stages of design development, be responsible for establishing and/or verifying programmatic requirements for mechanical rooms in order to:
 - Provide adequate safe access and manufacturer's recommended working clearances for all equipment.
 - Provide for replacement of the largest piece of equipment without removing permanent walls or large items of equipment or equipment essential to the ongoing day to day building use.
 - Provide direct access from the exterior or main corridor for major mechanical rooms exceeding 100 net square feet suited for replacement of equipment and preventing disruption of normal building functions.
 - Assure that building mechanical air intakes are located away from loading docks, emergency electrical power generators, emergency or ambulance vehicle entrances, and other external sources of noxious or toxic fumes. Consideration also must include proximity to wind-blown dust from streets, fields and ground care activities, designated tobacco smoking areas, combustion by-products, and biogenic materials related to evaporative cooling towers or intentional human contamination.
- b. In phased projects mechanical rooms must be sized to include equipment for all the phases.
- c. Boiler and/or chiller mechanical rooms must have external taps for the connection of a portable boiler and/or chiller. Mechanical rooms which house critical AHUs as identified by the CAFB project manager must have external taps for the connection of a portable boiler and/or chiller.
- d. Unobstructed accesses to filters, manual valves, zone control devices, automatic control equipment, etc., must be provided.
- e. Mechanical rooms must be ventilated by a thermostatically controlled fan, and must have a floor drain.
- f. Mechanical equipment rooms must be provided with Ethernet jack(s) in locations coordinated with CAFB Communications Squadron.

Attic/Ceiling Access

- a. Attic spaces may be used for air handling equipment; however, compressors, condensers, and distribution pumps must not be located in attics. Attic access must be from interior stairs or elevator, which must be large enough and suitable for replacement of the largest component of the mechanical equipment.
- b. Attic mechanical spaces must be equipped with lighting, convenience outlets, space for storage of mechanical drawings, maintenance manuals, filters, etc., and floor moisture detectors tied to the EMCS.
- c. All AHUs in attics must have protection so a large leak will not flood floors below.
- d. When air handling units are located in attics, zone control devices, such as VAV boxes, mixing boxes, reheat coils, etc., must also be located in the attic rather than in the ceiling of occupied spaces below.

- e. Unobstructed accesses to filters, manual valves, zone control devices, automatic control equipment, etc., must be provided.
- f. Access to ducted fan coil units on occupied floors must be from corridors, rather than through offices, classrooms, or other occupied spaces. Air conditioning compressors, condensers, and similar equipment serving buildings must be in an exterior, ground-mounted location readily accessible for maintenance, and effectively shielded from view. Such installations may be subject to approval by CAFB project manager.
- g. Access panels are not required in lay-in acoustical tile ceilings, except where ceiling clips are required.

HYDRONIC PIPING AND PUMPS

Piping

- a. Schedule 40 black steel pipe with welded joints is preferred for chilled water, condenser water and dual service piping 2-1/2 inches and larger. The use of approved alternative piping materials is encouraged. Chilled water piping in buildings must not be polyvinylchloride (PVC) pipe.
- b. Type "L" hard drawn copper is preferred for chilled water and dual service piping 2 inches and smaller. The use of approved alternative piping materials is encouraged.
- c. End connections to valves and equipment must be threaded union connections on piping 2 inches and smaller. Pipe ends 2-1/2 inches and larger must be flanged.
- d. External buried chilled water and dual service piping must be pre-insulated double wall type. Schedule 40 black steel carrier pipe with welded joints is preferred. Insulation thickness must optimize life-cycle cost. External jacket piping must be PVC or high density polyurethane. Insulation must comply with the above requirements or the latest version of ASHRAE 90.1, whichever one is more stringent.
- e. External uninsulated buried condenser water piping must have cathodic protection.
- f. Gate valves 2-inch and smaller must be bronze in accordance with MSS SP-80. Gate valves 2-1/2 inch and larger must be cast iron in accordance with MSS SP-70.
- g. Ball valves 2-inch and smaller must be copper alloy in accordance with MSS SP-110. Flanged ball valves 2-1/2 inches and larger must be bronze in accordance with MSS SP-72.
- h. Butterfly valves must be cast iron flanged, Type "I" tight shutoff type in accordance with MSS SP-67.
- i. Venturi-type flow measuring devices are preferred.

Pumps

- a. Pump size and type must be selected based on maximum efficiency at operating point. Pump design flow rate must be within +5% and -10% of the Best Efficiency Point (BEP) flow rate. Whenever possible, select pumps so that the design flow rate is to the right of the BEP.
- b. Pumps 5-hp and larger must have a variable frequency drive. The maximum impeller size must be specified for VFD-operated pumps to maximize pump efficiency.
- c. Use variable frequency drives on pumps in secondary piping systems.
- d. Chilled water systems must be variable volume with 2-way control valves. The position of all chilled water valves must be polled to control pump speed so no chilled water valve is commanded more than 95% open.
- e. Base-mount, end-suction pumps are preferred for chilled water, heating water and dual service duty.
- f. Chilled water pumps must have an epoxy coating to prevent corrosion due to condensation.
- g. Pump bases must drain to the mechanical room floor drain.
- h. Pumps must start/stop through the base EMCS.
- i. Electric motors must comply with the latest version of ASHRAE 90.1.
- j. Flexible connectors must be used at all pumps and equipment.
- k. Floor mounted pumps must have suction diffusers and triple duty valves.
- l. Flexible pipe joints must be stainless steel rather than rubber.

Valves

- a. All coils, pumps and fan coil units must have adequate isolation valves to allow replacement without draining the system.
- b. All shut off valves on chilled water, heating hot water, and glycol must be ball or butterfly; gate valves must not be used except in special circumstances. Acceptable manufacturers for high performance ball and butterfly valves are Adams, Bray, Jamesbury, and Zwick.
- c. All butterfly valves 6 inches and larger must have gear operators.
- d. All valves installed higher than 7 feet must have chain drives.

CENTRAL REFRIGERATION EQUIPMENT

Chillers: (N/A)

Cooling Towers: (N/A)

LOW TEMPERATURE WATER HEATING SYSTEMS

- a. Heating water for a building must be between 90 and 160 degrees Fahrenheit for heating. A means of night, weekend, and holiday, setback control must be provided on each boiler for energy conservation purposes.
- b. Low temperature water heaters must be evaluated on life-cycle cost effectiveness. Electric heat-pump, condensing natural gas boilers and solar-assisted systems must be considered.
- c. Integration of low temperature water heating with other building energy systems is highly encouraged (condenser de-superheaters, heat pump water heaters, etc.).
- d. Hot water re-heat systems and combined pre-heat and re-heat systems must be variable volume with 2-way control valves. On systems with a VFD, position of all hot water valves must be polled to control the pump speed so that no hot water valve is commanded more than 95% open. On systems without a VFD, a pressure-relief valve must be used to prevent the pump from dead-heading.
- e. All preheat valves must be commanded fully closed and perimeter heating systems must be off when the outside air temperature is above 55 degrees or when the unit is in economizer operation.
- f. Indication and controls must be connected to the Base EMCS system.

Boilers: (N/A)

Pipe and Fittings

- a. Schedule 40 black steel is preferred for piping 2-1/2 inch and larger. The use of approved alternative piping materials is encouraged.
- b. Type "L" hard drawn copper is preferred for piping 2 inches and smaller. The use of approved alternative piping materials is encouraged.
- c. End connections to valves and equipment 2 inches and smaller must be threaded union. Connections 2-1/2 inches and larger must be flanged.
- d. External buried piping must be pre-insulated double wall type. Schedule 40 black steel carrier pipe with welded joints is preferred. Insulation thickness must optimize life-cycle cost. External jacket piping must be PVC or high density polyurethane. Insulation must comply with the above requirements or the latest version of ASHRAE 90.1, whichever one is more stringent.
- e. Gate valves 2 inch and smaller must be bronze in accordance with MSS SP-80. Gate valves 2-1/2 inch and larger must be cast iron in accordance with MSS SP-70.
- f. Ball valves 2 inch and smaller must be copper alloy in accordance with MSS SP-110. Flanged ball valves 2-1/2 inch and larger must be bronze in accordance with MSS SP-72.
- g. Butterfly valves must be cast iron, flanged, Type "T" tight shutoff type in accordance with MSS SP-67.

AIR HANDLING EQUIPMENT**Air Handling Units (AHU)**

- a. Fans must be centrifugal type with airfoil blades.
- b. Chilled-water AHUs must be single-duct, variable air volume type with variable frequency drives.
- c. Chilled water AHUs must include an airside economizer.
- d. Chilled water coils must be sized for 42°F supply water temperature and 54°F return water temperature at peak load conditions. During off peak conditions it is acceptable for the return water temperature to be above 54°F.
- e. Chilled water coils must be sized for a maximum face velocity of 400 feet per minute.
- f. Chilled water coils must have a maximum of 6 rows and a maximum of 12 fins per inch; however more rows will be allowed if the air resistance is less than 0.5" of water. The coil face area can be as large as needed to obtain the required performance.
- g. Cooling coil casings and drain pans must be stainless steel. All structural supports, etc. in air handling units immediately downstream of humidifiers must be stainless steel.
- h. Provision must be made for removal of the fan shaft and the cooling and heating coils.

- i. Drain pans must be stainless steel and provide positive drainage.
- j. Chilled water AHUs must be connected to the Base EMCS.

Variable Air Volume (VAV) Terminal Units

- a. Maximum allowable air leakage rate must be 2 percent at three-inch water gauge.
- b. Casings must be minimum 26 gauge galvanized steel. Provide access panels where required for service and adjustment without disconnecting ducts.
- c. Boxes must be of double wall construction. Insulation must be a minimum of R-8 or the thickness required to prevent condensation, whichever is more conservative.
- d. Damper must maintain constant airflow within 5 percent of design airflow.
- e. Re-heat hot water coils must be an integral part of the box.
- f. VAV units must be of the pressure independent type and capable of 100% airtight shut-off.
- g. The position of all VAV dampers must be polled to control the fan speed so that no VAV box is commanded more than 95% open.
- h. Indication and controls must be connected to the Base EMCS system.
- i. Thermafusers are not allowed.

UNITARY AIR CONDITIONING EQUIPMENT

Package Terminal Units (PTU)

- a. PTUs must only be considered where mini-split systems and water source heat pumps are deemed impractical. Life-cycle cost comparison with the aforementioned systems must accompany PTU design.
- b. PTUs must have a minimum efficiency in accordance with the latest version of ASHRAE 90.1.
- c. PTUs must be removable from the inside of the building for servicing without removing the outside cabinet.
- d. PTUs must have integral electric resistance heaters, ARI certified and UL listed.
- e. Indication and controls must be connected to the Base EMCS system.

Single Package Units (SPU)

- a. Minimum efficiency must be in accordance with the latest version of ASHRAE 90.1 or 16 SEER, whichever is more stringent.
- b. Units must be equipped with either multiple-stage or variable speed compressors to ensure proper humidity control.
- c. Units must be direct expansion heat pumps with condensing gas-fired auxiliary heat. Electrical resistance heat is not permitted.
- d. DX Variable Air Volume systems are not permitted.
- e. Unit controls must be compatible and communicate with existing base EMCS.
- f. When provided for rooftop installation, the units must include factory roof curbs, flashing and transition plenum.
- g. Indication and controls must be connected to the Base EMCS system.

Water Source Heat Pump (WSHP) Type

- a. Minimum efficiency must be in accordance with the latest version of ASHRAE 90.1.
- b. Variable Refrigerant Volume systems, ground-coupled systems and domestic-water-coupled systems are encouraged.
- c. Unless demonstrated not to be cost effective, WSHPs are required in situations where building/space loads are less than 100 tons.
- d. WSHPs must be designed to operate in conjunction with a closed cooling tower and condensing boiler.
- e. Unit controls must be compatible and communicate with the existing base EMS.

Split System (SS) Type

- a. Minimum efficiency must be in accordance with the latest version of ASHRAE 90.1 or 16 SEER, whichever is more stringent.
- b. Units must be equipped with either multiple-stage or variable speed compressors to ensure proper humidity control.

- c. Split Systems must be heat pumps.
- d. Unless demonstrated not to be cost effective, Split Systems are preferred in situations where building/space loads are less than 15 tons.
- e. Variable Refrigerant Volume systems and mini-split heat pump systems are encouraged.
- f. Auxiliary heat, if required, must be supplied with either a condensing natural gas furnace or hydronic heat. Electrical resistance heat is not permitted.
- g. Provide separate assemblies designed to be used together and operate in accordance with ARI 210/240.
- h. Unit controls must be compatible and communicate with the existing base EMS.

VENTILATION

Outside Air Delivery

- a. Outside air intakes must not draw in exhaust air from adjacent systems, loading docks, parking lots, emergency generators, chemical storage, sewer manholes, or other external sources of noxious or toxic fumes. Outside air intakes must be above grade per Force Protection specifications.
- b. Unless demonstrated not to be cost effective, controls such as occupancy sensors or carbon dioxide sensors must be provided to minimize the flow of outside air (rather than full design flow) to rooms that are not occupied for periods of time.
- c. Spaces requiring more than 500 cfm must have a carbon dioxide sensor. A sequence must be employed to minimize the amount of outside air provided.
- d. VAV boxes must have a minimum flow of as little as 10% to minimize the outside air provided to unoccupied spaces.
- e. All buildings must have a nominal positive pressure. Positive pressure is to be maintained during all modes, but may be neutral if all exhaust fans are off. The total building must maintain positive pressure wherein special use rooms, laboratories, etc. may require negative pressure.
- f. Outside air dampers must have feedback of actual position to the EMCS, or other means of confirming operation.
- g. Outside air dampers must have a full closed position as well as a minimum position for normal occupied mode.
- h. The "Hand" position of the HOA switch must be configured so that after a fire the unit can run to evacuate smoke without the unit smoke detector tripping. Any connection to the building fire alarm system must be hard wired, not through the DDC system.

Exhaust Air

- a. Exhaust air must be fully ducted.
- b. Individual exhaust fans in janitor's closets or single toilet restrooms must not be used where central systems are available or reasonably achieved. If such individual exhausts are used, they must be equipped with timers or occupancy sensors to turn fans off after an approved period of time.
- c. Provide backdraft protection for multiple exhaust fan outlets that have been combined into manifolds.
- d. All roof top exhaust systems must be vertical up discharge.
- e. The discharge velocity from the stacks of lab exhaust and other noxious exhaust must be at least 3,000 fpm and the plume must be high enough to clear nearby obstructions; this requirement applies to induced flow type fans as well as fans with straight stacks.
- f. Positively pressurized exhaust duct must not be installed inside buildings except in mechanical rooms where non-lab exhaust connects directly to an exhaust plenum.
- g. Dedicated mail rooms must be fully exhausted.
- h. Minimal exhaust requirements must be in accordance with the most recent version of ASHRAE 62.1.
- i. Electrical or computer equipment must be cooled to temperature recommended by equipment manufacturer.
- j. Exhaust, or return if approved, must be provided near heat producing equipment such as freezers, refrigerators, icemakers, cold drink machines, incubators, autoclaves, etc.
- k. Kitchens must be supplied with tempered make-up air in the summer. Supply air must be tempered per code requirements, or be drawn from adjacent dining rooms.

DUCTWORK

- a. All ductwork must be installed in accordance with SMACNA HVAC Duct Construction Standards. Duct air leakage tests must be performed.
- b. All ductwork must be externally insulated. Internally insulated ductwork is not permitted. During renovations, all internally insulated ducts in the area being renovated must be replaced.
- c. Duct elbows must have turning vanes or an inside radius of at least 1/2 of the duct width. Transition elbows are not acceptable.
- d. Transitions from low to high velocity at outlet of AHUs must be smooth and tapered. Outlet plenums that are the full size of the AHU or cooling coil, with small high-velocity outlets, are not acceptable.
- e. Mixing boxes, blenders, or equivalent are required where outside air and return air mix to prevent stratification.
- f. Filters must be provided on both sides of heat recovery devices. A window and light must be provided to allow viewing of filters without stepping into the exhaust air stream.
- g. Perforated supplies or returns must not be used.
- h. Kitchen grease exhaust duct must be 16-gauge welded black steel or 18-gauge welded stainless steel.
- i. Kitchen dishwasher exhaust must be stainless steel.
- j. Shower exhaust ductwork must be aluminum or stainless steel.
- k. Provide sufficient number of access panels to permit easy access for cleaning of ducts.

MECHANICAL INSULATION

General Insulation Requirements

- a. Insulation must comply with the latest version of ASHRAE 90.1 or the following requirements, whichever one is more stringent.
- b. For condensation prevention in unconditioned spaces, below-ambient surfaces must be insulated to provide a minimum surface temperature of 82°F at ambient design conditions of 87°F db.
- c. For condensation prevention in conditioned spaces, below-ambient surfaces must be insulated to provide a minimum surface temperature of 77°F at ambient design conditions of 85°F db.
- d. Below-ambient surfaces must be protected by a continuous vapor retarder with a maximum permeance of 0.02 perm.

