UNITED STATES AIR FORCE

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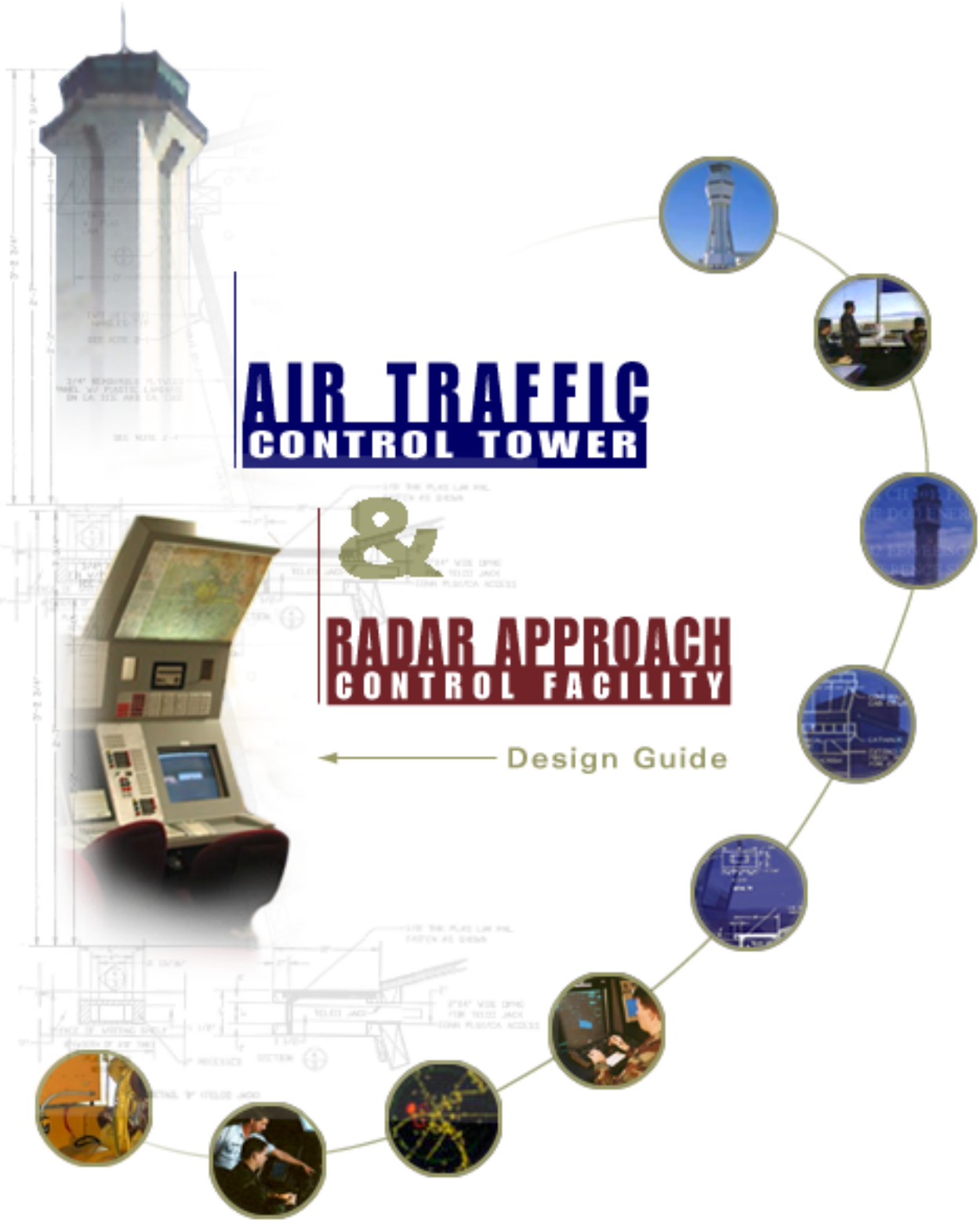

AIR TRAFFIC CONTROL TOWER

&

RADAR APPROACH CONTROL FACILITY

Design Guide

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ABOUT THIS GUIDE

The Air Force mission is to defend the United States through control and exploitation of air and space. To do this safely and effectively, we must be able to manage our air and space force assets in the air and on the ground. An important element in this process is control of aerial port and vicinity airspace at our bases. That function is carried out from two of the most important mission facilities at an installation—the Air Traffic Control Tower (ATCT) and Radar Approach Control (RAPCON) facilities. They are the life-blood of aerial port operations, integrating high tech electronic gear and professional airfield operations personnel.

Chapter 1 of this Guide is devoted to the design of ATCTs. Perhaps the tallest, most visible feature at most air bases is the air traffic control tower. It makes an undeniable aesthetic statement and can dominate the visual environment. It is our duty not only to make the tower a functional mission facility, but also a pleasing architectural statement.

RAPCON facilities control aircraft in a certain assigned airspace. RAPCONs house the leading edge, evolving electronic tracking and communications equipment needed to accomplish a complex job. Facility managers and designers must take advantage of, and team with, all the technical and functional resources the Air Force has to offer. Reference Chapter 2 of this document for RAPCON design guidelines.

We in the Air Force are committed to providing top-notch aerial port operations and state-of-the-art ATCT and RAPCON facilities. This will ensure that we remain the world's most respected air and space force.

An architecturally compatible, highly functional facility should result when you combine the knowledge from your design team with the information in this Design Guide.

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UNITED STATES AIR FORCE

CHAPTER 1

AIR TRAFFIC CONTROL TOWER

Design Guide

1.1.1 Purpose

This Design Guide provides basic guidance and criteria to programmers, planners, architects, engineers, design and construction agents, commanders, and construction contractors for the programming, design, and construction or renovation of Air Traffic Control Towers (ATCT). Specific items herein are minimum standards, and may be modified by particular requirements of the base or other special design parameters. For latest information and drawings, plans, utility, siting and electronic requirements, consult the Air Force Flight Standards Agency (AFFSA).

1.1.2 Scope And Objectives

The objective of this Guide is to improve the functionality and the working environment of our air traffic control towers (ATCT). The ATCT is one of the most visually prominent structures on a base. The architectural statement made by the air traffic control towers greatly influences visitors' impressions of the base. There is a professional obligation to actively control functional as well as aesthetically compatible facilities as a means of achieving design excellence in the Air Force. The key step in establishing the correct architectural statement is to design the structure so that the exterior elevations achieve architectural compatibility with the base general plan. Design considerations include regional, local, physical and man-made characteristics, i.e., history, culture, climate, landscape and existing architectural style.

It is important to design for these factors while at the same time achieving uniqueness. The architectural style, scale, form and contrast should be compatible within the context of other structures adjacent to the site. These elements are necessary to provide consistency with the base architectural theme. The correct combination of materials, textures, color, type of construction, details, and building systems should establish an architectural style that symbolizes a modern Air Force. The massing, shape, form and articulation should define the control tower shaft with clean, vertical lines and a smooth transition to the control tower cab. For the reasons presented here, there is no definitive architectural standard for the elevation view of control towers today. Designers should use the appropriate major command (MAJCOM) architectural and interior design standards as well as base level architectural, interior design, engineering, parking and landscaping standards.

1.1.3 Site Selection

1.1.3.1 Survey

Once the need for a new ATCT is validated, a site survey must be performed. The survey will determine the tower height, location, configuration and orientation prior to, or preferably in conjunction with, the conceptual design stage. The MAJCOM programming and requirements section coordinates the survey. A team of architects

and engineers will work closely with the MAJCOM project manager to conduct a charrette to investigate the requirements and develop a Project Definition (PD). Reference the USAF *Project Manager's Guide for Design and Construction* at http://www.afcee.brooks.af.mil/dc/products/pmguide/pmguide.asp for more information on charrette procedures. Coordination of efforts with a representative from AFFSA is required. Support for the team from the base comprehensive planner, structural engineers, environmental specialists, and electronic engineers from the applicable engineering and installation units (E&I) and host command civil engineers, as well as command, control, communications, and computers (C4) systems developers and the ATCT users, is essential to the charrette process. The site selection is conducted in accordance with (IAW) guidelines provided in AFMAN(I) 32-1123, attachment 18. Also comply with AFJMAN 32-1013, Volume 1 and AFM 32-1013, Volume 2. An Environmental Impact Analysis Process (EIAP) study must also be performed in accordance with the National Environmental Policy Act (NEPA).

1.1.3.2
Statement of Intent

A product of the site survey is the Statement of Intent (SOI). The SOI describes the location, configuration, orientation, required height, and civil engineering support requirements for the new tower. Copies of the SOI are provided to the Local Airfield Operations Flight (AOF), the Civil Engineer (CE), and the Local Communications Unit (LCU) for coordination and signatures by the Base Commander and/or Wing Commander and other appropriate base officials.

1.1.4 Work Not Included in the Construction Contract

The following items, except as noted, are government furnished equipment (GFE) and will be installed by others during construction or upon completion of the construction contract.

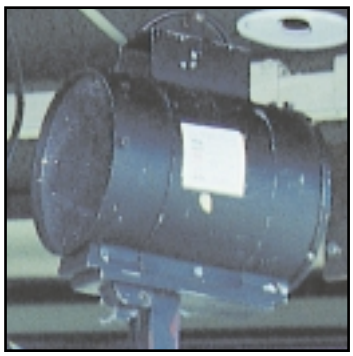
1.1.4.1
Antennas

Antennas will be mounted on antenna masts. All required safety features and lightning protection will be incorporated into the antenna masts to protect the property and personnel who work on them. E&I unit personnel will install antennas or the antenna installation will be contracted to relocate and install government-furnished equipment. The antenna mast must withstand wind loads based on the maximum gust conditions and take into consideration the projected heights of antennas to be mounted on the ATCT as well as being capable of resisting lateral loads required by the applicable safety codes. The architect-engineer (A-E) shall also consider ice loads and wind-borne salt spray in how it corrodes and affects radio inter-mod vulnerability.

1.1.4.1 Antennas

1.1.4.2
Light Guns

The construction contractor shall install eyebolts in the ceiling to hang light guns. These should be located adjacent to light gun outlets shown in Drawing 10 of Part 3 of this Chapter. If desired, the battery operated desk mount type light gun may be installed in lieu of the ceiling mount type. The light gun(s) shall be purchased with local operations and maintenance (O&M) funds. Approximate cost for each rechargeable battery-powered light gun is $6,000. If battery-powered light guns are used, a 115 +/- 10 VAC outlet must be installed on the console within three feet of each proposed light gun location. The A-E shall coordinate the location of the light guns with the user during the charrette.



1.1.4.2 Light Guns

1.1.4.3
TV Security System

The TV security system is government furnished and government installed (GFGI). The contractor provides rough-in and conduits with pull wires as required.

1.1.4.4
Tower Radar Display Monitor

The Tower Radar Display monitor is government furnished and installed. See paragraph 1.2.1.7 for design details.

1.1.5 Reliability and Maintainability

Reliability and maintainability must be included as an integral part of design. The A-E shall use ETL 88-4, *Reliability and Maintainability (R&M) Design Checklist*.

1.1.6 Programming

Consult AFH 32-1084, *Facility Requirements*, Chapter 5, Section I and use facility Category Code 149-962 to establish the overall scope of the facility. Refer to Table 5.10 to program individual spaces within the ATCT.

1.1.7 Hazardous Materials

No building products specified or used shall contain asbestos. Lead-based paint is restricted. The A-E shall verify the most current requirements and limitations with the base Environmental office prior to specifying the use of products containing lead. Building products shall be EPA compliant. Do not use products containing CFCs. Do not install systems that require use of Halon. Minimize use of materials that emit harsh gases for periods over 48 hours after installation.

1.2.1 Architectural and Structural

The recommended method to develop a conceptual design of an ATCT is through the charrette process. A charrette is an intensive one or two week on-site process where a team of architects and engineers interview the facility users, coordinate with a MAJCOM air traffic specialist, and the MAJCOM/CEP project manager to develop a Project Definition, to include a written design analysis and cost estimate. The charrette facilitates close coordination and quick decisions from all concerned parties and results in a fast track 10 percent design which better meets the needs of the user. It is essential to include E&I Communication personnel early in the charrette process. The Systems Telecommunications Engineering Management (STEM) is responsible for coordinating the local communications requirements.

1.2.1.1 Design

The ATCT will generally conform to the functional layout drawings shown in Part 3 and Part 4 of this Chapter. Except as otherwise specified, the designer shall choose all construction materials based on lowest economic life-cycle costs and shall conform to the requirements of MIL HDBK 1190, *Facility Planning and Design Guide*, and MIL HDBK 1008C, *Fire Protection for Facilities*. The design shall be based on the following minimum criteria:

1.2.1.2 Number of Floors

The designer shall provide the number of floors as required to meet the control tower height required, per the approved site survey.

1.2.1.2 Tower Shaft Structural

1.2.1.3 Loads

Dead and live loads shall be IAW current American Society of Civil Engineers (ASCE) publication ASCE 7, *Minimum Design Loads for Buildings and Other Structures*, latest

issue, except where supplemented by Army TI 809-4, *Seismic Design for Buildings*; AFM 88-3, Chapter 13 (Army TM 5-809-10), *Seismic Design for Buildings*; and ETL 00-5, *Seismic Design for Buildings and Other Structures*. Wind loads shall conform to the wind load design requirements of ASCE 7. The A-E shall evaluate potential snow loads and design accordingly.

1.2.1.4 Interior And Exterior Finishes And Colors

Control cab ceiling and other paintable surfaces above the windows in the cab shall have a non-reflective finish. Window sills shall be covered with a non-reflective, sound-absorbing material. Ceiling tiles should be a dark color to lessen interior light reflections. Interior colors should be a mix of warm and cool colors relating to the functional areas. Exterior colors should be compatible with base decor. When tone down is required, consideration should be given to use of pigmented concrete, stucco, exterior insulation and finish systems (EIFS), and concrete masonry units (CMU). EIFS should be limited to upper floors only and shall not be used on the first floor.

1.2.1.5 Window Mullions

Design window mullions in the control tower cab to comply with wind load requirements while at the same time reducing visual obstructions to the maximum extent possible. In addition, the structural mullions should be used for antenna cable access.

1.2.1.5 Window Mullions

1.2.1.6 Shaft Windows

As a minimum, a single window shall be provided on the runway side of the tower shaft in the Training/Crew Briefing room and in the Chief Controller's office. If structurally feasible, more windows may be installed on the runway side of the training/crew briefing room to facilitate training. Conventional steel structures with diagonal bracing may prevent the installation of additional windows. The number of windows in the rest of the tower shall be kept to a practical minimum for the sake of construction cost savings and maintenance/energy cost savings for the life of the facility. Consider specifying Energy Star labeled windows for energy conservation. Qualifying products are listed at http://www.energystar.gov/products/windows.

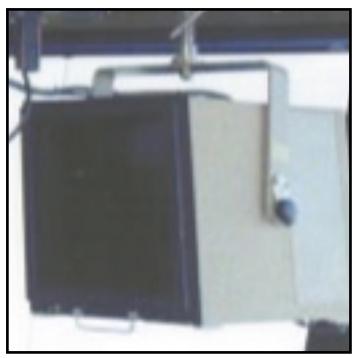
1.2.1.7
Tower Radar Display Equipment

1.2.1.7.a Ceiling Mounted Track

1.2.1.7.b Track

1.2.1.7.c Tower Radar Display Equipment

1.2.1.7.d Articulated Arm and STARS TDW



1.2.1.7.e Tower Radar Display Monitor

1.2.1.7.1 Design the Tower Radar Display track system IAW 38 EIG/EICF Sketch SK 86-1. The Tower Radar Display monitor is government furnished and installed. The monitor weight is approximately 68 kg (150 lbs). If an Articulated Arm is installed, this may delete the requirement for the DBRITE track. Consult HQ AFFSA/XRE for the Standard Terminal Automation Replacement System (STARS) delivery schedule. The ceiling mounted track and trolley are to be included in construction contract. Also reference Part 3, Drawing 12 and Part 4 drawings of this Guide. The trolley may be used with existing DBRITE or tower display workstation (TDW). AFFSA will send latest information upon request.

1.2.1.7.2 If using STARS systems, the STARS TDW will mount on an articulated arm (see Part 4 of this Guide) and will be installed by the Department of Defense (DoD) Advanced Automation System (DAAS) contractor. The mount for the

articulated arm shall be designed by the A-E and installed by the construction contractor. The total weight of the arm and flat screen monitor is 74 pounds. The total moment arm is 322.4 ft-lbs applied at the mounting point at the ceiling. The mount shall be placed midpoint between the Local/Ground position. The mount shall extend 2 – 4 inches below the level of the suspended ceiling in the tower cab and shall be securely mounted to the steel superstructure above. At locations that will not receive STARS until the out years, the tower facility must be designed to accommodate both the Articulated Arm and the DBRITE track mount.

1.2.1.8 Acoustical Requirements

Acoustical materials with high sound absorbent coefficients shall be used as necessary in the construction of the walls, floors, and ceilings to reduce the noise level in the cab and the crew/briefing room. The design decibel level shall be no greater than 65 db, as specified in paragraph 5.8.3.3.2 of MIL STD 1472D, dated 2 May 81. A sound study may be required if the tower is close to taxiways, engine start up ramps, or other noise-generating functions. In general, if the facility is constructed IAW the recommendations contained in this document the above noise criteria will be met. The carpeting of walls for acoustical attenuation is not allowed. However, if local conditions are such that it is impractical to obtain the desired db level using conventional construction practices and materials, MAJCOM engineers have the authority to modify the above requirement [Note: Smoke and flame spread properties for carpet installed in the vertical position differs from normal tests in the horizontal position and may not meet building code requirements.].

1.2.1.8.1 Carpet all occupied areas and other designated areas with anti-static carpet. Carpet edge molding shall be provided at all carpet edges.

1.2.1.8.2 The walls below the windows and the top of the air plenum in the cab shall be covered with acoustical material.

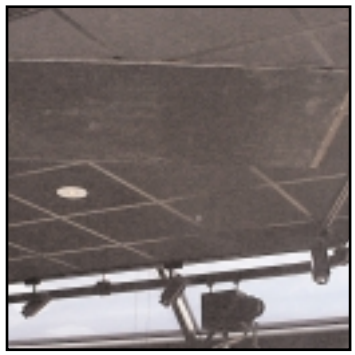
1.2.1.8.3 Acoustical ceiling tiles tend to get damaged from the frequent removal and replacement during equipment cable installations. The A-E needs to consider this fact when designing ceilings in the occupied areas. In addition, the A-E should consider the use of spray-on foam designed to control sound attenuation in equipment rooms and mechanical rooms. The A-E shall design the project to control sound attenuation in the electrical and mechanical equipment rooms since they generate a large volume of noise pollution.

1.2.1.8.4 Provide vibration isolation for all noise generating equipment; e.g. air handlers.

1.2.1.8.5 Set the back-up Class C generator on a structurally isolated slab.

1.2.1.9. Roof

1.2.1.9.1. The cab roof deck shall be sloped to drain away from center. Do not include gutters and downspouts. Shingle roofs are not allowed. The roof design should take into consideration the need to minimize rainwater from the roof dripping down the cab windows.



1.2.1.9.2 Retractable Ladder

1.2.1.9.2. Provide a permanent means of roof access via a ladder from either the cab or the catwalk area—preferably the cab. The ladder shall be retractable from ceiling space to the cab or catwalk floor. The installation of exterior stairs for access to the tower cab roof is not desirable. The metal stairway and safety climb obstruct visibility to view aircraft in the pattern.

1.2.1.9.3. Coordinate the location of the roof safety railing, antenna mast mounting, and the lightning protection system.

1.2.1.9.4. The roof surface must be designed to allow for pedestrian maintenance traffic.

1.2.9.5. Provide a place to safely shovel snow away in order to clear maintenance areas.

1.2.1.10 Control Cab Windows

Comply with FAA Order 6480 7c and Atch 1, and meet the following requirements for control cab windows:

1.2.1.10 Control Cab Window

1.2.1.10.1. Materials

Windows shall be double glazed units. Glass shall conform to ASTM C 1036-85. Window units shall consist of two panes of float glass separated by a 13 mm (½ in) air space. The outer pane shall be Type I, Class II, Quality q^3, slightly tinted blue/green, unless glass thickness over 6 mm (¼ in) is required, in which case, clear glass may be used. The inner pane shall be Type I, Class I, Quality q^3, clear. The use of P.P.G.'s "Starphire®" glass is highly encouraged. In areas of high sun or solar gain, use of a "low-E" glass is encouraged. Tempered glass may be used in upper glass panels in towers that have "sloped back" or "diamond cut" tower windows as long as it does not obstruct viewing aircraft flying overhead patterns.

1.2.1.10.2. Glass Thickness

Each of the two panes shall be at least 6 mm (¼ in) thick, but shall not exceed 13 mm (½ in). The total window thickness shall not exceed 1 ½ inches [13 mm (½ in) interior pane with 13 mm (½ in) air space and 13 mm (½ in) exterior pane]. The glass thickness should be sized to meet wind load design requirements of ANSI A58-1. Panes of unequal thickness can be used together, e.g., 6 mm (¼ in) tinted inside pane with a 13 mm (½ in) clear exterior pane. Tempered glass and laminated glass are not authorized for use in control tower cabs.

1.2.1.10.3. Air Space

The inner and outer panes shall be separated by a 13 mm (½ in) hermetically sealed space. The entrapped air shall be dehydrated by a drying agent. Dehydration shall be guaranteed for a period of at least five years. Window units shall be fabricated for use at the installation's elevation above mean sea level (AMSL). Units shall be free of any optical distortion at the time of installation.

1.2.1.10.4. Glazing Retainage

The ATCT shall be designed to meet seismic requirements, to include retainage of glazing in the control cab. The A-E shall design the glazing to meet seismic requirements. In environments with high wind, the addition of an intermediate mullion strip may be considered only as a last resort. Only one intermediate mullion strip per cab side is preferred.

1.2.1.10.5. Wind Loading

For design purposes, the tower cab glass shall be designed to withstand sustained wind speeds of 125 mph or more. The tower will most likely be evacuated when winds exceed 75 mph.

12.1.11
Control Cab Transparent Window Shades

1.2.1.11.1 Shades shall be at least .125 mm thick. Color shall be smoke gray and body dyed. Shades shall be provided with rollers with constant tension to prevent shade contact with windows.

1.2.1.11.2 Shades shall follow the slope of windows and shall match size and shape of cab windows when in fully drawn position. Where towers are designed with "diamond cut" sloped back glass, separate shades shall be installed for the upper windows. Provide shade pockets for storing the shades when not in use. Specifications can be provided by Plastic View (see below).

1.2.1.11.3 Shades shall be "See-Thru Window Shades" as manufactured by Plastic View Inc., 4585 Runway Street, Suite B, Simi, CA 93063, Phone (800) 468-6301, or an approved equal.

1.2.1.11.4 Electric rollers are not encouraged because manual cords allow for faster up and down action and access for light gun operation.

1.2.1.11.5 Use of "mini-blinds," opaque, semi-opaque material, or "mesh type fabric" in the tower cab is prohibited.

1.2.1.11.4 Shades

1.2.1.12
Control Cab Console

The A-E shall coordinate and validate the control cab console design through E&I, AFFSA, MAJCOM, and local ATCT personnel to ensure the design accommodates the required equipment, but use the attached 38 MSS/EGD Drawings SK SCCS-3 (see Part 4 of this Chapter) as a design guide. The contractor shall provide and install the airfield lighting panel, power outage indicator lights, door ajar indicator light, dimmer switch for overhead lights and the master control for the intercom system in the cab console. Boxes for wind indicators should be constructed by the contractor, and laminated with the same finish as the console. Place single "strip bays" at the Local Control Flight Data and Ground Control positions, in addition to the dual "strip bay" provided for the Flight Data position. All other equipment will be provided and installed by the government. Government installers will accomplish console cut-outs for government installed equipment. Console colors, equipment location and surface configuration design will be coordinated with local ATCT staff.

The location of the Supervisor of Flying (SOF), where required, will be coordinated with the Operations Group (OG) Commander, or designated representative. The A-E shall provide a sketch of the tower cab layout to the local ATCT staff at the charrette in order to finalize the operational requirements, positions, and equipment layouts.

1.2.1.13 Equipment Access

1.2.1.13.1 Provide physical access to all mechanical and electrical rooms large enough to remove the largest piece of equipment from the room. Provide a hoist or elevator to lift equipment to all floors above ground level. Reference the elevator requirements listed at paragraph 1.2.5 in this Guide. Also refer to ETL 88-4, *Reliability and Maintainability (R&M) Design Checklist*. Pay careful consideration to maintenance access when designing mechanical/electrical spaces.

1.2.1.13.2 In light of life-cycle design considerations (e.g. replacement or upgrading HVAC equipment in the future), it is recommended that a hatchway be installed in the floor between the tower cab floor and the mechanical room and also between the mechanical room floor and the Crew Rest/Ready Room floor (last floor with elevator access). The size and shape of the HVAC equipment and components should be able to fit through these openings. It is anticipated that the suspended ceiling in the Crew Rest/Ready Room will have to be removed during an upgrade.

1.2.1.14 Equipment Room Doors

The doors to the equipment rooms must be a minimum of 2.18 m (7 ft 2 in) high and 91 cm (36 in) wide to allow for the movement of electronic equipment racks through them. Equipment room doors shall have closers and be lockable.

1.2.1.15 Support Items

The project shall include connection to all required existing utilities such as water, sanitary sewer, electrical power, natural gas, communication ducts, etc. In seismic zones, all utilities shall be passed through the building envelope using flexible connectors and/or utility ducts which allow for the differential building movement anticipated as a result of a seismic event. All-weather access roads and parking areas shall be provided as required.

1.2.1.15.1. MAJCOM criteria shall control the access road and parking lot design. Lacking MAJCOM criteria, the minimum recommended criteria should include an access road and parking lot with a chip seal surface. Parking spaces should accommodate the overhead staff, normal day shift crews and a few spaces for visitors. The width of the access road should be 6.1 m (20 ft) minimum.

1.2.1.15.2. Communication ducts and spares for future expansion will be installed only where the use of direct bury cabling is not feasible, e.g., under roads, taxiways, runways, buildings, parking and other paved areas such as sidewalks. Include in the design 8 each 4 inch diameter ducts (2 of which shall have fiber cable and interduct).

1.2.1.16 Building Occupants

Refer to the Requirements and Management Plan (RAMP) or Customer Concept Design (CCD) for the number of building occupants and the hours of work.

1.2.1.17
Interruption Of Control Tower Operation

Contract documents should state that any required shutdown of the existing control tower during construction must be coordinated with the local contracting officer and AOF/CC. The local user will be responsible for making necessary arrangements for control tower operations, i.e., obtaining/using an alternate facility, such as TRV (Tower Restoral Vehicle) or AN/MSN-7, in cases where the existing tower is not available for use due to construction.

1.2.1.18
Specialties

Building directory, bulletin boards and interior signs shall be in accordance with AFPAM 32-1097, *Sign Standards Pamphlet*. The paragraphs below provide example guidance which can be used where no other suitable standard exists.

1.2.1.18.1 Building Directory

The design should require the installation of a suitably sized building directory located near the main entrance. The directory case should be constructed of extruded aluminum with an architectural finish. It should have a changeable letter board with contractor-furnished insertable letters and a sliding glass front.

1.2.1.18.2 Bulletin Boards

A bulletin board is required in the entrance. The bulletin board should be similar in construction to the building directory, except with a cork backboard.

1.2.1.18.2 Bulletin Boards

1.2.1.18.3. Interior Signage

Signage shall be in accordance with AFPAM 32-1097, *Sign Standards Pamphlet*. Floor levels must be clearly marked at each landing level so that fire and emergency response personnel can identify their location under smoke conditions.

1.2.1.19
Raised Access Flooring

The use of raised access flooring in the cab area is highly recommended to facilitate the periodic rearranging and upgrading of equipment and cables. Incorporate heating, ventilation, air conditioning, electrical, communications, and other systems in the raised flooring system to the greatest extent possible. The raised access flooring shall be rated to handle a minimum uniform live load of 150 psf. The A-E shall determine the required capacity of the raised access flooring system after calculating the anticipated uniform live loads, concentrated live loads, and dead loads. The raised access flooring shall be installed a minimum of 12 inches above finished floor. Consult AFM 88-4, Chapter 9 (Army TM 5-805-13) for more guidance.

1.2.1.20
Catwalk

The catwalk provides the controller with an unobstructed view of aircraft, the airfield, and the airspace environment. Interior cab areas that are visually obstructed by the tower roof, window mullions, and the area at the base of the tower can be seen from the catwalk. Another purpose of the catwalk is to provide access to wash the control cab windows.

1.2.2 Mechanical

The mechanical design shall include heating, ventilation, and air conditioning (HVAC), IAW ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) Handbook of Fundamentals and ASHRAE standards. Installation of a built-in vacuum cleaning system with a receptacle in the control tower cab is recommended. The A-E shall also check with the host command to determine if there are any additional requirements. A central HVAC system with non-static hoses and attachments (to prevent the build-up of static charges) will normally be provided unless specific engineering analysis indicates that subcentral HVAC systems will be more economical on a life-cycle cost basis (LCC). The A-E shall specify that testing, balancing, adjusting, and commissioning of the HVAC system take place prior to Government acceptance. This is critical because the heat load varies on each floor because of the different heat output of the equipment.

1.2.2.1 Life-Cycle Cost

The A-E shall conduct life-cycle cost studies on the mechanical system IAW ETL 94-4. The design should ensure an adequate level of building environmental conditioning at the least life-cycle cost. Alternative choices shall he made on the basis of least life-cycle cost rather than first cost. It is further expected that all mechanical equipment shall be installed with future maintenance needs, such as adequate accessibility, taken into account and that established commercial practices shall be followed. The A-E shall reference the *Project Manager's Guide for Design and Construction* at http://www.afcee.brooks.af.mil/dc/products/pmguide/pmguide.asp for more information.

1.2.2.2 Energy Conservation Measures

Energy conservation must be a special-interest item in the design of a project. All aspects of the design should be IAW ETL 94-4. To make the facility design functional from an energy conservation standpoint, the designer must consider and include, where applicable, the following:

1.2.2.2.1 Heating equipment selected (boilers/hot water heaters/furnaces) shall have efficiencies meeting chapter II, subpart 8.3.1 of 10 CFR 435.

1.2.2.2.2 Use limited range thermostats available from established manufacturers. See Federal Property Management Regulation, 41 CFR Chapter 101, 1 Jul 94 available as an appendix to the DoD Ener*gy Managers Handbook* on the Construction Criteria Base (CCB) CD-ROM.

1.2.2.2.3 Renewable energy technologies should be used whenever feasible and cost effective. Consider ground-source heat pumps, high-temperature solar, wind, or other energy sources.

1.2.2.2.4 Specify heating and cooling systems meeting Energy Star program standards. Qualifying products are listed at http://www.energystar.gov/products.

1.2.2.2.5 Consider solar hot water systems for energy efficiency. Maximize water efficiency by specifying water conserving fixtures, equipment, and systems. Refer to MIL HDBK 1165 for guidance.

1.2.2.3 Energy Management And Control System (EMCS)

All new/altered control towers shall be designed so they can be monitored by EMCS. The EMCS shall have the capability to monitor lighting systems, security systems, and other systems. The A-E shall consult the base EMCS office for the design requirements since each base is different. *Due to mission essential staffing requirements and flight safety considerations, the ATCT occupants, not the base EMCS office, shall have direct control of the thermostat to regulate appropriate heating and cooling levels. The A-E shall zone the HVAC system so that ATCT cab occupants can control the temperature in the cab. Electronic equipment rooms shall be treated as separate zones and with their own thermostats. Other floors shall be controlled by thermostats zoned to these floors.*

1.2.2.4 HVAC Media

Heating and air conditioning mediums will normally be hot and chilled water, respectively. However, as stated above, other systems may be used if justified by a life-cycle cost analysis.

1.2.2.5 Air Distribution

1.2.2.5.1 Control Cab

The control cab shall receive heating and air conditioning by an air handling unit located in the mechanical room directly below the cab. Provide redundancy for the control cab air handling unit.

1.2.2.5.2. Electrical Rooms

Electronic equipment rooms shall be provided with redundancy so that if one unit goes down another unit will be capable of handling the entire load. Also, electronic equipment rooms typically need cooling, even when other rooms need heat; consider having electronic equipment rooms on a dedicated, redundant unit.

1.2.2.5.3. All Other Floors

Air handling units shall serve all other areas to include lobbies and bathrooms.

1.2.2.6 Heating

Heating will normally be provided by a circulating hot water system. Water circulation shall be by means of two pumps, one operating pump and one standby pump.

1.2.2.7 Chillers

Two package chiller units shall be provided, each with a capacity equal to at least 60 percent of the total load, or equal to the total load of the control cab plus the electronic equipment rooms, whichever is greater. The chilled water system shall be provided with an operating chilled water pump and a standby pump. The distribution system shall be valved to allow

1.2.2.7 Chiller Redundancy

isolation of critical loads from the chilled water circuit. Interlock chillers so that in the event one fails or is down for maintenance, the second chiller will automatically begin operation.

1.2.2.8 Outside Design Temperatures.

Design air conditioning on the basis of 1.0 percent dry bulb temperature and 1.0 percent mean coincident wet bulb temperature summer occurrences or 0.4 percent annual occurrences as specified in AFMAN 32-7046, *Engineering Weather Data*. Design heating on the basis of a 99 percent dry bulb temperature.

1.2.2.9 Inside Design Conditions

Inside design conditions shall be IAW DoD E*nergy Managers Handbook*, 1996, Appendix D-Heating: 68 – 70 degrees Fahrenheit and Cooling: 76 – 78 degrees Fahrenheit.

1.2.2.10 Humidity

All equipment in the tower is designed to operate in relative humidity range of 35 to 80 percent. Humidity levels should be IAW ASHRAE standards.

1.2.2.11 Air Conditioning Loads

Loads will be calculated using normal air conditioning load calculation procedures. Loads shall be based upon a personnel occupancy as indicated in the RAMP. Loads due to electronic equipment should be verified during design. Minimum loads are as follows:

1.2.2.11.1. Control Cab: 8550 W (29,200 BTU/H)

1.2.2.11.2. Upper Electronic Equipment Room: 6676 W (22,800 BTU/H)

1.2.2.11.3. Lower Electronic Equipment Room: 7114 W (24,400 BTU/H)

1.2.2.11.4. Simulator Room: 7027 W (24,000 BTU/H)

(Do not consider the above heat loads when calculating heating requirements.)

1.2.2.12 System Control

Dual systems shall be sequentially controlled such that the loads are equally/alternately shared by each system. In the event of a chiller failure, control shall be such that the non-critical loads (all areas other than control cab and electronic equipment rooms) can be dropped. The control system shall be designed with simplicity of operation. Care shall be taken to locate thermostats in an area not subject to direct sunlight or other heat source.

1.2.2.13
Heat

1.2.2.13.1. System Types

Use the most cost effective heat source for the installation, i.e., steam, high temperature hot water, gas, oil, etc. In addition, provide a backup source of heat at the facility in case of primary source loss.

1.2.2.13.2. Water Treatment

Provide water treatment chemical feed and control equipment and pretreatment equipment IAW AFI 32-1054 for minimum life-cycle cost.

1.2.2.14
Ventilation/Air Conditioning System

Outside air quantities IAW the current ASHRAE standards shall be provided to all occupied spaces.

1.2.2.14.1 Architectural Screening

1.2.2.14.1 Architectural Screening

1.2.2.14.1. Mechanical Yard

Provide an appropriate architectural screen or enclosure for exterior equipment such as generators, fuel oil tanks, condensers and chiller equipment to maintain the aesthetics of the facility. In areas that receive significant snow accumulation, consider adding a roof over the mechanical yard to protect the systems.

1.2.2.14.2. Water Treatment

Provide water treatment chemical feed and control equipment compatible with existing chemical treatments used on the base for the water quality encountered lAW AFI 32-1054. Use good quality automatic chemical proportioning and blowdown equipment, such as electric contact make-up water meters, conductivity blowdown controllers and adjustable solenoid blowdown valves. Closed systems shall be treated as necessary for water quality and conditions IAW AFI 32-1054. A tight non-leaking closed system is the best protection against corrosion.

1.2.2.14.3. Location of Air Intake

Ensure that outside air intakes are not located in the vicinity of generators, loading docks, or other areas where exhaust may be present or where air quality is compromised.

1.2.2.15
Fuel Oil Storage Tanks

If fuel oil is used for heating, provide an above ground tank conforming to local, State and Federal environmental requirements, and NFPA 30. The heater and generator should also be able to run on diesel fuel. Above-ground self-diking tanks may be

used, provided that they are placed on a concrete pad, have spill and overfill protection, have interstitial monitoring, and the primary tank has a water drain and is epoxy-coated inside and outside. Tanks without these features may be used, but must be contained with a dike.

1.2.2.15 Typical Fuel Oil Storage Tank

1.2.2.16 Metering

Metering equipment is to be installed on all main energy and water supplies to the building, as required by ETL 94-2. Landscaped areas or areas that are irrigated should be metered separately, if water usage is considerable, in order to reduce sewer costs. Meters shall determine consumption, not rate of consumption. Demand or maximum flow meters are not required.

1.2.3 Plumbing

Plumbing design shall be IAW AFJMAN 32-1070, Chapter 4, and the *Uniform Plumbing Code* (UPC).

1.2.3.1. Building Water Supply

1.2.3.1.1. Source Of Supply

The water source for this facility shall be from the base water supply system. Note: Remote locations may require a separate well as a practical alternative to costly utility connections to the base water supply system.

1.2.3.1.2. Hot Water

Domestic hot water shall be provided for restroom areas. Consider an instantaneous hot water heating faucet or a small hot water heater in the restroom.

1.2.3.1.3. Water Pressure

The tower will likely need a water pressure booster system to get water to the cab.

1.2.3.1.4. Sink

Provide a sink with hot and cold running water in the control tower cab. The area below the sink should contain storage.

1.2.3.1.5. Hose Bibcock

Provide an external non-freeze hose bibcock on the catwalk and at ground level. Each hose bibcock will have a backflow preventor.

1.2.3.1.6. Backflow Prevention

The supply connection to each fixture or appliance that is subject to back-siphonage of non-potable liquids, solids or gases will be protected in accordance with the *UPC*.

1.2.3.2 Piping System

1.2.3.2.1. Materials

The exterior underground service piping to the facility shall be polyvinyl chloride (PVC) or type L copper. Do not use galvanized steel piping for the underground

water service because of corrosion problems. For interior piping, consider PVC or CPVC and polyethylene to reduce project cost.

1.2.3.2.2. Features

Domestic water lines should have water hammer arresters. Self-closing fixture valves should be used at all fixtures with combination hot/cold water faucets on all sinks and lavatories.

1.2.3.2.3. Restrooms

Provide a minimum of one unisex restroom. The primary restroom location shall be adjacent to the mechanical room directly below the control cab. Recommend providing one shower and locker area in towers with more than one restroom where the program requirements reflect a 24-hour work shift. Restroom fixtures and interior finishes shall be in accordance with MAJCOM design standards. Lacking MAJCOM or other standards, use the following guidance: Restroom doors shall be provided with a bathroom door lockset. Restrooms shall have one tank type water closet and one lavatory with mirror. Plumbing fixtures should be wall hung to facilitate cleaning and maintenance. Fully or partially recessed (depending on wall depth) towel dispensers with integral waste receptacles should be used. Dispenser/receptacle should have standard stainless steel architectural finish with a removable stainless steel waste container in the bottom receptacle portion. No sanitary napkin dispenser shall be installed in unisex restrooms. A sign depicting "In Use" should be included and installed to aid in occupancy notification.

1.2.4 Electrical and Telecommunications

1.2.4.1 Applicable Publications

Use AFJMAN 32-1080 (Army TM 5-811-1) and AFJMAN 32-1083 (Army TM 5-683) as guidance for design of control towers. Non-technical, critical-technical, and technical power must have separate panels.

1.2.4.2 Power Requirements

Non-technical, critical-technical, and technical power requirements must be determined by the total loads as calculated by the A-E.

1.2.4.3 Operational (Critical-Technical And Technical) Power Requirements

1.2.4.3.1. Control Cab (CONUS)

Government furnished electronic equipment to be installed by other than the construction contractor in the control cab will require a minimum of 6 each, single pole, 120 VAC, 20 amp circuit breakers from a 120/208 VAC, 60 Hz, three phase source designed to comply with ANSI C84.1. Terminate the six circuits in straight blade quad receptacles, Harvey Hubbell #5462 or equivalent, one receptacle located in/on the wall under each of the six wrap-around console positions. The branch circuit rating shall not be less than the non-continuous load plus 125 percent of the continuous load. Provide spare 1 pole, 20 AMP, 120 VAC circuit breakers in panel serving the control tower cab.

1.2.4.3.2. Upper Electronic Equipment Room (CONUS)

Electronic equipment to be installed in the upper electronic equipment room will require a minimum of 10 each, single pole, 120 VAC, 20 amp and 2 each 30 amp, single pole, 120 VAC circuit breakers from a 120/208 VAC, 60 Hz, three phase source designed to comply with ANSI C84.1. Total connected load will not exceed 100 amps. Enhanced Terminal Voice Switch (ETVS) racks require 30 amp, 2 pole breakers. The number of ETVS breakers is dependent upon the size of the switch. There shall be space for 3 of these breakers in the event that a BS-3 equipment is installed. Provide "unistrut" at 1.2 m (4 ft) maximum on center, on underside of floor above to hang cable racks/trays. These racks/trays shall be contractor furnished/contractor installed. The "unistrut" is 12 gage, Versabar Corp #VA-1 or equivalent, and is to be hung with the open side down. If the A-E designs overhead cable ladder and trays, they shall be a minimum of 12 inches wide and installed at least 7 feet 2 inches above the floors in both equipment rooms. The cable ladders or trays shall be centered over the proposed equipment racks in a "T" configuration originating from the vertical communications riser and shall be contractor furnished/contractor installed. The design shall include a 100 amp panel (minimum).

1.2.4.3.3. Lower Electronic Equipment Room (CONUS)

Electronic equipment to be installed in the lower electronic equipment room will require a minimum of 10 each, single pole, 120 VAC, 20 amp and 2 each, single pole, 120 VAC, 30 amp circuit breakers from a 120/208 VAC, 60 Hz, three phase source designed to comply with ANSI C84.1. Total connected load will not exceed 50 amps Provide "unistrut" as noted in the preceding paragraph. The design shall include a 100 amp panel (minimum).

1.2.4.3.4

Overseas locations shall use local power standards. Many European locations have 230/400 volts 50Hz at the transformer secondaries and are designed to provide nominal 220/380 volts 50Hz at the loads to allow some voltage drop. The United Kingdom has 240 volts line to neutral and Italy has 127 volts line to neutral, both at 50Hz. Wall power receptacles should meet location standard voltage requirements (European power standards) to accommodate procurement of local electric items (fans, coffee pots, etc.).

1.2.4.3.5. Simulator Classroom

A tower simulator will be installed in the simulator classroom at the base of the tower. The simulator will require a minimum of 10 each, single pole, 120 VAC, 20 amp circuit breakers and 2 each, single pole, 120 VAC, 30 amp circuit breakers from a 120/208VAC, 60 Hz, three-phase source designed to comply with ANSI C84.1. The total connected load will not exceed 100 amps. The A-E shall design dedicated circuit breakers for the proposed tower simulator equipment and separate convenience outlets distributed throughout the classroom.

1.2.4.4
Power Sources

Power sources shall consist of a primary source with a back-up Class C diesel generator IAW AFI 32-1062 and AFI 32-1063. The heater should also be able to run on diesel fuel.

1.2.4.4.1 Back-Up Generator

Back-up generator shall be Class C equipped with auto-start and auto-transfer capability. The generator shall be designed to come on line within 10 seconds after the primary source is lost. The generator run control system shall include a 0 – 2

hour adjustable timer. The timer shall operate on primary power and shall reset to the preset delay of 0 – 2 hours upon each power failure. A manual/automatic switch shall be provided to permit manual or automatic operation. The power system shall be equipped with a remote status power outage warning box. The power outage warning box shall be equipped with green, yellow and red lights, low db annunciator horn and silencer switch. The red light shall flash and the horn shall activate upon loss of primary power source. The yellow light shall remain on when running on standby power. The green light shall remain on when primary power is in use and/or available for use. Warning lights shall be located in the control cab console.

1.2.4.4.1.1. Generator Fuel Supply

Fuel storage shall be sized as specified in ETL 90-5. Design fuel storage and supply for emergency generators to ensure continuous operation during seismic events. This, for example, may require piping and flexible connections at the tank, building envelope, and generators that remain fuel tight throughout the seismic event and after. Consider the following when locating the tank: protection against damage (intentional or unintentional), protection against fuel spills, and containment of spills.

1.2.4.4.1.2. Generator Capacity

The generator shall be sized to meet critical-technical power loads in addition to technical power loads, described above. These critical-technical power loads shall include power for control cab lighting and HVAC systems serving the control cab, electronic equipment rooms and the elevator.

1.2.4.4.4. Power Surge Suppressor

The elevator motor should have a soft start system. The elevator power bus shall be isolated from technical power and critical-technical loads to protect such loads from transient voltage variations. Surge protection shall reduce lightning and switching surges to within acceptable quality power limits.

1.2.4.4.5. Uninterruptible Power Supply (UPS)

The STARS system will be provided with an UPS. The ETVS and digital voice recorder system (DVRS) are equipped with battery backup and shall not be fed from the UPS system. The facility is designed with generator backup to provide 100% power required in case of a power failure. If an UPS is required, as determined by the Base Civil Engineer, it shall be installed in conjunction with the building power system(s) and have a minimum backup capability of 15 minutes to provide a buffer when manually starting the generator. The UPS is classified as government furnished contractor installed (GFCI). Only technical power panels need to be served by the UPS.

1.2.4.5
Communication Ducting And Cabling Systems

Administrative telephone wiring/cabling must be installed under the Military Construction (MILCON) project and funded with MILCON appropriations. However, specialized communication wiring/cabling (e.g., cabling which extends from the air traffic control tower to the Radar Approach Control (RAPCON), Navigational Aids (NAVAIDs), remote transmitters and receivers, etc.) will be installed by in-house E&I personnel. Raceways, conduits, pullboxes, duct banks, etc., necessary for the installation of these specialized communication cables shall be included in the contract and are as follows:

1.2.4.5.1. Provide ducts within the tower as shown in Part 3 of this Chapter. Two 100 mm (4 in) ducts shall be provided for antenna cables between the equipment

room and the roof. Ducts shall be installed adjacent to each of two roof support columns and terminate in the weather heads on the roof. The two 100 mm (4 in) ducts for antenna cabling should not be a continuous run from the equipment room to the roof. The two conduits should run from the radio equipment room to the floor just below the cab. There should then be a cable ladder, trough or duct over to another set of 100 mm (4 in) conduits that continue the run up to the weather heads on the roof. Provide four 150 mm (6 in) ducts from the equipment room to the floor trench in the cab. Ducts shall be provided with pull boxes on each floor that they pass through, sized per the *National Electric Code* (NEC). Pull boxes must be large enough to allow meeting minimum bending radius specifications of any transmission lines running to the roof.

1.2.4.5.2. Where cables are required to be buried beneath paved areas, provide cable ducts to support future installation of specialized communication wiring/cabling. Generally, a bank containing six 100 mm (4 in) ducts is adequate for this purpose. Duct banks should be used for critical communications wiring; direct bury for other cabling will be at the discretion of the MAJCOM. Duct banks may be installed but are not required where the use of direct bury cabling is feasible.

1.2.4.5.3. Provide manholes and conduit stub-outs as necessary to accommodate future communications cable installation by others. Provide a 0.56 m^2 (6 sq ft) minimum communications space under the first floor, immediately beneath the communications duct riser. The manhole shall have a manhole access port from the first floor. Run six 100 mm (4 in) ducts from manhole below floor to a point at least 1.5 m (5 ft) beyond the building line. Direction of the duct lines will be provided at the pre-design conference.

1.2.4.5.4. Provide three 100 mm (4 in) conduits from the cable trays in the equipment rooms into the vertical communications chase.

1.2.4.5.5. Site specific requirements for communication ducts, conduits, manholes, and stub-outs will be shown in the RAMP or provided to the designer at the pre-design conference.

1.2.4.6
Cable Separation

Power and communication cables shall be physically separated by distance or by barrier to preclude power cables from coming into contact with communication cables in accordance with the *National Electric Code*. Cable ladders shall be provided. Vertical shafts shall be provided with fire separation assemblies in accordance with the other paragraphs in this section.

1.2.4.7
Communication Penetrations

Provide eight each 100 mm (4 in) cable penetrations in the concrete floor between each level of the communications riser. Install a full-height (floor to ceiling) cable ladder in the vertical communications riser. The ladder shall be installed on stand-offs to facilitate the ability to install cable ties to secure the cables to the ladder. Doors shall be installed at each level to facilitate cable installation and maintenance. Also provide communication penetrations for island areas where raised access flooring is not installed. The A-E shall specify that firestop material be installed at all penetrations.

1.2.4.8
Power Penetrations

Provide 6 each 100 mm (4 in) cable penetrations in the power chase. If desired, the 6 each 100 mm (4 in) cable penetrations in the power chase may be deleted in lieu of 300 mm x 400 mm (12 in x 16 in) rectangular opening for the building contractor to install power conduits, versus plenum-rated power cables. Doors shall be installed at each level to facilitate cable installation and maintenance. The A-E shall specify that firestop material be installed at all penetrations.

1.2.4.9
Emergency Lighting

Ensure the stairway lighting and at least one light in each continuously occupied room is supplied by circuits powered by the emergency generator. Provide emergency fixtures (conventional with battery-backup) in the stairway and also one in each room. Battery powered emergency lights (wall packs) are prohibited.

1.2.4.10
Telephone Cabinets

Provide a minimum 1070 mm wide by 1240 mm high by 150 mm deep (42 in x 49 in x 6 in) telephone cabinet in the upper electronic equipment room. The cabinet shall be interconnected by a 150 mm (6 in) square duct to the vertical communication riser. The cabinet shall be provided with "lift out" door. The main cable head shall be at ground level into the telephone room.

1.2.4.11
Lightning Protection

Lightning protection shall be provided IAW requirements of AFM 88-9 Chapter 3, ETL 90-6, and MIL STD 188-124B.

1.2.4.12
Exterior Lighting

Building entrances should be lit to 21.5 lx (2 foot-candles) by High Pressure Sodium (HPS) units. Specify the use solar powered luminaires when they meet lighting requirements and are cost effective.

1.2.4.13.
Obstruction Lights

Provide obstruction lights IAW requirements of AFI 32-1044, *Visual Air Navigation Systems.*

1.2.4.14
Parking Lot Lighting

Lighting should be provided per MAJCOM standards. Where no guidance is given: a lighting level of 5.4 lx (0.5 foot-candles) at ground level is required in the parking lots. The lighting should use HPS lamps for low energy consumption. Lighting should be mounted on aluminum/steel standards (anodized aluminum in coastal environments) which are mounted on concrete piers.

1.2.4.15 Lighting

1.2.4.15.1. Control Cab Area Lights

Area lights shall be recessed floodlights with non-reflective grooved baffles. Lighting should be compatible with night vision goggle requirements.

1.2.4.15.2. Control Cab Spotlights

Spotlights shall be recessed pinhole lights, dimmer controlled, with approximately 64 mm (2.5 in) opening, 100-watt bulb. Caution: Do not use fluorescent "energy efficient" bulbs in the recessed pinhole lights in the tower cab since they do not allow for a full range of dimming (0 – 100%) and can cause undesirable reflections off of the glass.

1.2.4.15.3. Gooseneck Lamps

Overhead spotlights cannot provide direct lighting to operator positions in ATCT layouts that include glass that slopes toward the interior of the cab. The A-E shall consider the use of desk-mounted gooseneck lamps to illuminate each position The gooseneck lamp must be fully dimmable and controlled from each position.

1.2.4.15.4. Simulator Classroom Lights

Lights in the classroom shall be fully dimmable.

1.2.4.15.5. Specify interior lighting that meets Energy Star program standards. Qualifying products are listed at http://www.energystar.gov/products.

1.2.4.16 Grounding

The tower shall have a multi-point (earth electrode sub-system) facility grounding system IAW AFI 32-1065. A Signal Reference subsystem wire (minimum 2/0 copper, yellow insulated) shall be installed in the vertical communication riser. Do not ground to the structure. The Signal Reference subsystem wire shall connect directly to the multi-point facility grounding electrode system. Grounding requirements will need to be enhanced for towers over 50 feet tall.

1.2.4.17 Equipment Reference Grid

The control tower cab and the electronic equipment rooms shall be provided with an equipment reference grid with embedded grounding plates as described in IEEE Standard 1100-1992 *(IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment)*. Also see Equipotential Grounding System, 1842 EEG Sketch LBWSOOOO8GSOO. In addition, provide a single point ground lug on the plywood backboards in both equipment rooms and the telephone room on the first floor connected to the equipotential ground plane.

1.2.4.18 Light Gun Outlets

Light gun outlets shall be provided in locations as shown in Part 3, Drawing 10 of this Chapter. Eye bolts for hanging the light guns shall be installed by contractor.

1.2.4.19 Telephone Outlets

Telephone outlets are required in the offices of the facility. It is recommended that a minimum of four each (one per wall) "quad" jacks (two each CAT 5 data and two

each CAT 5 telephone) be installed at each floor. Conduit for telephones can be stubbed, with bushings provided, above the ceiling where suspended ceilings are used. A cable tray should run from the Telephone Terminal Backboard (TTB) to and along the centerline of the facility when this method of installation is used. Conduit is only necessary for areas where there is no ceiling or there is no access above the ceiling. When conduit is used, it shall be prewired. Telephone service to the building will be provided by implementation of a communications scheme.

1.2.4.20
Service Outage Duration Limitations

The A-E shall specify that power outages for contractor connection will be arranged by coordination through the authorized representative of the contracting officer with the base utilities personnel. The contractor must request all outages in advance so that tower operations will not be inadvertently interrupted. Special provisions in the contract must clearly delineate these requirements.

1.2.4.21
Airfield Lighting Control

The Airfield Lighting Panel, with connections and interface to the airfield lighting vault, shall be provided and installed by the construction contractor, to include installation of the conduit and wiring for the lighting control panel. The size and number of conduit and conductors must be determined on a case-by-case basis. The contractor shall provide and install the airfield lighting control panel in the control cab console as shown on the console drawings. The contractor should make the physical connection (including underground ducting) from the airfield lighting vault to the airfield lighting control panel at the ATCT. Provide one 10 cm (4 in) empty square duct between power panel and floor trench in control cab. The airfield lighting control panel shall conform to minimum requirements of FAA specification L 821, *Panels for Remote Control of Airport Lighting*. Updated, improved controls are encouraged but must be approved by the MAJCOM.

1.2.5 Elevator

1.2.5.1
Requirements

Towers with a cab floor level of 50 ft or more above the ground level shall be equipped with an elevator. New elevators shall conform to the requirements of ASME/ANSI A17.1, *Safety Code for Elevators and Escalators*, and shall include a ventilated shaft. The elevator speed shall be a minimum of 0.76 m/s (150 ft/min). The elevator capacity shall be sufficient to transport the equipment installed above the ground floor.

1.2.5.2
Existing Elevators

Existing elevators shall conform to ASME/ANSI A17.3, except Phase II emergency in-car operation is not required. The specified net load shall not be less than 540 kg (1,200 lbs).

1.2.5.3 Type

As a general practice, electric elevators with a soft start system should be specified. However, consideration may be given to the use of a hydraulic elevator when the ATCT is less than 18 m (60 ft) in height.

1.2.5.4 Operation

The elevator shall operate from ground floor to training/simulator room (or upper equipment room) whichever is higher, stopping at each intermediate floor. Elevators shall be interconnected with the fire alarm/detection telephone and emergency power systems to recall the elevator to the ground floor and hold it there until the alarm is reset and/or the facility is returned to commercial power with the following exception: A three-position (on, off, and bypass) key-operated switch shall be installed in the first floor lobby to allow the elevator to operate on emergency power. When the switch is in the "on" position, normal elevator service shall be provided. When the switch is in the "bypass" position, the elevator shall operate independently of the fire alarm/detection system and the commercial power source. The key shall be removable only from the "on" or "off" positions. The elevator will be used to transport personnel and equipment.

1.2.5.5 Doors

All elevator doors are to be the sliding type and shall provide at least a 0.9 m wide by 2.2 m high (3 ft wide by 7 ft 2 in high) clear opening. Elevator doors shall not open to the stair enclosure.

1.2.5.6 Elevator Electronic Equipment

Provide a containment vessel in the absence of an industrial waste line. Some types of elevator systems require location of elevator supporting electronic equipment in a conditioned space.

1.2.5.7 Elevator Pit

The elevator pit shall have pit light, ground fault indicator (GFI) electrical outlet, pit ladder extending 1017 mm (42 in) above the sill line and 113 mm (4½ in) from the wall, and a sump pump connected to industrial waste line. Provide a containment vessel in the absence of an industrial waste line. Smoke detectors shall be installed in the elevator machine room and hallway in front of the elevator doors.

1.2.6 Fire Protection and Life Safety

This section provides the designer with fire protection and life safety information necessary to plan and design ATCTs and complies with applicable sections of AF directives, MIL HDBK 1008C *Fire Protection for Facilities, Engineering, Design, and Construction*, National Fire Codes, the National Fire Protection Association's (NFPA) *Life Safety Code, NFPA 101*, and the *Uniform Building Code* (UBC). These standards are applicable in CONUS and overseas. Host nation laws in overseas locations shall also be considered. The Status of Forces Agreement for the host nation should be consulted to guarantee that no conflicts occur.

1.2.6.1
Occupancy

Since ATCT facilities have well defined work areas, workstations and operational positions, occupancy loads are determined by actual count of people planned to occupy the facility. Included in the count should be current and future controllers, staff personnel, maintenance technicians and supervisors plus an allowance for visitors. The total occupancy of an ATCT is normally less than 25 people. Occupancy of the cab is generally 10 persons or less.

1.2.6.2
Protection For Persons With Disabilities

Persons who are unable to use the stairway for emergency egress and who are permitted access to the tower shall be restricted to the level of exit discharge only. The ATCT is intended to be manned by able-bodied personnel. Air Force policy requires all air traffic controllers to pass and maintain a current flight physical examination. Provisions for the physically handicapped are not applicable.

1.2.6.3.
Number Of Exits and Means of Egress

1.2.6.3.1. Towers shall be provided with a single exit when the following conditions are met:

(1) The tower is subject to occupancy by fewer than 25 persons all of which are part of the air traffic control tower operation.

(2) The tower is not used for living or sleeping purposes.

(3) The tower is of Type I or Type II construction,

(4) The tower interior wall and ceiling finish is Class A or Class B.

(5) The tower has no combustible materials in the structure, under the structure, or in the immediate vicinity of the structure, except necessary furniture.

(6) There are no high hazard occupancies in the tower or in its immediate vicinity—emergency power for the ATCT is permitted.

(7) Where the tower is located above a building, the single exit from the tower shall be provided by one of the following:

a. An exit enclosure separated from the building with no door openings to or from the building, or

b. An exit enclosure leading directly to an exit serving the building. A secondary egress such as a “Baker Life Chute” is not required.

1.2.6.3.2. The means of egress shall not be shared with an attached adjacent RAPCON or other occupancy. The A-E shall consider specifying a backup egress to provide a secondary means of escape from the cab, except when stairway and doors meet fire rated enclosure requirements and a secondary egress system is not required. Secondary egress from the tower, such as a “Baker Life Chute,” is not required.

1.2.6.4 Construction

All towers must be Type I or Type II (fire resistive) construction according to the UBC.

1.2.6.4.1. Fire rated partitions shall be installed to separate areas of hazardous occupancies such as mechanical, generator, storage, electrical and technical equipment rooms from areas of ordinary occupancy such as the stairway, offices, training rooms and control cab. Fire partitions shall be constructed to have a fire resistance rating of one hour with the exception of the mechanical and generator rooms greater than 9.3 m^2 (100 sf) which shall have a fire resistance rating of two hours and fire rated doors of one and one-half hours. Doors from areas of hazardous occupancies shall not open directly into the stairway, which shall be designed as a smoke proof enclosure.

1.2.6.4.2. All ducts and chases must be fire/smoke stopped by an approved/listed method at every floor. The construction contractor shall install firestops in the vertical cable ducts (IAW NFPA standards) after installation of the cables by government personnel. Stopping methods used must permit repeated removal and replacement, without special tools, to support changing requirements.

1.2.6.4.3. Flame spread and smoke development ratings shall be IAW MIL HDBK 1008C. A Class B interior finish may be substituted for Class A interior finish in areas of ordinary occupancy such as the offices, training rooms, and control cabs of towers that are completely protected with automatic sprinklers. All stairway finish material shall be Class A and floor finish shall be Class I rated.

1.2.6.5 Doors

1.2.6.5.1. Elevator Vestibule Or Stairway Landing.
Doors that connect with the stairwell must be equipped with automatic door closers. If the door has a lite to allow visibility from the floor into the stairwell, it shall be a fire-rated 5" x 20" vertical lite. Doors shall swing in the direction of egress travel when serving any hazardous area or serving an occupant load of 10 people or more. Doors shall have the capability of opening at least 90 degrees and have a clear width at the exit way of at least 910 mm (36 in).

1.2.6.5.2. All doors shall have a master keying system including coded entry doors. Key control should be compatible with the key control of the rest of the installation.

1.2.6.6 Stairways

1.2.6.6.1. ATCTs must have the stairway designed as a smoke proof enclosure. The purpose of the smoke proof enclosure is to prevent heat and smoke from entering the stairwell. The smoke proof enclosure shall consist of the vestibule and stairwell continuously enclosed from the ground floor to the bottom of the cab floor with a two-hour fire rated wall. The enclosure shall be a positively pressurized, fire rated enclosure.

1.2.6.6.2. The width of a new stairway shall be 1120 mm (44 in) minimum. There shall be not more than 3.7 m (12 ft) vertically between landings. The handrail may extend from each side of the stairway a distance of 88 mm (3 ½ in) into the required width. The stair rise shall not exceed 175 mm (7 in), and the tread shall be at least 275 mm (11 in), and the total height of two risers plus the width of one tread shall not be less than 610 mm (24 in), except as follows:

1.2.6.6.3. For a control tower that is to receive existing cab replacement only, the existing stairway will remain in use if it meets the requirements of NFPA 101, paragraph 5.2.2.1.

1.2.6.6.4. Non-complying stairs may continue to be used, subject to the approval of the user and the authority having jurisdiction (the Base Civil Engineer (BCE), acting in their capacity as the Base Fire Marshall).

1.2.6.6.5. Circular stairways are prohibited except in existing cabs where the circular stairway serves an occupant load of 10 persons or less and the minimum width of run is not less than 125 mm (5 in) and the rise is not more than 225 mm (9 in).

1.2.6.6.6. Floor levels must be clearly marked at each landing level so that in the event of an emergency, fire and rescue personnel can identify where they are.

1.2.6.7 Fire Suppression and Detection

1.2.6.7.1. Fire Sprinkler System.

Towers shall be provided with complete automatic sprinkler protection IAW MIL HDBK 1008C. Wet-type systems shall be provided in all areas, unless subject to freezing. Protection for electronic rooms shall be provided IAW ETL 93-5. If the ATCT and the RAPCON are collocated, a single fire sprinkler system may serve the ATCT and RAPCON provided that separate water flow indications are provided for each.

1.2.6.7.2. Fire Standpipe System

Towers more than 15.2 m (50 ft) to the cab floor (the minimum tower height per Part 3, Drawing 1 of this Guide is 5-stories or 16 m (53 ft)) must be provided with a Class I wet standpipe and an exterior fire department connection if the base water system has sufficient pressure to supply the standpipe. If the water system has insufficient pressure or is subject to freezing, then a dry Class I standpipe may be installed. Pressure and flow tests shall be conducted on the water mains near the project site showing static pressure and flow capacity. A copy of a recent Fire Department flow test should be attached to the RAMP. A machine room shall be provided with securable shut off valve installed outside elevator machine room.

1.2.6.7.3. Portable Fire Extinguishers and Cabinets

Fire extinguisher cabinets shall be semi-recessed or surface mounted, 213 mm deep by 300 mm wide by 675 mm high (8-½ in by 12 in by 27 in). Fire extinguishers will be government furnished, government installed. The fire suppression agent for hand-held extinguishers shall be suitable for Class A, B, and C fires. Halon extinguishers shall not be used.

1.2.6.7.4. Fire Detection and Notification System

1.2.6.7.4.1. Automatic smoke detection and alarm systems shall be installed in all ATCT facilities. Smoke detectors shall be located near all probable sources of fire or smoke, including mechanical equipment rooms, return air plenums, electrical/electronic rooms, facility operational areas, etc. Protection for electronic rooms shall be provided IAW ETL 93-5. The system must transmit both alarm and trouble signals to the fire department. Transmitter equipment must be compatible with receiving equipment at the fire department's alarm communications center.

1.2.6.7.4.2. Facility equipment generally includes manual pull stations, audible notification devices, visual notification devices, standby power supply, zoned control and transmission equipment.

1.2.6.7.4.3. All audible and visual notification devices shall be "private mode" devices.

1.2.6.7.4.4. A single fire detection and notification system may be serve an ATCT and attached adjacent RAPCON provided:

1.2.6.7.4.4.1. Each area is separately zoned for detection, water flow and manual pull stations.

1.2.6.7.4.4.2. Separate activation of the notification signals are provided for the ATCT and the RAPCON to prevent simultaneous evacuation of both technical areas.

1.2.6.8 Fire Hydrants

Fire hydrants shall be provided IAW MIL HDBK 1008C. Fire hydrants will be required as part of this facility. If added, fire hydrants are to conform to American Water Works Association (AWWA) Standard C502. Hydrants shall have two 64 mm (2 ½ in) hose connections and one 113 mm (4 ½ in) pumper connection and shall have a 150 mm (6 in) connection to the portable main. Outlets shall have American National Standard fire hose coupling threads; working parts shall be bronze. Hydrants shall be dry or wet barrel type conforming to the base standard and AWWA C502 with valve opening at least 125 mm (5 in) in diameter. At each fire hydrant installation, an isolation valve shall be installed between the hydrant and the main. The isolation valves must be contained in a valve box.

1.2.6.9 Cab Replacement Program

The cab replacement program is designed to take a structurally sound tower shaft and place a new operational cab on top and replace certain supporting equipment (mostly communications equipment). The result of this action is essentially to provide the tower with an operational life of a new tower. As a minimum, the following work should be done to the existing tower shaft:

1.2.6.9.1. All ducts and chases are to be fire-stopped. Stopping should provide for easy removal and replacement by cable maintenance personnel.

1.2.6.9.2. Flame spread and smoke development ratings shall be IAW MIL HDBK 1008C.

1.2.6.9.3. All other interior finish materials must be either Class A or B, and floor finishes must be either Class I or Class II rated.