Ductwork Insulation

- a. Insulation must be on the outside of the ductwork. Internal insulation is not permitted.
- b. Exposed outdoor ductwork must be insulated and wrapped with a minimum of 27 gauge aluminum jacket.
- c. Adhesives and installation of all insulation must be in accordance with manufacturer's recommendations.

Piping Insulation

- a. Horizontal internal storm drainage piping runs must have insulation and vapor retarder.
- b. Domestic hot water piping must be insulated.
- c. Above-grade exterior chilled water and heating water piping must be insulated and protected with an aluminum jacket.
- d. Buried exterior chilled water, heating water and dual service piping must be factory fabricated, pre-insulated piping.
- e. Refrigerant piping must be insulated.
- f. Insulation thickness must optimize life-cycle cost.
- g. Insulation must be continuous through floors, walls and studs.

GAUGES, INDICATORS AND THERMOSTATS

- a. Pressure gauges must be provided on supply and return of pumps, chilled water bundles, condenser water bundles, heat exchangers, heating coils, cooling coils, and where lines enter and exit mechanical rooms. Gauges must be 4 ½ inches in diameter or larger.
- b. Digital thermometers must be provided on supply and return of chilled water bundles, condenser water bundles, air handling unit coils, heat exchangers, and where lines enter and exit mechanical rooms.
- c. Gauges and thermometers must be mounted within 8' of the operating floor in a visible location.
- d. Gauges and thermometers must read to twice the operating pressure or temperature.
- e. Magnahelic or inclined manometer must be provided on AHU filters.

ENERGY MANAGEMENT CONTROL SYSTEMS (EMCS)

- a. All controls must be compatible and communicate with existing Base EMCS. Existing control system is a Johnson Controls Metasys system.
- b. All new equipment must use DDC control systems and be connected to the existing Base EMCS. Pneumatic controls are not allowed except where specifically required by Unified Facilities Criteria.
- c. A graphical control schematic must be developed for each new piece of equipment. The control schematic must be congruent with the existing Base EMCS control schematics. All points monitored must be displayed on the equipment schematic.
- d. For new buildings, a floor plan drawing must be used to display the location of all equipment. Space temperatures and set points must be displayed on this graphic. A link to all mechanical room equipment (boilers, chillers, cooling towers, etc.) must be provided in the upper right hand corner.
- e. For buildings that are too large to be displayed on a single screen, sections of the building floor plan may be used to display equipment, set points and temperatures. Links to all other floor plan screens must be provided in the upper left hand corner of each section graphic. The links must be provided on a small graphic of the total building floor plan. All screens must have a link to the mechanical room equipment in the upper right hand corner.
- k. Chilled water plants and hot water plants must have their total energy efficiency reported on the EMCS main page. The efficiency must be reported in kW/ton for the chilled water plant and in percent efficiency for the boiler plant. Total plant efficiency must include all devices that consume energy in the production of the utility delivered.
- l. When DDC is used on mechanical equipment (AHU, chiller, etc.), a laptop computer shelf with a required hook up must be provided at each piece of equipment.
- m. A 5 year warranty must be specified on electric actuators.
- n. During renovations, replace all pneumatics in the area being renovated with DDC and electric actuation.
- o. The vendor of electronic monitoring and controls must provide all control devices.

Chiller Controls

- a. The factory controls on the chiller must be capable of communicating with the Base EMCS.
- b. Chiller EMCS controls must display not less than the following points: chilled water supply temperature, chilled water return temperature, chilled water set point, status of chilled water pump(s), compressor status, compressor speed or IGV position, compressor power (kW), condenser bundle pressure drop, chilled water bundle pressure drop, condenser approach temperature, and chilled water approach temperature.

Cooling Tower Controls

- a. Cooling tower EMCS controls must display, at a minimum, the following points: condenser water supply temperature (supply from the tower), condenser water return temperature (return to the tower), condenser water set point, outside air wet-bulb temperature, status of cooling tower fan, cooling tower fan speed, status of condenser water pump(s), condenser water pump speed, and cooling tower bypass valve position.

Boiler Controls

- a. The factory controls on the boiler must be capable of communicating with the Base EMCS.
- b. Boiler EMCS controls must display not less than the following points: hot water supply temp., hot water return temp., hot water set point, status of heating water pump(s), boiler status, and the percent firing rate.

AHU Controls

- a. Factory controls on the AHU and VAV boxes must be capable of communicating with the Base EMCS.
- b. AHU EMCS controls must display, at a minimum, the following points: supply air temperature, pre-heat off-coil temperature, mixed air temperature, return air temperature, outside air temperature, outside air percentage, supply fan status, supply fan speed, chilled water supply temperature, chilled water return temperature, chilled water valve position, hot water supply temperature, hot water return temperature, hot water valve position, and pressure drop across the air filters. Where re-heat coils are located in the AHU, the cooling-coil off coil temperature must also be displayed.
- c. Valves for chilled water and hot water must be two-way linear control valves.
- d. All chilled water valves must be commanded fully closed when the outside air temperature is below 55°F or when the unit is in economizer operation.

- e. VAV EMCS controls must display, at a minimum, the following points: space temperature, space set point, supply air temperature to the space, damper position, and hot water valve position. Fan status must be required on fan-powered boxes. The supply air temperature from the air handler must be displayed on each VAV box screen.
- f. Mount supply and return fan VFDs close enough together so the readouts can be seen at the same time without moving.
- g. Sequence will specify if fans run continuously or can be shut off. Supply, return, and exhaust fans must be interlocked as required.
- h. Controls such as carbon dioxide (CO₂) or occupancy sensors must be used to modulate outside airflow in classrooms and auditoriums, unless demonstrated not to be cost effective. On units with CO₂ control, the sequence of operation must specify when outside air dampers can be closed, and when fans can be shut off.
- i. Units with CO₂ controls which serve only class rooms will be shut off during unoccupied hours when CO₂, temp, and relative humidity are satisfied; and restarted on demand by any of those sensors. An occupancy sensor will also restart AHU. If extreme conditions prevent the system from maintaining all set points, the CO₂ level will be allowed to drift. The EMCS will monitor points as required to detect failure to maintain any set point.

Unitary Controls

- a. Package Terminal Unit controls must display the status of the PTU, the space temperature, the space set point, and the mode of operation (heating/cooling).
- b. Single Packaged Unit controls must display, at a minimum, the following points: zone temperature(s), zone set point(s), supply air temperature, mixed air temperature, return air temperature, outside air temperature, outside air percentage, supply fan status, supply fan speed, compressor status, mode of operation (heating/cooling), gas-fired auxiliary heater status, and pressure drop across the air filters.
- c. Water Source Heat Pump controls must display, at a minimum, the following points: space temperature, space set point, and the mode of operation (heating/cooling). The heat rejection supply and return temperatures from the plant must also be displayed on each heat pump screen.
- d. Split System controls must display, at a minimum, the following points: space temperature, space set point, and the mode of operation (heating/cooling).

16. CAFB ELECTRICAL DESIGN STANDARDS

Electrical Characteristics: Primary voltage is 13.2 Kv and most secondary voltage systems are 120/208V or 277/480V, 3 phase, 4 wire. System voltage in each building shall be verified.

Material and Equipment Qualifications: Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years.

Regulatory Requirements: Equipment, materials, installation, and workmanship shall conform to the mandatory and advisory provisions of IEEE C2 and NFPA 70 and requirements specified herein.

Warning Signs: Provide warning signs for the enclosures of electrical equipment including substations, pad-mounted transformers, pad-mounted switches, generators, and switchgear having a nominal rating exceeding 600 volts.

Single-Phase Electric Motors: Unless otherwise requested, single-phase fractional-horsepower alternating-current motors shall be high efficiency types.

Polyphase Motors: Unless otherwise requested, polyphase motors shall be selected based on high efficiency characteristics relative to the applications.

Painting of Equipment: all electrical equipment shall have factory-applied painting systems.

THREE-PHASE PAD-MOUNTED TRANSFORMERS

High Voltage, Dead-Front Compartments: High-voltage compartment shall contain the incoming line, insulated high-voltage load-break connectors, bushing well inserts, six high-voltage bushing wells configured for loop feed

application, load-break switch handle(s), access to oil-immersed fuses, dead-front surge arresters, tap changer handle, connector parking stands with insulated standoff bushings, and ground pad.

- a. Insulated high-voltage load-break connectors: rated 95 kV BIL. Current rating: 200 amperes rms continuous. Connector shall have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.
- b. Bushing well inserts and feed-thru inserts: 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise.

Transformer: Oil-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type. Copper or aluminum windings are acceptable.

Insulating Liquid: Mineral oil: Type II. Identify transformer as "non-PCB" and "Type II mineral oil" on the nameplate.

Corrosion Protection: Bases and cabinets of transformers shall be corrosion resistant and shall be fabricated of stainless steel. Base shall include any part of pad-mounted transformer that is within 3 inches of concrete pad. Submit paint colors of bases cabinets, and tanks for approval by 14CES.

Ground Ring For Equipment: Provide a ground ring around high-voltage equipment consisting of a ring with copper wire around the periphery with ground rods in each corner, a ground rod in the transformer window and two lead-ins from the ground ring. Connections to the ring shall be made by exothermic welding or approved irreversible compression fittings.

UNDERGROUND TRANSMISSION and DISTRIBUTION

Rigid Metal Conduit: galvanized steel, threaded type.

Rigid Metal Conduit, PVC Coated: galvanized steel, threaded type, coated with a polyvinyl chloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mils thick.

Plastic Conduit for Direct Burial: NEMA TC 2, EPC-40-PVC.

Conductors Rated 600 Volts and Less

600 Volt Wires and Cables: Service entrance and direct buried conductors shall Type USE. Conductors in conduit other than service entrance shall conform to Type THHN/THWN-2. Conductors No.10 AWG shall be stranded. Conductors No.12 AWG and smaller shall be solid. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper.

Medium Voltage Cable: Cable for underground distribution system shall be ozone resistant ethylene-propylene-rubber-insulated (EPR) cable or cross-linked-thermosetting-insulated (XLP) cable. Cable shall have a polyvinyl chloride jacket. Neutral size, tape shield.

Medium Voltage Cable Terminations: Provide terminations including stress control terminator, ground clamp, connectors, and lugs. Terminator shall be the product of one manufacturer, suitable for the type and materials of the cable terminated. Furnish components in the form of a "UL listed" kit, including complete instructions which shall be followed for assembly and installation.

Indoor Terminations: shall be cold-shrink type or heat shrinkable type.

Buried Warning and Identification Tape: Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried cable and conduit. Tape shall be detectable by an electronic detection instrument.

Medium Voltage Cable Joints: Provide power cable joints (splices) suitable for continuous immersion in water and direct burial. Make joints only in accessible locations in manholes or handholes by using materials and methods specified herein and as designated by the written instructions of the cable manufacturer and the joint kit manufacturer.

INTERIOR DISTRIBUTION SYSTEM

Materials and Equipment: Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70. Grounding and bonding shall be in accordance with NFPA 70 and NFPA 780.

Conduit and Fittings: Shall conform to the following:

Rigid Metallic Conduit: GRS or rigid non-metallic shall be used in concrete, masonry walls if grouted and slabs, exposed to the weather or where subject to physical damage and on exterior of buildings. PVC may also be used in concrete.

Rigid, Threaded Zinc-Coated Steel Conduit: NEMA C80.1.

Rigid Nonmetallic Conduit: PVC Type EPC-40, or fiberglass conduit. Use for service entrance conduits from the utility substation or underground below floor slabs when required for 400 Hz circuits. Do not use PVC above the first floor slab of buildings. Underground portions outside the building shall be encased in minimum 3 inches of concrete and installed 36 inches below grade for high voltage conduits.

Intermediate Metal Conduit (IMC): IMC may be used in lieu of GRS as allowed by NFPA 70 and approved by Base Civil Engineering.

Electrical, Zinc-Coated Steel Metallic Tubing (EMT): Use EMT for branch circuits and feeders above suspended ceilings or exposed where not subject to physical damage. Do not use EMT underground, encased in concrete, mortar or grout, in hazardous locations, outdoors or in fire pump rooms.

Plastic-Coated Rigid Steel and IMC Conduit: Use in corrosive environments.

Flexible Metal Conduit: UL 1.

Liquid-Tight Flexible Metal Conduit: Steel UL 360.

Fittings for Metal Conduit, EMT, and Flexible Metal Conduit: Ferrous fittings shall be cadmium or zinc coated.

Fittings for Rigid Metal Conduit and IMC: Threaded-type. Split couplings unacceptable.

Fittings for EMT: Connections shall be threadless, die cast and raintight. Do not use crimp-on type. Set screw type may be used indoors only.

Fittings for Rigid Nonmetallic Conduit: NEMA TC 3, UL 514B.

Surface Metal Raceway: Two-piece painted steel, totally enclosed, snap-cover type.

Cable Trays: Cable trays shall form a wireway system, and shall be of depth needed. Cable trays shall be constructed of steel that has been zinc-coated after fabrication.

Outlet Boxes and Covers: UL 514A, cadmium or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

Cabinets, Junction Boxes, and Pull Boxes: Volume greater than 100 cubic inches, hot-dip, zinc-coated, if sheet steel.

Wires and Cables: Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

Conductors: Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 12 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductors no 10 shall be stranded. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

Minimum Conductor Sizes: Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

Insulation: Unless otherwise specified or required by NFPA 70, power and lighting wires shall be 600-volt, Type THHN/THWN-2. Grounding wire may be type THHN/THWN-2 remote-control and signal circuits shall be Type TW or TF.

DESIGN BUILD REQUIREMENTS

Toggle Switches: Single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic and/or thermoset plastic and mounting strap with grounding screw. Wiring terminals shall be screw-type, side-wired. Voltage rating 120V/277V. Switches shall be specification grade as a minimum.

Receptacles: Hard use, heavy-duty, grounding-type: Face and body shall be thermoplastic supported on a metal mounting strap. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. Receptacles shall be specification grade as a minimum.

Weatherproof Receptacles: Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Receptacle shall be UL listed for use in "wet locations with plug in use."

Ground-Fault Circuit Interrupter Receptacles: Duplex type 20 A, for mounting in standard outlet box.

Range Receptacles: NEMA 14-50 configuration, rated 50 amperes, 125/250 volts.

Dryer Receptacles: NEMA 14-30 configuration, rated 30 amperes, 125/250 volts.

Panelboards: Shall have a short-circuit current rating of 10,000 amperes symmetrical minimum. Panelboards for use as service disconnecting means shall be listed for such use. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. Directories shall indicate load served by each circuit in panelboard. Type directories and mount in holder behind transparent protective covering. Load centers shall not be used. Circuit breakers shall be bolt-on type. Do not use dual section panelboards. Do not use series rated breakers.

Panelboard Neutrals for Non-Linear Loads: Panelboard type shall have specific UL heat rise test for use on non-linear loads. Panelboard shall be heat rise tested, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing. Two neutral assemblies paralleled together with cable are not acceptable. Nameplates for panelboard rated for non-linear loads shall be marked "SUITABLE FOR NON-LINEAR LOADS."

Circuit Breakers: Thermal magnetic-type having a min. short-circuit current rating equal to the short-circuit current rating of the panelboard in which the breaker shall be mounted or shall be rated for the short-circuit availability at the point of connection of the panelboard. Series rated circuit breakers and plug-in breakers are not acceptable.

Circuit Breaker With GFCI or GFI: Shall be UL 943 and NFPA 70 listed.

Arc-Fault Circuit-Interrupters: Molded case circuit breaker shall be rated as indicated.

400 Hz Panelboard & Breakers: Panelboards and breakers for 400 Hz systems shall be "400 Hz" rated and labeled.

Load Centers: Load centers shall not be used.

Transformers: General purpose, dry-type, self-cooled. Provide transformers in NEMA enclosure. Transformer shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding 80 degrees C under full-rated load in maximum ambient of 40 degrees C. Transformer of 80 degrees C temperature rise shall be capable of carrying continuously 130 percent of nameplate kVA without exceeding insulation rating. Transformers shall be quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated. K rated transformers shall be used to mitigate harmonic effects of non-linear loads. Copper or aluminum windings are acceptable. Provide energy efficient transformers.

Motors: Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits shall have terminal voltage rating of 460 volts.

Telephone and Lan System: Comply with EIA/TIA-568-B, 569 and 606.

Grounding and Bonding Equipment: Ground rods shall be copper-clad steel, with minimum diameter of 3/4 in and minimum length of 10 ft.

End of Design-Build Requirements

DESIGN BUILD REQUIREMENTS

DESIGN AFTER AWARD

GENERAL: Design-Build services under this contract include verification of all CAFB-provided information, sufficient field investigation to ensure design and construction accuracy, and Design Development and all Construction Documents (CDs) necessary for construction and complete verification by CAFB CE-inspectors.