1.2.6.9.4. Fire protection for stairwells should meet the requirements of the design guide if practical, but never less than:

1.2.6.9.4.1. Stairwells in towers four (4) stories or more to the cab floor must have a separation assembly having at least a two hour fire resistive rating.

1.2.6.9.4.2. Stairwells in towers three (3) stories or less to the cab floor must have a separation assembly of one hour fire resistive rating.

1.2.6.9.4.3. Existing stairwells will remain in use provided that they meet the requirements of the NFPA 101, paragraph 5.2.2.1.

1.2.6.9.5. Elevators added as part of the cab replacement shall not open into the stair enclosure. Existing elevators which open into the stairs shall be provided with a smoke enclosure equivalent to the stairs, i.e., room walls adjacent to the elevator shaft shall be rated IAW ASME/ANSI A17.1, *Safety Code for Elevators and Escalators.*

1.2.6.9.6. Floor levels must be clearly marked at each landing level so that fire and rescue personnel under smoke conditions can identify where they are.

1.2.6.9.7. Fire suppression and detection shall comply with the requirements listed in the Fire Suppression and Detection section of this Guide. Wet-type systems shall be provided in all areas, unless subject to freezing. A dry pipe system with an exterior standpipe is allowable where direct connection to the base water supply is not available.

1.2.6.9.8. All doors shall be on a master key system including coded entry doors.

1.2.6.9.9. All doors that connect with the stairs must be equipped with an automatic closer.

1.2.7 Security

1.2.7.1 Telephones

Provide and install an intercom station at the main entrance to the tower and at the entrance to the control cab. The intercom station located on the exterior of the tower must be installed in a weatherproof box.

1.2.7.2 Door Locks

Provide and install cipher locks, door closers, and electric strikes on the main entrance door and the door into the control cab. The wiring for the electric strikes shall be remote to the lower equipment room where the proposed ETVS will activate the relay. Also provide a light in the control cab console which indicates when either of these doors is not closed. The lock on the main entry and cab doors shall have a remote control override switch, controllable from the tower cab.

1.2.7.3 Entrances

Recommend a covered or recessed entrance or inner vestibule with outer and inner doors as possible options to allow for security requirements and provide protection from the elements. Provide a one-way reinforced window and a slot in the main entry door and the entry door to the control cab for the passage of identification cards.

1.2.7.4 Security Camera

The tower shall be prewired for a security camera system. The security camera shall allow the tower cab supervisor to view the main entrance door. A second camera shall be mounted to view the entrance door to the tower cab. The system may be designed so that the monitor cycles between each door, or by utilizing a split screen

mode where one half of the monitor displays the first floor entry and the other half of the monitor displays the tower cab entry door.

1.2.8 Intercom System

An intercom system shall be provided and installed to allow audible communication between all floors and stations specified above. The intercom system shall be simple and allow the cab to do an "All Call" to every floor, including the tower simulator classroom. Master control shall be located in the control cab. The intercom system is purchased and installed by the contractor in the prewiring contract.

1.2.9 Life-Cycle Cost

Design decisions for the project shall be based on consideration of life-cycle cost. The life-cycle cost study and analysis shall examine all practical civil, structural, architectural, mechanical, electrical, plumbing, energy conservation components, and other systems to determine alternatives and associated maintenance and operational costs. Alternative choices shall he made on the basis of least life-cycle cost rather than first cost. The A-E shall reference the *Project Manager's Guide for Design and Construction* at http://www.afcee.brooks.af.mil/dc/products/pmguide/pmguide.asp for more information.

1.2.10 Sustainability and Environmental Compatibility

Air Force ATCTs must incorporate sustainable development principles and reflect regional environmental uniqueness. The goals of sustainability are to conserve energy, water, and raw materials; prevent environmental degradation caused by construction, operations, and disposal of facilities; and create built environments which are livable, healthy, and productive. By carefully analyzing these factors, an ATCT can achieve a cohesive sense of scale, tradition, and compatibility while sustaining the mission and the environment. For further information and guidance, see the USAF *Environmentally Responsible Facilities Guide* at http://www.afcee.brooks.af.mil/green/facilitiesguide/erfguide.pdf and the *Whole Building Design Guide* at http://www.wbdg.org.

A sustainable facility achieves optimum resource efficiency and minimizes damage to the human and natural environments through all the phases of its life cycle. Sustainable development requires an integrated approach to programming, planning, and design. The project team works with six fundamental sustainability principles:

- optimize site potential
- minimize energy consumption
- protect and conserve water
- use environmentally preferable products
- enhance indoor environmental quality, and
- design to minimize the impact of facility O&M practices.

More details can be found in the *Whole Building Design Guide,* http://www.wbdg.org (select "Sustainable" from the "Design Objectives" tab of the home page).

The A-E shall also reference the Civil Engineer (CE) Sustainability Policy Memo for guidance.

1.2.10.1 Programming

Project programmers work with the design team and environmental management early in the programming process to consider mission requirements and sustainable development principles. This team will establish specific goals and strategies for the project which will be carried out through programming, design and construction.

1.2.10.2 Budget and Life-Cycle Considerations

Project programmers have the opportunity and responsibility to ensure that sustainable development goals are supported in the project budget. The Air Force (AF) goal is to maximize sustainable design within normal facility budgets; however, sustainable methods, materials, or systems will sometimes have higher first costs. Do not automatically exclude design options because of increased cost without further analysis. Additional investment for one building system can often reduce the first costs in other systems through an integrated design approach. For example, the increased cost of energy
efficient lighting systems that produce less heat can be offset by downsizing the HVAC system. For further information and guidance, see the USAF *Environmentally Responsible Facilities Guide*.

1.2.10.3 Siting

Develop a site plan that makes the most of the site's existing natural resources. Where possible, conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

1.2.10.4 Paving

Consider the use of permeable pavements for parking and walkways, as a technique for recharging groundwater and reducing the contaminated storm water runoff from the site.

1.2.10.5 Grading

Prepare a grading plan that maintains natural runoff patterns to the greatest extent possible. Limit disruption of natural water flows by minimizing storm water runoff, increasing on-site infiltration, and reducing contaminants.

1.2.10.6 Retention Basins

Keep storm water onsite rather than dumping it to collection facilities. As an alternative to large retention basins that could be a hazard to children, control storm water at the source by the use of micro-scale features that are distributed throughout the site. Integrate the landscape design into the storm water management strategy, creating planted areas that benefit from storm water while removing pollutants through natural processes.

1.2.10.7 Landscaping and Irrigation

Sprinkler irrigation should only be used when rainwater is insufficient to maintain landscaped areas. Select native plants and design the site for natural storm water management. The use of native plants minimizes the need for chemical pesticides and herbicides used in landscape maintenance.

1.2.10.8 Affirmative Procurement

When selecting building materials, consider the recycled content requirements for affirmative procurement of products included in the Environmental Protection Agency's (EPA) list of guideline items. Federal agencies buying these items must buy products made with recycled materials, unless these products do not meet technical requirements, are more expensive than comparable virgin material products, are not available competitively from two or more sources, or are not available in a timely manner. Some of the items in this list related to exterior design and the building shell include insulation, cement and concrete, latex paint, patio blocks, and structural fiberboard. The list changes as EPA adds new items every other year. A complete list of guideline items and their recycled content requirements is located at http://www.epa.gov/cpg/products.

Note: The drawings are meant as examples and can be modified as the design requires

DRAW. 1.
SCHEMATIC CONTROL TOWER SECTION

DRAW. 2.
FIRST FLOOR PLAN

DRAW. 3.
TYPICAL FLOOR PLAN

DRAW. 4.
TYPICAL FLOOR PLAN WITH TOILET

DRAW. 5.
TYPICAL ELECTRICAL EQUIPMENT ROOM [3rd and 4th LEVEL BELOW CAB]

DRAW. 6.
ELECTRICAL EQUIPMENT ROOM SECTION

DRAW. 7.
READY/BREAK ROOM

DRAW. 8.
MECHANICAL ROOM [LEVEL BELOW CAB]

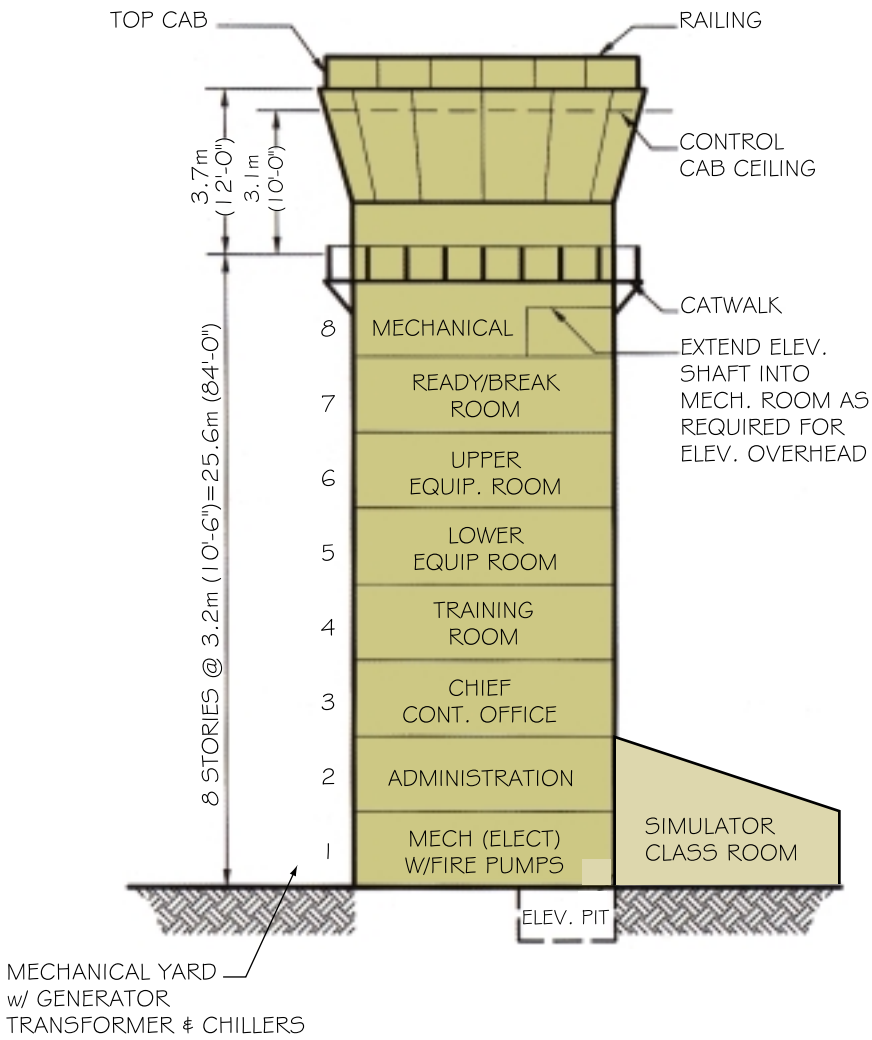
DRAW. 9.
CONTROL CAB

DRAW. 10.
CONTROL CAB [REFLECTED CEILING PLAN]

DRAW. 11.
CONTROL CAB WIRING SCHEMATIC

DRAW. 12.
DBRITE TRACK PLAN

DRAW. 13.
SCHEMATIC HOT AND CHILLED WATER PIPING



Drawing 1 | Schematic control tower section

Note:

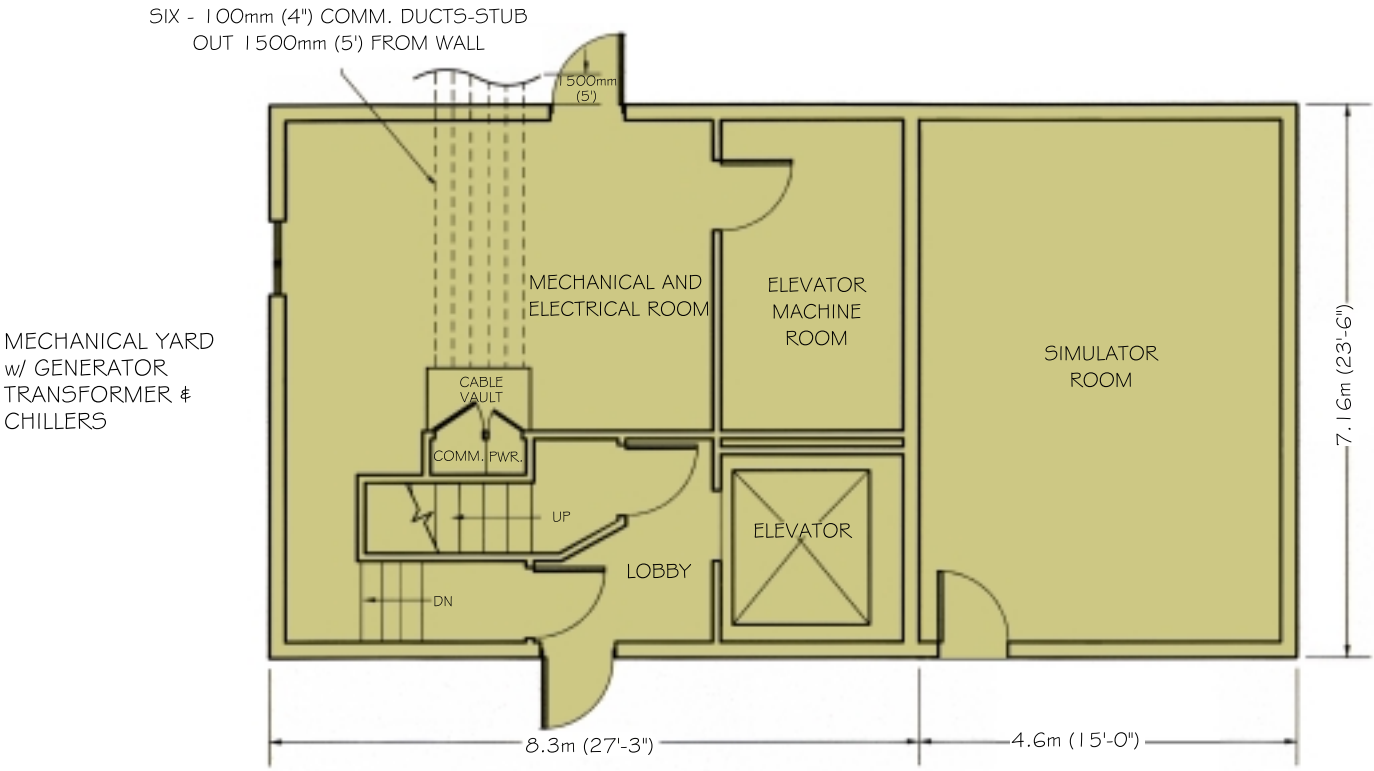
1. Minimun tower consists of the floors listed below the cab. Floors included are:

1st floor -	Elevator and lower Mechanical room Simulator room Mechanical yard
2nd floor -	Administration
3rd floor -	Chief controller's office
4th floor -	Training room
5th floor -	Lower equipment room
6th floor -	Upper equipment room
7th floor -	Ready/Break room
8th floor -	Mechanical room

2. Tower height is determined at the time of the site survey IAW AFR 86-5 ATCH 2.

3. The number of admin. floors is dependent upon tower height. All floors not otherwise identified are finished out for admin. use as needed.

4. Drawing is meant as an example and can be modified
as the design requires.

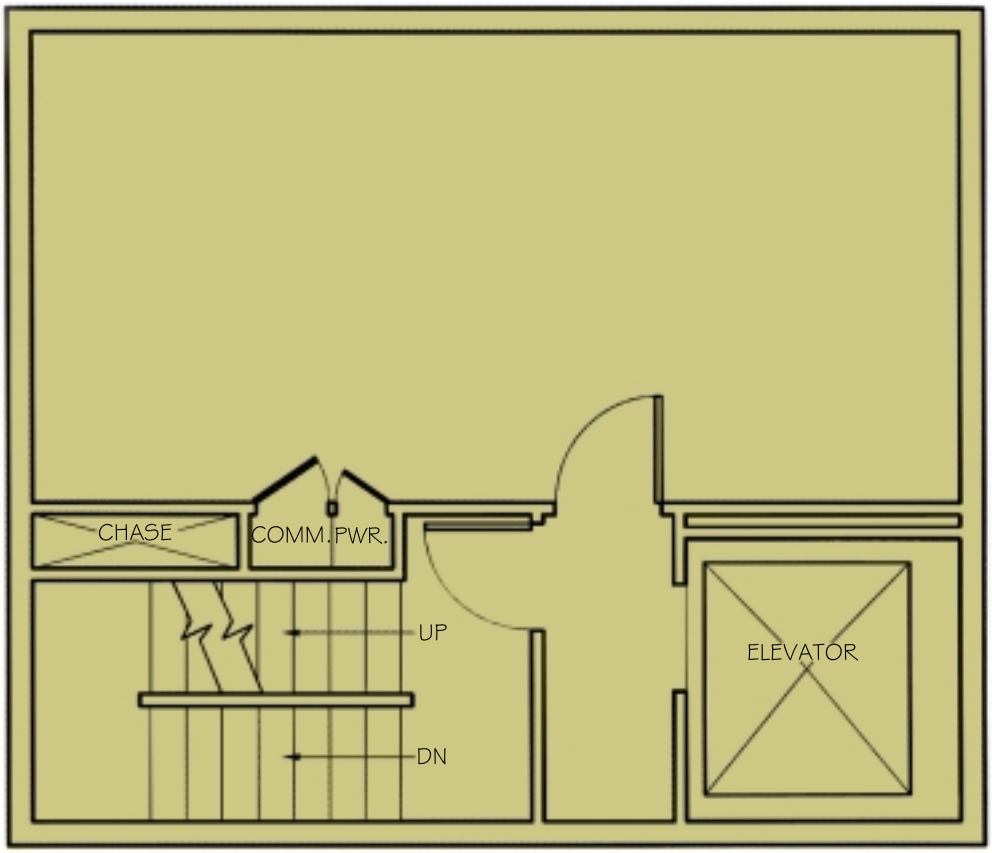


Notes:

1. Drawing is meant as an example and can be modified as the design requires.

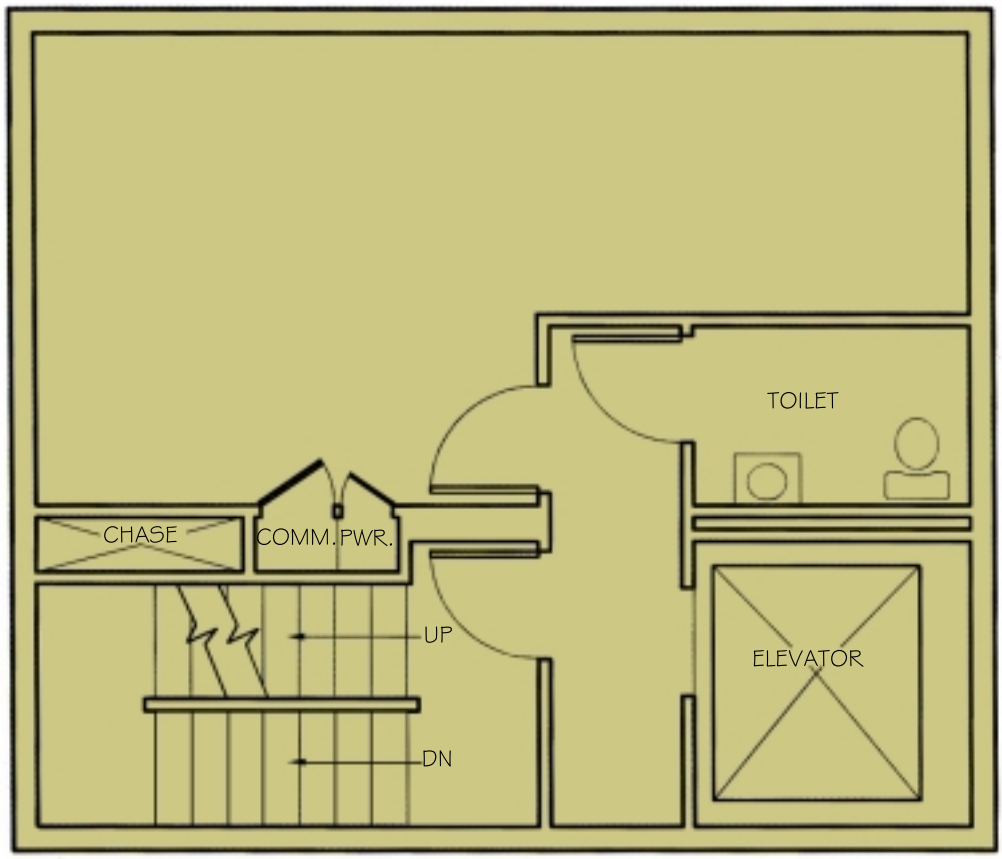
Drawing 2 | First Floor

Note: Drawing is meant as an example and can be modified as the design requires.



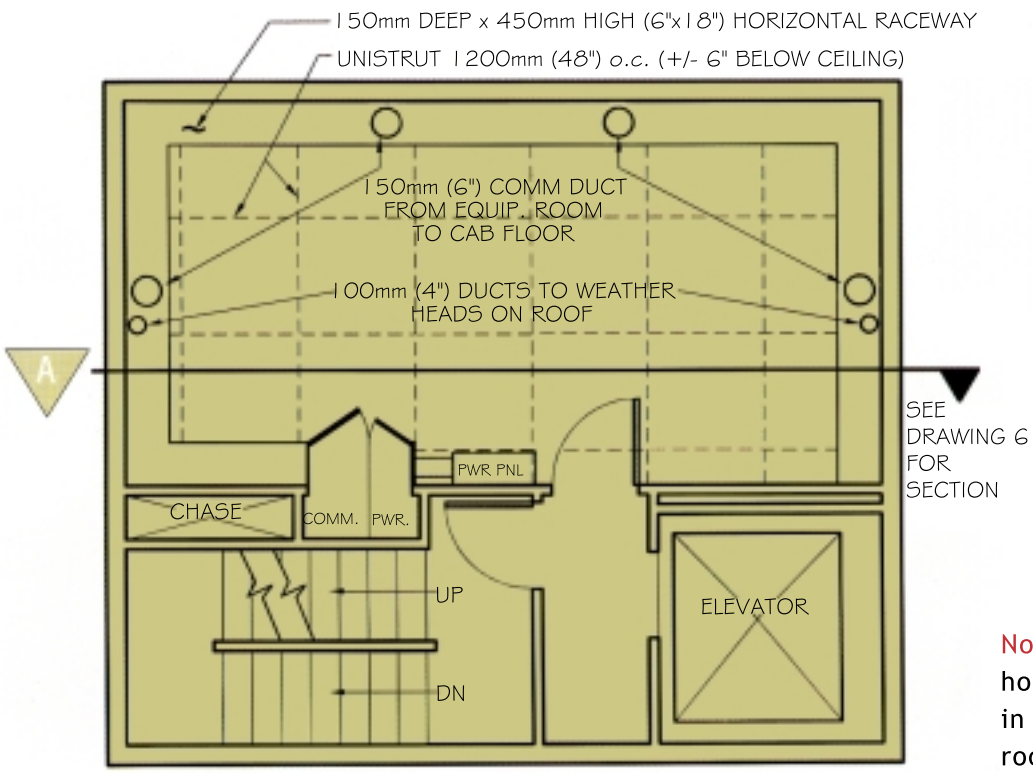
Drawing 3 | Typical floor plan

Note: Drawing is meant as an example and can be modified as the design requires.



Drawing 4 | Typical floor plan with toilet

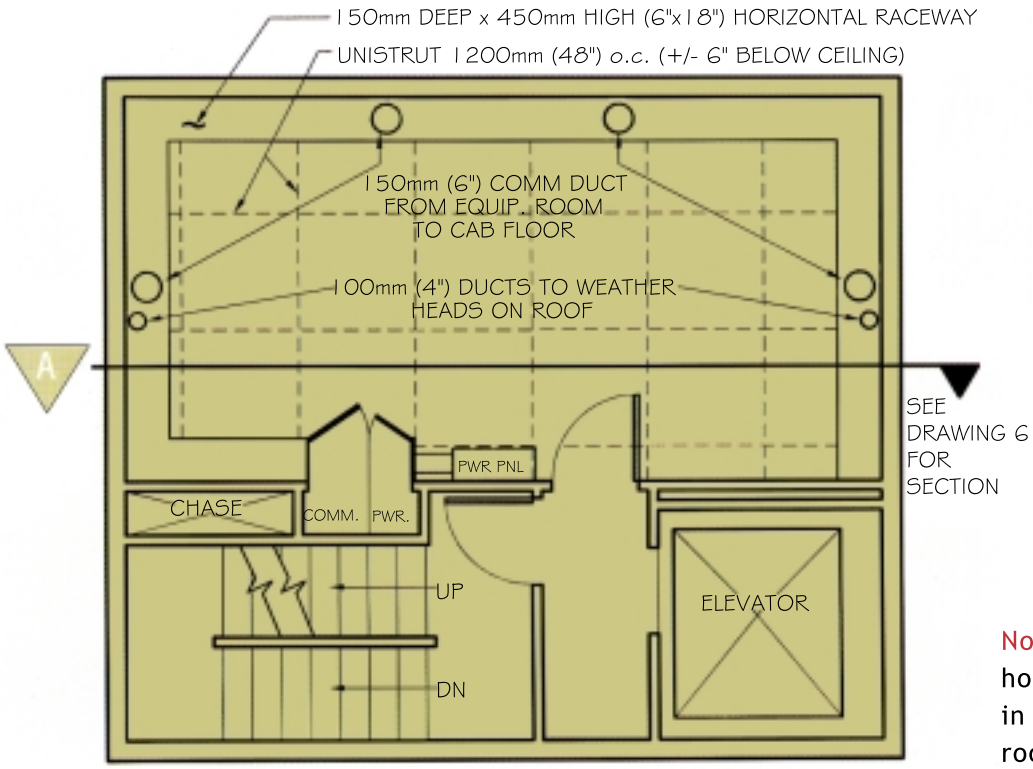
Note: Drawing is meant as an example and can be modified as the design requires



Note: Delete horizontal raceway in lower equipment rooms. Connect top of Demarc panel to vertical comm. riser with 100mm x 200mm (4" x 8") duct same as bottom duct.

Drawing 5 | Typical Electrical Equipment Room [3rd & 4th level below cab]

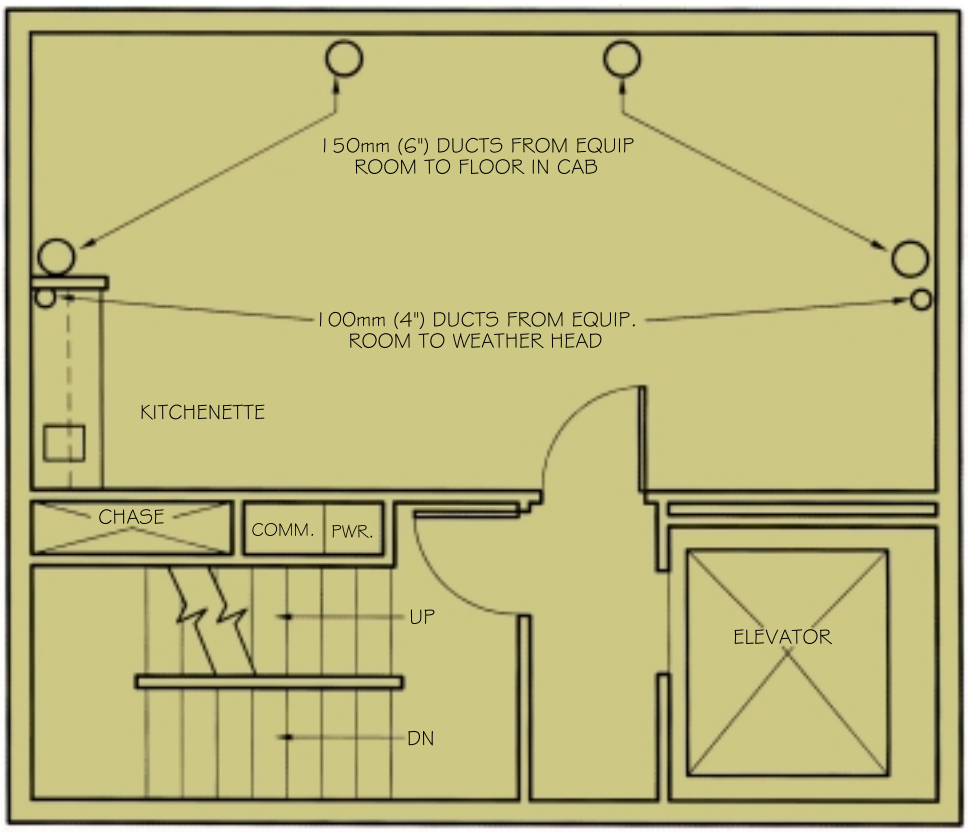
Note: Drawing is meant as an example and can be modified as the design requires



Note: Delete horizontal raceway in lower equipment rooms. Connect top of Demarc panel to vertical comm. riser with 100mm x 200mm (4" x 8") duct same as bottom duct.

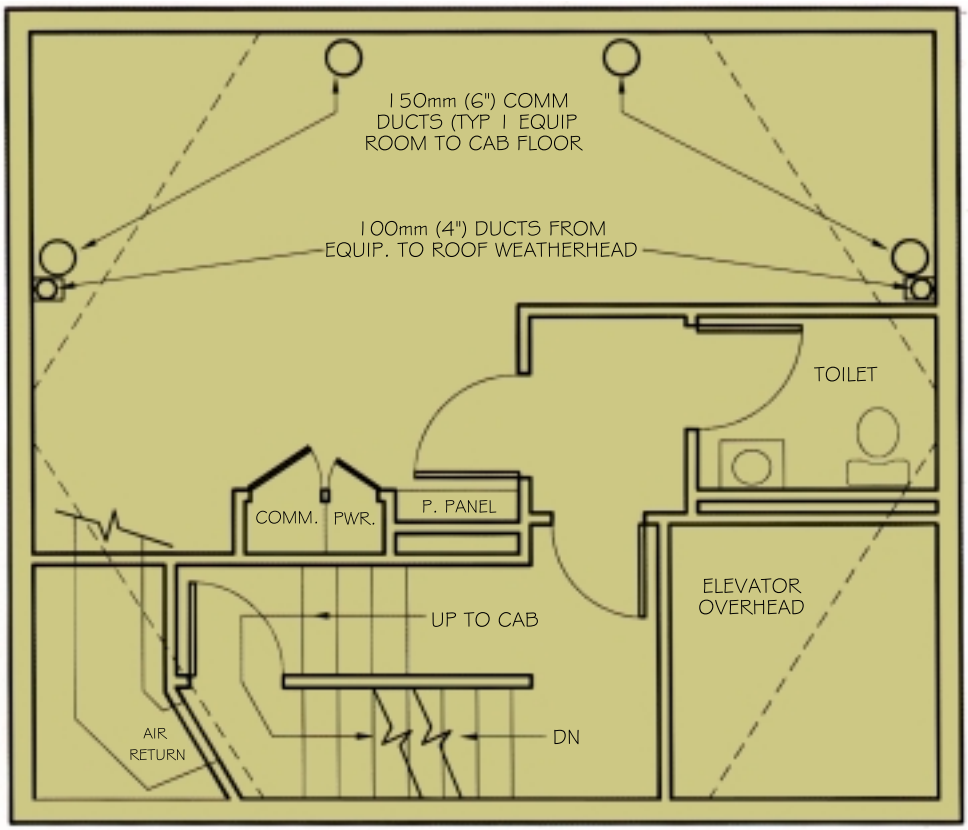
Drawing 6 | Electrical Equipment Room Section

Note: Drawing is meant as an example and can be modified as the design requires.