1. ADMINISTRATION:

A. General: The CO is responsible for administration of this contract. The CAFB Base Civil Engineer (BCE) as represented by the Civil Engineering Project Manager (CEPM) is the technical representative of the CO.

B. CONTRACTOR RESPONSIBILITY

SOW Becomes Contractor Responsibility: Upon contract award Contractor assumes full responsibility for both design and construction. Assume all existing conditions included in this SOW are incomplete and unverified. Therefore determine actual existing conditions by research of available documents and performing necessary site investigations. DPs, investigate and ascertain the design efficacy of this SOW and accordingly recommend to the CEPM. CDs shall incorporate all SOW requirements, and necessary verifications and corrections to the design and existing conditions. The CD and Construction quality and completeness shall deliver fully functional and usable renovations to the satisfaction of the government. Contractor assumes sole responsibility for design or construction deficiencies arising from SOW incompleteness or inaccuracy and at no cost to government shall correct same deficiencies, regardless of when they are discovered.

Review Comments: During each review, CAFB will make comments on the design submittals that will modify the drawings and specifications. The Government will make no additional payments to Contractor for the incorporation of comments. Review comments are considered part of the Design-Build process.

Contractor Still Responsible after Government Review: Government review or approval of all or part of design or construction submittals shall neither obviate nor diminish the whole or any part of the responsibility of either Contractor or DPs of Record. Government disapprovals of design related submittals during either design or construction phases shall be reviewed and resubmitted by the appropriate Design Professionals of Record. Contractor remains fully responsible for all aspects of both design and construction.

Design and Construction Differentiated:

- 1) All Contractor design responsibilities outlined in the SOW, whether stated or implied, shall be performed by Design Professionals of Record, i.e. Architect(s) or Engineer(s) licensed to practice in one or more states of the US. All design drawings in every submittal phase shall bear the Seal and Signature of the Design Professional who prepared it. Unsealed drawings will not be accepted.
- 2) The Design Professionals of Record shall seal, sign and date each design drawing under their responsible discipline for each submittal. The DPM shall stamp, sign and date, to certify coordinated design between disciplines, each design drawing at each submittal stage. The sentence "This design has been coordinated with all other design disciplines" shall be placed above the DPM's signature
- 3) The Contractor shall provide for approval the names and experience of all Design Professionals intended for use on the Project, to include names, qualifications, and functions of key personnel.
- 4) Full construction administration services shall be provided by appropriate DPs including review and (if acceptable) approval of submittals, bi-monthly construction progress site visits and reports, physical attendance at not less than two construction progress meetings per month and development of clarification drawings as necessary or requested by CAFB.
- 5) Personnel within the construction part of Contractor entity are not qualified to be Design Professionals under this Contract, even if licensure requirements have been met. Likewise, Design Professionals may not directly participate in any construction part of Contractor entity.

Design: Design Professionals (DPs) are responsible for the professional quality, code compliance, technical accuracy, and coordination of all designs, drawings, specifications, and other Construction Documents. Contractor shall use design and construction practices, materials and equipment accepted within the

construction industry and in compliance with this SOW. All DP work shall be done according to the SOW and standard best practices by their respective professions. DPs shall according to their best professional judgment be guided by the Standards & References (S&R) in Design Development and creating Construction Documents (CDs). CDs include construction drawings, specifications, submittals, and design analyses as required in this SOW. All specified materials shall be new, of high quality, durable and easily maintained.

SOW Criteria: Design and construction shall comply with the letter and intent of requirements, specifications, drawings, in this Statement of Work (SOW) including amendments, attachments, and documents referenced herein. This SOW is intended to prescribe fully functional, operational and maintainable facilities supporting to the extent practicable the CAFB mission. Normal design development and CD creation shall accommodate actual design and construction conditions and additional CEPM input during design reviews. Do not deviate from these criteria without obtaining prior written approval from the CEPM and the CO. Promptly submit questions or problems with the SOW along with recommended solutions to the CEPM at design reviews.

Codes and S&R Compliance: Code reviews and life safety analyses in this SOW are preliminary. Contractor and DPs shall comply with all applicable codes, standards and references for design and construction.

Technical Specifications: DPs shall develop technical specifications **using the UFGS**.

C. Points of Contact (POC):

1. Unless otherwise noted, Contractor shall direct all requests for information to the CO and BCE. Contractor shall maintain close liaison with the CO and BCE to assure proper coordination of work.
2. Design Project Manager (DPM): Contractor shall appoint a DP as the DPM to be the POC between Contractor and Government. The DPM is responsible for coordination of all design work including field visits, design submittals and record drawings. Within seven (7) days of Award, Contractor shall submit in writing the name of its DPM to the CO.
3. Construction Project Manager (CPM): Contractor shall appoint a CPM to be the POC between Contractor and Government. The CPM is responsible for coordination of all construction including construction progress meetings, design submittals and record drawings. Within seven (7) days of Award, Contractor shall submit in writing the name of its CPM to the CO.
4. CE Project Manager (CEPM): The BCE will appoint a CEPM who will provide technical support to the Contracting Officer and Contractor and will serve as POC for the DPM on all technical matters of the work. All DP efforts will be coordinated with the CEPM.
5. If a Contractor prepared document including drawing, specification, letter, sketch, report, estimate, and computation sheet, is classified by the CO "FOR OFFICIAL USE ONLY", then all documents produced shall also be plainly marked "FOR OFFICIAL USE ONLY" unless otherwise directed by the CO.

- D. Record Drawings: One electronic copy (CD-ROM) of record documents will be provided (during negotiation) to Contractor without warranty, express or implied, regarding their completeness or accuracy. More copies that Contractor needs are at contractor expense. Contractor shall verify existing sizes and locations shown on record drawings. Inadequate verification of existing conditions shall not: (1) relieve Contractor from design accountability or completing the work within the contract price; or (2) substantiate or validate any financial remuneration to the Contractor. Develop designs according to the most current verified existing conditions. If Contractor discovers conditions requiring scope change(s), immediately notify the CO in writing.

2. **FIELD INVESTIGATION:**

- A. Site Investigation: Prior to commencing design, Contractor Design Professionals (DP) shall within 28 days of Award of Contract complete site visits and all field work necessary to determine existing conditions. The DPs shall verify, correct and/or append Record Drawings and thoroughly document all actual field conditions including materials, systems and dimensions. Contractor shall be responsible for subsequent construction problems arising from inadequate field investigation. Visiting Contractor personnel must report to the CEPM upon each day's arrival and again at their departure to discuss field work progress.
- B. Site Visits: Provide the CO a written record of each site visit within seven (7) days. The record shall include the visit date, visitor names, phone numbers and email addresses, purpose(s) of visit, observations, information gathered, and direction received. Number each written record in consecutive order.

Contractor shall make the following minimum number of visits to the project site(s):

1. Pre-Bid: perform field investigation, measure and photo (in non-restricted areas) relevant existing conditions and meet with CEPM to clarify design intent and scope of work.
2. Submittals (35%, 65%, 95% & 100%): discuss government comments and necessary revisions.
3. Contractor DPs shall make all necessary additional visits for complete and accurate accomplishment of the work, at no additional cost to the Government.

3. DESIGN CRITERIA:

- A. Design Qualification: Contractor shall be directed by the professional judgment of DPs including licensed Architects, and licensed Structural, Mechanical, Plumbing, Electrical, and Civil Engineers and Surveyors. Throughout design and construction, Contractor must fully comply with both letter and intent of the requirements set forth in documents including: the Contract, the SOW, and all applicable government requirements, building codes and governing authorities including the S&R identified herein. Contractor DPs shall produce and affix their professional seal on all CDs for this project.
- B. SOW, CDs and Added Value: This SOW includes the following requirements: Design-Build, Government Furnished Design (GFD) less than 35% Concept Drawings, CD-ROM, Design-After-Award, Administration of Construction, Quality, Safety Health and Environmental Protection, Construction, Inspection and Testing. GFD is conceptual: Contractor is expected to add extensive value to the GFD and SOW by incorporating additional CEPM design review requirements and through CDs that ensure quality construction and provide CAFB CMI with direct and simple verification thereof.

4. DESIGN SUBMITTALS:

Design Submittal Schedule: Within 14 days after issue of Notice-to-Proceed with Design Contractor shall submit a schedule of design submittals (with review dates) to the CEPM and CO. Upon approval, the schedule will not be revised except for written declaration of hardship approved in advance by the CO. Design progress payments will not be made without an approved schedule of design submittals.

If a design submittal will be late, Contractor shall notify the CO in writing at least 7-days before the scheduled submittal date. If such notice is not provided, not less than seven (7) days will be added to the Government review time. More government review time may be added as determined by the CO. If the government is late in reviewing a submittal, the CO may allow an appropriate time extension at the end of the project.

Government Review: The Contractor shall provide not less than four (4) design submittals for CAFB review and comment. The government will evaluate each for conformance with the SOW and if previous CEPM comments are incorporated. The CEPM will transfer CAFB agency Review Comments either directly onto a copy of the drawings and/or a separate list. The first Submittal is the 35%. Each remaining submittal shall embody increased articulation of letter, intent and design consequences of the SOW and CEPM comments through CDs which are either 65%, 95% or 100% complete. Unless otherwise noted, CAFB will complete review and comment for 35%, and 65% design submittals in twenty-one (21) days and on 95% design submittals in fourteen (14) days.

Submittal Review Conference: Review conferences for each design submittal will occur the week after CAFBs review period and be located in the BCE Main Conference Room, unless the CO designates otherwise. The CEPM and 14CES representatives and Design Professionals will meet in person (not teleconferenced, etc.). The Review Comments will be used as an outline agenda. Each profession shall be represented at these meetings by no less than two DPs: first, the person who did the actual work (i.e. worked the most hours on the CDs); and second, their supervisor. DPs shall incorporate into the CDs any additional CAFB comments, suggestions or requirements stated in the Review Conference. Contractor shall take and distribute meeting minutes. Government Reviews or Review Conferences will not occur during the last two weeks of the calendar year or around Thanksgiving.

Review Comments: After a Design Review Conference, the CO will forward review comments in an MS Word or Excel file to the Contractor. Contractor shall add responses to the file and email the revised file to the CO and CAFB. Review Comments not incorporated into a subsequent submittal render that submittal incomplete. If for any reason a submittal's completion percentage is unsatisfactory to the CEPM, the submittal will be returned for Contractor to complete and resubmit. Contractor or DP disagreement with any CAFB review comments shall be

submitted in writing within seven (7) days of receipt of CAFBs comments. If a comment exceeds the contracted Scope of Work, then do not comply but immediately notify the CO in writing.

Design Submittal Requirements:

A. 35% Design Submittal:

Drawings shall manifest all design intent, embody all Document Requirements herein, and present sufficient detail to permit adequate review as satisfactory to the CEPM. Show existing site conditions and demolition work in complete detail and separate from new work drawings. The following are required:

Construction Drawings not less than 35% complete fully manifesting design intent. Enclose annotations of intent in rectangular boxes. Drawings shall include the following:

- 1) Provide an index of drawings.
- 2) Floor plans with layout of all spaces, including corridors, exits, and utility spaces. Emphasize and annotate special design items or deviations from standards. Show gross floor areas for each area of renovation including the Command Posts and CAT Rooms in Buildings 724 and 847 and Areas-A and B in Bldg-724. Indicate floor and roof framing and loading (Bid Options 1 & 2 only). Show doors, door types and provide door schedule. Show furniture and equipment layouts to ensure design functionality. Remove furniture layouts and labels prior to 100% Submittal, unless otherwise directed by CEPM.
- 3) Site or plot plans showing critical existing and new contours, drainage requirements, and relation of building exits to existing site elements including sidewalks, streets, driveways, parking, access roads, service areas, and utilities. Locate areas affected by construction.
- 4) A reflected ceiling plan showing all items of equipment which will be in the ceiling after completion of work, as well as the ceiling elevations above finished floor(s).
- 5) Utility layouts (i.e. electrical, water, sewer, gas) showing systems and connection locations.
- 6) Interior Elevations and Partial Exterior Elevations showing floor heights, windows, doors, building materials, and finished grades. Show cabinets and kitchen and bathroom fixtures on Interior Elevations.
- 7) Heating, Air Conditioning, Ventilation, Refrigeration and Plumbing: Locate and show space requirements for all existing and new mechanical equipment. Show single line diagrams of pipes and equipment and their locations, with approximate sizes and capacities. Provide schedules, plan views, side views, and sections necessary for adequate review. Outline Specifications shall include approximate capacities of all major mechanical and plumbing items with brief descriptions of function and systems operations.
- 8) Electrical including lights, power, communication, fire alarm and detection, and security systems: Show typical exterior and interior lighting layouts, proposed fixture types, fixture schedules, foot-candle levels, emergency and exit lights. Locate and annotate power devices and loads, metering, cables, raceways, distribution panels, transformers, generators, UPS equipment, switches, etc. Show communication outlets, equipment, raceways, panels, rooms, and cable runs. Show plans, sections, and details for lightning protection systems and other special grounding. Show layout of fire alarm, detection, and notification devices and systems. Use diagrams for power, lighting, fire alarm and security systems, and communication. Note significant short-circuit values and settings for adjustable protective devices.
- 9) Plans and Sections of structures, including framing, major details, etc.
- 10) Wall, roof and partition sections including facing materials, thicknesses and attachment methods.
- 11) In addition to the Preliminary Drawings, the 35% Submittal shall include:
 - a. Outline specifications that include all and only materials and systems to be used.
 - b. At each Design Submittal after the Design Concept Submittal, the CEPM shall provide finish color and material options for review by the CEPM along with all colors available for each finish material in the project. The CEPM will review and comment at each Design Review Conference until all finish selections have been made to the satisfaction of the government.
 - c. Detailed cost estimate.
 - d. Design Analysis.

- B. 65% Design Submittal: The following are required:
1. All items required in the 35% Submittal, revised and corrected as necessary to 65% complete.
 2. Specifications edited to include ONLY necessary sections.
- C. 95% Design Submittal: The following are required:
1. All items required in the 65% Submittal, revised and corrected as necessary to 95% complete.
 2. Construction Drawings complete including all previously submitted drawings with all previous review comments integrated; Completed CDs according to the construction document quality section of this SOW; Include all design in CD drawings (Shop drawings are not design drawings).
 3. Design Analysis complete including all previously submitted backup material revised as necessary. Include design calculations and explanations of design decisions not obvious to second party review.
 4. Specifications complete and bound with cover sheet sealed and signed by all DPs.
- D. 100% Design Submittal: The following are required:
1. All items required in the 95% Submittal, revised and corrected as necessary to 100% complete.
 2. CDs according to the Construction Document Quality section of this SOW, 100% complete.
 3. Final Design Analysis bound with cover sheet and signed by all DPs.
 4. Final cost estimate.
 5. Final Specifications complete and bound with cover sheet and signed by all DPs.
 6. Annotated 95% Review Comments.
 7. Annotated 100% Review Comments (if required).
 8. If CDs require corrections or are not 100%; (a) submittal will be declined with comments; (b) Contractor must incorporate all comments and resubmit to CEPM for more review; (c) Label subsequent Submittals 100%-A, 100%-B, etc.; (d) Label FINAL **only after** CEPM approves the last 100% submittal; (e) Repeat Steps (a), (b) and (c) until CDs are complete; (f) Do not begin construction until FINAL CDs have been approved and a Notice to Proceed (NTP) with construction has been issued by the Contracting Officer.
- E. Revisions of Incomplete CDs: The DPs shall correct and clarify errors, omissions, or ambiguities in the 100% CDs discovered any time after their approval by CAFB. DPs revisions shall be timely to prevent construction delays. The CEPM may mark-up corrections to CDs and forward copies to the Contractor. All corrections shall be made by the DPs and submitted according to this section of the SOW.
- F. Design Submittal Schedule: Complete work within specified time and deliver submittals to the CO according to the design schedule. The time needed by Government to review Design Submittals varies with the CEPM workload. Review periods set forth in completion schedules are the maximum times anticipated.
- G. As-Built Documents (As-BUILTS)
- 1) As-Built Types: Drawings; Specifications; Addenda; Change Orders and other modifications; Reviewed Shop Drawings, Product Data, Samples; Manufacturer's assembly, installation, and adjusting instructions.
 - 2) Project Scope Elements: Keep at all times As-BUILTS in Contractor project office, stored separately from documents used for construction. Promptly, legibly and accurately record field conditions and construction that differ from the Approved 100% CDs including field changes of dimension or detail, approved product substitutions (including manufacturer, model & number) on the As-BUILTS in red pencil or red ink. Mark product specifications with description of actual products installed, including: manufacturer's name and product model and number; product substitutions; Changes made via Addenda; and Modifications.
 - 3) Maintenance: Ensure complete and accurate entries for future Government reference. Keep As-BUILTS current with construction: update not less than daily. As-BUILTS may at any time be reviewed by the CMI to verify they are current and accurate. At CMI request, bring As-BUILTS to construction progress meetings. If As-BUILTS are not maintained, Progress Payment(s) may be refused until As-BUILTS are made current.
 - 4) Subsurface Site Elements: Show and dimension the correct horizontal and vertical locations of all discovered subsurface items including: depths of foundations relative to floor datum; and external and internal utility pipes, lines and conduit; and their sizes, types, changes in direction, below surface depths of runs, valves, splices, and boxes. Reference these lines and appurtenances to permanent surface elements, i.e. the As-Built Drawings shall show, by offset dimensions to two permanently fixed surface features, the end

of each run and each change in direction. Locate valve splice boxes and similar items by dimensioning along the utility run from a known reference point.

- 5) **Project Completion:** Submit completed As-Built Drawings Prior to Final Inspection, in the Required Formats (see below) to the Contracting Officer. Final Inspection and Punch-List will not be scheduled until the CO has received the As-Built.

5. DOCUMENTS:

- A. **Delivery:** Contractor shall deliver documents including CD-ROMs, hard copies and correspondence either by hand-delivery or shipped via overnight or second day to meet submittal deadlines. Send a transmittal letter with each submittal, noting the date, design percent, submittal type, list of items submitted, transmittal number and Contractor point of contact with telephone number and email address. Ship documents to:

14th Contracting Squadron
495 Harpe Boulevard, Suite
Columbus AFB, MS 39710

In addition to physical delivery, e-mail all design and construction submittals to the multiple CAFB addressees in the CO-provided distribution list including the CEPM. The CO may revise the distribution list at any time.

- B. **Requirements:** Submit **all Design Submittal documents** including 35%; 65%; 95%; 100%; Shop Drawings; As-Built (with final Payment Application); via paper (Hard Copy) and CD-ROM. The only acceptable electronic file media is CD-ROM. Submit three hard copies of each document along with two CD-ROMs. Each CD-ROM shall contain one copy of each document in each of the following file formats: ***.dwg, *.dwf and *.pdf**. Deliver hard copies and CD-ROMs together to CAFB. The following are required for each design submittal and other submittals as noted:

- 1) **Hard Copy Drawings:** Submit on D size (24"x36") heavyweight white bond paper (each set bound) with all writing clearly legible. Additional sets (and sizes) shall be provided as requested by the CO.
- 2) **Auto CAD™ Version:** If files output by Contractor Design Professional's Auto CAD™ version are more recent than the CAFB version can use, the Design Professionals shall convert its submittal files to the most recent *.DWF and *.DWG AutoCAD format accessible to the CAFB version.
- 3) **DWF File Format:** A set of drawings published to a single AutoCAD™ *.DWF file. Make layers accessible to AutoCAD™ Design Reviewer. Pre-set all *.dwf drawing plot viewport(s), layers, and line-types to exactly plot their corresponding Hard Copy sheet.
- 4) **PDF File Format:** An electronic set of drawings published to a single full-size highest-resolution *.PDF file using the latest version of Adobe Acrobat. Make layers on-off accessible in *.PDF. Each *.pdf drawing sheet shall plot output identical to its corresponding hard copy.
- 5) **Drawing and File Sequence:** The hard copy drawing sequence and the *.DWG, *.DWF and *.PDF file or folder sequence shall match the drawing sequence in the hard copy drawing index.
- 6) **Consistent Plots and Format:** Plot drawings to scales that legibly differentiate all line weights including, line types, hatching, shading, dimensioning, arrows, and lettering. Plot scales shall render visible all required construction information for each drawing. Each *.dwg, *.dwf and *.pdf drawing shall be identical to the corresponding hard-copy sheet. Pre-set each *.DWG, *.DWF and *.PDF file to plot output identical to its corresponding hard copy. Use only standard AutoCAD™ fonts (and Ariel) shall be used. Maintain a consistent drawing numbering scheme. Keep the number of layers to a minimum.
- 7) **Drawing Title Blocks:** Use the CAFB title block with the latest signature format on all drawings. The title block is available in *.DWG format from 14CES.
- 8) **Design Units:** The drawings shall use only Imperial (English) units.
- 9) **Cover Sheet:** CEPM will provide Contractor with a CAFB map covering the general project locations for the drawing cover sheet. DPs shall show and annotate Project Locations (Bldg-724 and Bldg-847), Haul Routes, CO-Bldg 730, Main Gate, South Gate, BCE-Bldg 385, and other items as directed by the CEPM.
- 10) **Other (including supplementary) Documents:** Three (3) Hard Copies. Burn onto the aforementioned two (2) CD-ROMs: two (2) each **PDF File Format** and latest *originating* software format files (e.g. Design Analyses & Specifications [MS-Word]; Cost Estimates, tables, charts, schedules, and graphs [MS-Excel]).
- 11) **As-Built Drawings:** Contractor shall provide the following:
 - a. **Hard Copy Drawings** conforming to above Requirement with the same name.
 - b. Three (3) 11" × 17" Hard Copy sets conforming to the above **Hard Copy Drawings** Requirement.

- c. Two (2) CD-ROM disks each containing three (3) complete sets of drawings in digital form:
 - One AutoCAD™ *.DWF file conforming to this section.
 - Add a folder to each CD-ROM containing one AutoCAD™*.dwg file for each CD Drawing. Arrange the files to match the sequence in the Hard Copy drawing index. Bind X-refs to *.dwg files so drawings are independent, and not supported by reference files. Pre-set all *.dwg drawing plot viewport(s), layers, and line-types to exactly plot the corresponding Hard Copy sheet.
 - PDF File Format conforming to this section.

C. Supplementary Documents: Although not necessarily part of the CDs, these documents are required to complete the project and shall be submitted according to the above item B Requirements: they include Product Data; Shop Drawings; Reference Drawings; Design Analysis; Asbestos Survey and Reports; Maps; Concrete Compression Test Reports; Lead-Based Paint Reports.

6. CONSTRUCTION DOCUMENT QUALITY:

The Construction Documents (CDs) shall be a fully coordinated unit of drawings and specifications completely and accurately describing the project to the satisfaction of the government. The CDs shall legibly present, identify, dimension and annotate every aspect of the project including the layout of spaces, the overall project form, distinct project forms, construction methods, location and distribution of all material, geometric, energy, and physical substances, elements and systems, and the relationships of all project aspects to one another and to the physical environment. Government CD evaluation criteria include the following:

- A. Independence: CAFB will not solicit bids from other contractors using the Contractor project designs. However, the CDs shall still meet the professional standards of accuracy and completeness necessary for the project as if being successfully competitively bid by independent Contractors.
- B. Completeness: CAFB reserves the right to review all construction. Therefore, the CDs shall contain all drawings necessary to both direct construction and support Government inspection by revealing in advance all details of the completed project. Anything to be built in the project must be shown in the drawings. Detail drawings as necessary to verify both shop drawings and conformance with the SOW. An unfinished part of the CDs may be completed by reference to other parts of the CDs (e.g., If a wall section does not show top-of-wall supports, then some other drawing in the set must exist that shows the top-of-wall supports).
- C. Consistency: All CD elements within and between professional disciplines shall combine to form one integral whole. Information in any part of the CDs shall not disagree or conflict with information in any other part of the CDs (e.g., Do not show one element on two drawings and on each note it as a different material). Coordinate drawings so two or more elements are not shown to occupy the same space (e.g., A sprinkler head should not appear within a light fixture on a Reflected Ceiling Plan). Only show project-applicable standard details and minimize wasted space on drawing sheets. Do not use shop drawings as design drawings.
- D. Constructability: The professional requirement that CDs represent the integration of physical elements, building methods, and interaction of finished construction with the environment necessitates the extra-geometric nature of design drawings (e.g., omitted CAD precision and exaggerated detail proportions may be necessary to visualize flashing overlaps). Ambiguity with respect to constructability is unacceptable. The government reserved right to review all intended methods of construction requires Contractor to make them all visible in the drawings. Drawings shall delineate construction that can be straightforwardly achieved through conventional construction methods (e.g., a 1/4" air cavity may be **drawn** behind face brick, but masons could far more easily and quickly lay face brick with a 3/4" cavity. A 30° precast edge is easily **drawn**, but almost impossible to build. Brick on elevations should be correctly scaled so locations and dimensions of wall objects and openings may be verified by counting brick).
- E. Conformance: Conform CDs to all project requirements including: The SOW including the CAFB design concept and all clarifications and modifications thereto including subsequent meetings, memos, telephone calls, and email communications; The Design and Construction Requirements; recognized Architecture and Engineering drafting standards and practices and by *Documents Requirements* (section 5-B).
- F. Rectifiable: If either Contractor or CAFB discovers CD deficits subsequent to 100% approval, regardless of whether time of discovery was prior or subsequent to issuance of the Notice to Proceed, Contractor shall

immediately correct the same deficits on the As-Built Drawings. All such CD corrections shall be submitted to the CEPM for review within one week of discovery. Corrections shall not be built until after CEPM approval. Any such revisions shall incur neither Contract time extension nor Government expense.

- G. **SPECIFICATIONS:** Develop according to the UFGS system. Require that the specifications override the drawings if the two conflict. Edit specifications to apply only to this project. Delete irrelevant specification sections, paragraphs and lines. Simplify specifications to the extent practicable. Critical items shall be covered in full scope to ensure quality construction and government verifiability thereof. However, for routine or simple items DPs shall use drawing notes to annotate important specification items or to replace verbose specifications.
- 1) When federal or military standards or specifications are referenced, the entire names of the references shall be cited including: annotations of applicable amendments, revisions, etc. and all related approval dates of issue, revision, amendment, or notice. Use the revision date listed in the Department of Defense Index of Specifications and Standards (DoDISS) and its supplements. Applicable DoDISS and supplement dates shall also be listed in the specifications. An example follows:
FS TT-P-38 (Rev. D; Am. 1) Paint, Aluminum,
15 Jan 85 Ready-Mixed
 - 2) CAFB prefers equipment specifications based on one manufacturer. When this is done, clearly state the name, catalog numbers, salient features etc. and compare with other manufacturers' equipment.

7. DESIGN ANALYSIS

The DPs shall include a design analysis in each design submittal and with the final Construction Documents (CD). Compile the design analysis on 8-1/2 x 11-inch paper except that 11x17 sheets may be used when required for graphs or other special calculation forms. All sheets shall be in reproducible form. Material may be typewritten, hand lettered, handwritten, or a combination thereof, provided it is legible to the CEPM. Left-Side Margin shall be 1-1/2 inches. Right-Side Margin shall be 1/2-inch. Top and Bottom margins shall be 1-inch. The analysis shall, in an orderly and logical manner accommodate review and, as applicable, include the following:

- A. **Organization:** Number each sheet sequentially and bind them in order under a cover. The cover and all page headers/footers shall bear the submittal date, project name, project number, and building number(s). Also, page headers/footers shall bear the professional discipline, subject, designer, and checker. Resubmit the CAFB-approved 100% Design Analysis bearing "FINAL DESIGN ANALYSIS" on the cover and on each page.
- B. **Index:** The DP shall develop an index of all required design elements. The index shall use sections and subsections, etc. The primary sections shall be the professional disciplines involved. The index shall appear immediately after the title page in the Design Analysis book.
- C. **Summary:** Brief description of work and declarations of Designer's assumptions.
- D. **Recommendations:** The analysis shall annotate all professional recommendations from all applicable disciplines including design elements requiring calculation of size and strength or rendering engineering decisions. Include the annotations immediately after the index.
- E. **Reports:** Include annotations, equations, tables used to develop the design. Provide equipment sizes and explanations of selection criteria including calculations.
- F. **Diagrams:** According to professional best-practice. Those showing designer intent shall be present both in the design analysis (can be hand sketches) and on the drawings (via AutoCAD).
- G. **References:** If possible, include in Design Analysis e.g. photos, maps or subsurface data. For others, list those used e.g. for computations, equations, tables, curves, etc.
- H. **Design Calculations:** If voluminous, bind them separately from the narrative part of the design analysis. Work shall be clean and legible. Add a title page and index for each set of calculations and a table of contents (an index of the indices) if there is more than one set. Identify document sources including references, loading conditions, supplementary sketches, formulae, and graphs. Declare all assumptions. Explain all conclusions. Calculation sheets shall bear the names of computer and checker and calculation and checking dates. The same person may not compute and check any part of the calculations.

- I. Software: When used to perform design calculations, include descriptions of software and copies of input data and output summaries. If large, divide output into logical volumes. Precede each set of computer printouts by an index and a description of the computation(s) performed. If several sets of computations are submitted, provide a table of contents (an index of the indices). DP is responsible for errors even if caused by the software. Software descriptions shall:
- 1) Explain the design method, including assumptions, theories, and formulae.
 - 2) Include diagrams, adequately noted.
 - 3) State exactly the computations performed by the software.
 - 4) Provide all necessary explanations of computer printout format, symbols, and abbreviations.
 - 5) Use adequate and consistent notation.
 - 6) Provide sufficient information to permit manual checks of the results
- J. Cost Analysis: The DPs shall provide comparative cost analyses to validate selections of utility types and sources, major equipment, building components, materials, construction methods, plumbing, lighting, heating, electrical systems, and interior and exterior finishes. Cost analyses shall project life cycle costs including O&M. The DPs shall practicably value engineer the project.
- K. Review Comments: Include prior submittal review comments and answers at the end of the Design Analysis.

8. COORDINATION

Design RFI Document: Submit in MS-Word format to CO each week from Design NTP until CDs approved FINAL. This document shall contain all DP questions, each with a unique item number (continue numbering from week to week), requesting DP's name, and a detailed question. CEPM will provide the requested information below each question and the document will then be returned to the Contractor. Contractor shall email the document to the CO.

If the CO requests a design change after the Design Complete Submittal drawings and specifications have been delivered, then this shall be considered a change and proper payment will be made by the CO.

If a design submittal is not of the required quality for the design phase, CAFB may return the submittal to Contractor so design quality can be rectified. The review time will begin when the submittal received is of the quality level required for the design phase required by the Government. Returned incomplete submittals will not be the basis of a claim by Contractor for additional time or money.

Design Progress Payments: The CO will authorize periodic payments to Contractor for the value of work performed to date. Payment amounts will be determined by the CO by comparing the Contractor's Request For Payment to the CIM evaluation of Contractor provided Progress Reports.

Surveying and Mapping: Contractor shall provide any necessary land surveys. All land surveying and mapping shall be performed or directly supervised by a Registered Land Surveyor. Any qualified survey person may perform construction layout surveys, but a registered surveyor must perform any benchmark or control surveys. The Registered Land Surveyor shall review and certify as correct all necessary survey work as follows: "I certify the data has been reviewed and meets the minimum standards for control surveys, National Map Standards and Project requirements" (signature and registration number).

End of Design After Award

DESIGN AFTER AWARD

ADMINISTRATION of CONSTRUCTION

1. PERFORMANCE CAPABILITIES

- A. Contractor shall keep *project exclusive* management and technical support personnel at a CAFB office throughout construction. One week prior to the start of work under this contract, Contractor shall submit in writing to the CO for approval the names and credentials of Contractor Project Manager, Contractor Site Superintendent, Quality Control Manager and all design subcontractors intended for use on this project. Subsequent proposed changes of approved personnel shall be submitted in writing to and receive prior approval from the CO before working on the project. Each of these personnel may upon CO approval hold additional onsite duties which shall not diminish their required performance. Contractor must demonstrate to the Government's satisfaction that proposed personnel exceed education, technical and experience levels of personnel described in this Contract including the following:
- 1) Contractor Project Manager (CPM) - Provide management of the prime contract to include subcontract purchasing and administration, review of material submittals and shop drawings. CPM shall have full authority to develop cost proposals, negotiate with Government and subcontractors, sign awards and modifications, supervise project superintendents, attend weekly CO/CE/PM Contractor status meetings as well as pre-performance site visits, pre-final and final inspections. The CPM must have a minimum of 5 years previous experience as primary contract manager or equivalent experience as a primary estimator and negotiator with a contracting firm engaged in similar multi-discipline commercial construction projects. CPM must also have not less than 5 years' experience managing subcontractors.
 - 2) Contractor Site Superintendent (CSS) - Provide on-site construction superintendent(s) to oversee all work under this contract. Site supervision shall be daily (constant throughout each day) and includes submission of detailed weekly progress reports, scheduling and coordination of subcontractors and material suppliers, and attendance at all construction progress meetings, CO site visits, and pre-final and final inspections. Superintendents shall have a minimum of 5 years previous experience as a project superintendent (exclusive of time employed as a tradesman or working foreman) for a general contracting firm overseeing one or more multi-discipline commercial construction projects. The superintendent shall be available within 15 minutes during all normal working hours, except for such incidental errands as required by his duties. The superintendent shall be responsible for the proper coordination and timeliness of the work, and for the proper workmanship of all trades; therefore, his absence from the project site without a suitable substitute Contractor representative shall be considered as damaging to the government.
 - 3) Quality Control Manager (QCM) - Provide quality control management for the project. QCM shall **be constant throughout each day** to ensure full compliance with all safety requirements, verification that work and materials in place and stored on site are in accordance with the approved construction documents, shop drawings and material submittals. QCM shall submit daily status reports recording activities at each project site, prepare and coordinate material submittal sheets and shop drawing submittals, schedule and coordinate testing procedures, prepare quality control reports for construction progress and other required meetings, and attend all pre-final and final inspections. QCM shall have a minimum of five years' experience in Quality Control Management of multidiscipline construction projects.
- B. Contractor shall have additional personnel including management, technical, service, labor or subcontractor, available as necessary to fulfill all construction contract requirements. The government may restrict employment under this contract of any personnel identified as a potential threat to the health, safety, security, well-being, or operational mission of CAFB and its population.
- C. Contractor shall be available by telephone 24-hours a day, 7-days a week and upon 15 minutes' notice during normal duty hours and 30 minutes' notice during non-duty hours shall meet the CO at a CO designated location.