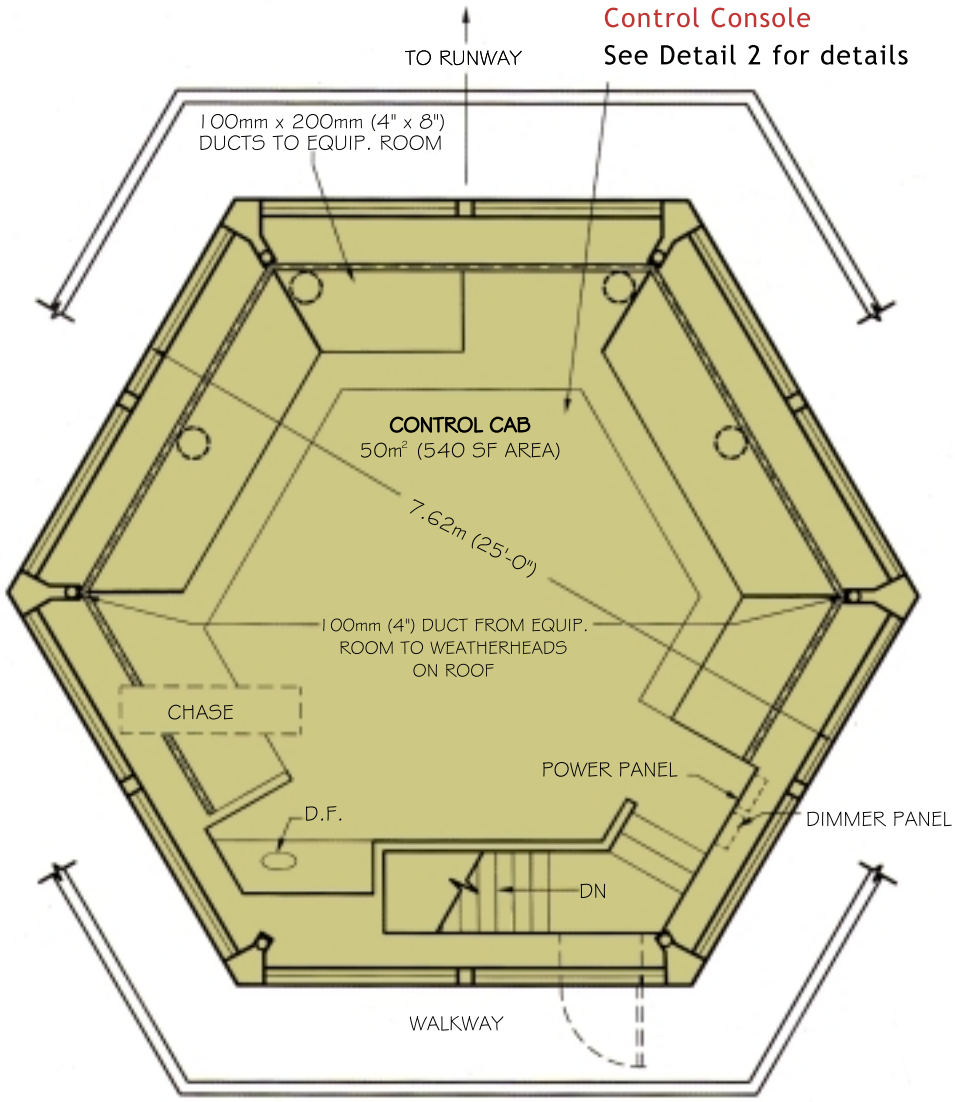
Drawing 7 | Ready/Break Room

Note: Drawing is meant as an example and can be modified as the design requires



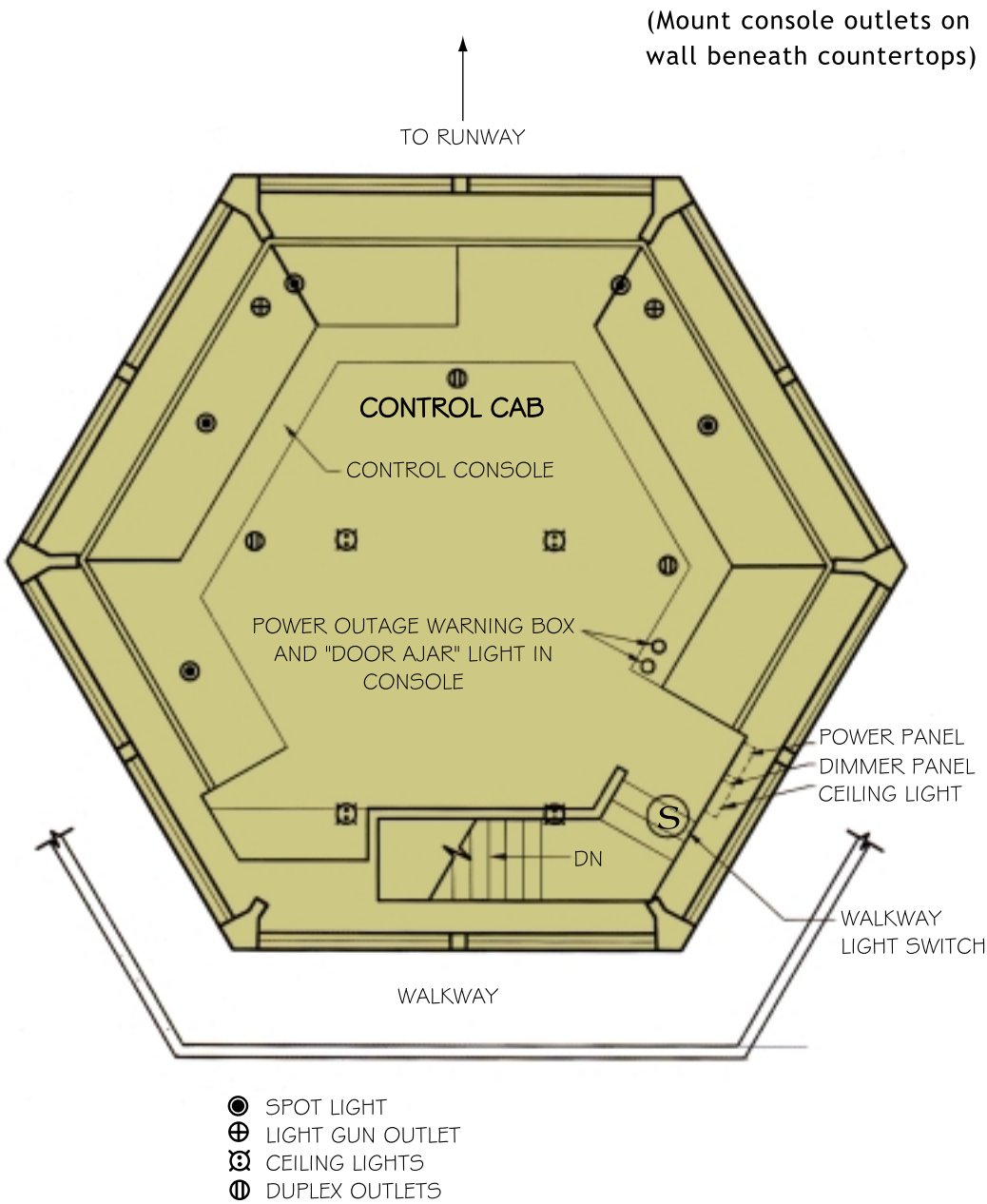
Drawing 8 | Mechanical Room [level below cab]

Note: Drawing is meant as an example and can be modified as the design requires



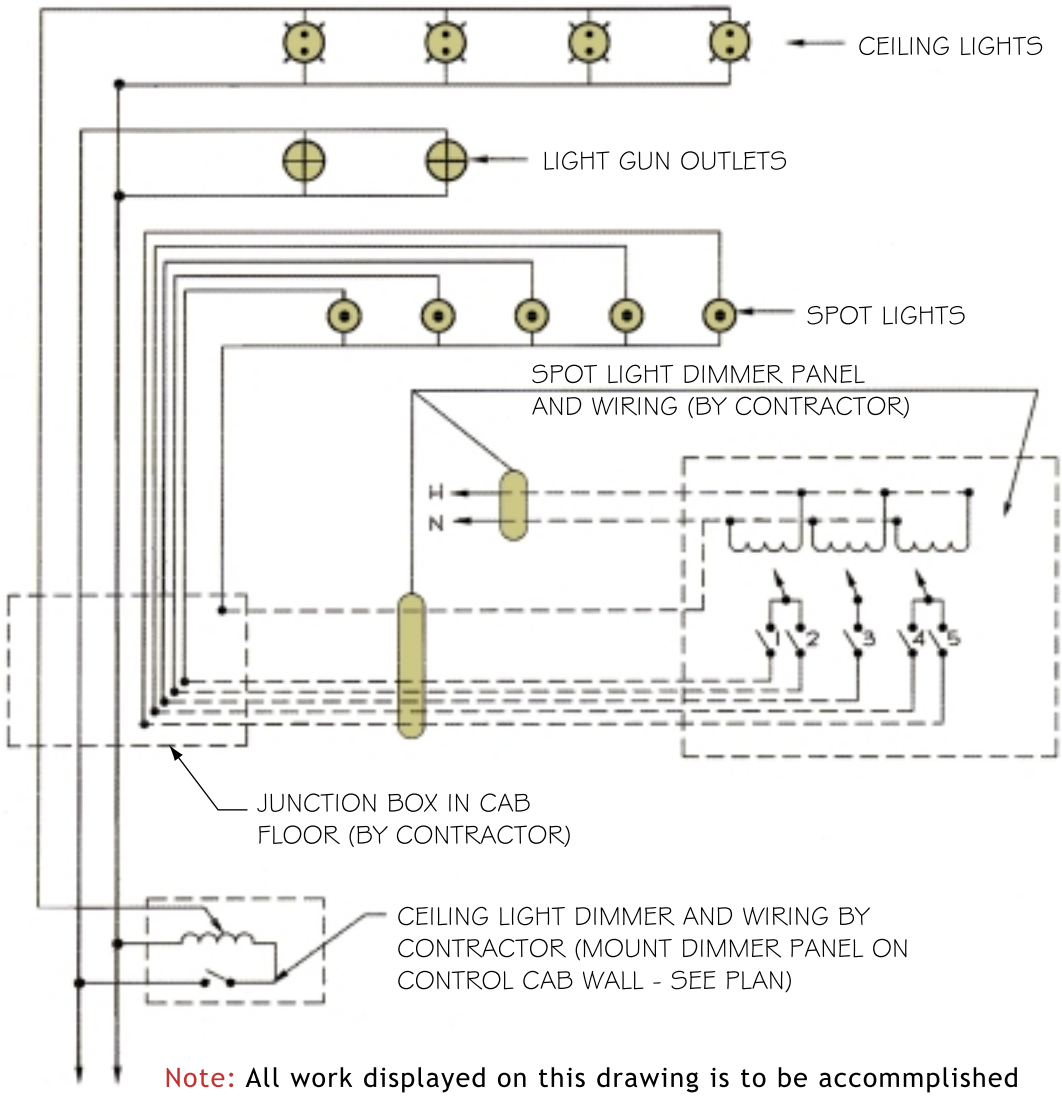
Drawing 9 | Control Cab

Note: Drawing is meant as an example and can be modified as the design requires



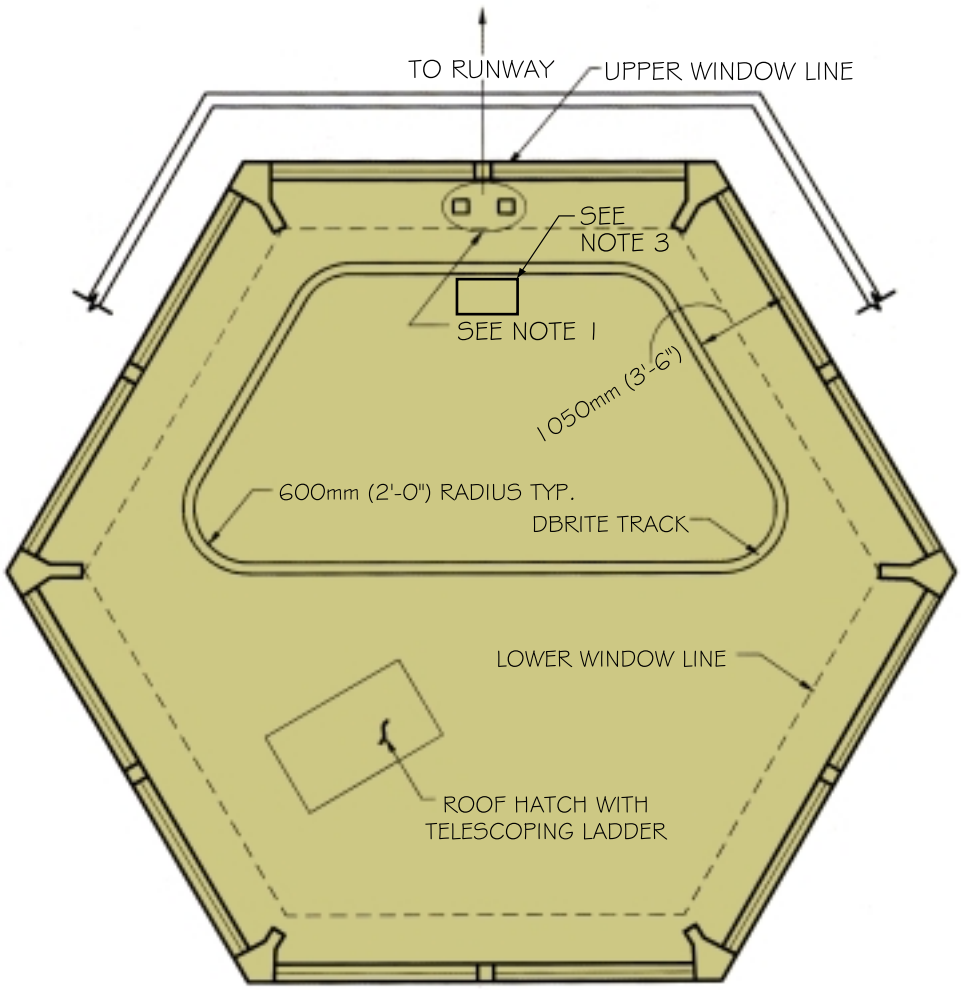
Drawing 10 | Control Cab [Reflected Ceiling Plan]

Note: Drawing is meant as an example and can be modified as the design requires



Note: All work displayed on this drawing is to be accommplished by the contractor unless otherwise indicated.

Drawing 11 | Control Cab Wiring Schematic

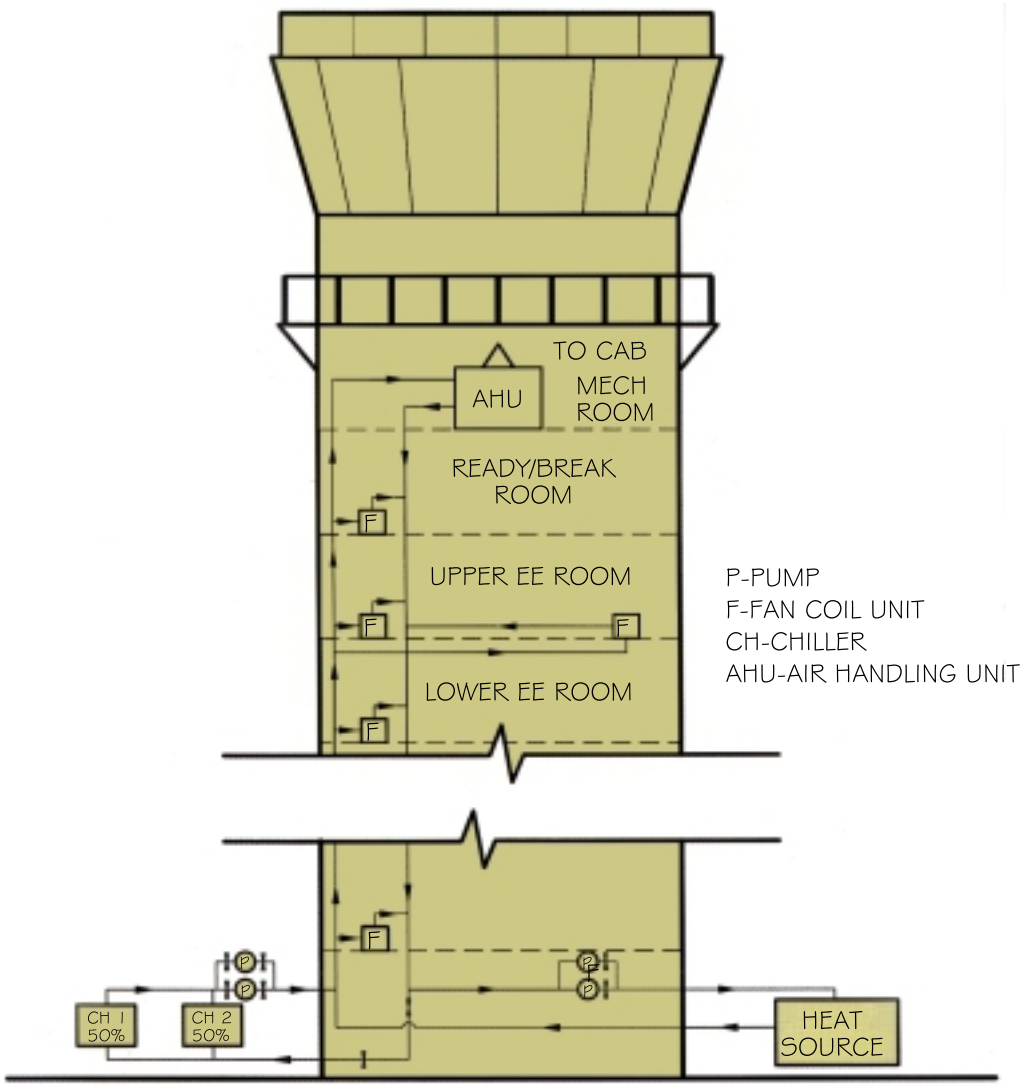


Drawing 12 | DBRITE Track Plan

Notes:

1. Provide two 100mm x 100mm (4" x 4") deep boxes, one for power and one for comm. Install two 38mm (1 1/2") conduits between boxes and floor.
2. See 1842 EEG/EEISG sketch SK 86-1
3. The Articulated Arm will be mounted in lieu of DBRITE Track at locations receiving the DoD Advanced System (DAAS), also known as STARS.
4. Drawing is meant as an example and can be modified as the design requires.

Note: Drawing is meant as an example and can be modified as the design requires



Drawing 13 | Schematic Hot & Chilled Water Piping

TECHNICAL DRAWINGS

SHEET 1.
ATCT WRAP AROUND CONSOLE Plan

SHEET 2.
ATCT WRAP AROUND CONSOLE Sections

SHEET 3.
ATCT WRAP AROUND CONSOLE NAVAIDS

SHEET 4.
ATCT WRAP AROUND CONSOLE SOF Positions

SHEET 5.
ATCT WRAP AROUND CONSOLE Clock Case

SHEET 6.
ATCT SUPERVISOR'S CONSOLE—ISOMETRIC

SHEET 7.
ATCT SUPERVISOR'S CONSOLE—DETAILS

SHEET 8.
ATCT JACK BOX DETAILS

MISCELLANEOUS DRAWINGS & DETAILS

ATCT CAB CONSOLE PLAN (WEST CONTROL TOWER, RANDOLPH AFB, TEXAS)

ARTICULATED ARM CEILING MOUNT, RAYTHEON DRAWING, DATED 13 MAR 00

CEILING MOUNT INSTALLATION KIT, RAYTHEON DRAWING, DATED 11 MAY 00

DETAILS, RAYTHEON DRAWING, DATED 15 MAY 00

DBRITE TRACK INSTALLATION DETAILS, HQ 38 EIG DRAWING, DATED 31 AUG 95

DBRITE AND STARS TDW FLAT PANEL DISPLAY ELEVATION, RAYTHEON DRAWING, DATED 31 JAN 01

DBRITE MONITOR/MOUNT POSITION, DATED 3 JAN 01

DBRITE MONITOR YOKE MOUNT DRAWING

PROPOSED FLAT PANEL MONITOR ADAPTER DRAWING, DATED 3 JAN 01

GROUNDING PLANS AND DETAILS, U.S. ARMY CORPS OF ENGINEERS DRAWING, DATED 21 DEC 99

DETAIL 1

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED

GENERAL NOTES:

1. THIS SHEET SHOWS GENERAL LOCATION OF EQUIPMENT TO BE INSTALLED BY OTHERS.
2. SITE ADAPT ALL DIMENSIONS ON THIS SHEET.
3. ALL THE GOVERMENT FURNISHED EQUIPMENT MUST BE FIELD VERIFIED AND COORDINATED WITH THE AIR TRAFFIC CONTROL TOWER CHIEF CONTROLLER AND STAFF PRIOR TO ISTALLATION.

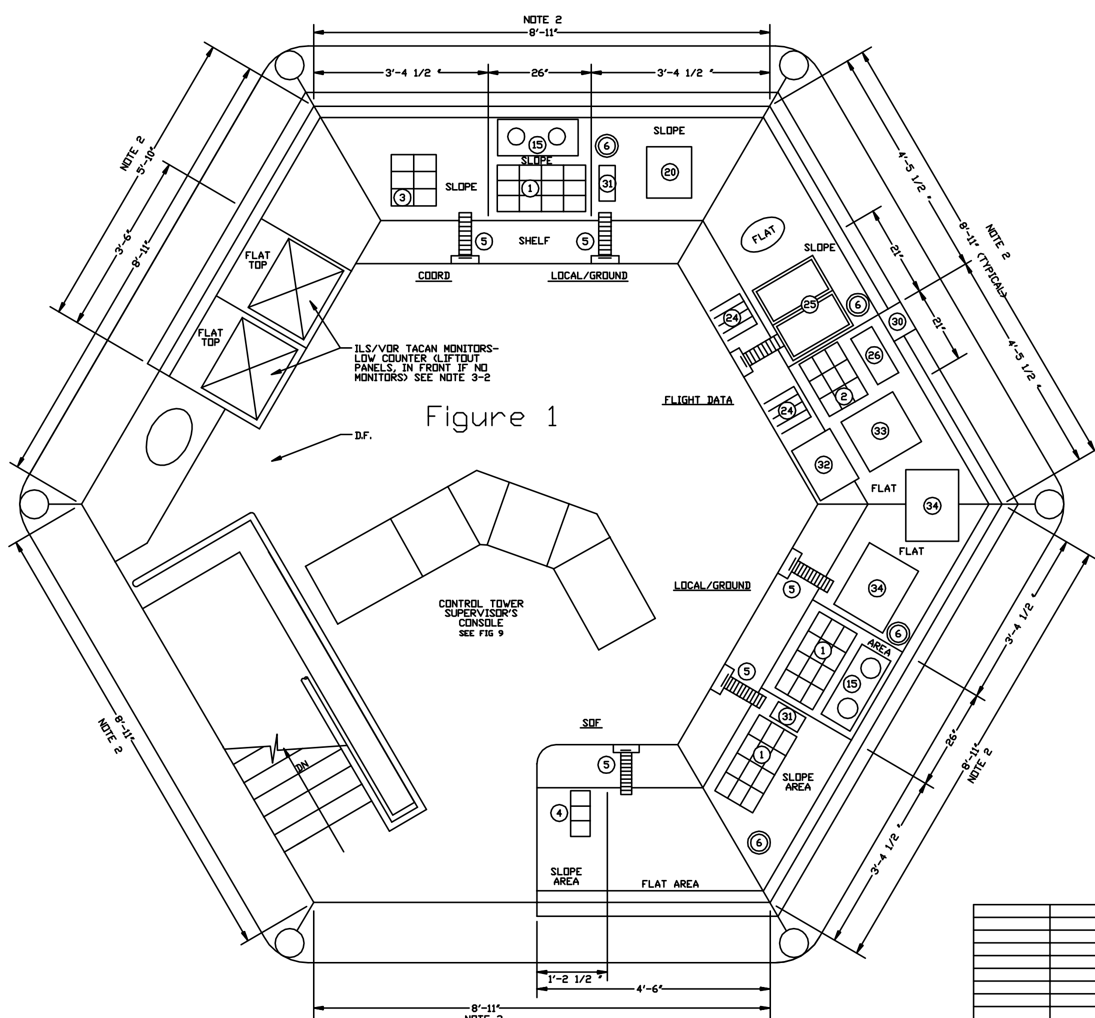


FIGURE 1

CONSOLE EQUIPMENT KEY

ITEM NO.	DESCRIPTION	POSITION LOC	GRN	FD	SPV	COOR	SDF	FACE PANEL SIZE (LXWXD)	QTY	REMARKS
1	12 MODULE KEY SYSTEM	X	X		X			21"X12 1/2 "X3"	3	ALUM FRAME PROVIDED WITH KEY SYSTEM
2	9 MODULE KEY SYSTEM			X				15 3/4 "X2 1/2 "X3"	1	
3	6 MODULE KEY SYSTEM					X		10 1/2 "X12 1/2 "X3"	1	
4	3 MODULE KEY SYSTEM						X	7 1/4 "X10 1/2 "X3"	1	
5	HEADSET JACK UNIT (RECESS)	X	X	X	X	X	X	4"X1 1/2 "X12"	6	
6	POSITION SPEAKER	X	X	X	X	X		5 1/2 " O	6	
7	ILS MON PNL-C8826, GRN 27							19 1/2 "x13 1/2 "		TO BE INSTALLED VERTICALLY UNDER FLAT TOP COUNTER
8	ILS MON PNL-C8826, GRN 29							19"x10 1/2 "		
9	ILS INTERLOCK PANEL							19"x3 1/2 "		
10	TACAN MONITOR DNL C2234							19"x14"x14"		
11	VOR MONITOR PNL-342B							19"x14"x3 1/2 "		
12	VOR MONITOR PNL-474A							19"x14" 5 1/4 "		
13	VOR MONITOR PNL-422A							19"x14"x3 1/2 "		
14	DBRITE REMOTE CONTROL UNIT							16" X 8"		
15	WIND INDICATOR PNL	X	X					19"x7" (APPROX)	2 sets	TO BE INSTALLED IN TURRET AT LOCAL/GROUND POSITION
16	WIND SELECTOR PNL							19"X3 1/2 "	1	
17	RECORDER MONITOR PNL							19"X4 3/4 "	1	
18	ELECTROWRITER							9"X15"		SURFACE MTD
19	B/U PNL (MULTI-CHANNEL)							19"X7"	1	
20	FIELD LIGHTING PNL							19"X15 1/2 "X6 1/2 "	1	FIELD VERIFY SIZE FIELD VERIFY LOCATION
21	ATIS REMOTE UNIT							4"X5"	1	
22	FDEP ANK UNIT							14 1/2 "X10 1/2 "	1	RECESS IN WRITING SHELF SEE DETAIL
23	FDEP PRINTER							16 1/4 "X12 3/8 "		SURFACE MTD
24	FLIGHT STRIP STORAGE BIN			X				8" X 2"	2	
25	FLIGHT PROGRESS BOARD			X				18 3/4 "X16"	1	
26	CRASH PHONE CRADLE/PNL			X				12 17/32"X6"	1	FIELD VERIFY SIZE
27	BAIL-OUT ALARM SWITCH			X				5"X2"	1	FIELD VERIFY SIZE
28	SPOTLIGHT DIMMER CONTROL	SEE REMARKS						———	3	EXACT LOC. DETERM @ SITE
29	THEATER LIGHT (OPNG:8 3/16"X4 5/8")	X	X	X				9 3/8 "X5 3/4 "X3 1/2 "		
30	CLOCK							IN BOX ENCL.		TO BE SET ON 5' SHELF
31	REQUEST/ACKNOWLEDGE	X	X					3 3/4 "X8"X11 1/2 "		
32	FDIO-REPL ALPHA-NUM KEYBOARD							10 1/2 "X14 1/2 "X3 1/4 "	1	
33	FDIO-CRT MONITOR							14 1/2 "X14 1/2 "X14 1/2 "	1	
34	FDIO-REPL FLT STRIP PTR							13 1/4 "X17"X7"	2	1 IN USE + HOT BACKUP

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES-TOLERANCES ON: FRACTIONS DECIMALS ANGLES

DR JUDD 17 MAY 95
CHK NELSON 17 MAY 95
ENG
AIR FORCE AUTHENTICATION O'PECKO 17 MAY 95
AIR FORCE RELEASE

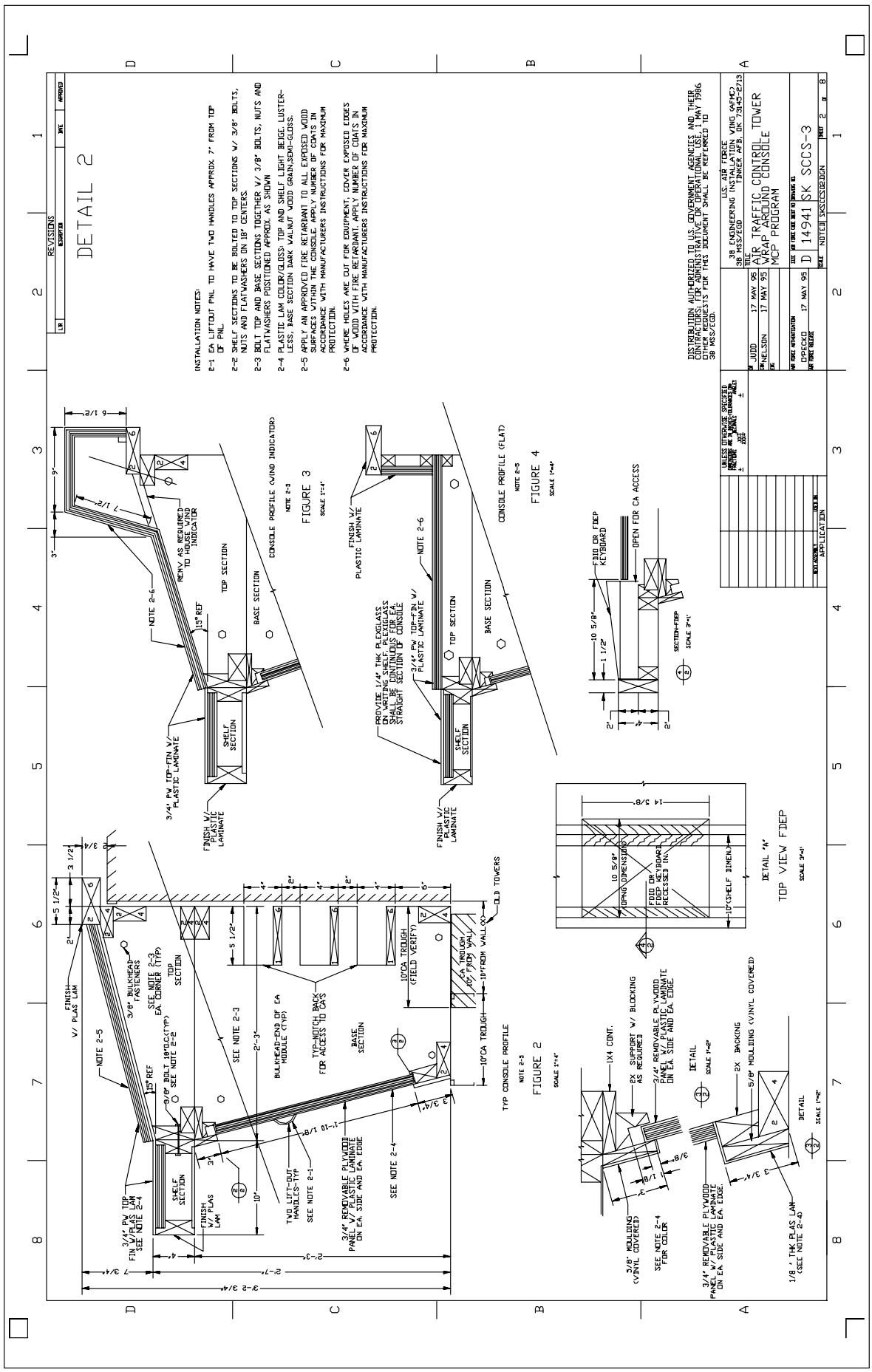
U.S. AIR FORCE
38 ENGINEERING INSTALLATION WING (AFMC)
38 MSS/EGD TINKER AFB, OK 73145-2713