2. COMMENCEMENT, PROSECUTION & COMPLETION

- A. Contractor shall start design and various construction phases at times specified by CO issued Notices to Proceed (NTP), prosecute the work, and complete the entire work within the Period of Performance.

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- B. Contractor shall provide a Submittal Log (Schedule of Material Submittals), Progress Schedules, Progress Reports, Status Reports and Barricade Plan.
- 1) **Submittal Log:** See Material Submittals and Shop Drawings below.
 - 2) **Progress Schedule:** (AF Form 3064) Submit weekly. Subdivide total schedule into individual work items. Show completed work percentages at the end of each reporting period. Submit first progress schedule to the CO within 7 days after Notice to Proceed (NTP) for construction.
 - 3) **Progress Reports:** (AF Form 3065) Submit Project Progress reports to the CO once a week on the first working day of each month. Describe the percentage of work completed during the report period. If behind schedule, report in writing what actions will be taken to regain the schedule. If the CO agrees to add days to the contract performance period, Contractor shall provide an amended schedule.
 - 4) **Status Reports:** Submit to the CO daily reports of the work status. In each report, list the tasks accomplished for that day, any deliveries received, equipment currently on-site, weather conditions for that day and number of personnel working on each area listed by trade. Photos may be included.
 - 5) **Barricade Plan:** Submit to the Airfield Manager for approval before starting any staging or work.
- C. **Period of Performance:** Is the period between the Design NTP and the time all construction is complete, including all punch list items, and final inspection is approved by the government. A multi-stage Period of Performance will be used to separate the different areas of construction outlined in the Summary.
- D. **Contract Completion:** At contract conclusion, vacate all work areas, including: Contractor offices, storage and staging areas, and individual work sites. Restore these areas to their condition prior to Contractor occupancy not more than 14 days from the earlier of: approved final inspection or CO notification.
- E. **Coordination and Project Conditions:** Schedule and manage submittals, materials, products, equipment, manpower, etc. to control all parts of the work efficiently and orderly. Verify compatibility of existing building utilities with new operating equipment. Coordinate required space, supports, and mechanical and electrical work shown (even if via diagrams) on Drawings. Follow routing shown for pipes, ducts, and conduit; place runs parallel with building lines. Maximize accessibility for maintenance and repair to other systems. Where possible, conceal wiring behind finish surfaces and co-locate fixtures and outlets with finish elements. Coordinate pre-Substantial Completion clean-up in separate building areas. After CAFB occupancy, coordinate site access to correct defective (or non-compliant with CDs), to minimize disruption of Government activities.
- F. **Cutting and Patching:** Only employ skilled and experienced workers to cut and patch. Report in writing to the CO wherever cutting and patching might degrade: safety; appearance, structure, weatherproofing, O&M, or separate Contractor or government construction. Prevent damage to existing or new construction and provide proper surfaces to receive patching and finishing. Match new finishes to existing adjacent surfaces unless noted otherwise. Maintain integrity of existing walls, ceilings, or floors; completely seal voids. Refinish entire assemblies and continuous surfaces to nearest intersection. Cut, drill, fit, seal, patch, etc. per CDs e.g.: mechanical and electrical penetrations; integration of new components with one another or with existing construction; removal and replacement of defective and non-conforming elements; remove samples for testing.
- G. **Special Procedures:** Employ skilled and experienced tradespersons to perform alteration work. Remove debris from open work areas and concealed spaces. Remove, cut, and patch to minimize damage and provide means of restoring products and finishes to original or specified condition. If a change of plane of 1/4 inch or more is discovered, submit recommendation to the CO for providing a smooth transition. Patch or replace portions of existing surfaces which are damaged or showing other imperfections. Finish surfaces as specified.
- H. **Welding Permits:** No cutting or welding shall be permitted without first obtaining a permit issued by the Base Fire Department. All fire and safety regulations are to be followed stringently. Contractor's failure to obtain a cutting or welding permit may not be reason for extending the contract performance period. Any damages incurred while welding work is done without a permit are the responsibility of Contractor.

3. SCHEDULING

- A. Contractor shall coordinate all work schedules and manage progress of work with the CO and CEPM prior to start of work. Weekly progress meetings will be conducted with the CO, CMI, and Contractor's team which may require corporate management representation at AFB discretion.
- B. Contractor shall schedule all work. Performance periods shall not be established or extended to accommodate insufficient personnel resources. Contractor will not move crews on and off the project while making minimal progress on concurrent projects as this shall be construed as having an inadequate work force to fulfill the contract requirements. Contractor's CPM and CSS shall not change more than two (2) times during project construction as this would demonstrate an inadequate management force to fulfill contract requirements.
- C. Before construction begins, Contractor shall agree with CO on a sequence of procedures; means of access to premises and buildings; materials and equipment storage space; delivery of materials and use of approaches, corridors, and stairways. Contractor may be required to revise the CD work-phasing schedule.
- D. Interference and inconvenience to government operations and personnel caused by project work including use and delivery of materials, tools and equipment shall be kept to a minimum.
- E. The Government may require that work, so far as practicable, be done in separate phases. Each phase may relate to a different occupied or unoccupied area, in which work in one area shall be completed before work in another area shall begin. Phased work areas shall be clearly delineated and annotated in the CDs.
- F. Hours of Work: Normal work hours shall be Monday through Friday from 7:30am to 4:15pm excepting days observed as Federal Holidays as listed below:
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|----------------------------------|-----------------------------|
| 1) New Year's Day | 1 January |
| 2) Martin Luther King's Birthday | Third Monday in January |
| 3) President's Day | Third Monday in February |
| 4) Memorial Day | Last Monday in May |
| 5) Independence Day | 4 July |
| 6) Labor Day | First Monday in September |
| 7) Columbus Day | Second Monday in October |
| 8) Veterans Day | Second Monday in November |
| 9) Thanksgiving Day | Fourth Thursday in November |
| 10) Christmas Day | 25 December |
- 11) Observe Saturday holidays the preceding Friday. Observe Sunday holidays the succeeding Monday.
- 12) For weekend, after hours, or holiday work, submit a 72 hour advance written request to the CO, describing dates, locations and types of work. AFB has the right to approve or deny the request. Work in AFB occupied areas during extra-normal work hours require AF escorts in the occupied areas. Modification to contract sum or period of performance will not be allowed.
- 13) The government's request for Contractor to work outside of the normal duty hours shall be justification for modification to contract sum or period of performance.
- 14) If AFB observes an unscheduled holiday, participates in training exercises, etc. Contractor may be prohibited from working for part or the whole of a day. 14CES does not know how many or when these activities might be scheduled, but anticipate not less than two per year. CMI will allow additional contract time for these disruptions. Zero-cost modification to period of performance will be allowed.
- G. Construction Schedule: Submit preliminary schedule to the CO at the Preconstruction Meeting, but not later than twenty-one (21) days after issuance of Notice to Proceed. After AFB review and comment, revise and resubmit schedule within fourteen (14) days. Upon approval by the CO, the schedule becomes the official Construction Progress Schedule. Keep a copy available at Contractor (field) Office. This schedule will only be changed with prior approval of the CO through a contract Modification.
- H. Construction Progress Schedule: Accurate and current bar chart having a separate horizontal line for each major activity of subcontractors, manufacturers, and suppliers. Vertical lines identify each week's first work day. Show entire construction sequence by activity, identifying separate work stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration of each activity. Revise chart weekly,

or as directed by CO, to accurately identify progress made, percentage completion, and projected completion date for each activity. Show activities modified and scope changes. Submit written report to identify problems, anticipated delays, corrective actions, and affected completion dates. Provide additional progress schedule information as requested by the CMI. Construction progress schedule update forms will be provided at the preconstruction conference. Submit Progress Schedule with each Payment Application and as requested by CO.

4. MANAGING

- A. Preconstruction Conference: at CAFB will be scheduled by the CO before issuing the NTP. Required attendees include the CO, Contractor, Contractor Project Manager (CPM), CEPM, and Contractor Site Superintendent (CSS). Contractor shall record meeting minutes and within seven (7) days after the meeting distribute two (2) copies to all participants and to all others affected by decisions made at the meeting. The meeting Agenda will be issued in advance by the CO and will include one or more of the following:
- 1) Execution of Government-Contractor Agreement.
 - 2) Submission of executed bonds and insurance certificates.
 - 3) Distribution of Contract Documents.
 - 4) Submission of Subcontractors list, products list, schedule of values, and progress schedule.
 - 5) Designation of personnel representing the parties in Contract.
 - 6) Discuss procedures for processing field orders, submittals, substitutions, payment applications, proposal requests, Change Orders, and Contract closeout.
 - 7) Construction Schedule
- B. Site Mobilization Meeting: Prior to Contractor project site(s) occupancy, the CO will schedule a meeting at which required attendants include the CO, Contractor, Contractor's Project Manager (CPM), Contractor's Site Superintendent (CSS), and major Subcontractors. Contractor shall record meeting minutes and within seven (7) days after the meeting distribute two (2) copies to all participants, and to all others affected by decisions made at the meeting. The Agenda for this meeting will include:
- 1) Government and Contractor Use of Premises.
 - 2) Government Requirements.
 - 3) Construction facilities and controls provided by Government.
 - 4) Temporary utilities provided by Government.
 - 5) Security and Housekeeping Procedures.
 - 6) Construction Schedules.
 - 7) Application for Payment Procedures.
 - 8) Testing Procedures.
 - 9) Record Documents Maintenance Procedures.
- C. Weekly Progress Meetings: with the CMI will occur throughout construction duration. Required attendants include the CO, Contractor, the CPM, and the CSS. Contractor shall record meeting minutes and within seven (7) days after the meeting distribute two (2) copies to all participants, and to all others affected by decisions made at the meeting. The agenda for these meetings will include the following:
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|---|--|
| 1) Review previous week's work progress. | Review minutes of previous meetings. |
| 2) Evaluate work quality and safety. | Review field observations, problems, and decisions. |
| 3) Construction Schedule update. | Corrective measures planned to regain projected schedules. |
| 4) Evaluate construction progress. | Identification of problems which impede planned progress. |
| 5) Work progress planned for the next week. | Effect of proposed changes on construction schedule |
| 6) Submittals: review status and schedule. | Review of off-site fabrication and delivery schedules. |
| 7) Other business | Quality and work standards maintenance |

5. MATERIAL SUBMITTALS and SHOP DRAWINGS

- A. Definitions: A **submittal** is a package of project information, samples, drawings, schedules, certifications, product data, shop drawings, etc., delivered to the CO for Government review. A **deviation** is a submittal wherein Contractor identifies an item that agrees with the intent of the CDs, but does not precisely conform to those documents and Contractor requests either substitution or change for the purpose of increasing the quality of the final product. A Submittal or Deviation of a system shall be considered as an integrated collection of component parts.

- B. Purpose: Submittals formalize Government review of Contractor choices in complying with the CDs and providing Minimum Installer Qualifications (see Section VIII). They also formalize Contractor's proposed Deviations, color choices, shop drawings, etc. early enough in the contract time when changes will have less impact on the ordering of materials and products.
- C. Accountability: Contractor is wholly responsible for the contents of a submittal. Contractor and Design Professional of record by act of submittal certify that all items listed or implied, fully meet the intent, materiality and requirements of the design, quality, and functionality of the CDs. Neither Contractor furnishing nor Government approval of a submittal shall either suspend or waive Contractor responsibility for full compliance with the CDs.
- D. Basic Compliance: Comply with all "Material Submittals and Shop Drawings" requirements of the SOW. Bulk Submittal: Deliver as many submittals as possible to the CO within twenty-one (21) days of 100% Design approval. Submittals not included in the Bulk Submittal period may be delivered later, but must provide adequate time for Government Review (see below).
Submittals shall be accurate, legible, with all detail necessary for a thorough review. Every copy of Product data shall clearly identify proposed models, options, and relevant design data including physical, functional, and utility connection requirements. Where practicable, render manufacturer data specific to this Project. Contractor shall review, approval stamp and sign **every** submittal before delivery to the CO. DPs shall review, approval stamp and sign all submittals **relevant to their profession** including shop drawings and multi-discipline coordination. Each submittal package and shop drawing sheet shall bear appropriate stamps and approval signatures before delivery to the CO. Each submittal shall be attached to a Material Approval Submittal (MAS) form (AF Form 3000). Multiple items submitted on one AF Form 3000 will be accepted or rejected together as a single unit (one rejected item means all items rejected). One copy of each reviewed submittal will be returned with its MAS form marked to indicate approval or disapproval.
- E. Government Review: Contractor shall deliver four (4) copies of each submittal. Contractor shall allow thirty-five (35) days for government review of Bulk Submittal excluding delivery time from and to Contractor. If any submittal needs to be returned by the CO before the thirty-five (35) days, Contractor shall so indicate in the Submittal Log. Submittals delivered after the Bulk Submittal period will be returned in fourteen (14) days excluding delivery time from and to Contractor.
- F. Submittal Log: Contractor shall during the design phase of the project log all construction submittals required by completing a "Schedule of Material Submittals" (AF Form 66). The form shall include all submittals necessary to insure the project is built to the satisfaction of CAFB including shop drawings, manufacturer's literature, product data, certificates of compliance, material samples, finish samples, extensions to the design, guarantees, test results, etc. The CO will provide Contractor with an AF form 66 template. Contractor shall complete and submit the AF Form 66 in MS-Excel electronic format and in hard-copy format to the CO for review and approval by the CEPM within fourteen (14) days upon issuance of the NTP. Form 66 shall be the first submittal item and shall be attached to its own (MAS) form. Place the entire Submittal Log in an appendix of the final specifications.
- G. Proposed Products and Qualified Installers List: Within 28 days after Notice to Proceed is issued, submit list of major products proposed for use, with manufacturer name, trade name, model or catalog number designation, and reference standards (for products specified only by reference standards) of each product.
- H. Product Data: Submit to CO for review and approval. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' data with information specific to this Project. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets service of functional equipment and appliances. After CEPM review and approval, provide record documents copies according to the *Documents Requirements* in Section-5 of *Design After Award* above.
- I. Material Approval Submittal: The CO will provide Contractor with MAS form template. Each MAS form shall be attached to one and only one submittal item. Multiple submittal items on a single MAS form will be rejected without review. The MAS "Submission Number" shall be the same as its corresponding "Item No." in the Submittal Log. Each submittal shall reference the specifications paragraph or the drawing sheet number where the submittal is required. Clearly mark an MAS form "DEVIATION" for any whole system or any part thereof to which the Deviation applies. The Deviation shall be reviewed by the CEPM.

- J. Re-Submittals: Resubmitted MAS forms shall bear the original “submission number” with an alphabetic suffix (sequenced for multiple re-submittals). Identify all changes made since the previous submission. Allow fourteen (14) days for government review excluding delivery time from and to Contractor.
- K. Materials, Finishes, Patterns, Textures, Colors, etc.: Submit samples of all visible exterior or interior finish items including: surfaces, materials, paint, fixtures, doors and frames, windows, glass, and hardware prior to ordering or installation. Contractor shall deliver the full range of available manufacturer samples via the CO to the CEPM showing all materials, finishes, patterns, textures and colors available for each item. Submit ALL samples at the same time. **Attach to each sample an AF Form 3000 with EEPZ Project Number, Project Name, a unique Submittal Number; Contractor, Subcontractor, and/or Supplier; and Drawing Number and Specification Section.** The CEPM will make selections and will keep one sample of each item submitted. Any non-compliance with this paragraph voids any selection regardless of CEPM approval to the contrary. Samples shall be the actual material, or actual material coatings bonded to the actual backup material that will be installed. Submittals with false or approximate material or color renderings shall be rejected. Sample sizes shall be sufficient for the CEPM to perceive true colors and patterns. If a submitted material does not meet the design objectives, CAFB reserves the right to reject the product and require a new submittal. The CEPM decision in this regard shall be final.
- L. Certifications: Submit all Contractor, subcontractor, fabricator, and manufacturer certifications for review and, if acceptable, approval by the government. Denote the specified requirements met or exceeded by the certified element provided whether material, construction system, portion of work, product, equipment, etc... Include supporting references, data, affidavits, certificates, etc. Certifications may be recent or previous test results on the same provided element, but must be acceptable to Government.
- M. Manufacturers Information: For each manufactured product provided in this Project, submit three copies of all manufacturers printed instructions for delivery, storage, assembly, installation, adjusting, finishing, and usage to the Government. Submit three copies to the CO of any manufacturer’s field report within 30 days of manufacturer’s field visit and observations.
- N. DD Form 1354: Contractor shall submit a completed DD Form 1354, *Transfer and Acceptance of Military Real Property* to the CO prior to final punch-walk.