TITLE: AIR TRAFFIC CONTROL TOWER WRAP AROUND CONSOLE MCP PROGRAM

SIZE D | 14941 | SK SCCS-3

SCALE NONE | SKSCCS01.DGN | SHEET 1 OF 8

NEXT ASSEMBLY | USED ON | APPLICATION


DETAIL 2
REVISIONS
INSTALLATION NOTES:
2-1 EA LIFTOUT PNL TO HAVE TWO HANDLES APPROX. 7" FROM TOP OF PNL.
2-2 SHELF SECTIONS TO BE BOLTED TO TOP SECTIONS W/ 3/8" BOLTS, NUTS AND FLATWASHERS ON 18" CENTERS.
2-3 BOLT TOP AND BASE SECTIONS TOGETHER W/ 3/8" BOLTS, NUTS AND FLATWASHERS POSITIONED APPROX. AS SHOWN
2-4 PLASTIC LAM COLOR/GLOSS: TOP AND SHELF LIGHT BEIGE, LUSTER-LESS; BASE SECTION DARK WALNUT WOOD GRAIN,SEMI-GLOSS.
2-5 APPLY AN APPROVED FIRE RETARDANT TO ALL EXPOSED WOOD SURFACES WITHIN THE CONSOLE APPLY NUMBER OF COATS IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS FOR MAXIMUM PROTECTION.
2-6 WHERE HOLES ARE CUT FOR EQUIPMENT, COVER EXPOSED EDGES OF WOOD WITH FIRE RETARDANT. APPLY NUMBER OF COATS IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS FOR MAXIMUM PROTECTION.
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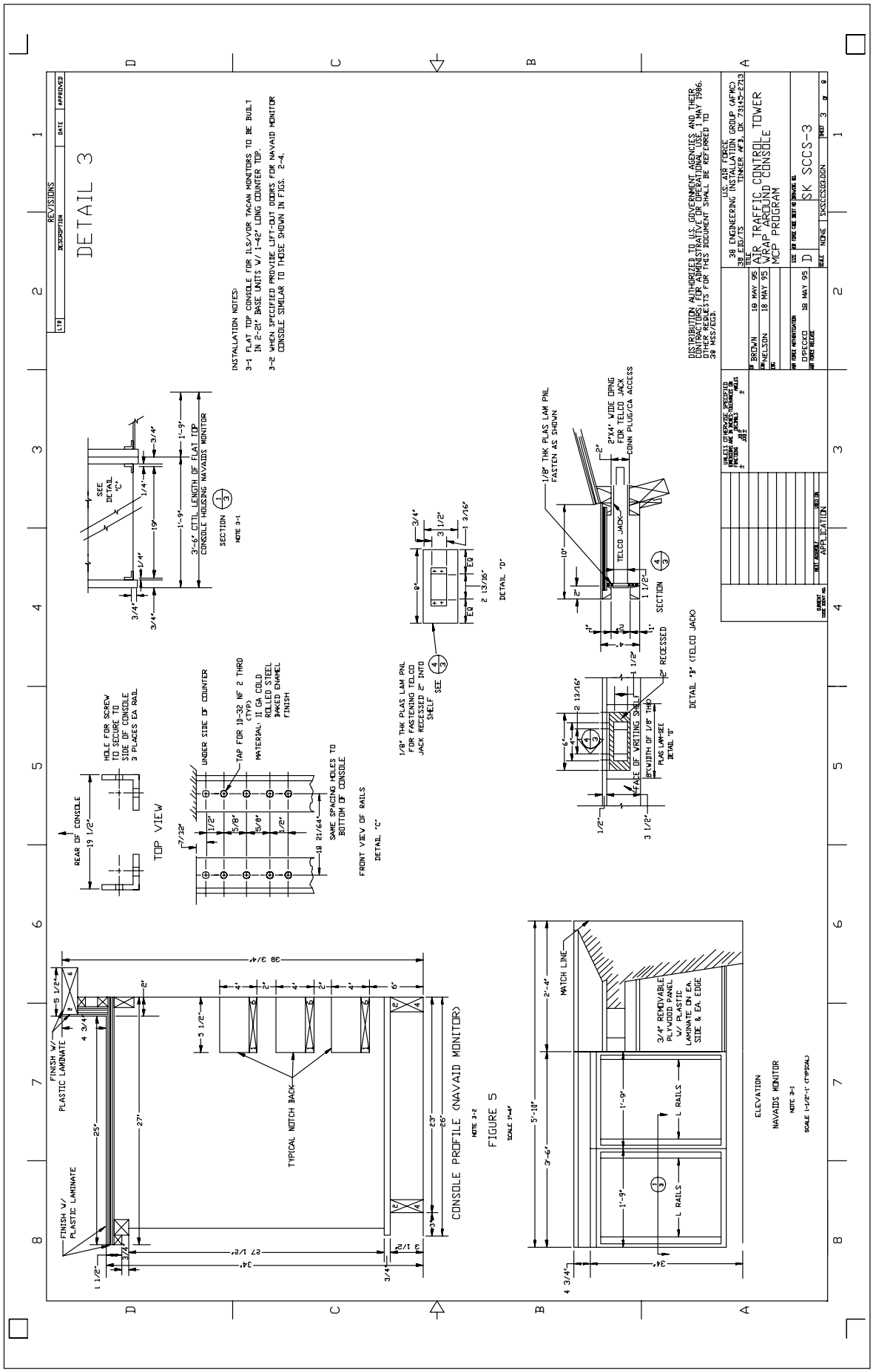
US AIR FORCE
38 ENGINEERING INSTALLATION WING (AFMC)
38 MSG/EGD
TINKER AFB, OK 73145-2713
AIR TRAFFIC CONTROL TOWER
WRAP AROUND CONSOLE
MCP PROGRAM
D 14941 SK SCCS-3
FIGURE 3
FIGURE 4
FIGURE 2
DETAIL 'A'
TOP VIEW FDEP
DETAIL
CONSOLE PROFILE (FLAT)
CONSOLE PROFILE (WIND INDICATOR)
TYP CONSOLE PROFILE
BASE SECTION
TOP SECTION
SHELF SECTION
OLD TOWERS
FIDO OR FIEP KEYBOARD
OPEN FOR CA ACCESS
REMV AS REQUIRED TO HOUSE WIND INDICATOR
PROVIDE 1/4" THK PLEXIGLASS ON WRITING SHELF. PLEXIGLASS SHALL BE CONTINUOUS AS CONSOLE STRAIGHT SECTION OF CONSOLE
3/4" PW TOP-FIN W/ PLASTIC LAMINATE
FINISH W/ PLASTIC LAMINATE
FINISH W/ PLAS LAM
3/4" PW TOP FIN W/ PLAS LAM SEE NOTE 2-4
3/4" REMOVABLE PLYWOOD PANEL W/ PLASTIC LAMINATE ON EA. SIDE AND EA. EDGE
SEE NOTE 2-4
SEE NOTE 2-3
SEE NOTE 2-5
SEE NOTE 2-6
TYP. LIFT-OUT HANDLES-TYP
BULKHEAD-END OF EA MODULE (TYP)
TYP-NOTCH BACK FOR ACCESS TO CA'S
10"CA TROUGH (FIELD VERIFY)
CA TROUGH AT FDEP W/O
10"CA TROUGH
19" FROM WALL
3/8" MOULDING (VINYL COVERED)
1X4 CONT.
2X SUPPORT W/ BLOCKING AS REQUIRED
2X BACKING
5/8" MOULDING (VINYL COVERED)
1/8" THK PLAS LAM (SEE NOTE 2-4)
10 5/8" OPNG DIMENSIONS
FIDO OR FIEP KEYBOARD RECESSED IN.
10"SHELF DIMEN.
SECTION-FDEP


DETAIL 3
INSTALLATION NOTES:
3-1 FLAT TOP CONSOLE FOR ILS/VOR TACAN MONITORS TO BE BUILT IN 2-21" BASE UNITS W/ 1-42" LONG COUNTER TOP.
3-2 WHEN SPECIFIED PROVIDE LIFT-OUT DOORS FOR NAVAID MONITOR CONSOLE SIMILAR TO THOSE SHOWN IN FIGS. 2-4.
SECTION
NOTE 3-1
3'-6" CTIL LENGTH OF FLAT TOP CONSOLE HOUSING NAVAIDS MONITOR
SEE DETAIL 'C'
TOP VIEW
REAR OF CONSOLE
HOLE FOR SCREW TO SECURE TO SIDE OF CONSOLE 3 PLACES EA RAIL
UNDER SIDE OF COUNTER
TAP FOR 10-32 NF 2 THRD (TYP)
MATERIAL: 11 GA COLD ROLLED STEEL BAKED ENAMEL FINISH
SAME SPACING HOLES TO BOTTOM OF CONSOLE
FRONT VIEW OF RAILS
DETAIL 'C'
1/8" THK PLAS LAM PNL FOR FASTENING TELCO JACK RECESSED 2" INTO SHELF
SEE
DETAIL 'D'
1/8" THK PLAS LAM PNL FASTEN AS SHOWN
2"X4" WIDE OPNG FOR TELCO JACK CONN PLUG/CA ACCESS
TELCO JACK
SECTION
2" RECESSED
EDGE OF WRITING SHELF
BTWIDTH OF 1/8" THKPLAS LAM-SEE DETAIL "D"
DETAIL 'B' (TELCO JACK)
FINISH W/ PLASTIC LAMINATE
TYPICAL NOTCH BACK
CONSOLE PROFILE (NAVAID MONITOR)
NOTE 3-2
FIGURE 5
SCALE 1"=1'
3/4" REMOVABLE PLYWOOD PANEL W/ PLASTIC LAMINATE ON EA SIDE & EA EDGE
L RAILS
MATCH LINE
ELEVATION
NAVAIDS MONITOR
NOTE 3-2
SCALE 1-1/2"=1' (TYPICAL)
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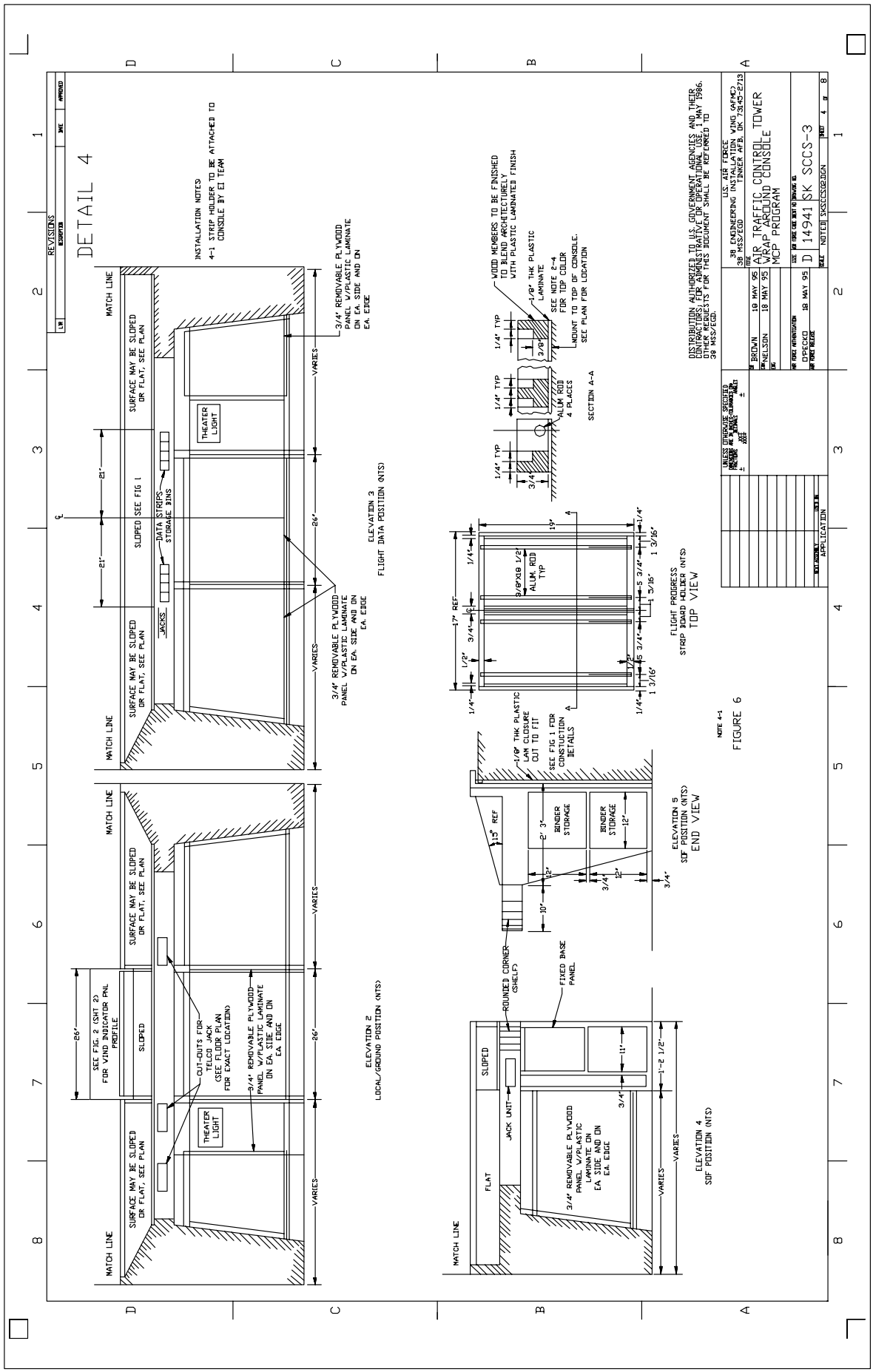
REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
38 ENGINEERING INSTALLATION GROUP (AFMC)
TINKER AFB, OK 73145-2713
AIR TRAFFIC CONTROL TOWER
WRAP AROUND CONSOLE
MCP PROGRAM
SK SCCS-3
SIZE D
SCALE NONE
SHEET 3 OF 8


DETAIL 4
INSTALLATION NOTES
4-1 STRIP HOLDER TO BE ATTACHED TO CONSOLE BY EI TEAM
SURFACE MAY BE SLOPED OR FLAT, SEE PLAN
SLOPED SEE FIG 1
MATCH LINE
JACKS
DATA STRIPS STORAGE BINS
THEATER LIGHT
3/4" REMOVABLE PLYWOOD PANEL W/PLASTIC LAMINATE ON EA. SIDE AND ON EA. EDGE
VARIES
26"
21"
ELEVATION 3
FLIGHT DATA POSITION (NTS)
SEE FIG. 2 (SHT 2) FOR VIND INDICATOR PNL PROFILE
SLOPED
CUT-OUTS FOR TELCO JACK (SEE FLOOR PLAN FOR EXACT LOCATION)
ELEVATION 2
LOCAL/GROUND POSITION (NTS)
FLAT
JACK UNIT
ROUNDED CORNER (SHELF)
FIXED BASE PANEL
11"
1'-2 1/2"
ELEVATION 4
SDF POSITION (NTS)
WOOD MEMBERS TO BE FINISHED TO BLEND ARCHITECTURELY WITH PLASTIC LAMINATED FINISH
1/4" TYP
1/8" THK PLASTIC LAMINATE
3/8"
SEE NOTE 2-4 FOR TOP COLOR
MOUNT TO TOP OF CONSOLE. SEE PLAN FOR LOCATION
ALUM ROD 4 PLACES
3/4"
SECTION A-A
3/8"X1@ 1/2" ALUM ROD TYP
17" REF
19"
1/4"
3/4"
1/2"
1 3/16"
1 5/16"
5 3/4"
FLIGHT PROGRESS STRIP BOARD HOLDER (NTS)
TOP VIEW
1/8" THK PLASTIC LAM CLOSURE CUT TO FIT
SEE FIG 1 FOR CONSTUCTION DETAILS
15" REF
2' 3"
BINDER STORAGE
12"
10"
ELEVATION 5
SDF POSITION (NTS)
END VIEW
NOTE 4-1
FIGURE 6
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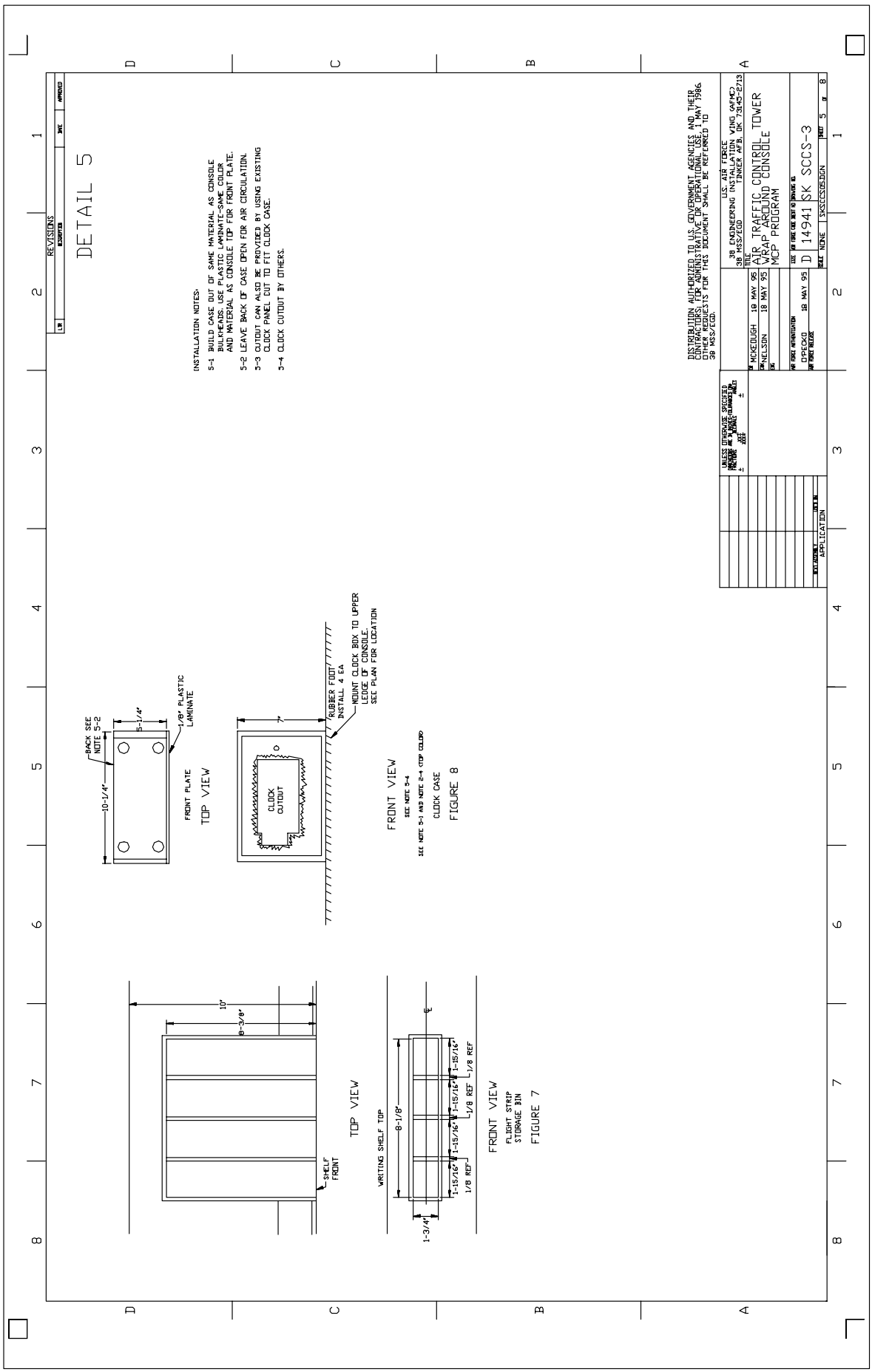
38 ENGINEERING INSTALLATION WING (AFMC)
38 MSS/EGDD
TINKER AFB, OK 73145-2713
AIR TRAFFIC CONTROL AND AIRPORT TOWER MCP PROGRAM
D 14941 SK SCCS-3
SCALE NONE
SHEET 4 OF 8
APPLICATION
DRAWN 18 MAY 95
CHECKED 18 MAY 95
APPROVED 18 MAY 95
REVISIONS


DETAIL 5
INSTALLATION NOTES:
5-1 BUILD CASE OUT OF SAME MATERIAL AS CONSOLE BULKHEADS. USE PLASTIC LAMINATE-SAME COLOR AND MATERIAL AS CONSOLE TOP FOR FRONT PLATE.
5-2 LEAVE BACK OF CASE OPEN FOR AIR CIRCULATION.
5-3 CUTOUT CAN ALSO BE PROVIDED BY USING EXISTING CLOCK PANEL CUT TO FIT CLOCK CASE.
5-4 CLOCK CUTOUT BY OTHERS.
REVISIONS
DESCRIPTION
BY
APPROVED
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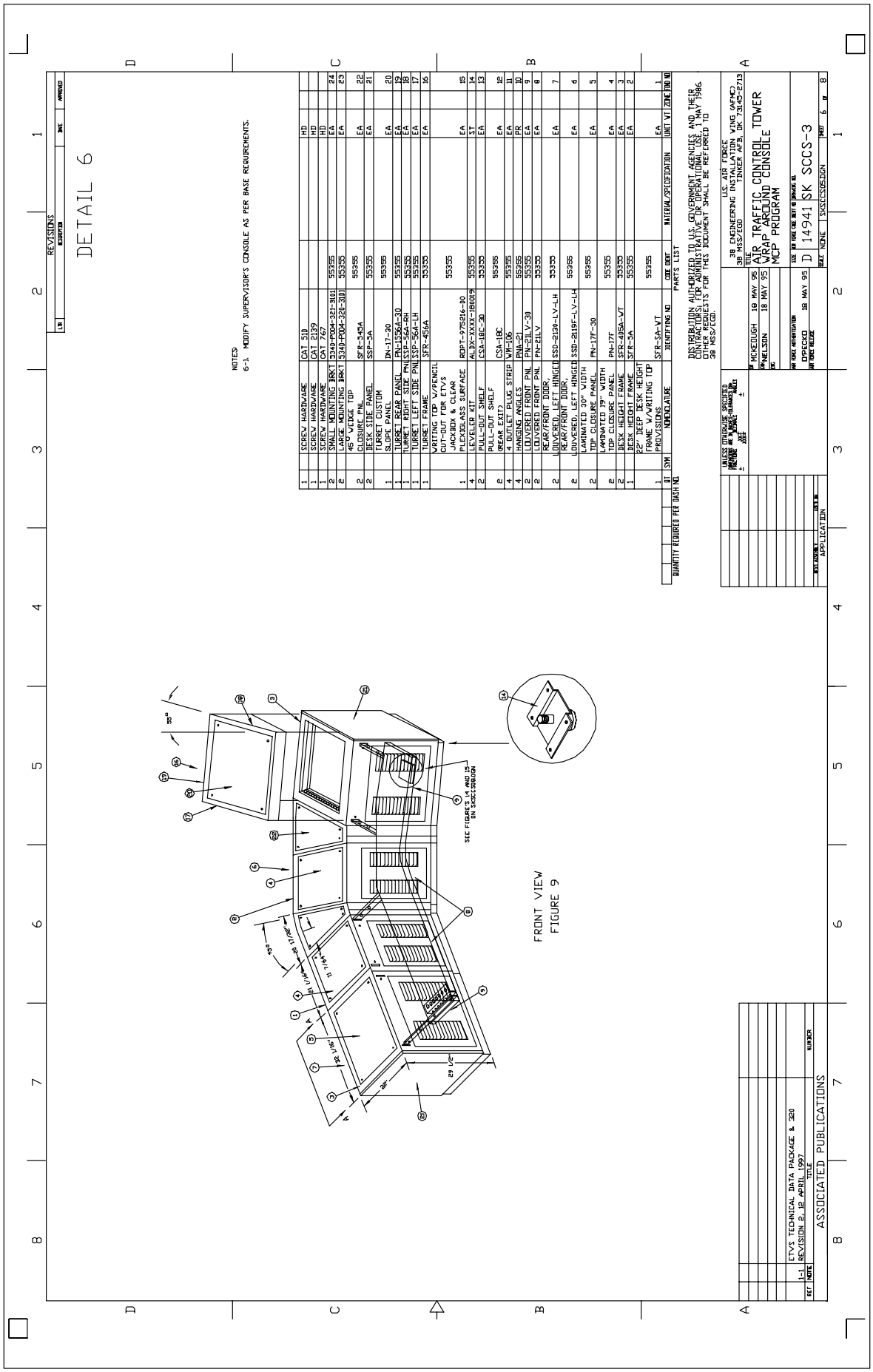
38 ENGINEERING INSTALLATION WING, GAFMC
38 MSS/EGD TYNDALL AFB, FL 32403-6213
AIR TRAFFIC CONTROL TOWER
WRAP AROUND CONSOLE
MCP PROGRAM
D 14941 SK SCCS-3
SCALE NONE
SCCS DESIGN
SHEET 5 OF 8
TOP VIEW
FRONT PLATE
1/8" PLASTIC LAMINATE
BACK SEE NOTE 5-2
10-1/4"
5-1/4"
FRONT VIEW
CLOCK CUTOUT
RUBBER FOOT/ INSTALL 4 EA
MOUNT CLOCK BOX TO UPPER LEDGE OF CONSOLE. SEE PLAN FOR LOCATION
7
SEE NOTE 5-3
SEE NOTE 5-4 AND NOTE 5-4 (TOP COLOR)
CLOCK CASE
FIGURE 8
TOP VIEW
SHELF FRONT
10"
8-3/8"
FRONT VIEW
WRITING SHELF TOP
FLIGHT STRIP STORAGE BIN
8-1/8"
1-15/16"
1/8 REF
1-3/4"
FIGURE 7


DETAIL 6
NOTES:
6-1. MODIFY SUPERVISOR'S CONSOLE AS PER BASE REQUIREMENTS.
FRONT VIEW
FIGURE 9
SEE FIGURES 14 AND 15 ON SHEET 8
AIR TRAFFIC CONTROL TOWER
MRAB ARCAIRD CONSOLE
MCP PROGRAM
D 14941 SK SCCS-3
ASSOCIATED PUBLICATIONS
ETVS TECHNICAL DATA PACKAGE & 32D
REVISION 2, 12 APRIL 1997
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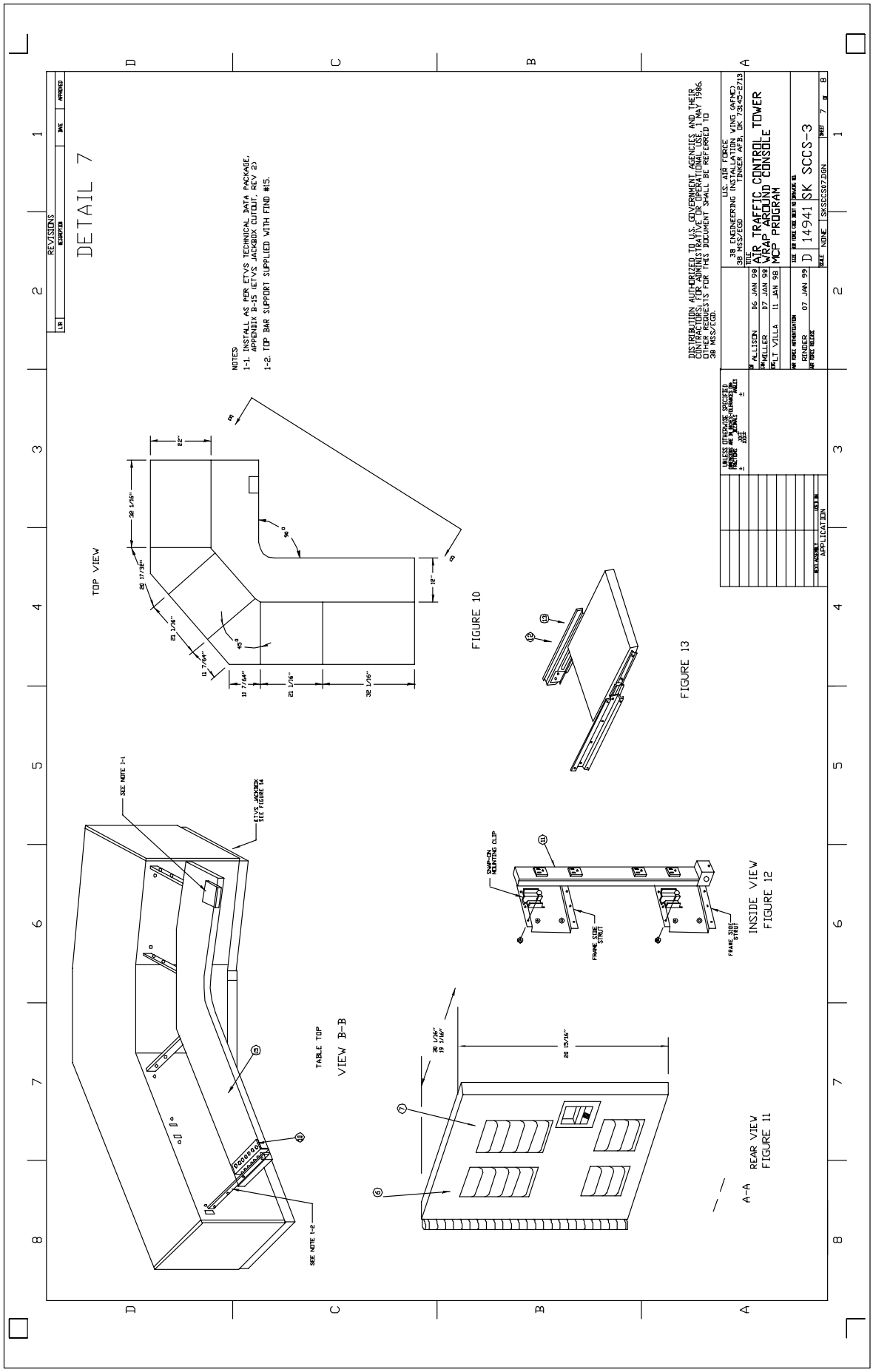
DETAIL 7
NOTES
1-1. INSTALL AS PER ETVS TECHNICAL DATA PACKAGE, APPENDIX B-15 (ETVS JACKBOX CUTOUT, REV 2).
1-2. TOP BAR SUPPORT SUPPLIED WITH FIND #15.
TOP VIEW
FIGURE 10
FIGURE 13
SEE NOTE 1-1
ETVS JACKBOX SEE FIGURE 14
SEE NOTE 1-2
TABLE TOP
VIEW B-B
SWIVEL MOUNTING CLIP
FRAME SIDE STRUT
INSIDE VIEW
FIGURE 12
A-A
REAR VIEW
FIGURE 11
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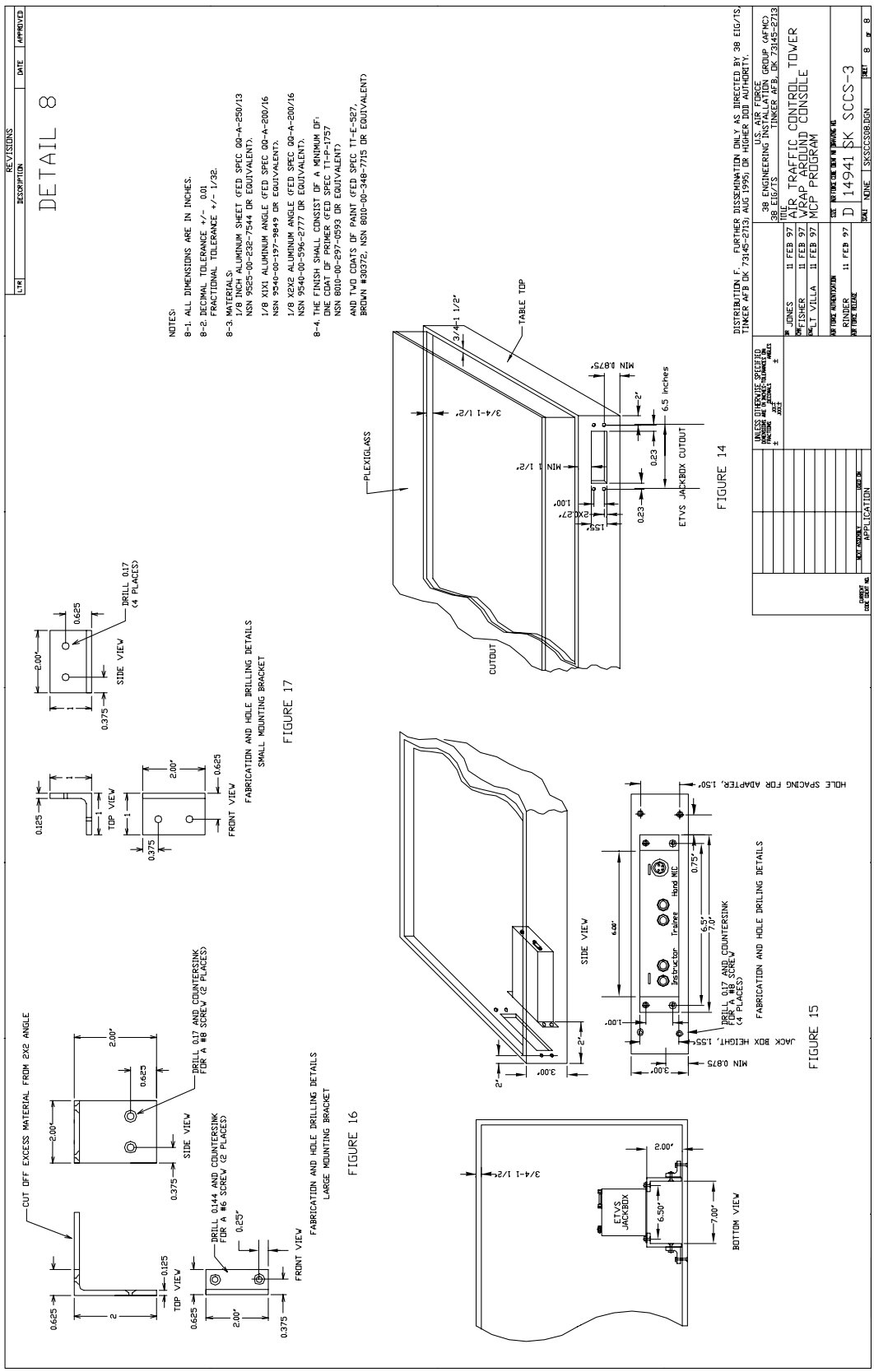
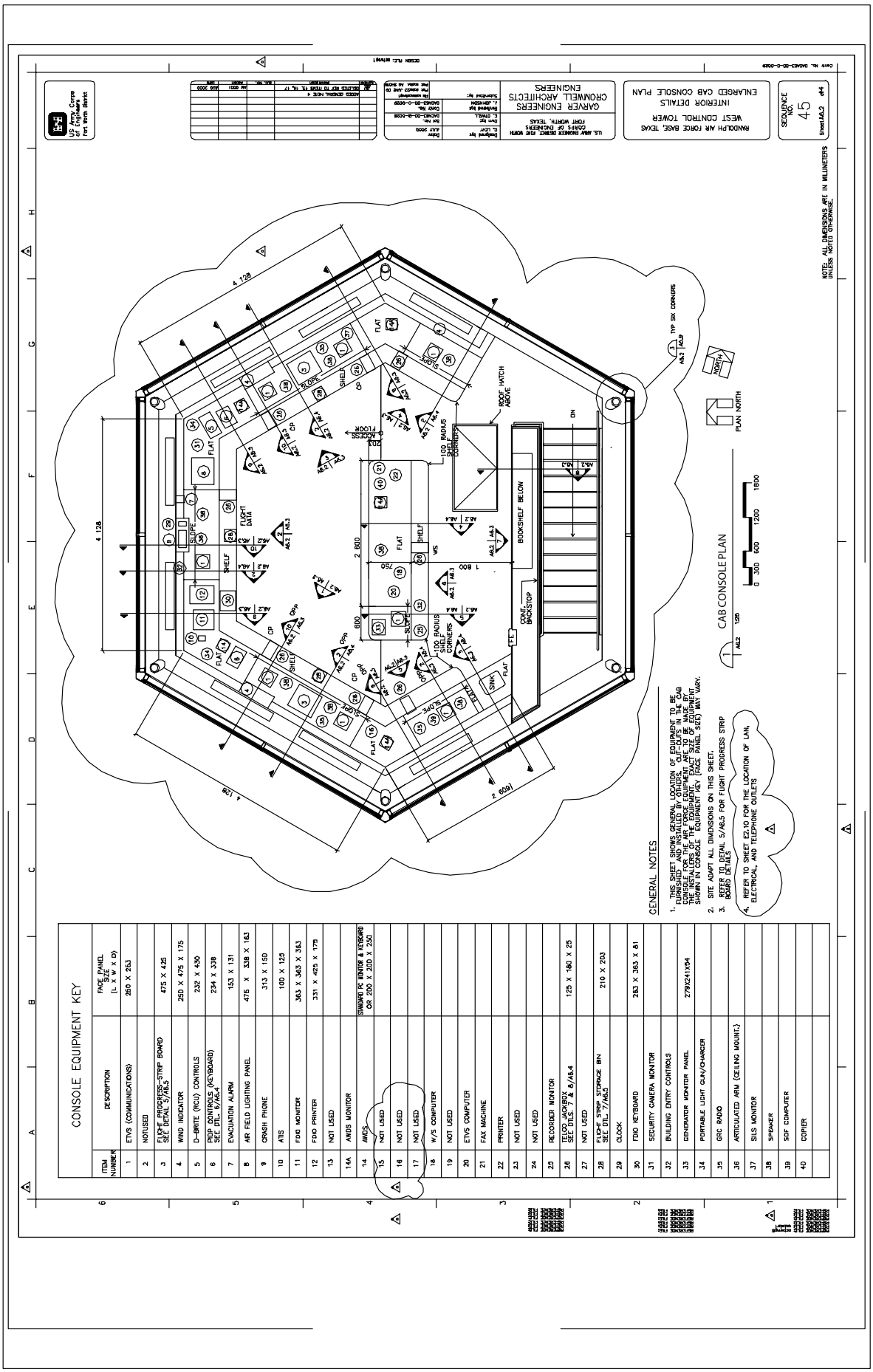
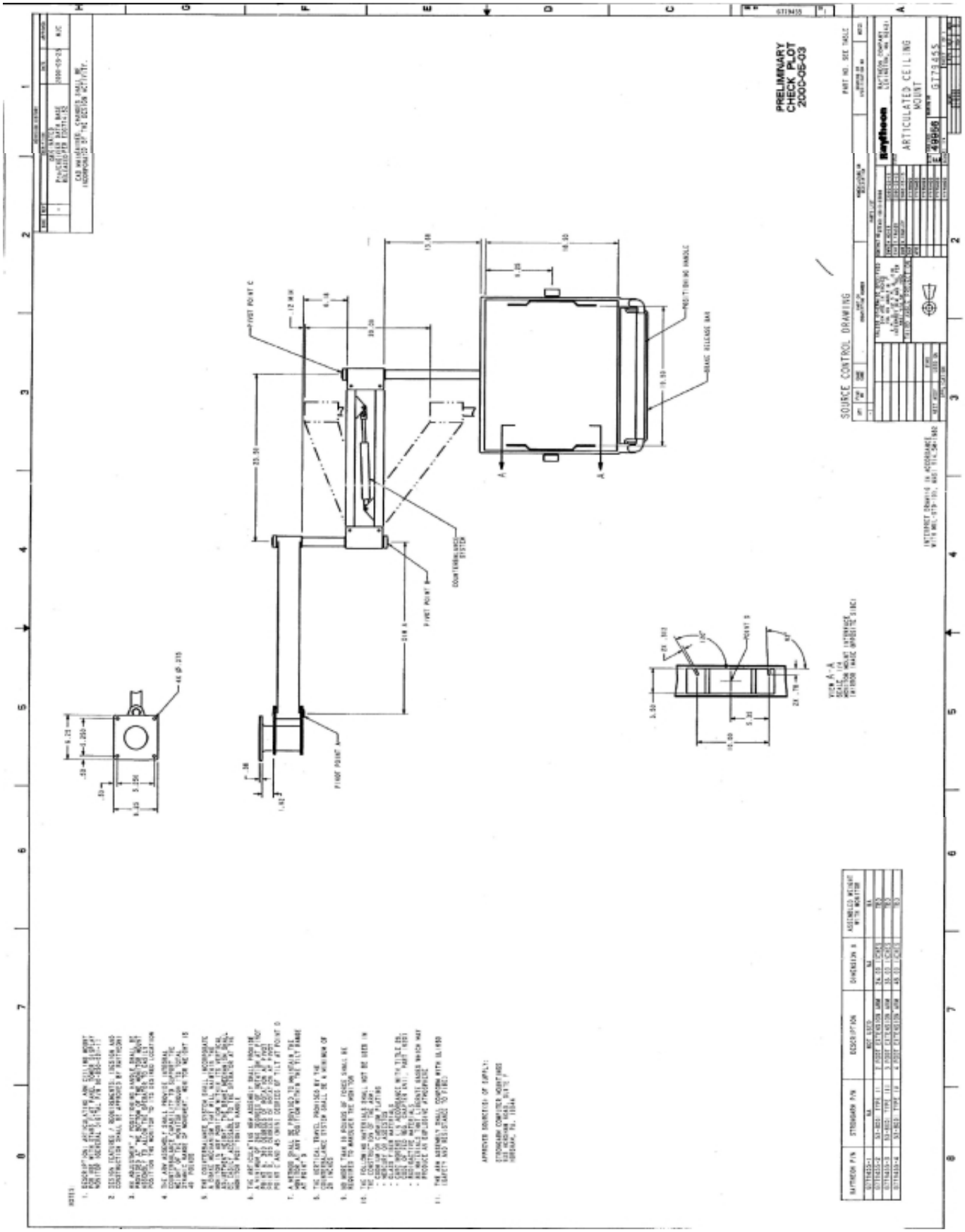
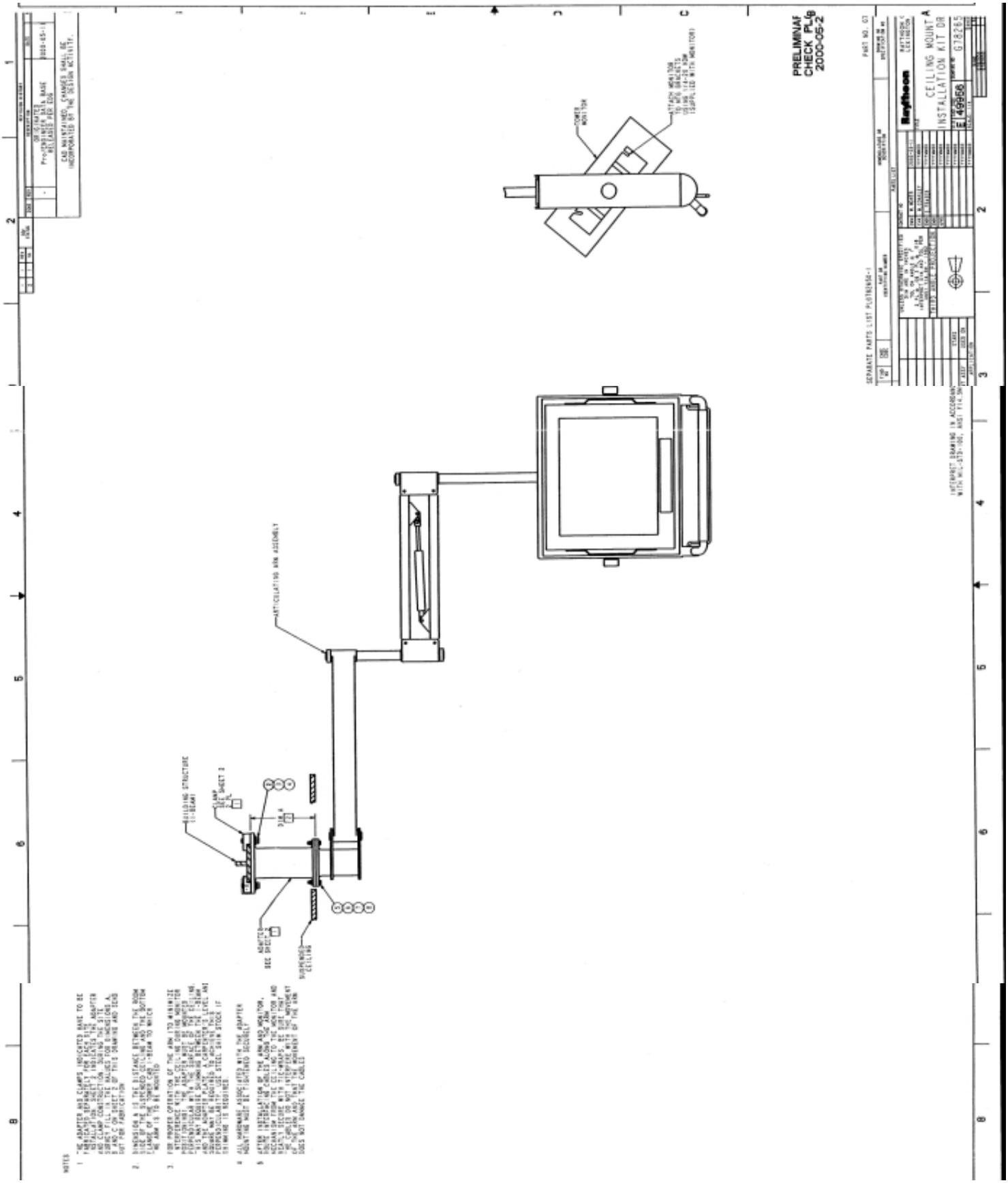
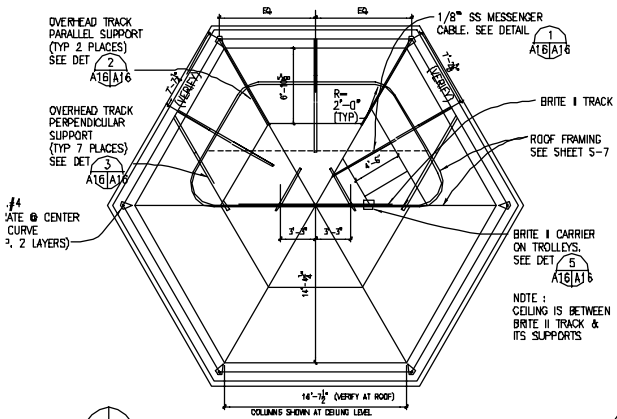
3B ENGINEERING INSTALLATION, VING (AFMC)
TINKER AFB, OK 73145-2713
AIR TRAFFIC CONTROL TOWER
WRAP AROUND CONSOLE
MCP PROGRAM
D 14941 SK SCCS-3
SKSCCS97.DGN