6. WORK by GOVERNMENT

- A. The government reserves the right to accomplish work using government or Contractor work forces other than those contracted for the Project, as the Government deems necessary or desirable, and so doing will not breach or otherwise violate the Project contract. The Contractor may be required to coordinate work with one or more other Contractors in order to complete the Project. CAFB will remove existing furniture and office partitions; Contractor shall remove all built-ins including built-in furniture and cabinets.
- B. Materials designated Government Furnished Contractor Installed (GFCI) will be furnished by the government and installed by Contractor. The CO will designate which of these GFCI materials will be delivered to Contractor for storage at the construction site and which Contractor shall transport from a government storage area (on base) to the construction site. Contractor shall protect all Government furnished items from damage during transport, storage and installation and shall replace damaged items with same items of equal or greater value at no cost to the Government. Contractor shall return all uninstalled Government-furnished materials or equipment to a CO designated area on CAFB at no cost to the Government.
- C. Contractor shall bear responsibility for any existing Government material or equipment to be removed and reinstalled. Contractor shall protect against damage or loss any government equipment remaining at construction sites. Government equipment damaged or lost while stored or moved by Contractor shall be replaced by Contractor with equal or better equipment.

7. PRE-FINAL and FINAL INSPECTION

- A. Contractor may request a pre-final inspection purposed to obtain government assistance in identifying potential problems prior to final inspection. However, any discrepancies identified at the pre-final inspection must be completed before the final inspection.

- B. Contractor shall schedule final inspection NOT LATER than the contract completion date unless precluded by government scheduling problems. Before requesting final inspection, Contractor shall submit to the CO project close-out documents including: hard-copy and CD-ROM as-built drawings, all test and recycling reports, O&M manuals, DD1354 package, and a quality control (QC) report signed by his QCM listing any discrepancies. Contractor shall submit a written request for final inspection to the CO a minimum of 36 hours prior to the requested inspection date. The request shall include certification that Work is complete according to the CDs and ready for CO review. If the CO approves the request, Submit final Payment Application identifying total adjusted Contract Sum, previous payments and payment remaining due.
- C. The QCM, Contractor's superintendent and CO will conduct the final inspection. Contractor and subcontractors shall correct discrepancies and punch-list items within the time limit specified by the CO. In undertaking a final inspection, if the Government determines the project unsuitable for final inspection, the CO will end the inspection and not less than 24-hours shall pass before the final is rescheduled. If, due to one or more such terminations, the actual final inspection date is later than the contract completion date, Liquidated Damages (LDs) may be assessed before the rescheduled "final" inspection. Contractor shall submit each request for rescheduled final inspection in writing to the CO.
- D. The CMI and CEPM are the designated representatives of the CO for the purpose of technical surveillance of workmanship and inspection of materials for work performed under this contract. This designation in no way authorizes anyone other than the CO to obligate the government to changes in the terms of the contract. All field changes must be approved by the CO prior to accomplishment. Government inspections or related comments shall neither constitute QC nor in any way either substitute or supplement Contractor's QCM responsibility. CMI shall conduct inspections, but only the CO may authorize final acceptance.

8. WARRANTY

- A. Minimum Installer Qualifications: Prerequisite to all warranty and required on every aspect of this project are demonstrated Minimum Installer Qualifications including: Proof of at least three years of membership or trade-related organization, Documented five years of experience and five jobs of similar size, complexity and cost, Proof of manufacturer certification that the installer is qualified to perform the work specified, and Letter from a DP (not directly involved in the project) that they are familiar with the installers work and the installer has demonstrated the necessary skill and workmanship to work on this project.
- B. Standard Warranty: Provide a materials and workmanship warranty for all work for not less than one year from time of project acceptance by the government. Roofing shall have a no-dollar-limit joint subcontractor & manufacturer full-system warranty for water-tightness for not less than 20-years. In addition
- C. Exceptions to Standard Warranty: Where this SOW requires longer warranties for one or more products or systems, the extended warranties shall supersede the Standard Warranty, but in no case shall any item in the project be warranted for less than the Standard Warranty. Whenever products or systems offer a warranty greater than the Standard Warranty, Contractor shall pass the greater warranty in full to the Government.
- D. Equipment Data:
- 1) Major Equipment: Provide a list of all equipment furnished and installed under this contract. This list shall include each piece of equipment having a serial number. Each listing shall positively identify the piece of property by including all the following information as applicable: date installed/replaced, warranty/guarantee expiration date, item installed, type, model, serial number, style, voltage, cycles, horsepower, size, quantity, frame, item cost, item replacement cost, and location of item/equipment. This list shall be furnished to the contracting officer as one (1) reproducible and three (3) copies at the contracting officer's request any time during the contract
 - 2) Major equipment includes air conditioners, air handlers, transformers, and electric motors, compressors, condensing units, chillers, exhaust fans, generators and transfer switches. Contractor shall place an Equipment Warranty sticker on all equipment furnished and installed under this contract.
 - 3) This is not meant to include: light switches, fixtures, relays, valves, and such material items as: piping, insulation, and minor component parts of larger assemblies

- E. Contractor and Subcontractors shall perform any warranty related work according to all manufacturer specifications and recommendations so as not to reduce or void any warranty. Contractor shall transfer all manufacturer warranties to the government on a submittal AF Form 3000 prior to project closeout.
- F. Emergency Repair: Failure of any mission essential work under warranty constitutes an emergency and Contractor shall complete repair work not less than 48-hours from notification by the CO. Contractor must complete corrective repair(s) not later than a date to be established by the CO. If not responsive in a timely manner, Contractor may be charged for Government to complete repairs.
- G. Non-Emergency Repair: Contractor shall respond within 48-hours and affect corrective action in such timely manner as to minimize down-time and mediate inconvenience to any CAFB employees. CO's determination of appropriate time to complete repair(s) shall govern.
- H. Contractor Non-Responsiveness: If Contractor fails to respond to notifications, the CO will find repair methods and seek restitution through legal means including through Contractor bonding agents.

9. CONTRACTOR OFFICE

- A. Provide ready-for-occupancy Contractor Field Office within twenty-one (21) days from Notice to Proceed. No contractor employee may reside at CAFB.
- B. No CAFB building will be available for Contractor who shall therefore provide a temporary office on CAFB. At the Pre-Construction Conference the CO will designate a site for Contractor's installation of a temporary office on CAFB (not less than 30' from existing structures). Proposed improvements including extensions of utility lines into this area shall be approved by the CO prior to installation. Contractor shall bear all expenses of these improvements and temporary office. Prior to contract completion, remove buildings, foundations, and utility services and restore all areas thereby affected to their original condition.
- C. Contractor's office shall be a weather tight standard manufactured structure, with floors raised above ground, securely fixed to foundations, with steps and landings (that are well lighted) at entrance doors, having a clean appearance and color (inside and outside) that are aesthetically acceptable to the CEPM with no patches, broken windows, dirt, rust, etc. with trailers having skirts to grade. As necessary, fill and grade to drain site away from office. Contractor is responsible for and pays for all site work and setup.
- D. Provide and maintain the office with services and equipment including working HVAC equipment to automatically maintain 68° heating and 76° cooling, electric lighting, electrical receptacles, fire extinguishers, and adequate lighting (50 fc at desk top height). Provide drawing display table and space for Project meetings with table and chairs to accommodate 6-8 people.
- E. Provide office with items including a facsimile machine, Email address, and telephone service (may be cell) so Contractor employees may be contacted at all times during normal duty hours. Provide CO with an emergency phone number so Contractor can be reached at all other times. All installation, connection and operation costs of these items including utilities, phone, computer, and internet and office security shall be provided at Contractor's expense. All on-base connections shall be coordinated and monitored by the CO.
- F. Contractor shall furnish its own housekeeping and janitorial services for office space. At all times maintain in clean and orderly appearance the interior and exterior of Contractor base office. Trees and shrubs shall be kept trimmed and regular mowing shall keep grass and other ground cover to not more than 4" height. Maintain approach walks and steps free from mud, water and snow.
- G. Contractor shall provide a commercially produced white painted metal job sign on the office bearing Contractor's name and project name in four-inch high black lettering.

10. CONSTRUCTION SITES

- A. Temporary Power: Provide all necessary electrical connections including temporary transformers, utility poles, cable, weather-heads, panels, and any other electrical items needed for construction. Final electrical hookup shall be done after approval of the Contracting Officer, and with a minimum written twenty-one (21)-day notification of hookup. All electrical work shall conform to the latest editions of the National Electrical Code (NEC) and the National Electrical Safety Code (NESC). Any hookups to the exterior electrical system (anything outside the building demarcations) will be done by or under the inspection of 4-

County Electric Power Association. Requests for any exterior work must be submitted to the 14CES Electrical COR not less than 21-days in advance. Weekends and holidays are not included in the 21-days.

- B. Neat and Orderly: Maintain construction sites neat, clean, and orderly. Clean site at each day's end from job site debris, waste, and rubbish (job-generated or blown-in), and dispose of properly and remove tools and equipment from passageways. Do not leave or enclose debris, waste or rubbish in pipe chases, plenums, attics, or other closed or remote spaces. Contain dust within project site (plastic barriers) and prevent it from moving into occupied areas. Broom and vacuum interior areas prior to start of surface finishing, and keep dust away from finishes. Contractor shall bear final clean-up costs. At end of project, return all construction-affected non-project elements to original condition (including accesses, grass, dirt, sprinkler systems, etc.).

Prevent pests and insects from entering the building renovation areas. Keep all facilities, equipment, and vehicles fully serviced and usable. Daily remove from site rusted, broken, torn, bent, or otherwise objectionable elements, equipment, material, dumpsters or vehicles. Only normal operator maintenance on Contractor vehicles is allowed on site. Maintain trees and shrubs trimmed, grass regularly mowed and other ground cover not exceeding 4" in height: remove clippings or mowing debris on the day of maintenance. If the CO determines the site is unsafe due to clutter or debris, the CO may immediately halt construction and the site shall be cleaned by Contractor without delay to the project deadline.

- C. Parking: As approved by the CMI, locate temporary on and/or off site contractor parking and restrict construction parking to these areas only. Provide barriers to separate construction from base parking and post "Construction Paring Only" signs. Do not allow heavy vehicles, construction equipment or staging in parking areas. Keep parking areas free from mud, dirt, snow, ice, etc. Repair damaged paving including air breaks, potholes, low areas, standing water and other deficiencies, to maintain paving and drainage in their original condition. Repair all adjacent areas damaged by use of parking, to their original condition. Do not allow contractor vehicles to park or drive on grass at any time without prior approval from the CO.
- D. Noise Control: Contractor shall comply with all applicable state and local laws, ordinances, and regulations relative to noise control. The government may require that operations that generate excessive noise be scheduled at other than standard work hours. In Bldg-724 "noise" is sound which can penetrate existing second floor construction and this noise is not permitted: On any Wednesday; 07:00-12:00 Mondays, Tuesdays, Thursdays, and Fridays; During any additional meetings for which contractor will be given 12-24 hour advance notice; Emergency meetings for which contractor will be given no advance notice.
- E. Site Storage: As approved by the CMI, locate an exterior area to store all equipment and supplies in a manner that precludes theft or damage of any kind (including mechanical, fire, and climatic). Provide ample fire extinguishers at the storage area(s). Provide environmental conditions necessary to protect materials and products from wind, rain, excessive heat or cold and contact with ground including: wrapped tarps or climate controlled storage shed(s). Keep stored materials sorted, separated and neatly stacked, and provide adequate space and light for maintenance and inspection of materials and products. Locate construction equipment and vehicles in one area of the site. Provide a new six-foot high chain-link security fence (and an optional top outrigger of three-strand barbed wire) with vehicular and pedestrian gate(s) with locks. Always keep vegetation clear from the fence. Periodically clean, maintain, and inspect all storage areas and stored equipment products and materials. Keep approach walks free from mud, water and snow.
- F. Dumpsters: Trash, debris or other refuse within the work areas shall not be visible, but shall be fully placed into (never overflowing) approved dumpsters or other manufactured disposal receptacles. Place receptacles within work areas, inconspicuous from the main roads, as approved by the CMI. Refuse from the project shall not be dumped into government dumpsters. Construction refuse found in government dumpsters shall immediately be removed either by Contractor or by the CAFB at Contractor's expense as directed by the CO. Before the end of project and prior to final inspection, the receptacles shall be removed by Contractor who shall restore exposed dumpster-covered surfaces to equal or exceed their original condition.
- G. Hauling Trash and Debris: Contractor shall dispose of all trash and debris via sanitary landfill or other approved method conforming to all local, state, and federal guidelines and regulations. All refuse removal trucks shall be covered and secured prior to leaving job sites. If any materials fall from the trucks, they shall be stopped and reloaded to prevent falling debris. Contractor shall bear all liability for any damage or

injury resulting from falling debris. Certified dump tickets, including cost, for all waste disposals marked with the project number shall be submitted to the CO for all waste disposals.

- H. Access and Haul Routes: Propose and obtain prior CO approval for hauling and site access thoroughfares and confine construction traffic to these routes. Provide traffic control at CO designated areas of haul routes to minimize interference with normal CAFB traffic. Off-site streets and parking lots soiled by mud, dirt, debris, foreign objects, or spills caused by Contractor shall be cleaned off the same day. Keep parking aprons, taxi-ways and sidewalks used to access work or staging areas clean and clear of all foreign objects and debris at all times.
- I. Vehicle Access: Build any necessary temporary all-weather access roads (with prior CO approval) from existing pavement to serve construction areas, of width and load bearing capacity to provide unimpeded construction traffic. Provide and maintain 20 foot wide driveways with unimpeded access to fire hydrants, control valves and for emergency vehicles. Remove all mud from vehicles before they enter paved areas.
- J. Concrete Truck Cleaning: CAFB has no approved concrete truck clean-out sites. Washing-out of on-site concrete trucks may be done only into Contractor-owned dumpsters. If concrete trucks are cleaned out anywhere else on base, clean-up charges will be billed back to Contractor.
- K. Trees, Shrubs, and Hedges and other Plants: Provide barriers to prevent injury to any plant not designated for removal within or near the project site or haul routes. Do not fasten ropes or cables to any existing trees. Vehicles or equipment shall never be driven or parked within the drip line of any tree. Obtain written approval from the CO before removing or pruning any plant. Smaller plants including shrubs, hedges or trees damaged during construction, shall be replaced with plants of equal size, type, and value with a one-year warranty at no expense to the government. Larger trees damaged during construction shall be recompensed with a number of smaller trees with an aggregate area of noon-shade equal to the larger tree. Damaged or destroyed plants shall be replaced between 1 November and 1 April.
- L. Special Excavation Requirements: Contractor shall obtain a permit (AF Form 103) prior to any excavation and shall provide drawings showing exact location and description of the proposed excavation. The Government will help the CPM/QCM obtain excavation permits. The government will make a reasonable effort to locate and identify buried lines. "In the area" shall mean "three (3) feet in all directions", except when the CO indicates otherwise. Any lines flagged or painted on-site or identified on the drawings or digging permit shall be avoided by Contractor whenever possible.

Call 811 to locate all utility lines in advance. Be extra careful when work is near underground lines and, if any line is broken Contractor shall bear all excavation or repair expenses. Immediately notify the CO if any utility line is damaged and also immediately notify the fire department if any gas line is damaged or broken. If a line is broken that was not marked by 811 services or identified on drawings or permit, repair costs will be borne by the Government, unless the CO determines otherwise. If responsible for the damaged line, Contractor shall **IMMEDIATELY** repair the line to its prior condition at no cost to the Government. Contractor shall maintain all marks provided by Base CE or 811 services for the project duration. Any utilities discovered during excavations that are not shown on the drawings shall be drawn and annotated on the As-Built drawings.

- M. Protecting Installed Construction: Protect installed work, especially where and how specified in the CDs, including: Provide temporary protection for installed products. Control activity in immediate work area to prevent damage. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect with durable sheet materials finished floors, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects. Restrict traffic or storage on waterproofed or roofed surfaces. Obtain and comply with all manufacturer recommendations for protection of installed equipment, products or materials.