REVISIONS
LTR
DESCRIPTION
DATE
APPROVED
DETAIL 8
NOTES:
8-1. ALL DIMENSIONS ARE IN INCHES.
8-2. DECIMAL TOLERANCE +/- .01
FRACTIONAL TOLERANCE +/- 1/32.
8-3. MATERIALS:
1/8 INCH ALUMINUM SHEET (FED SPEC QQ-A-250/13
NSN 9525-00-232-7544 OR EQUIVALENT).
1/8 X1X1 ALUMINUM ANGLE (FED SPEC QQ-A-200/16
NSN 9546-00-197-9849 OR EQUIVALENT).
1/8 X2X2 ALUMINUM ANGLE (FED SPEC QQ-A-200/16
NSN 9540-00-596-2777 OR EQUIVALENT).
8-4. THE FINISH SHALL CONSIST OF A MINIMUM OF:
ONE COAT OF PRIMER (FED SPEC TT-P-1757
NSN 8010-00-297-0593 OR EQUIVALENT)
AND TWO COATS OF PAINT (FED SPEC TT-E-527,
BROWN #30372, NSN 8010-00-348-7715 OR EQUIVALENT)
DRILL 0.17 (4 PLACES)
SIDE VIEW
TOP VIEW
FRONT VIEW
FABRICATION AND HOLE DRILLING DETAILS
SMALL MOUNTING BRACKET
FIGURE 17
CUT OFF EXCESS MATERIAL FROM 2X2 ANGLE
DRILL 0.17 AND COUNTERSINK FOR A #8 SCREW (2 PLACES)
DRILL 0.144 AND COUNTERSINK FOR A #6 SCREW (2 PLACES)
FABRICATION AND HOLE DRILLING DETAILS
LARGE MOUNTING BRACKET
FIGURE 16
PLEXIGLASS
TABLE TOP
CUTOUT
ETVS JACKBOX CUTOUT
FIGURE 14
SIDE VIEW
HOLE SPACING FOR ADAPTER, 1.50"
JACK BOX HEIGHT, 1.55"
MIN 0.875"
DRILL 0.17 AND COUNTERSINK FOR A #8 SCREW (4 PLACES)
FABRICATION AND HOLE DRILLING DETAILS
FIGURE 15
ETVS JACKBOX
BOTTOM VIEW
DISTRIBUTION F. FURTHER DISSEMINATION ONLY AS DIRECTED BY 38 EIG/TS, TINKER AFB OK 73145-2713 AUG 1995) OR HIGHER DOD AUTHORITY.
UNLESS DIMENSIONS SPECIFIED
38 ENGINEERING INSTALLATION GROUP (AFMC)
38 EIG/TS
U.S. AIR FORCE
TINKER AFB, OK 73145-2713
M JONES 11 FEB 97
CHK FISHER 11 FEB 97
ENGR LT VILLA 11 FEB 97
AIR TRAFFIC CONTROL TOWER
WRAP AROUND CONSOLE
MCP PROGRAM
RINDER 11 FEB 97
D 14941 SK SCCS-3
APPLICATION
NONE
SKSCCS08.DGN
8 OF 8

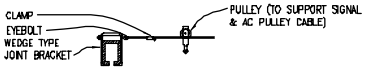

CONSOLE EQUIPMENT KEY
ITEM NUMBER
DESCRIPTION
FACE PANEL SIZE (L x W x D)
1 ETVS (COMMUNICATIONS) 250 X 263
2 NOTUSED
3 FLIGHT PROGRESS STRIP BOARD SEE DETAIL 5/A6.2 475 X 425
4 WIND INDICATOR 250 X 475 X 175
5 D-BRITE (RCU) CONTROLS 232 X 430
6 PIDP CONTROLS (KEYBOARD) SEE DTL. 6/A6.4 234 X 338
7 EVACUATION ALARM 153 X 131
8 AIR FIELD LIGHTING PANEL 476 X 338 X 163
9 CRASH PHONE 313 X 150
10 ATIS 100 X 125
11 FDIO MONITOR 363 X 363 X 363
12 FDIO PRINTER 331 X 425 X 175
13 NOT USED
14A AWDS MONITOR SAMSUNG PC MONITOR & KEYBOARD OR 200 X 200 X 250
14 AWDS
15 NOT USED
16 NOT USED
17 NOT USED
18 W/S COMPUTER
19 NOT USED
20 ETVS COMPUTER
21 FAX MACHINE
22 PRINTER
23 NOT USED
24 NOT USED
25 RECORDER MONITOR
26 TELCO JACKFIELD SEE DTLS. 7 & 8/A6.4 125 X 180 X 25
27 NOT USED
28 FLIGHT STRIP STORAGE BIN SEE DTL. 7/A6.3 210 X 253
29 CLOCK
30 FDIO KEYBOARD 263 X 363 X 81
31 SECURITY CAMERA MONITOR
32 BUILDING ENTRY CONTROLS
33 GENERATOR MONITOR PANEL 279X241X54
34 PORTABLE LIGHT GUN/CHARGER
35 GRC RADIO
36 ARTICULATED ARM (CEILING MOUNT)
37 SILS MONITOR
38 SPEAKER
39 SDF COMPUTER
40 COPIER
GENERAL NOTES
1. THIS SHEET SHOWS GENERAL LOCATION OF EQUIPMENT TO BE FURNISHED AND INSTALLED BY OTHERS IN THE CAB CONSOLE. FOR THE MAKE OF EQUIPMENT, EXACT SIZE OF EQUIPMENT SHOWN IN CONSOLE EQUIPMENT KEY (FACE PANEL SIZE) MAY VARY.
2. SITE ADAPT ALL DIMENSIONS ON THIS SHEET.
3. REFER TO DETAIL 5/A6.5 FOR FLIGHT PROGRESS STRIP BOARD DETAILS
4. REFER TO SHEET E2.10 FOR THE LOCATION OF LAN, ELECTRICAL, AND TELEPHONE OUTLETS
CAB CONSOLE PLAN
PLAN NORTH
RANDOLPH AIR FORCE BASE, TEXAS
WEST CONTROL TOWER
INTERIOR DETAILS
ENLARGED CAB CONSOLE PLAN
GARVER ENGINEERS
CROMWELL ARCHITECTS
ENGINEERS
SEQUENCE NO. 45
NOTE: ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE


PRELIMINARY
CHECK PLOT
2000-05-03
SOURCE CONTROL DRAWING
ARTICULATED CEILING MOUNT
Raytheon
NOTES:
APPROVED SOURCE(S) OF SUPPLY:

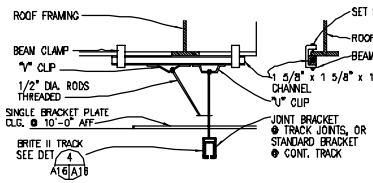

PRELIMINARY
CHECK PLOT
2000-05-2
Raytheon
CEILING MOUNT A
INSTALLATION KIT DR
E149958
G78285
NOTES
1. THE ADAPTER AND CLAMPS INDICATED HERE TO BE
2. DIMENSION A IS THE DISTANCE BETWEEN THE ROOM
3. FOR PROPER ORIENTATION OF THE ARM TO MINIMIZE
4. ALL HARDWARE ASSOCIATED WITH THE ADAPTER
5. AFTER INSTALLATION OF THE ARM AND MONITOR,
6. DO NOT INTERFERE WITH THE MOVEMENT
7. DO NOT DAMAGE THE CABLES



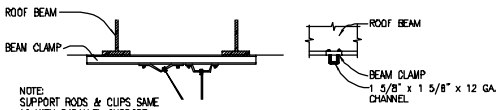
PLAN AT BRITE II TRACK AND WINCH FRAMING
SCALE: NOT TO SCALE



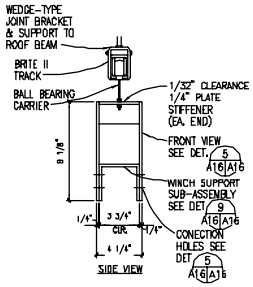
1 A16|A16 CABLE SUPPORT SCALE: 3"=1'-0"



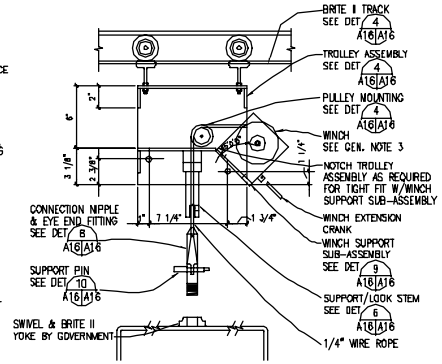
2 A16|A16 PARALLEL TRACK SUPPORT SCALE: NOT TO SCALE



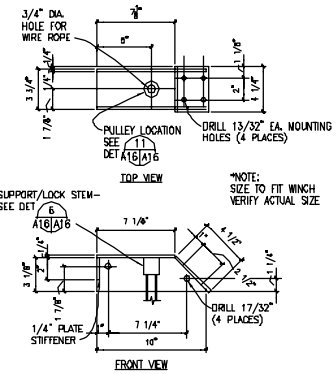
3 A16|A16 PERPENDICULAR TRACK SUPPORT SCALE: NOT TO SCALE



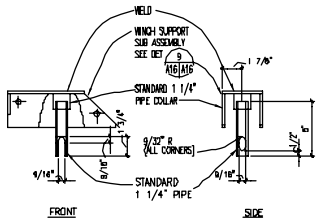
4 A16|A16 TROLLEY ASSEMBLY SCALE: 3"=1'-0"



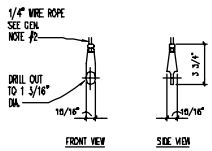
5 A16|A16 BRITE II CARRIER & WINCH MOUNTING SCALE: 3"=1'-0"



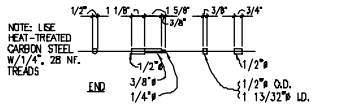
9 A16|A16 WINCH SUPPORT SUB ASSEMBLY SCALE: 3"=1'-0"



6 A16|A16 SUPPORT/LOCK STEM SCALE: 3"=1'-0"



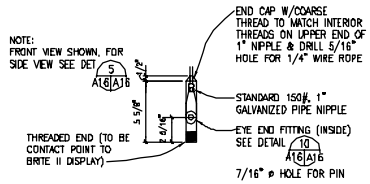
7 A16|A16 EYE END FITTING SCALE: 3"=1'-0"



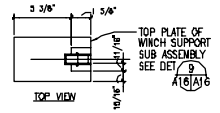
10 A16|A16 SUPPORT PIN SCALE: 3"=1'-0"

GENERAL NOTES:

1. TROLLEY ASSEMBLY MATERIAL IS 1/4" COLD ROLLED STEEL (ALL WELDED.)
2. 1/4" WIRE ROPE – USE EXTRA FLEXIBLE HOISTING ROPE 8 x 19 CONSTRUCTION
3. WINCH 500 LB. CAPACITY, WORM TEAR W/AUTOMATIC SELF-LOCKING BRAKE. HAND CRANK W/ ADJUSTABLE HANDLE.
4. TRACK SYSTEM 1 3/4" x 2 5/16" 11 GA. STEEL TRACK W/ JOINT BRACKETS & HANGING BRACKETS AS REQUIRED BY THE MANUFACTURER
5. CARRIERS: 2-WHEEL BALL BEARING TYPE W/THREADED STEM, 125 LB. CAPACITY PER CARRIER.



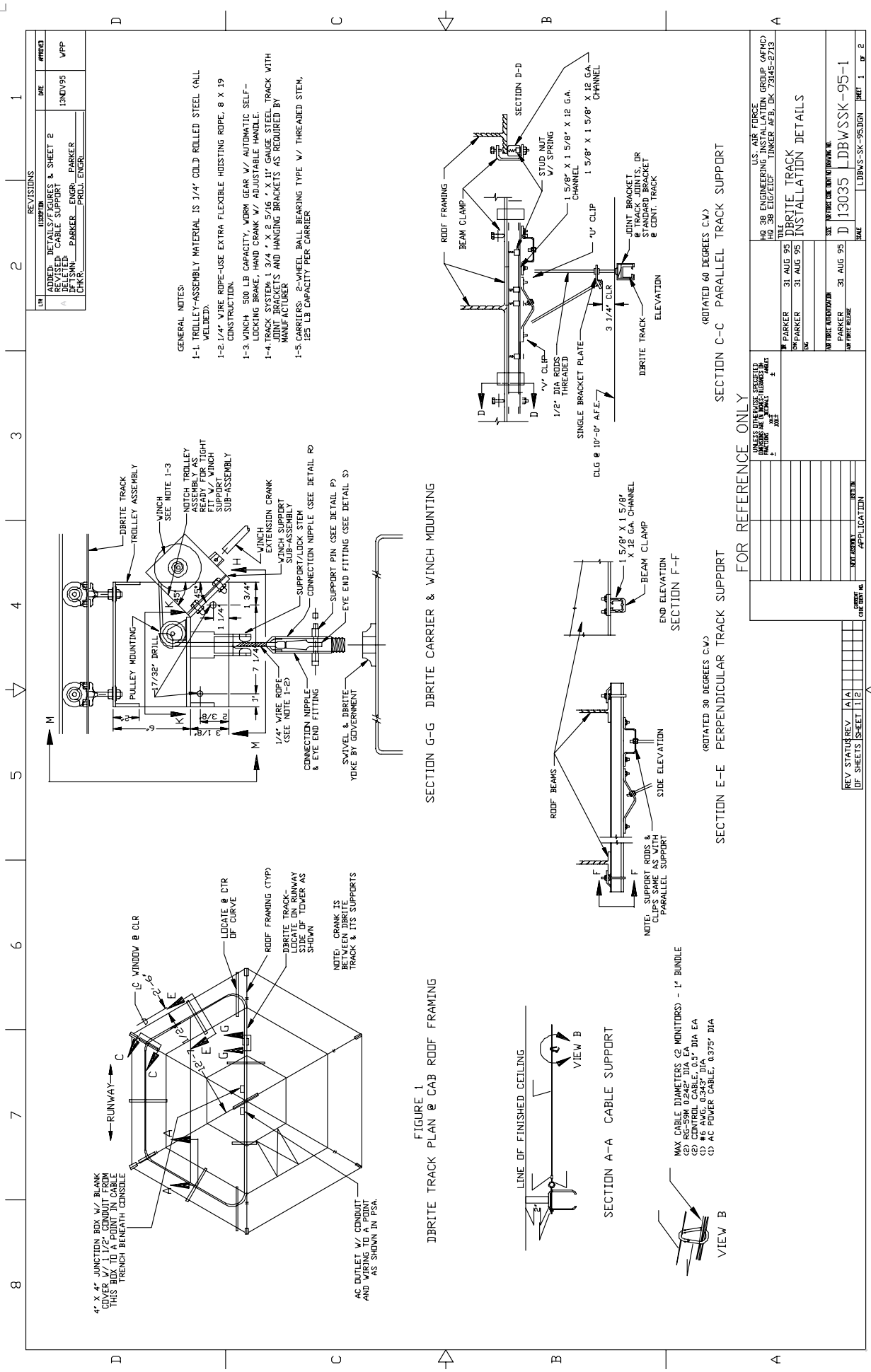
8 A16|A16 CONNECTION NIPPLE SCALE: 3"=1'-0"



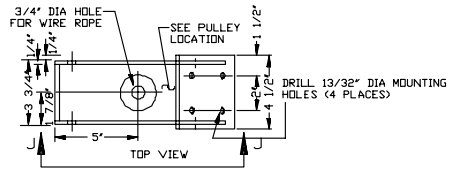
11 A16|A16 PULLEY LOCATION SCALE: 3"=1'-0"

SCALE: 1/2" = 1'-0"

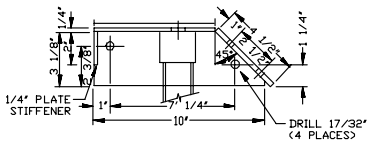
J:\02029\DWG\A\WSTA16.DWG 08/31/1999 16:45 REHicken


REVISIONS
LTR DESCRIPTION DATE APPROVED
A ADDED: DETAILS/FIGURES & SHEET 2
REVISED: CABLE SUPPORT
DELETED:
DETAILED PARKER ENGR. PARKER
CHKR PROJ. ENGR.
13NOV95 WPP
GENERAL NOTES:
1-1. TROLLEY-ASSEMBLY MATERIAL IS 1/4" COLD ROLLED STEEL (ALL WELDED).
1-2. 1/4" WIRE ROPE-USE EXTRA FLEXIBLE HOISTING ROPE, 8 X 19 CONSTRUCTION.
1-3. WINCH 500 LB CAPACITY, WORM GEAR W/ AUTOMATIC SELF-LOCKING BRAKE, HAND CRANK W/ ADJUSTABLE HANDLE.
1-4. TRACK SYSTEM: 1 3/4 " X 2 5/16 " X 11" GAUGE STEEL TRACK WITH JOINT BRACKETS AND HANGING BRACKETS AS REQUIRED BY MANUFACTURER
1-5. CARRIERS: 2-WHEEL BALL BEARING TYPE W/ THREADED STEM, 125 LB CAPACITY PER CARRIER
DBRITE TRACK TROLLEY ASSEMBLY
WINCH SEE NOTE 1-3
NOTCH TROLLEY ASSEMBLY AS READY FOR TIGHT FIT W/ WINCH SUPPORT SUB-ASSEMBLY
WINCH EXTENSION CRANK
WINCH SUPPORT SUB-ASSEMBLY
SUPPORT/LOCK STEM
CONNECTION NIPPLE (SEE DETAIL R)
SUPPORT PIN (SEE DETAIL P)
EYE END FITTING (SEE DETAIL S)
PULLEY MOUNTING
17/32" DRILL
1/4" WIRE ROPE (SEE NOTE 1-2)
CONNECTION NIPPLE & EYE END FITTING
SWIVEL & DBRITE YOKE BY GOVERNMENT
SECTION G-G DBRITE CARRIER & WINCH MOUNTING
ROOF FRAMING
BEAM CLAMP
SECTION D-D
STUD NUT W/ SPRING
1 5/8" X 1 5/8" X 12 GA. CHANNEL
"U" CLIP
JOINT BRACKET @ TRACK JOINTS, OR STANDARD BRACKET @ CONT. TRACK
"V" CLIP
1/2" DIA RODS THREADED
SINGLE BRACKET PLATE
3 1/4" CLR
DBRITE TRACK
ELEVATION
CLG @ 10'-0" A.F.F.
(ROTATED 60 DEGREES C.W.)
SECTION C-C PARALLEL TRACK SUPPORT
FOR REFERENCE ONLY
1 5/8" X 1 5/8" X 12 GA. CHANNEL
BEAM CLAMP
END ELEVATION
SECTION F-F
ROOF BEAMS
SIDE ELEVATION
NOTE: SUPPORT RODS & CLIPS SAME AS WITH PARALLEL SUPPORT
(ROTATED 30 DEGREES C.W.)
SECTION E-E PERPENDICULAR TRACK SUPPORT
4" X 4" JUNCTION BOX W/ BLANK COVER W/ 1/2" CONDUIT FROM THIS BOX TO A POINT IN CABLE TRENCH BENEATH CONSOLE
RUNWAY
℄ WINDOW @ CLR
LOCATE @ CTR OF CURVE
ROOF FRAMING (TYP)
DBRITE TRACK- LOCATE ON RUNWAY SIDE OF TOWER AS SHOWN
NOTE: CRANK IS BETWEEN DBRITE TRACK & ITS SUPPORTS
AC OUTLET W/ CONDUIT AND WIRING TO A POINT AS SHOWN IN PSA.
FIGURE 1
DBRITE TRACK PLAN @ CAB ROOF FRAMING
LINE OF FINISHED CEILING
VIEW B
SECTION A-A CABLE SUPPORT
MAX CABLE DIAMETERS (2 MONITORS) - 1" BUNDLE
(2) RG59M 0.242" DIA EA
(2) CONTROL CABLE 0.5" DIA EA
(1) #6 AWG, 0.343" DIA
(1) AC POWER CABLE, 0.375" DIA
VIEW B
U.S. AIR FORCE
HQ 38 ENGINEERING INSTALLATION GROUP (AFMC)
HQ 38 EIG/EIOF TINKER AFB, OK 73145-2713
TITLE
DBRITE TRACK
INSTALLATION DETAILS
DRAWN PARKER 31 AUG 95
CHK PARKER 31 AUG 95
ENG
AIR FORCE AUTHENTICATION
PARKER 31 AUG 95
AIR FORCE RELEASE
SIZE D
D 13035 LDBWSSK-95-1
SCALE
LDBWS-SK-95.DGN SHEET 1 OF 2
REV STATUS REV A A
OF SHEETS SHEET 1 2
NEXT ASSEMBLY
APPLICATION
DRAWING NO.