11. CONSTRUCTION EQUIPMENT

- A. All Contractor-supplied equipment is the sole responsibility of Contractor. The government is not liable for theft, vandalism, or damage to any Contractor supplies or equipment on CAFB. Secure and protect all materials and equipment from damage. Do not leave equipment unattended anywhere on CAFB.
- B. Equipment and Vehicles: Those used on base shall be safe and in good operating condition. The CMI may at any time inspect and reject any on-base equipment they consider unsafe, in poor operating condition, or

inappropriate for work. Immediately notify the CO of broken down Contractor equipment on CAFB. Move broken down equipment to a CO-designated location within 24-hours. Keep any construction equipment with metal wheels or tracks (i.e. roller, excavator etc.) off CAFB paved areas. All equipment shall be trailer hauled to and from construction sites. Prevent loading pavement beyond design capacity which is greater than or equal to the legal capacity of local roads accessing CAFB.

12. AVAILABILITY of UTILITY SERVICES at JOB SITES

- A. Water: Subject to available supply, the Government, without charge to Contractor will from existing outlets and supplies furnish reasonable amounts of potable water. Conserve water. Provide temporary pipe insulation to prevent freezing. Contractor, at its own expense, shall install and maintain necessary temporary connections and distribution lines and shall remove the connections and lines prior to final acceptance of construction. Water services may not be available at or adjacent to Contractor's staging, storage or office areas, but may be obtained from an outlet as designated by the Contracting Officer.
- B. Electricity: The CAFB exterior electrical system is privatized and is the property of *4-County EPA*. Designs that install, alter or connect to the system must incorporate the *4-County EPA* design standards. The 14CES Electrical COR is the *4-County EPA* liaison and POC for the Contractor. Electricity is available subject to approval from the 14CES Electrical COR. *4-County EPA* must review and approve design submittals for any construction that requires an upgrade, connection to, or disconnection from the System. Contractor must allow fourteen (14) days for this review. Request hookups not less than 21-days in advance. Costs will be determined by *4-County EPA* as negotiated with the 14CES Electrical COR and all costs shall be borne entirely by the Contractor. Electricity extending from lugs of the existing transformer will be without cost once lug connections have been made. Transformer is the property of *4-County EPA*. Do not disrupt CAFB service without prior 14CES Electrical COR approval. Contractor shall, bearing all expenses, install and maintain temporary connections and distribution lines and shall remove the connections and lines prior to final acceptance of construction. All electrical work shall conform to the latest editions of the National Electrical Code (NEC) and the National Electrical Safety Code (NEC).
- C. Sanitary Provisions: CO will designate spaces near the building site for sanitary facilities provided the Contractor provides housekeeping and maintenance during construction. If the CO is not satisfied with the condition of the restrooms, this permission will be rescinded. Existing facilities may not be used. Contractor shall at its expense provide and maintain temporary facilities and necessary appurtenances and shall remove same prior to final acceptance.

13. TEMPORARY UTILITIES

- A. Temporary Electric Wiring: shall meet the requirements as established below and shall be installed, maintained, and removed by Contractor at no expense to the Government. Skilled electrical tradesman shall accomplish work. Do not disrupt any CAFB use of service without prior CO approval.
- B. Temporary Power and Lighting: Contractor shall provide construction power according to the safety requirements of the National Electric Code, NFPA 70. Enforce all electrical safety requirements for subcontractor work. All 15 and 20-Amp outlets not part of the permanent building or structure wiring, shall have ground fault circuit interrupters (GFI) for personnel protection. GFI shall be provided for extension cords and for all permanent receptacles that are not properly grounded. Provide and maintain construction lighting of not less than 2 watts/ft², exterior staging and storage lighting of not less than 1 fc, and after-dark interior lighting of not less than 0.25 fc. Do not use permanent building lighting during construction.
- C. Heating Cooling & Ventilation: Provide and maintain heating and cooling devices needed to maintain construction operations. Provide these devices with regular preventative maintenance including new filters, lubrication, and parts replacement. Maintain a maximum ambient temperature of 80°F and a minimum ambient temperature of 55°F where construction is in progress. Ventilate enclosed areas to cure materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Construction Tools and Equipment: Superseding other requirements, temporary wiring conductors installed for operation of construction tools and equipment shall be either Type TW or THW contained in metal raceways or shall be hard usage or extra hard usage multi-conductor cord. Temporary wiring shall be

secured in a workmanlike manner above the ground or floor without obstructing movement of personnel or equipment. Open wiring may only be used outside of building and according to the provisions of the NEC.

- E. Removal Prior to Substantial Completion: Remove temporary utilities, equipment, facilities, and materials, prior to final inspection. Remove underground installations to a minimum depth of 2 feet. Grade site as required. Clean and repair damage caused by installation or use of temporary work. Restore existing site and facilities to remain to original condition before construction.

14. CONSTRUCTION SECURITY

Security Program: Protect Work including construction site, construction office and all construction material, tools and equipment from damage, theft, vandalism, and unauthorized entry until project is turned over complete to the government. Submit a construction security program coordinated with CAFB's existing security services and obtain CO approval for project mobilization. Maintain program throughout construction until CAFB occupancy.

Entry Control: Restrict entry of persons and vehicles into Project site(s) to authorized persons with proper identification. Coordinate access control with CAFB security forces.

Use of Electromagnetic Emission Devices: Electromagnetic emission devices include: radio/RADAR transmitters, navigational aids, instrumentation's, signaling, intrusion detection and identification devices, mobile and fixed business radio communication equipment, and Military Affiliate Radio Station (MARS), Citizen Band (CB) and amateur radio stations. Contractor shall comply with the AFMTC Regulation Sup 1 to AFR 700-14 which is available for inspection at the Communications Squadron, Bldg 900, CAFB, MS.

Airfield Requirements

- a. Contractor shall contact 14 Civil Engineering Squadron, Columbus AFB, or Base Operations for construction restrictions involving the flight line, taxiway and runway areas and shall comply with Air Force Regulation 55-48 (AFR 55-48)
- b. Two-way radio contact on VHF Radio is required for all vehicles, equipment and personnel working on the flight line, taxiways and runways. The government will provide radios when they are required.

Contractor Restrictions

- a. Unauthorized Reconnaissance: Contractor access to areas outside of the immediate work area (excluding restrooms near the work site, public eating facilities, direct haul and access routes, CO and CMI, and points of supply and storage) is prohibited. Persons engaged in unauthorized reconnaissance of other Contractor or government activity will be referred to the CO for disposition.
- b. Cameras: Cameras and photographing are forbidden on CAFB except by prior written approval of the CO.
- c. Toilet Facilities: Contractor personnel will not use building facilities.
- d. Smoking in AETC Facilities or on Site: The Base Commander has restricted smoking of tobacco products on Base to designated smoking areas only. Contractor and Subcontractor employees and visitors are subject to the same restrictions as government personnel. AFI 40-102, Tobacco Use in the Air Force, and its AETC supplement 1, outline the procedures used by the commander to control smoking on Base.

End of Administration of Construction

ADMINISTRATION of CONSTRUCTION

QUALITY REQUIREMENTS

Present to CO a Quality Control Plan (QCP) that ensures all Work adheres to required standards and CDs. The QCP shall include: who is responsible for quality inspections; acceptance or rejection processing; documenting and resolving deficiencies; trend analysis; corrective action identification; and coordination with CAFB inspectors. After award the QCP becomes a compliance document for the entire project. The QCP shall specify Contractor inspection items and frequency (not less than daily). CAFB may require changes to the QCP during the life of the project.

- A. Contractor is responsible for project quality control, from design through completion. Provide and maintain a comprehensive Quality Control Program to insure that all materials and workmanship fully comply with the CDs. CAFB inspections do not constitute de facto quality control for Contractor on this project. The QCP includes:
- 1) Monitor quality of suppliers, manufacturers, products, services, site conditions, and workmanship.
 - 2) Insure all completed new construction is protected from damage, deterioration or degradation of any kind.
 - 3) Thorough compliance with manufacturers' instructions and tolerances (if manufacturers' instructions or tolerances conflict with Contract Documents, obtain CEPM clarification before proceeding).
 - 4) Application of more stringent standards, tolerances and codes, whenever two or more disagree.
 - 5) Verify work is performed only by personnel qualified to produce the specified quality.
 - 6) Verify field measurements exactly correspond to CDs, Shop Drawings or manufacturer instructions.
 - 7) Verify connections and use anchors designed to withstand stresses, vibration, distortion, or disfigurement.
 - 8) Prevent the accumulation of product fabrication and installation tolerances.
 - 9) Monitor and adjust product dimensions and positioning before securing in place.
- B. The QCP shall incorporate both acceptable work quality and government inspections. Contractor shall inspect and document all work quality compared to the minimum standards. Documentation shall include completion and submittal of a "Contractor's Quality Control Report (QCR) Daily Log of Construction – Military" to the CE Inspector each day. QCP standards and reference actions include:
- 1) Comply with related association, trade, or other consensus standard for products or workmanship, unless applicable codes are more stringent.
 - 2) Conformance to reference standards whose issue dates precede the final Contract Documents date, unless code sets a specific date.
 - 3) Obtaining copies of standards where required by product specification sections.
 - 4) If specified reference standards conflict with CDs, obtain CEPM clarification before proceeding.
 - 5) Corrective Actions for Defects in the Work including:
 - a. Replace the Work, or portions of the Work, not conforming to specified requirements. The Work or portions of the Work shall both be referred to as "Work" or "the Work".
 - b. If, in the opinion of the CMI, it is not practical to remove and replace the Work, the defective Work may remain, but the CO will direct an appropriate remedy or determine a payment adjustment.
 - c. The authority of the Government to assess the defect and determine payment adjustment(s) is final.
 - d. Rejected Products: Payment will not be made for rejected products for any of the following:
 - i. Products wasted or disposed of in an unacceptable manner.
 - ii. Products determined as unacceptable before or after placement.
 - iii. Products not completely unloaded from the transporting vehicle.
 - iv. Products placed beyond the lines and levels of the required Work.
 - v. Products remaining at work site(s) after completion of the Work.
 - vi. Loading, hauling, and disposing of rejected products.
- C. Quality Control Manager QCM: The Quality Control Manager shall direct Contractor's QCP and shall be responsible for plan administration and inspection of work. The QCM shall during normal duty hours be available to meet with the CO upon 30 minutes notification at a location selected by the CO.
- D. Materials Testing: If required by the Construction Documents, Contractor shall employ and pay for services of an independent testing agency or laboratory acceptable to the Government. Within seven (7) days of NTP issue date submit: testing laboratory name, address, and telephone number; and names of full time registered Engineers/specialists and responsible officer; and a copy of the most recent laboratory facilities inspection report

made by Materials Reference Laboratory of National Institute of Standards and Technology, with memorandum of remedies of any deficiencies reported by the inspection.

- 1) All tests of materials or systems shall be certified and submitted in the original form.
- 2) Concrete compressive strength test cylinders or borings shall be taken in the presence of, and at the times and locations designated by the CMI. Contractor shall notify the CO 36 hours prior to any concrete placement. The CO shall notify the CMI 24 hours prior to concrete placement. Contractor shall immediately label test cylinders legibly with black permanent marker indicating cylinder number, project number, and date.
- 3) Perform compaction tests of fill material in the presence of the CMI, who will specify each test location. Compaction tests will be required for each lift. Contractor shall notify the CMI at least 24 hours in advance of each test and results of any compaction test performed without the CMI present will not be accepted.
- 4) Inspections, tests, and reports of lab test results made by Contractor, and Contractor agents shall be furnished according to the Project specifications. Contractor shall bear all costs for tests required for quality assurance. Government requested tests beyond those required by the CDs, the QCP or standard industry practice will be paid by the Government. Copies of environmental related test results shall be to the CO via Submittal.

E. TESTING and INSPECTION SERVICES

- 1) Testing Consultant: Contractor shall employ an independent firm to perform tests, inspections and other services specified in the Construction Documents and as required by the CMI. Testing equipment shall be calibrated at reasonable intervals with devices of accuracy traceable to the National Institute of Standards and Technology or to professionally accepted values of natural physical constants. Testing, inspections and source quality control may occur on or off the project site. Employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with the Construction Documents.
- 2) Contractor Responsibilities: Assist testing firm with incidental tasks; furnish samples of materials, design mix, equipment, tools, storage; and provide safe access. Notify CMI and testing firm 24 hours before services required. Pay testing firm for required additional tests and samples. Re-testing or re-inspection required because of non-conformance to CDs shall be performed by the same independent firm as directed by the CO.
- 3) Agency Responsibilities: Test samples of mixes submitted by Contractor. Provide qualified personnel at site. Cooperate with CMI and Contractor in providing services. Perform specified sampling and product testing according to specified standards. Ascertain compliance of materials and mixes with requirements of Contract Documents. Promptly notify CMI and Contractor of observed irregularities or non-conformance of Work or products. Perform additional tests required by Government. Attend preconstruction and all progress meetings.
- 4) Agency Reports: After each test, promptly submit reports in duplicate to CO, to CMI and to Contractor. Reports shall indicate observations, results of tests, and compliance or non-compliance with CDs. When requested by CMI, provide test results interpretations including: Issue date; project title and number; location within the project; inspector's name; date and time of sampling or inspection; identification of product and specification section; type of inspection or test; test date; test results; conformance with CDs.
- 5) Testing Authority Limits: Agency or laboratory may not release, revoke, alter, or enlarge the Contract Documents. Agency or laboratory may not approve or accept any portion of the Work. Agency or laboratory may not assume any Contractor duties. Agency or laboratory has no authority to stop the Work.

F. MANUFACTURERS' FIELD SERVICES

In applicable specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, surface and installation conditions, workmanship quality, equipment start-up, and to test, adjust and balance equipment as necessary, and to initiate instructions when necessary. CDs shall require that manufacturer field inspectors submit observer qualifications to CMI at least 30 days prior to site visits and that observer is subject to CO approval. Require observer to report observations, decisions or directions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

G. EXAMINATION

CDs shall require Verification that existing site conditions and substrate surfaces are acceptable for subsequent Work. State specific conditions in individual specification sections and that: beginning new Work means

acceptance of existing conditions. As applicable, CD's shall require verification that existing materials are capable of structural support or attachment of new Work being applied or attached. Require in CDs that utility services are available, of the correct characteristics, and in the correct locations.

H. PRODUCT REQUIREMENTS

Provide products suitable for intended use from qualified manufacturers. Provide products of each type by a single manufacturer unless specified otherwise. Do not use materials or equipment removed from existing premises, unless specifically allowed by the Contract Documents. Provide interchangeable components of the same manufacturer for components being replaced.

Delivery, Storage and Handling: Transport, protect, handle and store products according to manufacturer's instructions. Product seals and labels shall be intact, visible and legible at all times. Inspect shipments to ensure that products are undamaged and comply with CD requirements. Keep all products away from contact with the ground. Protect products from any form of soiling, disfigurement, damage, condensation and degradation to products before and after installation. Arrange stored products to permit access for inspection.

Substitutions: may be considered when an Originally Specified Product (OSP) becomes unavailable through no fault of the Contractor. Contractor shall submit any substitution six weeks prior to the earlier of its project-required or scheduled ship-date. No substitution shall incur an increase in the Contract Cost. Substitution requests shall have neither the appearance of nor be attached to any Material Submittal or Shop Drawing. Using Submittal forms or process to obtain approval for substitutions will be viewed as an attempt to defraud the government.

A Substitution Request Represents that Contractor: warrants that the proposed substitution meets or exceeds the OSP quality; will provide an equal or better warranty for the substitution than for the OSP; will make changes to other Work necessary to accommodate the substitution and that those changes will not reduce the quality of the whole or any part of the Project; will revise Construction Documents (As-Builts) as necessary; waives claims for any additional costs or time extension arising from incorporation of the substitution into the Project; will reimburse Government for review or redesign services associated with re-approval by authorities.

Substitution Request Procedure: Provide at least three alternatives for any requested substitution. Submit three copies of each alternative for review by the CEPM. Limit each request to one proposed Substitution. Request each substitution on Contractor company letterhead. Attach all information necessary (including Shop Drawings, Product Data, and certified test results) to satisfy CEPM that substitution is equivalent to the OSP. For each request, obtain a review and approval seal and signature from applicable DP(s) and Contractor affixed to the report. CAFB shall select one alternative or reject all three, whereby Contractor shall request another substitution. Additional requests shall incur an increase in the Contract Cost. Burden of proof is on Contractor.

I. CLOSEOUT PROCEDURES

Final Cleaning: Execute prior to final project assessment. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces. Clean equipment and fixtures to a sanitary condition with appropriate cleaning materials. Clean operating equipment filters. Clean debris from roofs, gutters, downspouts, and drainage systems. Clean site; sweep paved areas, rake clean landscaped surfaces. Remove waste and surplus materials, rubbish, and construction facilities from the site.

Certification of Completion: Submit written certification to CO that CDs have been reviewed, Work has been inspected, and that Work is complete according to the CDs and ready for review. Deliver to the CO all documentation required by governing or other authorities (e.g. completed As-Built Drawings or environmental reports). Do not submit final Application for Payment until completion of final punch-list.

Starting Of Systems: Coordinate schedule for start-up of various equipment and systems. Notify Government seven days prior to start-up of each item. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer. Verify that wiring and support components for equipment are complete and tested. Execute start-up under supervision of applicable personnel in accordance with manufacturer's instructions. Submit a written report that equipment or system has been properly installed and is functioning correctly.

QUALITY REQUIREMENTS

Demonstration and Instructions: Demonstrate operation and maintenance of products and equipment to CAFB personnel two weeks prior to Substantial Completion with a manufacturer's representative who is knowledgeable about the Project. If equipment or systems require seasonal operation and Substantial Completion is out-of-season, perform demonstration within six months. Use operation and maintenance (O&M) manuals as basis for instruction. Review contents of manual with Government personnel in detail to explain all aspects of operation and maintenance. Demonstrate operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed time, at CO designated location. Prepare and insert additional information in operations and maintenance manuals when need for additional data becomes apparent during instruction. Provide adequate amount of time required for instruction on each item of equipment and systems necessary for complete cognizance by government maintenance personnel, but not less than indicated in individual specification sections.

Operation and Maintenance Manuals: Submit bound in 8-1/2 x 11 inch (A4) text pages, three D size ring binders with durable plastic covers. Binder cover(s) shall bear: the title "OPERATION and MAINTENANCE INSTRUCTIONS"; project title; project number; and binder subject matter. Subdivide binder contents with reinforced punched tabbed permanent page dividers; with section dividers clearly printed under reinforced laminated plastic tabs; organized logically as described below:

- 1) Drawings: Bind with text; fold larger drawings to size of text pages.
- 2) Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - Part 1: Directory, listing names, addresses, and telephone numbers of Contractor, Subcontractors, and major equipment suppliers.
 - Part 2: O&M instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify: Significant design criteria; List of equipment; Parts list for each component; Operating instructions; Maintenance instructions for equipment and systems; and Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - Part 3: Project documents and certificates, including the following: Shop drawings and product data; Air and water balance reports; Certificates; Originals and photocopies of warranties and bonds.
- 3) Submit draft copy of completed volumes 21 days prior to final inspection. This copy will be returned with CO comments after final inspection. Revise content of all document sets as required prior to final submission. Submit two sets of revised final volumes, within 14 days after final inspection.

Spare Parts and Maintenance Products: Specify spare parts and extra products adequate for equipment and products maintenance for two years beyond the warranty period. Specify project site delivery location(s) and require delivery receipts prior to final payment to Contractor.

Product Warranties and Bonds: Require the following: Obtain and collect transferrable warranties, and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within 14 days after completion of related work; Verify documents are legal, complete, and notarized; Co-Execute submittals when required; Provide Table of Contents and assemble in three D side ring binder with durable plastic cover; Submit prior to final Payment Application. Require these document submittal times: For equipment or component parts put into service during construction and with CO permission: within 14 days of acceptance; Others: within 14 days of Substantial Completion, before final Payment Application; If acceptance delayed beyond Substantial Completion: within 14 days after acceptance, stating acceptance date as the beginning of the warranty or bond period.

Maintenance Service: Specify that: Service and maintenance shall be furnished during warranty periods; System components shall be examined at a frequency consistent with reliable operation and be cleaned, adjusted and lubricated as required; Parts shall be repaired or replaced whenever required; Only parts produced by the original component manufacturer shall be used; and Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the CO.

End of Quality Requirements

QUALITY REQUIREMENTS

SAFETY, HEALTH and ENVIRONMENTAL PROTECTION

1. SAFETY and HEALTH

- A. Contractor Responsibility: Contractor bears full responsibility and liability for compliance with all OSHA and applicable state and local safety and health regulations for this Project and holds the Government harmless for any Contractor (see Definitions of Basic Terms) action resulting in illness, injury, or death. Contractor is solely responsible for ensuring the safety of all Contractor and non-contractor personnel whenever and wherever present on CAFB. Additional safety and health requirements stated or implied in this SOW apply to Contractor work that could affect non-contractor personnel at CAFB.
- B. Applicable Publications: The publications listed below form a part of these Base Standards to the extent referenced herein or in the Project scope. The publications are referred by basic designation only. Wherever listed publications are applicable, Contractor shall comply with the latest extant publication.
- 1) Code of Federal Regulations (CFR)
 - OSHA General industry Safety and Health Standards (29CFR1910) Publications
 - OSHA Construction Industry Standards (29 CFR 1926)
 - National Emission Standards for Hazardous Air Pollutants (40 CFR, Part61)
 - Hazardous Chemical Reporting (40 CFR 370)
 - 2) Federal Standards (Fed Std)
 - 313A Material Safety data Sheets, Preparation and the Submission of Safety and Health requirements, DA Circular 40-83-4
 - 3) No asbestos containing materials will be allowed in performance of this contract or anywhere on CAFB.
- C. Safety Program: Contractor shall organize, maintain and document a program to ensure compliance with safety requirements, with personnel assigned to manage its functions including: administrative, liaison, and technical to implement, direct, monitor, control, and allocate resources for all safety tasks within all aspects of the work. Contractor shall ensure full compliance of all on-site subcontractors with all safety requirements. All safety documents and related data shall be available in the Contractor site office for review by the CO at any time.
- D. Confined Spaces: Before entering a "Confined Space", the CMI shall brief Contractor on the space's known hazards. Contractor shall develop a Confined Space plan and obtain a Confined Space permit. Government provided information and issued permit notwithstanding, Contractor remains fully responsible for the safety of anyone directly or indirectly affected by work in that confined space.

2. ENVIRONMENTAL PROTECTION

A. CONTRACTOR RESPONSIBILITIES

- 1) Comply with federal, state, local and Air Force environmental laws and regulations including those in this SOW. Comply with CAFB's Environmental, Safety and Occupational Health (EESOH) Policy (see the CAFB website: <http://www.columbus.af.mil/>). Report significant environmental impacts to the CO.
- 2) Continuously maintain a current Material Safety Data Sheets (MSDS) file of all items stored by Contractor at CAFB, including chemicals of any nature e.g. Ozone Depleting, paint, and any other hazardous items. The MSDS file shall be immediately available upon request by the CO.
- 3) CAFB is subject to federal, state and local environmental protection inspections. EPA, Mississippi Department of Environmental Quality (MDEQ), or other agency inspections may include questioning contractor personnel and site and process investigations. Provide documentation of any training required by federal, state or local regulations and as requested by the CO and inspectors.
- 4) If a Notice of Violation (NOV) is issued to the government or Contractor due to Contractor's error or omission, Contractor shall be held liable for damages to include fines, penalties and/or corrective actions imposed by federal, state or local agencies.

QUALITY REQUIREMENTS

- 5) Materials found on site but not in the CDs, the disturbance of which poses danger to human health, (e.g. polychlorinated biphenyl's (PCBs), lead-based paint and friable & non-friable asbestos): Contractor shall not disturb the material but shall immediately notify the CO, and CE Inspector. Failure to notify relieves the government from all cost and/or performance time liability until the CO is notified. Submit written notification within seven (7) days of verbal notification. Direct questions to the CO. Dispose of existing lead-based paint according to a lead-based paint plan agreed to by contractor CI and CO.
- 6) Obtain prior written approval from CO and Base Radiation Safety Officer (14MDOS/SGOAB) to bring radioactive material (RAM), such as soil density meters, onto CAFB, or conduct operations involving RAM on base. If RAM will be brought onto base, provide 14 MDOS/SGOAB (via CO) a copy of Contractor radioactive material permit and training certificates.
- 7) Comply with all applicable OSHA and EPA related Federal, State, Local Laws, Regulations, ordinances, and standards and with specific instructions or directions given to Contractor by CAFB regarding same.
- 8) Report all quantities of hazardous and toxic materials stored, used or brought onto CAFB according to 40 CFR 370 Hazardous Chemical Reporting and 40 CFR 372 Toxic Chemical Release Reporting to Federal, State and Local agencies according to Executive Order 12856 & the Emergency Planning & Community Right to Know Act to the CO who will forward to 14CES/CEQV who will report to EPA.
- 9) As applicable, develop an Integrated Solid Waste Management (ISWM) Plan.

B. REFERENCES

- 1) These include: Code of Federal Regulations (CFR) series 29 (OSHA), 40 (Environmental) and 49 (DOT), Clean Water Act, Clean Air Act, Resource Conservation & Recovery Act (RCRA), Comprehensive Environmental Response, Compensation and Liability Act, Emergency Planning and Community Right-to Know Act and amendments to these acts including the Federal Facilities Compliance Act.

C. PROHIBITIONS: Superseding any regulation, document or reference, the following are prohibited on CAFB:

- 1) Class I Ozone Depleting Substances (ODS) defined in Section 602(a) of the Clean Air Act; Radioactive materials or instruments capable of producing ionizing radiation; Materials containing asbestos, PCBs or mercury; and materials containing hazardous lead concentrations (> 0.06 %). No lead-containing paint may be used on CAFB. Submit exception requests to the CO in writing.
- 2) Disposal of any substances directly into the sanitary sewer system or anywhere they can indirectly enter the storm system or any natural waterway is prohibited. Disposal of any hazardous material on base.
- 3) Unmarked containers anywhere on base: Contents of all containers shall be labeled. Keep containers closed when not in use.

D. SUBMITTALS: Submit the following to the CO:

- 1) A demolition plan prior to starting work according to the base Integrated Solid Waste Management (ISWM) Plan for 14CES/CEVQ approval.
- 2) Hazmat reports according to AFI 32-7086: *Hazardous Materials Management* for approval by the Hazmat Management Program Manager.
- 3) A list of proposed Hazmats and quantities to be used on the job with MSDS's for authorization prior to bringing the materials onto CAFB according to AFI 32-7086. After work has started, Contractor shall provide consumption reports, in format specified in AFI 32-7086, once every month.
- 4) A list of materials and quantities used on the Project: Submit at least monthly and as required by the CO.
- 5) Contractor shall submit separate copies of the CAFB Air Emissions Equipment Worksheet for each emission source to be permanently installed on CAFB including diesel generators or other gas-fired equipment. Submit prior to equipment installation.
- 6) All stormwater pollution prevention plans shall include site-specific best practices to prevent pollution due to erosion and/or sedimentation. If the project is: 1) less than one acre; contractor shall submit a stormwater pollution prevention plan to the CO or Construction Inspector for review; 2) greater than one

but less than five acres; contractor shall complete a small construction notice of intent and a Stormwater Pollution Prevention Plan, and submit copies of both documents to the CO or CI before commencement of work; 3) greater than five acres; contractor shall submit a Baseline Notice of Intent to the CO and CI for review before submitting to the Mississippi Department of Environmental Quality (MDEQ). Obtain a National Pollution Discharge Elimination System (NPDES) permit prior to commencement of work. Submit a copy of Stormwater Pollution Prevention Plan to the CO and CI prior to plan implementation.

Examples of managed and tracked hazardous materials include the following:

1 Abrasive & Bead Blast Compounds	14 Acids & Bases	27 Adhesives
2 Alcohol, Denatured, Isopropyl, etc.	15 Antifreeze	28 Anti-Seize Compounds
3 Battery, Rechargeable, Ni-Cad & Lead Acid	16 Cement, Concrete	29 Cement, Insulation & Pipe
4 Cleaners & Cleaning Compounds	17 Corrosion Preventatives	30 Degreasers
5 Fire Extinguisher & Dry Chemical Agents	18 Fertilizers	31 Fuels
6 Fluid, Coolant, Cutting, Hydraulic, etc	19 Greases	32 Fungicides
7 Gasses, Chemical & Compressed	20 Herbicides	33 Inhibitors
8 Metal Finishing & Polishing Compounds	21 Naphtha	34 Oil Products
9 Paints & Associated Products	22 Insecticides	35 Strippers
10 Pipe & Joint Compounds	23 Lubricant, Dry Film	36 Varnish, Insulating
11 Spackling Compounds	24 Reagents	37 Silicones
12 Water Softening Compounds	25 Rodenticides	38 Solders
13 Waterproof Sealant & Sealers	26 Sealing Compounds	39

E. RECYCLING AND AFFIRMATIVE PROCUREMENT

- 1) To the extent practicable, Contractor shall recycle demolished materials. Report to CI disposal of all materials removed from site, including those recycled. Report shall include disposal date, description and quantities of items, disposal company locations, disposal site locations and signature of disposal company representatives. Contact the CAFB Recycling Center when determining Contractor's best disposal alternatives for Copper, Aluminum, Cardboard or Steel. If the CAFB Recycling Center is the Contractor's best disposal option for one or more of these materials, notify the CI not less than two weeks prior to removal of those materials from the site. The 14CES will arrange with the Recycling Center for government-furnished disposal dumpsters to be placed in or near the construction site. Each type of material will be placed in separate dumpsters.
- 2) Follow EPA procurement guidelines, and comply with the "buy-recycled" program established under section 6002 of the Resource Conservation and Recovery Act (RCRA). Contact the CO for a copy of this document.

F. HAZARDOUS MATERIAL/WASTE

- 1) Do not store Hazardous Material or Waste (HMW) at CAFB without prior CO approval. Store and use Hazmat according to all federal, state and local laws and regulations. Do not store any materials in containers touching the ground. Maintain containers in good condition with no holes, leaks, creases or excessive rust. Keep containers closed when not in use.
- 2) Keep Material Safety Data Sheets (MSDS) for all HMW available in Contractor site office.
- 3) Any hazardous or special waste generated shall be handled according to all local, state and federal laws and regulations, including RCRA and DOT requirements for waste management and transport. Contractor shall obtain all necessary permits, licenses and approvals unless waived in writing by the CO.
- 4) Contractor shall maintain records of all waste determinations, including appropriate results of analysis performed, substances and sample locations, date and time of collection, and other pertinent data as required by 40 CFR Part 280, Section 74 and 40 CFR, Part 262, Subpart D.
- 5) The CAFB EPA identification number will appear on all Hazmat manifests. Obtain 14CES/CEVQ signature on all Hazmat manifests and submit a copy to the CO not later than COB of the day waste is transported off base. Submit a closed copy of Hazmat manifests prior to the earlier of final inspection or 30 days after transporting waste off base. Contractor bears all cost and liability associated with containerizing, loading, shipping, and disposing of hazardous waste.

- 6) Comply with 29 CFR 1926.1910 when handling Hazmat or disturbing or dismantling structures containing hazardous materials. Work disturbing asbestos containing materials shall comply with Federal, State, and local laws and regulations including 40 CFR, Part 61. Personnel who will handle hazardous or toxic materials shall have the necessary certifications prior to work.
- 7) Remove all Hazmats not used on the project but still in usable condition upon completion of the project. CAFB will not accept any unused Hazmats including paint, thinners, etc. as they belong to Contractor.

G. SPILLS AND CLEANUP

- 1) If any amount or type of HMW including all petroleum products is spilled, the Contractor shall immediately report the spill to the CO and CI: HMW material (attach MSDS form); time and location, estimated HMW amount; surface receiving HMW; and HMW path (e.g. did or will material soon enter a drain inlet, waterway, soil, etc.). Spills include HMW's released from ruptured or leaking storage receptacles (e.g. tanks), transmission lines, valves, or gas leaks (e.g. chlorine).
- 2) Contractor shall immediately contain and then clean up spills. If Contractor cannot begin cleanup within 15 minutes of the spill, CAFB reserves the right to begin and continue cleanup until Contractor can take over either directly or via subcontractor as approved by the CO.
- 3) All costs incurred by the government until Contractor is capable of taking control, as determined by the CO, shall be the sole responsibility of Contractor. Contractor shall ensure equipment, material and trained personnel are available to meet response time and cleanup requirements.
- 4) Contractor shall characterize and dispose of HMW and cleanup using personnel trained and certified to cleanup HMW. Remove all HMW and cleanup material from CAFB and transport, store and dispose according to applicable regulations. Restore spill site to its condition prior to the spill.
- 5) CAFB reserves the right to direct cleanups. The 14CES will determine best cleanup actions.

H. MISCELLANEOUS

- 1) Preserve natural resources within the project site.
- 2) Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Secondary containment is required around temporary fuel oil or petroleum storage tanks larger than 660 gallons and around smaller tanks if any leakage could enter a storm drain, ditch or other waterway. Notify the CO prior to bringing any tanks on-site.
- 3) Pick up solid wastes and place in covered containers, which are regularly emptied. Prevent contamination of site or other areas when handling or disposing of wastes. Dispose of garbage, rubbish and debris according to applicable federal, state and local requirements.
- 4) Provide barriers to divert surface water runoff away from all open excavations. Protect all drains from any on-site storm water erosion and sedimentation.
- 5) Upon discovery of any archeological or historical item, Contractor shall cordon off and carefully preserve such item(s) from further disturbance and immediately notify the CO.
- 6) If during normal site construction Contractor discovers evidence related to previous contamination including discolored soil, strong hydrocarbon aroma, etc., Contractor will notify the CO to obtain any required remedial actions. CAFB is a closed Installation Restoration Program site; therefore Contractor bears all cost and liability for required mitigation actions or adverse conditions created by construction.

End of Safety, Health and Environmental Protection