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	ADDED: DETAILS/FIGURES & SHEET 2 REVISED: CABLE SUPPORT DELETED: DFTSMN: PARKER ENGR: PARKER CHKR: PROJ. ENGR:	13NOV95	WPP

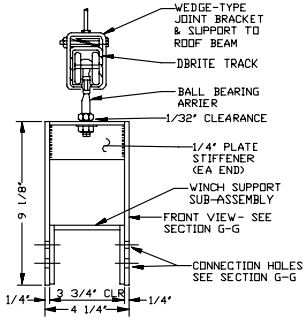


SECTION H-H WINCH SUPPORT SUB-ASSEMBLY

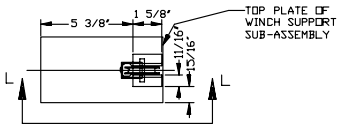


(SEE ALSO VIEW N)

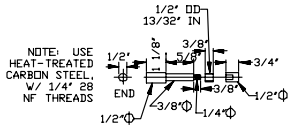
SECTION J-J WINCH SUPPORT SUB-ASSEMBLY



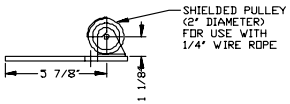
SECTION M-M TROLLEY ASSEMBLY



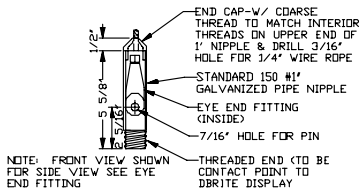
SECTION K-K PULLY MOUNTING



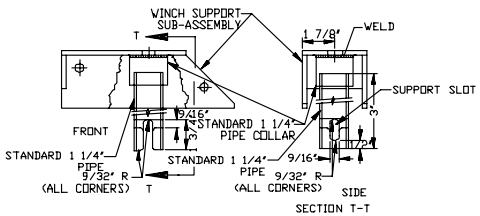
DETAIL P SUPPORT PIN



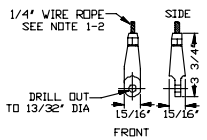
SECTION L-L PULLEY FRONT VIEW



DETAIL R CONNECTION NIPPLE



VIEW N SUPPORT/LOCK STEM



DETAIL S EYE END FITTING

FOR REFERENCE ONLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

DR PARKER
CHK PARKER
ENG PARKER
AIR FORCE AUTHENTICATION
AIR FORCE RELEASE

CURRENT CODE IDENT NO. | NEXT ASSEMBLY | USED ON
APPLICATION

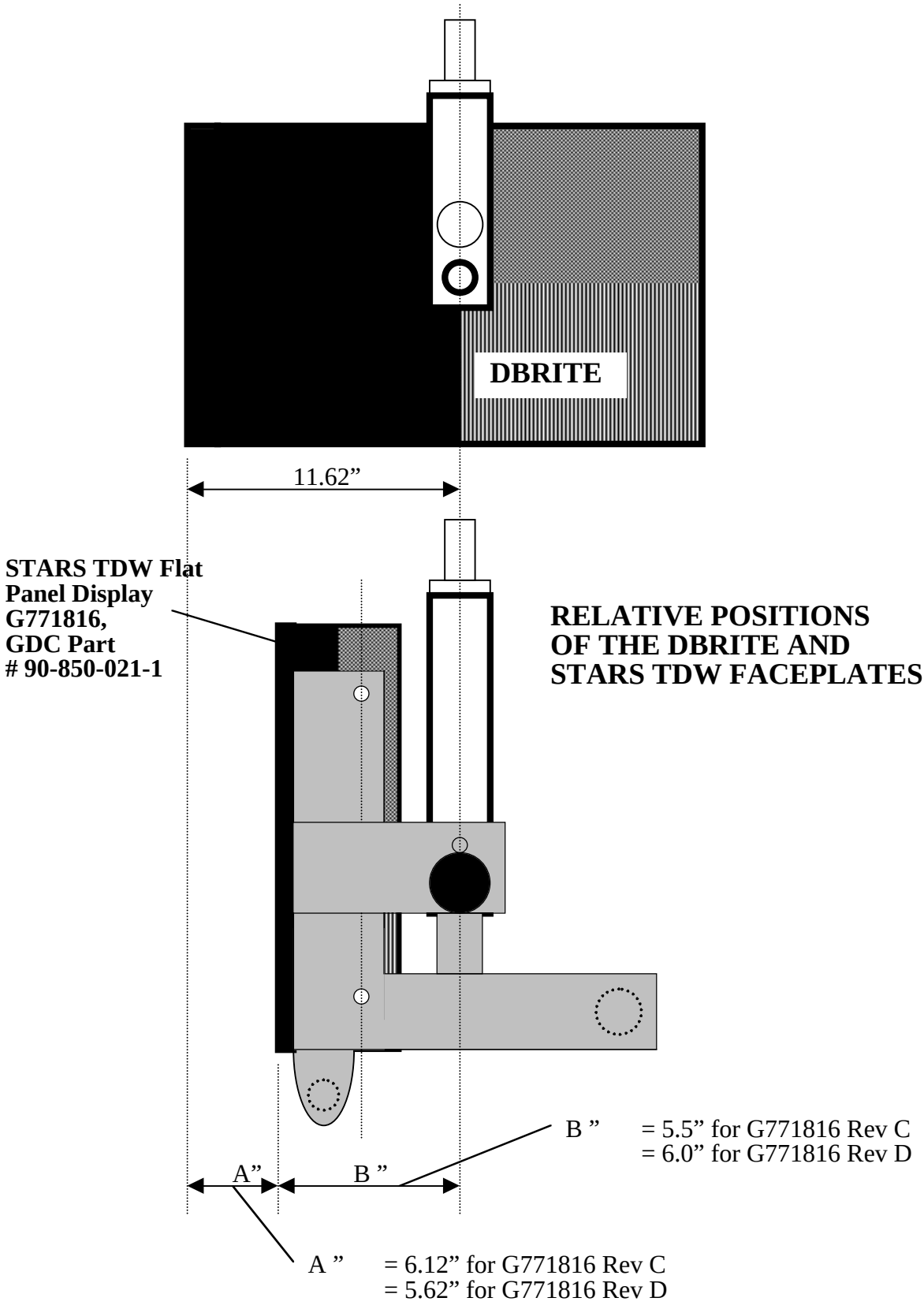
U.S. AIR FORCE
HQ 38 ENGINEERING INSTALLATION GROUP (AFMC)
HQ 38 EIG/EICF TINKER AFB, OK 73145-2713

TITLE
DBRITE TRACK
INSTALLATION DETAILS

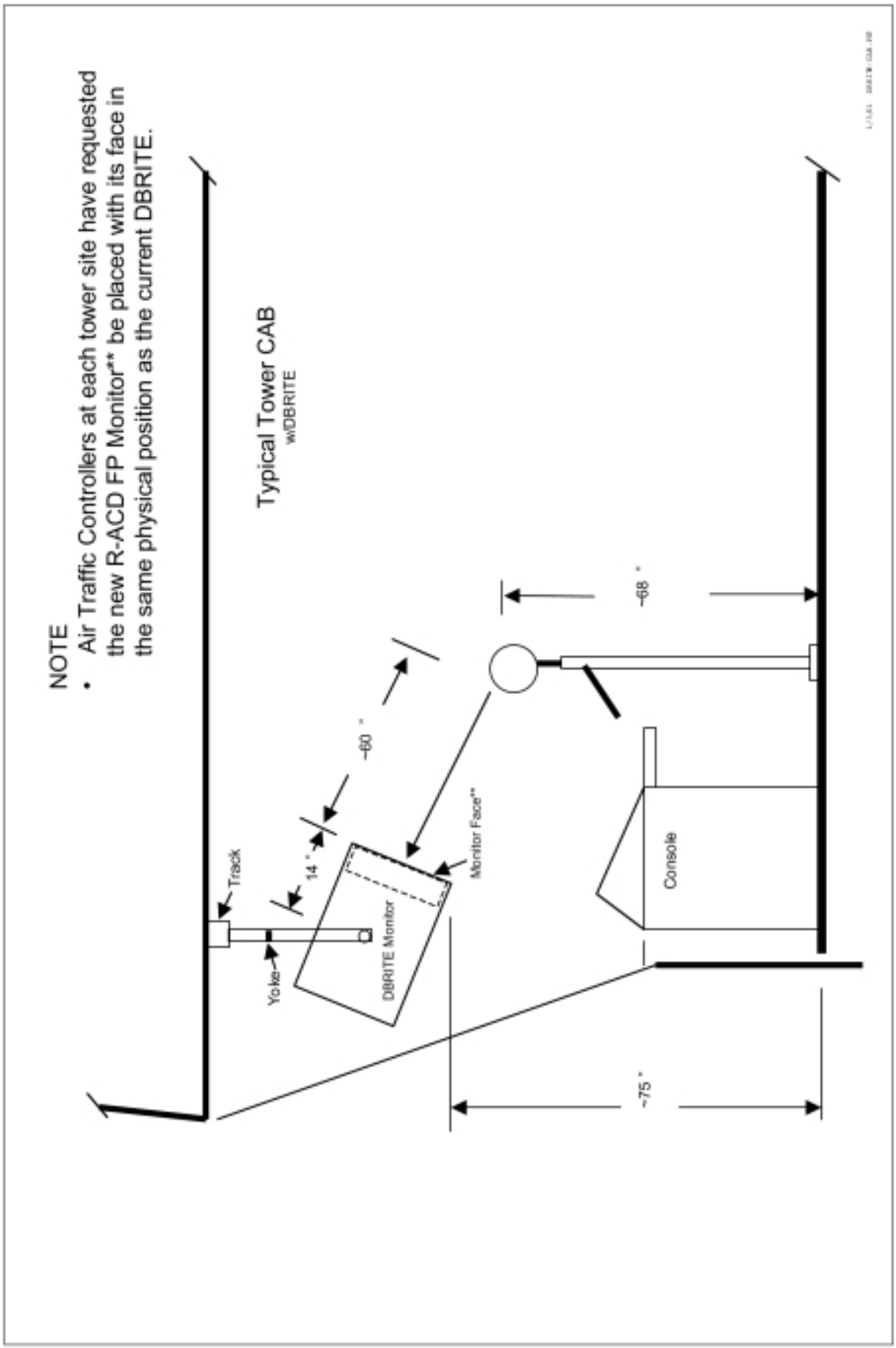
SIZE D | AIR FORCE CODE IDENT NO 14941 | DRAWING NO LDBWSSK-95-1

SCALE | SHEET 2 OF 2

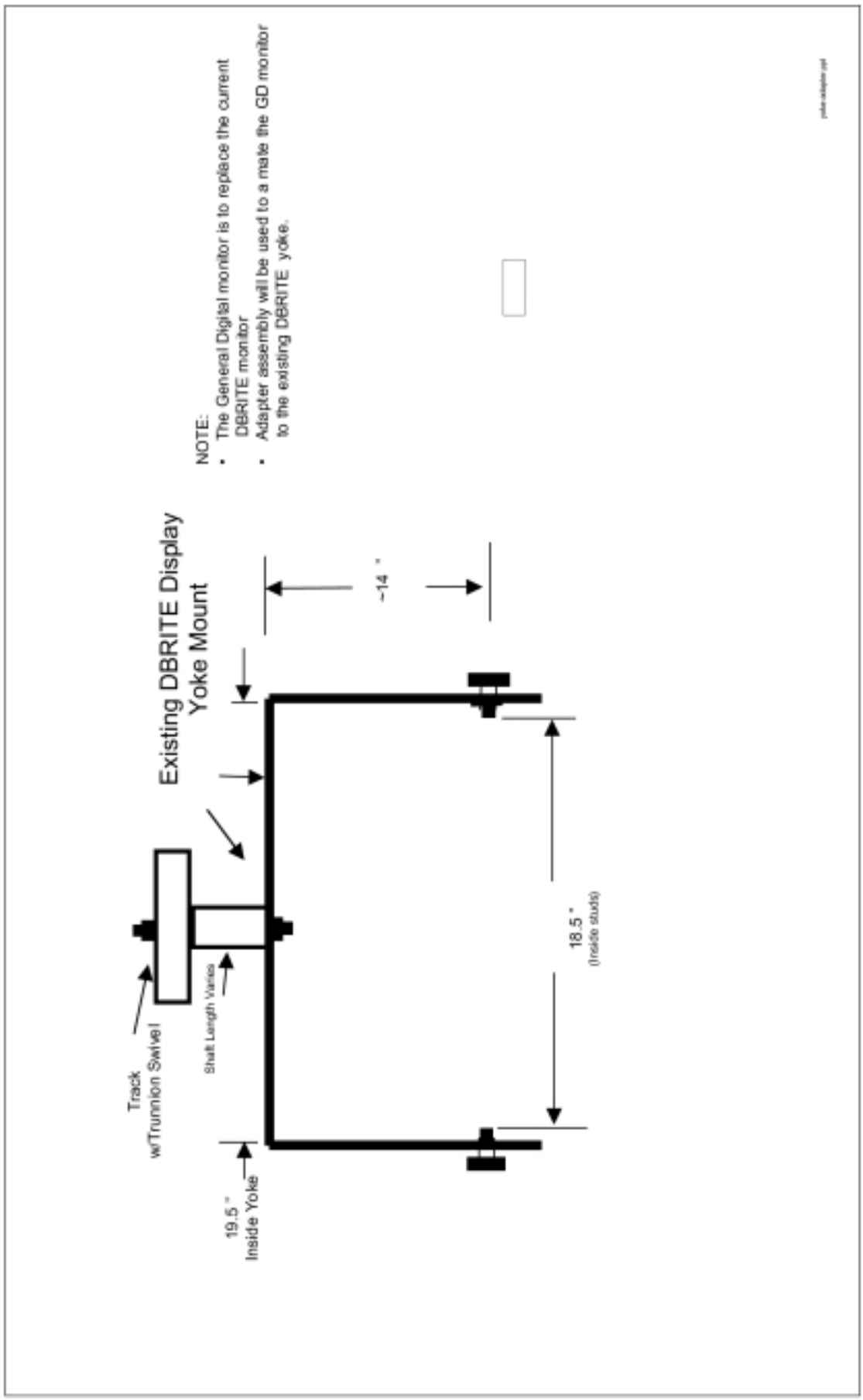
RAYTHEON


DBRITE
11.62”
STARS TDW Flat Panel Display G771816, GDC Part # 90-850-021-1
RELATIVE POSITIONS OF THE DBRITE AND STARS TDW FACEPLATES
B ” = 5.5” for G771816 Rev C
= 6.0” for G771816 Rev D
A”
B ”
A ” = 6.12” for G771816 Rev C
= 5.62” for G771816 Rev D

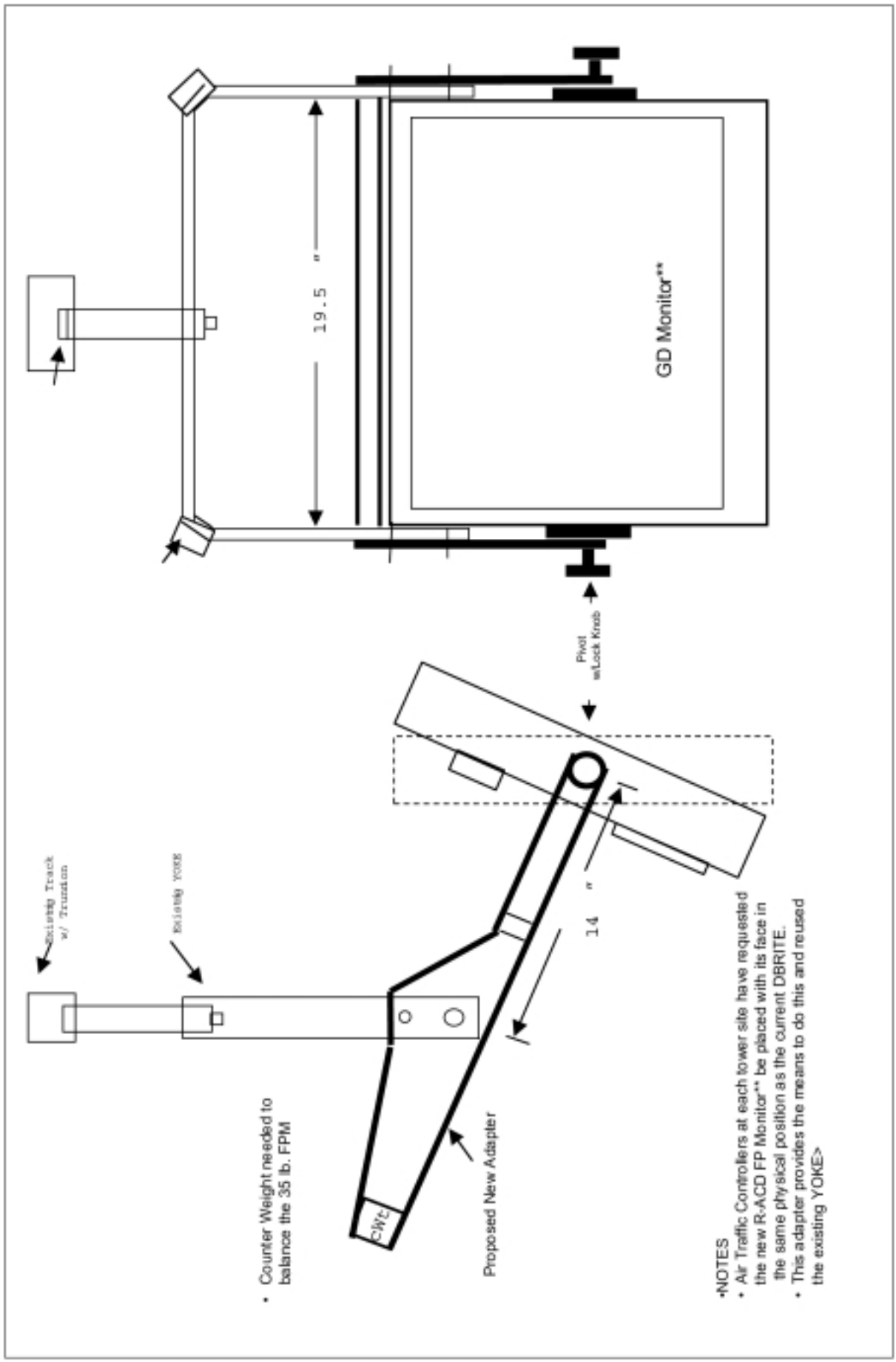
DBRITE MONITOR/ MOUNT POSITION

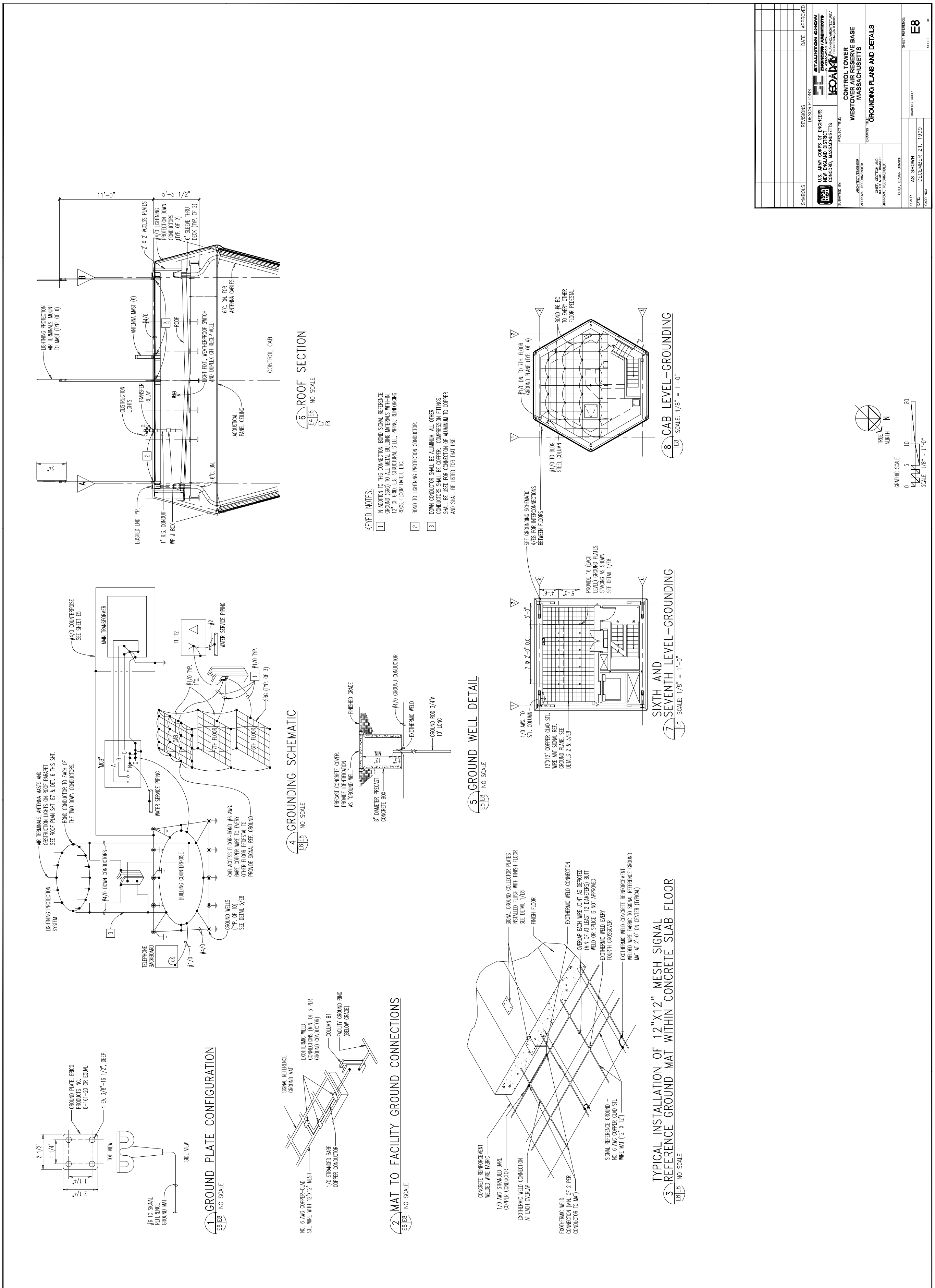


DBRITE MONITOR YOKE MOUNT



PROPOSED FLAT PANEL MONITOR ADAPTER




1 GROUND PLATE CONFIGURATION
E8 E8 NO SCALE
2 MAT TO FACILITY GROUND CONNECTIONS
E8 NO SCALE
3 TYPICAL INSTALLATION OF 12"X12" MESH SIGNAL REFERENCE GROUND MAT WITHIN CONCRETE SLAB FLOOR
E8 E8 NO SCALE
4 GROUNDING SCHEMATIC
E8 E8 NO SCALE
5 GROUND WELL DETAIL
E5 E8 NO SCALE
6 ROOF SECTION
E4 E8 NO SCALE
7 SIXTH AND SEVENTH LEVEL-GROUNDING
E8 SCALE: 1/8" = 1'-0"
8 CAB LEVEL-GROUNDING
E8 SCALE: 1/8" = 1'-0"
KEYED NOTES:
CONTROL TOWER
WESTOVER AIR RESERVE BASE
MASSACHUSETTS
GROUNDING PLANS AND DETAILS
E8

Note: The following tables are to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the ATCT design charette.

Architectural Program for ATCTs			
Space	**Occupants/Visitors**	**SF**	**Notes**
Lobby			
Elevator			
Elevator Machine Room			
Mechanical and Electrical Room			
Simulator Classroom			
Mechanical Yard			
Administration			
Chief Controller's Office			
Training Room			
Lower Equipment Room			
Upper Equipment Room			
Ready/Break Room			
Mechanical Room			
Cab			
Toilet Room			
Communications/Power Closet			
Stairs			
Total			

- Provide circulation and additional spaces as required.
- Consult AFH 32-1084, paragraph 5.32 Category Code 149-962, Air Traffic Control Tower for space requirements.

Note: The following table is to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the ATCT design charrette.

Room Finish Schedule for ATCTs

Space	Floor	Walls	Ceiling
Lobby	Vinyl Composition Tile (VCT)	Paint or Vinyl Wall Covering (VWC)	Suspended Acoustical Ceiling Tile (SACT)
Elevator	VCT	Mfg standard finish	Mfg standard finish
Elevator Machine Room	Concrete or VCT	Paint	Gypsum board (GYP)
Mechanical and Electrical Room	Concrete	Paint	Exposed or spray-on acoustical foam
Simulator Classroom	Carpet	Paint or VWC	SACT
Administration	Carpet	Paint or VWC	SACT
Chief Controller's Office	Carpet	VWC	SACT
Training Room	Carpet	Paint or VWC	SACT
Lower Equipment Room	VCT	Paint	Exposed or spray-on acoustical foam
Upper Equipment Room	VCT	Paint	Exposed or spray-on acoustical foam
Ready/Break Room	Carpet	Paint or VWC	SACT
Mechanical Room	VCT	Paint	Exposed or spray-on acoustical foam
Cab	Carpet	Paint or VWC	SACT (dark, non-reflective color)
Toilet Room	VCT or Ceramic Tile (CT)	Paint or CT	GYP
Communications/Power Closet	VCT	Paint	Exposed
Stairs	VCT	Paint	GYP

Note: The following table is to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the ATCT design charrette.

Lighting for ATCTs

Space	Level (fc)	Type	Notes
Lobby	10-20	Fluorescent	
Elevator	10-20	Fluorescent	
Elevator Machine Room	10-20	Fluorescent	
Mechanical and Electrical Room	40-60	Fluorescent	
Simulator Classroom	30-50	Fluorescent	Dimmable
Administration	40-60	Fluorescent	
Chief Controller's Office	40-60	Fluorescent	
Training Room	20-40	Fluorescent	
Lower Equipment Room	40-60	Fluorescent	
Upper Equipment Room	40-60	Fluorescent	
Ready/Break Room	30-50	Fluorescent	
Mechanical Room	40-60	Fluorescent	
Cab	40-60	Incandescent and Spotlight	Dimmable. Provide task lighting at 60-120 fc at work locations
Toilet Room	40-50	Fluorescent	
Communications/Power Closet	40-60	Fluorescent	
Stairs	10-20	Fluorescent	

• Provide emergency battery ballast fixtures in stairs and in each room.

Note: The following table is to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the ATCT design charrette.

UNITED STATES AIR FORCE

U.S. AIR FORCE

CHAPTER 2
RADAR APPROACH CONTROL FACILITY
Design Guide

2.1.1 Purpose

This Design Guide provides basic guidance and criteria to programmers, planners, architects, engineers, design and construction agents, commanders, and construction contractors for the programming, design, and construction or renovation of Radar Approach Control (RAPCON) facilities. The purpose of RAPCON is the control of that portion of Air Traffic Control (ATC) that cannot be seen by the Air Traffic Control Tower (ATCT) controllers. Once the tower controllers can see an aircraft, the ATCT takes over the landing instructions. Also included in all RAPCON facilities is the training of future RAPCON controllers. RAPCON facilities house all radar approach control functions.

2.1.1.1 Coverage Areas

RAPCONs provide regional coverage and provide approach control for several installations or airports within that range. Military and civilian entities provide RAPCON services for each other. In some cases, the civilian airport provides RAPCON services for local military installations. There are also military bases that provide RAPCON services to civilian airports. Neither the function nor the facilities are duplicated making it critical that that the design and engineering support uninterrupted operations.

2.1.1.2 Applicable Publications

The operations of a RAPCON is dictated by AFPD 13-2, *Air Traffic Control, Airspace, Airfield and Range Management*; AFI 13-203, *Air Traffic Control*; AFI 13-216, *Evaluation of Air Traffic Control and Landing Systems (ATCALS)*; and, AFI 13-218, *Air Traffic Control System Evaluation Program*. The facility is protected under AFI 31-101 *Protection of Controlled Areas* and other force protection initiatives applicable to the particular installation.

2.1.2 Scope and Objectives

2.1.2.1. Scope

The scope of this Guide encompasses design guidance for analog system facilities, digital systems facilities, and the engineering requirements to support each. While new Radar Approach Control systems are digital using Standard Terminal Automation Replacement System (STARS) and Digital Airport Surveillance Radar (DASR), current facilities need to be maintained and renovated until replaced by digital systems. Some RAPCONs are unique and may not transition to this new equipment in the foreseeable future.

2.1.2.2 Objectives

The objective of this chapter is to aid the design professionals' understanding of all RAPCON facilities for adequate renovation and future design. The chapter provides a thorough description of RAPCON functions and their relationships to each other. Included are descriptions of different types of radar and other communications equipment used in these facilities and the appropriate engineering support for each. Architectural, interior, engineering, exterior, and site design standards are also covered.

2.1.3 Site Selection

2.1.3.1 Siting

RAPCON facilities can be sited anywhere within the range of the radar providing radar assisted approach control. The RAPCON functions well in a single story facility, making it an ideal candidate for siting near airfields where building heights are restricted by airport conical surfaces or imaginary surfaces. The A-E shall make the most of the site's existing natural resources.

2.1.3.2 Proximity

Even though ATCTs and RAPCONs both perform air traffic operations, they do not need to be sited next to each other. RAPCON personnel and Air Traffic Control Tower personnel communicate and interact through voice communication lines. RAPCON personnel are not redundant to ATCT personnel, with the exception of the Airfield Operations Flight Commander (AOF/CC). While most existing RAPCON facilities are separate from Base Operations and the Control Tower, some installations have collocated the RAPCON, ATCT, and Base Operations within a single facility.

2.1.4 Work Not Included in the Construction Contract

The design of the facility shall include space and engineering support for all RAPCON operations. However, the construction contractor is not responsible for furnishing or installing:

2.1.4.1 Cabling

Data or communications cabling internal to the facility, other than office telephone systems and local area network (LAN) cabling to desktop computers.

2.1.4.2 Racks and Housing

Equipment room communications racks, communications equipment or radar/radar housing. This does not include wall mounted data or telecommunications cabinets or related conduit as outlined in other sections.

2.1.5 Reliability and Maintainability

The RAPCON must operate without interruption. Reliability and ease of maintenance are vital to support uninterrupted operations. The RAPCON facility

shall be configured to accept a government furnished Uninterruptible Power Supply (UPS) system sized to accommodate all technical power loads in the proposed RAPCON facility for a period of at least 15 minutes in case the generator needs to be manually started. The area for this system shall be in the communications equipment room and permit easy access by system maintenance personnel. The design shall incorporate ETL 88-4, *Reliability and Maintainability (R&M) Design Checklist.*

2.1.6 Programming

Consult AFH 32-1084, *Facility Requirements*, Chapter 4, Section E and use facility Category Code 134-375 to establish the overall scope of the facility. Specific space requirements, adjacencies, and needs will be given to the A-E at the charrette or pre-design meeting. Also see the notional floor plan located in Part 4 of this Chapter and Design Programming Tables located in Part 5 of this Chapter.

2.1.7 Hazardous Materials

No building products specified or used shall contain asbestos. Lead-based paint is restricted. The A-E shall verify the most current requirements and limitations with the base Environmental office prior to specifying the use of products containing lead. Building products shall be EPA compliant. The A-E shall not specify the use of products containing CFCs or systems that require use of Halon. The A-E shall minimize use of materials that emit harsh gases for periods over 48 hours after installation.

2.2.1 Functional Relationships within a RAPCON

2.2.1.1 Overview

2.2.1.1.1 Effective functional relationships in a RAPCON will add to the ease of operations. Because on-duty controllers are also responsible for training new controllers, it is important to ensure that they have ready access to spaces that support their multiple duties, without hindering their performance.

2.2.1.1.2 In RAPCONs where the Operations (Ops)/Instrument Flight Rules (IFR) room is dark to accommodate analog scopes, it is helpful to collocate certain spaces so that personnel do not exit and re-enter the Ops/IFR. The designers should allow for minimum light sensitivity adjustment for personnel working in or around the Ops/IFR area. Lighting in toilet rooms, break rooms, etc. that are used by these personnel should be dimly lit. The amount of care that the designer devotes to this issue and similar issues will, in part, determine the quality of the RAPCON work environment.

2.2.1.1.3 The location of training areas may be dependent upon how a particular RAPCON operates.

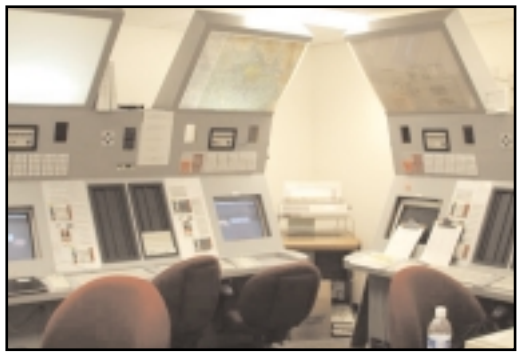
2.2.1.1.3.1 For areas that train a high number of controllers, or where the on-duty controller staff also does the Computer Based Instruction (CBI) training, the training room should be adjacent to the Ops/IFR room. When there is heightened on-scope activity, on-duty controller-trainers can be easily contacted and can quickly return to the Ops/IFR.

2.2.1.1.3.2 Manning and the number of personnel being trained are diminished at RAPCONs where the mission covers a smaller number of approaches. The training room, if separate from the briefing room, may be small enough to accommodate only 1 or 2 computers. Most training takes place where controller/trainers are actively at work. Some RAPCONs train personnel directly on airport surveillance radar (ASR) scopes to more quickly participate in control activities. These personnel are also able to simultaneously observe controllers at work since they are trained in the Ops/IFR.

2.2.1.1.4 Simulator training set-up also varies. Its location depends upon size of the RAPCON, RAPCON staff, configuration of the space within the RAPCON facility and the type of equipment available for training. RAPCONs still using ASR and precision approach radar (PAR) scopes have their PAR simulators within the already darkened Ops/IFR. The CBI simulators for ASR training are in separate, well-lit rooms. Digital simulators for the PAR functions can be in well-lit rooms as well.

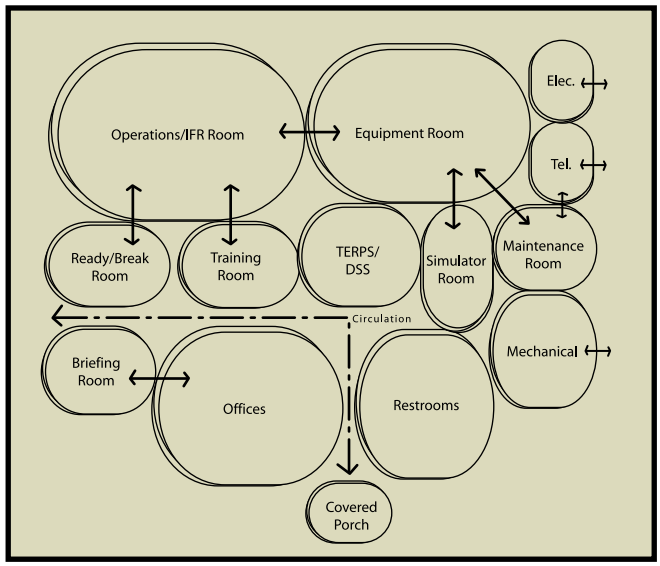
This RAPCON has been successful with completely separate training and simulator rooms.

2.2.1.1.4.a Digital Scope Simulator



2.2.1.2.4 Luke AFB RAPCON Simulator Training Room

2.2.1.2 Function Descriptions and Common Relationships



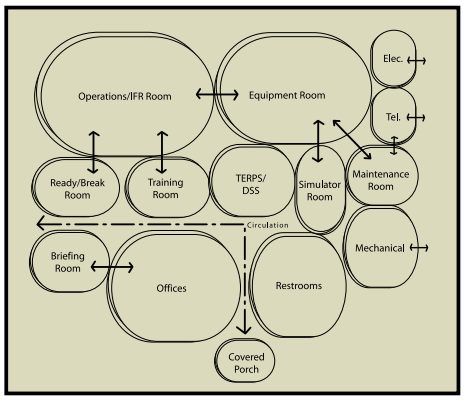
2.2.1.2 RAPCON *Functional and Spatial Relationships and Adjacencies*

The above bubble diagram is intended to show the spatial relationships, functional relationships, and adjacencies of a RAPCON. Arrows indicate circulation required from room to room, or directly to the exterior. Specific program and adjacency requirements will be given to the A-E at the charrette or pre-design meeting. Also reference the notional floor plan at Part 4 of this Chapter.

2.2.1.2.1 Operations/Instrument Flight Rules (Ops/IFR) Room. This is the primary functional area of a RAPCON. This space should be located within the facility and never exit directly to the outside. All radar-controlled approaches are handled from this room. Along with radarscopes, there is a station for a Watch Supervisor who oversees all scope activity. The Ops/IFR room requires a considerable amount of circulation space.

2.2.1.2.1.1 In an analog system, there are airport surveillance radar (ASR) scopes and precision approach radar (PAR) scopes. In the new digital system there is a Standard Terminal Automation Replacement System (STARS) with Digital Airport Surveillance Radar (DASR). Area Surveillance is the primary function of radar approach control. The analog system requires almost total darkness to allow controllers to view the scopes. The new digital system allows normal office lighting as it is computer based. The A-E needs to be cognizant of the specific equipment systems being installed in order to design a quality facility.

2.2.1.2.1.2 Whether analog or digital, ASRs are used for airport approach until aircraft are within visual range of the ATCT. All aircraft flying under instrument flight rules (IFR) are monitored by radar to the greatest extent possible. Most ATCTs have a radar display for ensuring IFR aircraft are afforded additional and continuous monitoring until landing. Analog systems require separate PAR scopes which are used to support a difficult visual approach to the landing strip. STARS/DASR serves both functions. In RAPCONs with several scopes, scopes are positioned with controllers sitting with their backs to each other making it possible for each to turn around and view other scopes.



2.2.1.2.1.3 When there are more than 4 or 5 scopes, the layout of the scope area is usually with an equal number of scopes on opposite sides of the room. In an analog system, the ASRs are closest to the main entrance to the room and the Watch Supervisor's area. The PARs are used less frequently and are generally located at the farthest point from the primary entry.

2.2.1.2.1.4 There are typically 4 to 8 ASR scopes and 2 to 3 PAR scopes, depending on the size of the mission. There are never less than two on-line PAR scopes for the purpose of back-up capability. The cost of an analog scope prohibits the existence of off-line functional "spares".

2.2.1.2.1.5 Each controller wears a headset with a long cord, or "leash", linked into the network of RAPCON and ATCT controllers. Controllers wearing a leash may walk to other scopes in the room to observe or assist. For this reason, it is important to not create impediments between scopes.

2.2.1.2.1.6 The Watch Supervisor oversees all activities in the Ops/ISR room. In RAPCONs without digital systems, the optimum position for the Watch Supervisor is in the center of the room between the two banks of scopes so they have the ability to see all scopes from one position. Watch Supervisors have radar displays in RAPCONs equipped with digital systems.

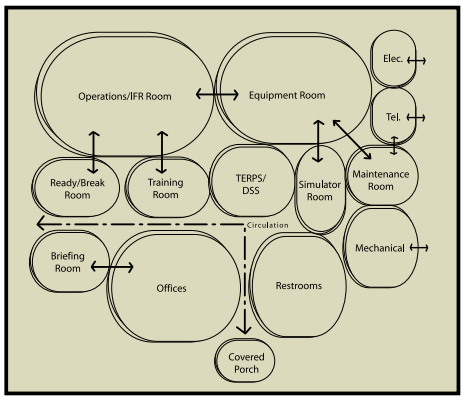
2.2.1.2.1.7 The Watch Supervisor shall have a console or desk equipped with a local telephone, controller communications, and back-up radio connectivity to the ATCT. If the desk is centrally located, it must be designed so that the Watch Supervisor can easily go from one bank of scopes to the other. It is also possible to locate the Watch Supervisor's desk area at the end of a bank of scopes, with a longer leash. Some IFR's have a centrally located communications connection for the coordinator's leash, suspended from the ceiling or a communications tray, to minimize the tangle of leashes and allow the greatest range for the coordinator.

2.2.1.2.1.8 The Ops/IFR room will be unlit if it contains analog equipment. The A-E needs to be mindful to design adjacencies so that personnel do not constantly switch from unlit rooms to well-lit rooms. The goal is that the design layout minimizes the personnel's eyesight readjustment time.

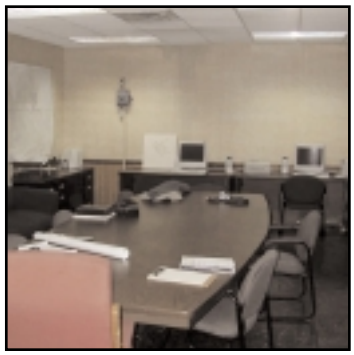

2.2.1.2.8 OPS IFR Room

2.2.1.2.2 Training Room. The training room houses the Computer Based Instruction (CBI) component of RAPCON training. Any given RAPCON tends to have a consistent number of trainees. Depending upon the number of personnel in training, this area may have between two and five computers. This function should be in its own space and should be adjacent to or near the Ops/IFR as controller/trainers frequently circulate between the Ops/IFR and Training rooms.

2.2.1.2.2 Training Room

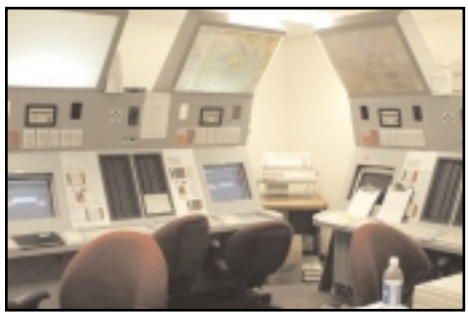


2.2.1.2.3 Briefing Room. This briefing and conference room should be sized for the entire RAPCON shift, plus the AOF/CC and the new shift Watch Supervisor. The Briefing Room should be sized to accommodate an adequately-sized conference table.



2.2.1.2.3 Briefing Room

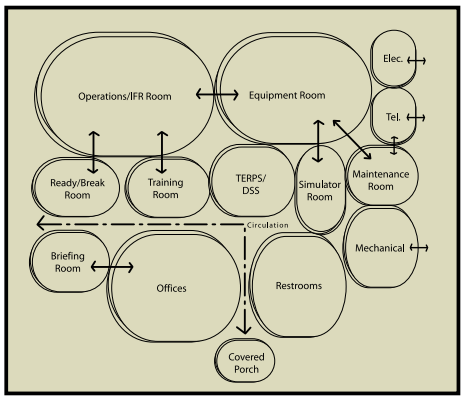
2.2.1.2.4 Simulator Room. In many existing analog RAPCONs, the simulators are within the Ops/IFR where training is overseen by on-duty controllers. Old computer based programs did not handle Precision Approach Radar and had limited ASR scenarios. Training is taught on the simulators which are actual PAR scopes within the darkened Ops/IFR.



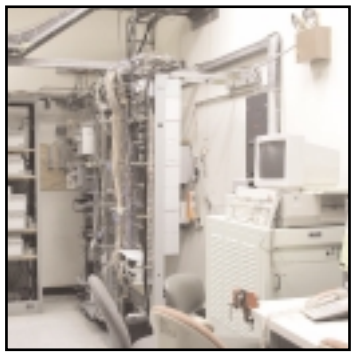
2.2.1.1.4a Digital Scope Simulator

2.2.1.2.4.1 As RAPCONs transition to digital technology and digital training becomes available, simulators can be in a separate room with normal office lighting. Simulators can be constructed to mimic the analog scope setup, but use CBI modules within the simulator and have these simulators in an office lighting set up.

2.2.1.2.5 Equipment Room. The communications equipment room is as critical to the RAPCON facility as the Ops/IFR Room. The comm racks are the termination points for all lines entering and departing the RAPCON facility for feeding data to and from the scopes in the Ops/IFR. The Equipment Room should be immediately adjacent to the Ops/IFR.



2.2.1.2.5.1 The amount of equipment will determine the number of government furnished government installed (GFGI) equipment racks that are required. All rack equipment shall have UPS.



2.2.1.2.5a Equipment Room with Workspace

2.2.1.2.5b Equipment Room Racks

2.2.1.2.5c VCSS/EVTS Equipment Racks (BS-4)

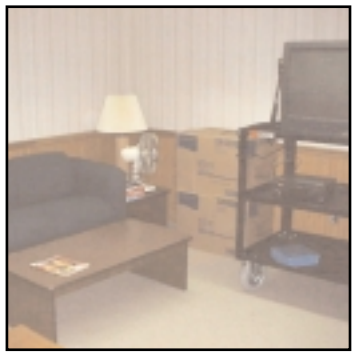
2.2.1.2.5d Communication Boards

2.2.1.2.5.2 The Equipment Room will house the Enhanced Terminal Voice Switch (ETVS), which must be maintained without interruption.

2.2.1.2.6 Maintenance Room Workbench

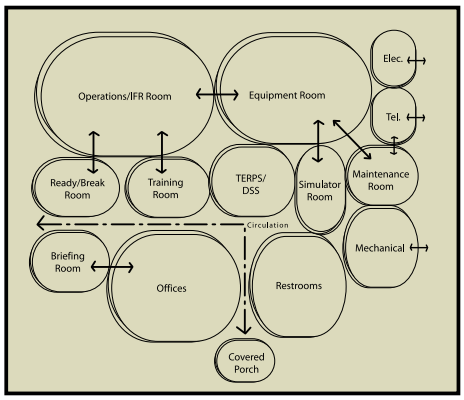
2.2.1.2.6 Maintenance Room. In smaller RAPCONS with limited personnel, the maintenance area has been within the Equipment Room. These work areas are too small and the worksurface tends to be used for other needs, limiting the availability of the bench for maintenance use. The A-E shall design a Maintenance Room for soldering and storage space for spare parts. This space should be adjacent to the Equipment Room and should have direct access to the Telephone Room.

2.2.1.2.7 Break Room/Ready Room. This area should be equipped with a microwave, refrigerator, water fountain, and vending machines and should provide and place to relax and unwind (couches, tables, chairs, television, etc.). Kitchen counters and cabinets should be provided. Cable television connection shall also be provided.



2.2.1.2.7 Break Room

2.2.1.2.7.1 The Break Room/Ready Room should ideally be immediately off the Ops/IFR. It must be accessible to trainees and RAPCON maintenance personnel as well as the on-duty controller crew. The Break Room/Ready Room should also be accessible to the administrative offices. When immediately adjacent to an analog Ops/IFR, the lighting level in this space should be dimmed. Allow for full lighting for cleaning purposes.



2.2.1.2.8 Toilet Rooms. If space and budget allow, there should be toilet rooms available adjacent to the Ops/IFR room and the Break Room/Ready Room. Toilet rooms for administrative personnel and visitors should be provided in the administrative area. Personnel toilet rooms should include half-height lockers and changing room (60% male/40% female). In overseas locations, full height lockers should be provided.

2.2.1.2.9 Administrative Office area. The administrative area supports the business functions of RAPCON. The following offices shall be provided within the administrative area.

2.2.1.2.9.1 Chief, Airfield Operations Flight (AOF) Commander's office. The AOF/CC office may, or may not, be included in the RAPCON design. This officer is in responsible for the overall management of the flight, which includes ATCT, RAPCON, Airfield Management, and Base Operations. If possible, this office should be located in another facility other than the RAPCON so that flying customers can meet with them at a facility that is not in a controlled area.

2.2.1.2.9.1 AOF Chief's Office

2.2.1.2.9.2 Chief Controller's office. The Chief Controller controls all operations of the RAPCON and reports back to the AOF/CC. All personnel within the RAPCON report to the Chief Controller.

2.2.1.2.9.3 Air Traffic Control Training office. This individual is responsible for keeping all training materials up to date as well as for ensuring the training of new personnel and continuing education of current controllers.

2.2.1.2.9.4 Standardization-Evaluation office. This individual maintains the currency of the RAPCON, ensures compliance with Air Force RAPCON standards, and evaluates procedures that are in operation.

2.2.1.2.9.5 TERPS (terminal procedures)/DSS (data systems specialist) office. This area is the largest office requirement in the administrative area. The TERPS office is responsible for actual planning and plotting of approach and procedures, revising procedures that are in place, updating procedures based on new criteria such as airfield mishaps, new aircraft controls, etc. The TERPS office requires space for a large format plotter, drafting table, AutoCAD workstation, map storage drawers, and shelving for active Technical Orders as well as those under development. The A-E shall consult the MAJCOM to confirm the location of TERPS.

2.3.1 Architectural, Structural, and Fire and Life Safety

2.3.1.1 General

2.3.1.1.1 Design Process: The A-E shall follow procedures listed in the *Project Manager's Guide for Design and Construction* and the previous Chapter of this Guide, and:

2.3.1.1.1.1 Notify and include AF Flight Standards Agency (AFFSA) in the design schedule and design submissions.

2.3.1.1.1.2 Include the Systems Integration Engineer in the Project Definition Design Charrette.

2.3.1.1.1.3 Allow for systems installation, connection, and testing in the construction schedule.

2.3.1.1.1.4 Consult Part 4 of this Chapter for a notional floor plan.

2.3.1.1.2 The designer shall coordinate criteria in this part with the ATCT Chapter. This elements outlined in this Part are unique to RAPCONs and are in addition to criteria in the Air Traffic Control Tower chapter.

2.3.1.2 Exterior Criteria

2.3.1.2.1 Parking. Provide enough spaces for a 2-shift overlap (e.g. 35 persons on the day shift plus 10 persons on the evening shift equals a 45 space requirement). Also include visitors' spaces and handicapped spaces.

2.3.1.2.2 Service. Provide drive-up access to service entries for equipment delivery to the Equipment Room, the Ops/IFR Room via the Equipment Room, and Mechanical Room.

2.3.1.2.2.1 The A-E shall design a screened maintenance yard for the chiller, back-up generator fuel tank, garbage collection (dumpster), generator, transformer, etc. In cold-weather climates, the generator may be located in a generator room.

2.3.1.2.2.2 Provide hose spigots around the exterior of the facility.

2.3.1.2.2.1 Generator in Generator Room

2.3.1.2.2.3 Specify landscaping for the site. Landscape requirements are defined in the installation's Architectural and Landscape Compatibility Guides.

2.3.1.2.2.4 The A-E shall design covered entrances or overhangs for each entry area.

2.3.1.3 Building Shell Criteria

2.3.1.3.1 Windows shall be incorporated at the administrative areas. Introducing natural light into other spaces should be strongly considered. The designer should consider high bay windows in the Equipment, Maintenance, and Break/Ready rooms to allow natural light for energy savings and morale purposes. Light shelves can be used to bounce light into the space. Window openings should be configured to deter forced entry. Glass block can be used effectively to allow natural light and particular designs and textures can obscure vision. Glass block is difficult to penetrate and has a high R-value which helps reduce heat load in comparison to standard windows. Consider specifying Energy Star labeled windows for energy conservation. Qualifying products are listed at http://www.energystar.gov/products/windows.

2.3.1.3.2 Follow the installation's Architectural Compatibility Guide for exterior treatment and design style.

2.3.1.3.3 The roof shall be sloped to, or past, the exterior walls. Internal roof drains are prohibited. Asphalt shingles or other loose materials that can blow off the roof shall not be considered due to proximity to flightlines, runways and taxiways.

2.3.1.4 Interior Criteria

2.3.1.4.1 Raised access flooring systems are mandatory in the Operations/IFR Room, Equipment Room, Maintenance Room, and Simulator Room. Raised access floor tiles in the Ops/IFR and Simulator rooms shall be cement-filled steel with carpet tile finish. Raised access floor tiles in the Equipment and Maintenance rooms shall be wood core with linoleum or other non-static finish. Provide a comprehensive grounding system as outlined in the Mechanical/Electrical paragraph.

2.3.1.4.1.1 If the raised floor areas are over ⅓ of the total floor area of the RAPCON, consider incorporating raised access floor into the entire building. Provide all air supply under the floor with open ceiling or a suspended ceiling used as return air plenum. This type of system is easily maintainable, is extremely energy efficient, and saves costs of maintaining and cleaning ductwork.

2.3.1.4.2 Provide a 5-foot clear equipment clearance space between the equipment consoles and the wall behind equipment consoles in the Ops/IFR room, for easy removal of equipment for maintenance.

2.3.1.4.3 In addition to handicap accessibility, ramps are also necessary for routine equipment-moving efforts.

2.3.1.4.4 A call button or telephone shall be installed outside the building entrance as well as a closed circuit TV camera. Adequate space for closed circuit television (CCTV) monitor shall be provided in the Watch Supervisor's area and along with directory, awards, etc. in the entry vestibule. The designer should consider including a canopy in the design if the main entry it is not under the roof.

2.3.1.4.5 Provide an interior storage area for miscellaneous supplies for the office and operational functions of the RAPCON. Provide separate storage for janitorial supplies, preferably in the form of a janitor's closet near the toilet facilities.

2.3.1.4.6 At least one leaf of double-door sets shall be a 4'-0" door. Doors from the Equipment Room to the Maintenance Room and from the Ops/IFR (if directly connected) to the Maintenance Room shall be a minimum of 48" to allow passage of equipment being maintained.

2.3.1.4.6.1 All other doors in equipment areas shall be 3'-6" minimum.

2.3.1.4.6.2 The primary building entry door should be steel with wire a glass vision lite and cipher lock. All exterior doors shall be steel.

2.3.1.4.6.3 Provide a small, narrow wire glass lite in the Ops/IFR room door.

2.3.1.4.6.4 All other doors (office, toilet, etc.) shall be 3'-0" minimum.

2.3.1.4.7 Floor, wall, and ceiling finishes shall be based on the Room Finish Schedule located in Part 5 of this Chapter. If suspended ceilings are installed in the Ops/IFR Room, Equipment Room, or Maintenance Room, they shall be at least 9'-0" high.

2.3.1.4.8 White boards should be provided in the Briefing and Training rooms.

2.3.1.4.9 In order to save space, the designer may consider employing a "ported wall" where the back of the STARS monitor and associated canopy structure penetrate a common wall with the Equipment Room.

2.3.1.4.10 Soundproofing. Provide full-height 3-½" sound attenuation batt insulation in all walls surrounding the Ops/IFR. Achieve a minimum STC of 45. Where the RAPCON is immediately adjacent to an active runway, consider increasing the STC to mitigate engine noise. As a minimum, door frames should have acoustical stripping around all frames. Acoustically insulated frames are preferable. An acoustical sill may be provided between the Ops/IFR and external rooms. Do not provide sills between the Ops/IFR and the equipment room since they obstruct the movement of equipment. Ops/IFR doors shall be solid core and rated at STC 35 or above.

2.3.1.4.11 Antistatic carpet. Carpet tiles with rubberized backing and anti-static properties shall be installed in spaces with cementitious filled steel tile raised floor.

2.3.1.5
Fire Protection and Life Safety

This section provides the designer with fire protection and life safety information necessary to plan and design RAPCONs and complies with applicable sections of AF directives, MIL HDBK 1008C *Fire Protection for Facilities, Engineering, Design, and Construction, National Fire Codes*, the National Fire Protection Association's *Life Safety Code, NFPA 101*, and the *Uniform Building Code* (UBC). These standards are applicable in CONUS and overseas. Host nation laws in overseas locations should also be considered. The Status of Forces Agreement for the host nation should be consulted to guarantee that no conflicts occur.

2.3.1.5.1
Occupant Load

Since RAPCON facilities have well defined work areas, work stations, and operational positions, occupancy loads are determined by the actual number of people planned to occupy the facility. This number should include current and future controllers, staff personnel, maintenance technicians, and supervisors. Also include an allowance for a very limited number of visitors.

2.3.1.5.2
Accessibility

Air Force policy requires all air traffic controllers to pass and maintain a current flight physical examination. Therefore, by requirement, the RAPCON will be manned by able-bodied personnel. However, the A-E shall design accessible spaces for all areas that may have visitors. The A-E shall also consider employing "universal design" concepts in all areas (e.g. ramps instead of stairs at entryways; use lever handles instead of doorknobs, etc.). These simple universal design concepts aid in the moving of equipment, opening doors, etc.

2.3.1.5.3
Means of Egress

2.3.1.5.3.1 RAPCONs shall have not less than two exits and shall comply with NFPA 101, *Life Safety Code*.

2.3.1.5.3.2 The RAPCON means of egress shall not be shared with an attached adjacent ATCT.

2.3.1.5.4
Construction

The RAPCON must be Type I or Type II construction according to the *Uniform Building Code* (UBC).

2.3.1.5.4.1. Fire rated partitions shall be installed to separate areas of hazardous occupancies such as mechanical, generator, storage, electrical and technical equipment rooms from areas of ordinary occupancy, such as offices and training rooms. Fire partitions shall be constructed to have a fire resistance rating of one hour, with the exception of the mechanical and generator rooms greater than 9.3 m^2 (100 sf) which shall have a fire resistance rating of two hours and fire rated doors of one and one-half hours.

2.3.1.5.4.2. All ducts and chases must be fire/smoke stopped by an approved/ listed method. In any areas where there are overhead cables, the construction contractor shall install fire stops in cable duct wall penetrations IAW NFPA standards after installation of cables by government personnel. Stopping methods used must permit repeated removal and replacement, without special tools, to support changing requirements.

2.3.1.5.4.3. Flame spread and smoke development ratings shall be IAW MIL HDBK 1008C.

2.3.1.5.4.4. The minimum separation from an attached ATCT shall be not less than 2-hour fire resistive construction.

2.3.1.5.5
Doors

All doors shall be solid core, rated as required by NFPA and local building codes. They shall have a master keying system including coded entry doors. Key control

should be compatible with the key control of the rest of the installation. Key operation shall over-ride cipher locks.

2.3.1.5.6 Fire Suppression

2.3.1.5.6.1 RAPCONs shall be provided with complete automatic sprinkler protection IAW MIL HDBK 1008C. Wet-type systems shall be provided in all areas unless subject to freezing. Protection for electronic rooms shall be provided IAW ETL 93-5. A single sprinkler system may serve the ATCT and an attached RAPCON provided that separate water flow indications are provided for each.

2.3.1.5.6.2 Fire extinguisher cabinets shall be semi-recessed or surface mounted, 213 mm deep by 300 mm wide by 675 mm high (8-½ in by 12 in by 27 in). Fire extinguishers will be government furnished, government installed. The fire suppression agent for hand-held extinguishers shall be suitable for Class A, B and C fires. Halon extinguishers shall not be used.

2.3.1.5.7 Fire Detection and Notification Systems

2.3.1.5.7.1. Automatic smoke detection and notification systems shall be installed in all RAPCON facilities. Smoke detectors shall be located near all probable sources of fire or smoke including mechanical equipment rooms, return air plenums, electrical/electronic rooms, facility operational areas, etc. Protection for electronic rooms shall be provided IAW ETL 93-5. The system must transmit both alarm and trouble signals to the installation fire department. Transmitter equipment must be compatible with receiving equipment at the installation fire department's alarm communications center.

2.3.1.5.7.2 Facility equipment generally includes manual pull stations, audible notification devices, visual notification devices, standby power supply, zoned control and transmission equipment.

2.3.1.5.7.3 Audible and visual notification devices in operational and technical areas shall be 'private mode' devices. Audible and visual notification devices in public areas shall be 'public mode' devices.

2.3.1.5.7.4 A single fire detection and notification system may serve an ATCT and attached adjacent RAPCON provided:

2.3.1.5.7.4.1. Each area is separately zoned for detection, water flow and manual pull stations.

2.3.1.5.7.4.2. Separate activation of the notification signals are provided for the ATCT and the RAPCON to prevent simultaneous evacuation of both technical areas.

2.3.1.5.8 Fire Hydrants

Fire hydrants shall be provided IAW MIL HDBK 1008C. Fire hydrants will be required as part of this facility. If added, fire hydrants are to conform to American Water Works Association (AWWA) Standard C502. Hydrants shall have two 64 mm (2-½ in) hose connections and one 113 mm (4-½ in) pump truck connection and shall have a 150 mm (6 in) connection to the potable main. Outlets shall have American National Standard fire hose coupling threads, and all working parts shall be bronze. Hydrants shall be dry or wet barrel type conforming to the base standard and AWWA C502 with valve opening at least 125 mm (5 in) in diameter. At each

fire hydrant installation, an isolation valve shall be installed between the hydrant and the main. The isolation valves must be contained in a valve box.

2.3.2 Mechanical/Electrical Systems

2.3.2.1 Power Requirements

All electrical supply and installation shall comply with the *National Electrical Code* (NEC).

2.3.2.1.1. Space requirements

2.3.2.1.1.1 Ops/IFR and Equipment Rooms. The designer shall consult the Systems Integration Engineer (SIE) on power support requirements and panel locations. The SIE will provide a comprehensive list of equipment including their electrical requirements and significant watt or BTU output. Similarly, the A-E shall consult the equipment manufacturers for accurate power requirements, including requirements for power or frequency filters. Power distribution panels for the Ops/IFR and Equipment Room requirements shall be in the Equipment Room or adjacent equipment Maintenance room. These spaces shall be supplied separately from the rest of the building.

2.3.2.1.1.2 Other building areas. Power distribution panels for the spaces outside the IRF/Ops and Equipment Rooms shall be in an electrical closet location accessible to base maintenance personnel. All hallways shall have at least one duplex outlet for janitorial personnel. Office spaces shall have at least one duplex outlet located for the convenience of janitorial personnel in addition to the standard requirement for an office space.

2.3.2.1.1.3. TERPS. The TERPS has multiple equipment requirements (computers, scanners, plotters, etc.). Consider replacing standard office duplex locations with fourplex outlets. If practical, provide integral surge protection for these outlets.

2.3.2.1.2 Dedicated Circuits

Provide dedicated circuits for each piece of equipment in the Ops/IFR and for each rack in the Equipment Room so that removal for maintenance of any piece of equipment has no effect on the balance of the RAPCON. Circuits in the Ops/IFR should be clean to eliminate electrical interference from any other equipment.

2.3.2.1.3 Grounding

Provide a grounding grid on all raised flooring systems and isolated grounds for each piece of equipment and equipment racks. Check local code requirements. Provide equipotential grounding plane connections in the areas where equipment racks will be installed. Racks must be directly grounded for maintenance and should operate on a grounded power supply.

2.3.2.1.4 Equipotential Ground Plane

In addition to the RAPCON grounding requirements in the Equipment Room, Ops/IFR Room, and Simulator Room, a single point ground connected to the Equipotential Ground Plane is required on the plywood panel for the telephone cable breakout. If the ETVS is on a separate rack, provide a grounding connection for this rack.

2.3.2.1.5
Electrical Equipment Room

The Electrical Room shall have exterior access as well as access from within the RAPCON. A pad-mounted transformer shall be provided.

2.3.2.1.6
Service Outage Duration Limitations

The A-E shall specify that power outages for contractor connection will be arranged by coordination through the authorized representative of the contracting officer with the base utilities personnel. The contractor must request all outages in advance so that RAPCON operations will not be inadvertently interrupted. Special provisions in the contract must clearly delineate these requirements.

2.3.2.2
Lighting

2.3.2.2.1
Interior Lighting

Lighting in Ops/IFR Room shall have 0 – 100% dimming capability. In areas immediately adjacent to the Ops/IFR, the lighting shall be dimmable to 50%. All other lighting in the RAPCON shall be standard lighting and shall meet Energy Star program standards. Qualifying products are listed at http://www.energystar.gov/products.

2.3.2.2.2
Exterior Lighting

The A-E shall specify solar powered exterior luminaires when they meet lighting requirements and are cost effective. Ensure building entry is lighted to meet criteria necessary for closed circuit cameras to function properly. Parking lots shall be lighted in accordance with flight line parking criteria.

2.3.2.3
Mechanical

2.3.2.3.1
Heating

Heating will normally be provided by a circulating hot water system. Water circulation shall be by means of two pumps, one operating pump and one standby pump.

2.3.2.3.2
Chillers

Two package chiller units shall be provided, each with a capacity equal to at least 60 percent of the total load, or equal to the total load of the Ops/IFR plus the electronic equipment rooms, whichever is greater. The chilled water system shall be provided with an operating chilled water pump and a standby pump. The distribution system shall be valved to allow isolation of critical loads from the chilled water circuit. Interlock chillers so that in the event one fails or is down for maintenance, the second chiller will automatically begin operation.

2.3.2.3.3
Outside Design Temperatures.

Design air conditioning on the basis of 1.0 percent dry bulb temperature and 1.0 percent mean coincident wet bulb temperature summer occurrences or 0.4 percent annual occurrences as specified in AFMAN 32-7046, *Engineering Weather Data Design* heating on the basis of a 99 percent dry bulb temperature.

2.3.2.3.2 Inside Design Conditions

Inside design conditions shall be IAW DoD *Energy Managers Handbook*, 1996, Appendix D—Heating: 68 – 70 degrees Fahrenheit and Cooling: 76 – 78 degrees Fahrenheit.

2.3.2.3.2.1 Humidity. All equipment in the RAPCON is designed to operate in relative humidity range of 35 to 80 percent. Humidity levels should be IAW ASHRAE standards.

2.3.2.3.2.2 Air Conditioning Loads. Loads will be calculated using normal air conditioning load calculation procedures. Loads shall be based upon a personnel occupancy as indicated in the RAMP. Loads due to electronic equipment should be verified during design.

2.3.2.3.3 System Control

Dual systems shall be sequentially controlled such that the loads are equally/alternately shared by each system. In the event of a chiller failure, control shall be such that the non-critical loads (areas other than the Ops/IFR Room and electronic equipment rooms) can be dropped. The control system shall be designed stressing simplicity of operation. Care shall be taken to locate thermostats in an area not subject to direct sunlight or other heat source.

2.3.2.3.4 Heat

2.3.2.3.4.1 System Types

Use the most cost effective heat source for the installation, i.e., steam, high temperature hot water, gas, oil, etc. In addition, provide a backup source of heat at the facility in case of primary source loss.

2.3.2.3.4.2 Water Treatment

Provide water treatment chemical feed and control equipment and pretreatment equipment IAW AFI 32-1054, for minimum life-cycle cost.

2.3.2.3.4.3 Ventilation/Air Conditioning System

Outside air quantities IAW ASHRAE, current edition, shall be provided to all occupied spaces.

2.3.2.3.5 Mechanical Yard

Provide an appropriate architectural screen or enclosure for exterior equipment such as generators, fuel oil tanks, condensers and chiller equipment to maintain the aesthetics of the facility. In areas that receive significant snow accumulation, consider adding a roof over the mechanical yard to protect the systems.

2.3.2.3.6 Water Treatment

Provide water treatment chemical feed and control equipment compatible with existing chemical treatments used on the base for the water quality encountered IAW AFI 32-1054. Use good quality automatic chemical proportioning and blowdown equipment, such as electric contact make-up water meters, conductivity blowdown controllers and adjustable solenoid blowdown valves. Closed systems shall be treated as necessary for water quality and conditions IAW AFI 32-1054. A tight non-leaking closed system is the best protection against corrosion.

2.3.2.3.7. Location of Air Intake

Ensure that outside air intakes are not located in the vicinity of generators, loading docks, or other areas where exhaust may be present or where air quality is compromised.

2.3.2.3.8 Fuel Oil Storage Tanks

If fuel oil is used for heating, provide an above ground tank conforming to local, State and Federal environmental requirements, and NFPA 30. The heater and generator should also be able to run on diesel fuel. Above-ground self-diking tanks may be used, provided they are placed on a concrete pad, have spill and overfill protection, have interstitial monitoring, and the primary tank has a water drain and is epoxy-coated inside and outside. Tanks without these features may be used, but must be contained with a dike.

2.3.2.3.9 Metering

Metering equipment is to be installed on all main energy and water supplies to the building, as required by ETL 94-2. Landscaped areas or areas that are irrigated should be metered separately, if water usage is considerable, in order to reduce sewer costs. Meters shall determine consumption, not rate of consumption. Demand or maximum flow meters are not required.

2.3.2.4 Plumbing

Plumbing design shall be IAW AFJMAN 32-1070 Chapter 4, and the *Uniform Plumbing Code* (UPC).

2.3.2.4.1 Building Water Supply

2.3.2.4.1.1. Source Of Supply

Water source for this facility shall be from the installation water supply system. Remote locations may require a separate well as a practical alternative to costly utility connections to the base water supply system.

2.3.2.4.1.2. Hot Water

Domestic hot water shall be provided for restroom areas.

2.3.2.4.1.3. Hose Bibcock

Provide an external non-freeze hose bibcocks around the building. Each hose bibcock will have a backflow preventor.

2.3.2.4.1.4. Backflow Prevention

The supply connection to each fixture or appliance that is subject to back-siphonage of non-potable liquids, solids or gases will be protected in accordance with the *UPC*.

2.3.2.4.2 Piping System

2.3.2.4.2.1. Materials

The exterior underground service piping to the facility shall be polyvinyl chloride (PVC) or type L copper. Do not use galvanized steel piping for the underground water service because of corrosion problems. For interior piping, consider PVC or CPVC and polyethylene to reduce project cost.

2.3.2.4.2.2. Features

Domestic water lines should have water hammer arresters. Self-closing fixture valves should be used at all fixtures with combination hot/cold water faucets on all sinks and lavatories.

2.3.2.4.2.3. Restrooms

Recommend providing shower(s) and locker area in each restroom Restroom fixtures and interior finishes shall be in accordance with MAJCOM design standards. Lacking MAJCOM or other standards, use the following guidance. Restroom doors shall be provided with a bathroom door lockset. Restrooms shall have tank type water closets and lavatories with mirror. Plumbing fixtures should be wall hung to facilitate cleaning and maintenance. Fully or partially recessed (depending on wall depth) towel dispensers with integral waste receptacles should be used. Dispenser/receptacle should have standard stainless steel architectural finish with a removable stainless steel waste container in the bottom receptacle portion.

2.3.2.5 Emergency Systems

2.3.2.5.1 Uninterruptible Power Supply (UPS)

The RAPCON facility shall be configured to accept a Government-furnished Uninterruptible Power Supply (UPS) system sized to accommodate all technical power loads in the proposed RAPCON facility for a period of 15 minutes in case the generator needs to be manually started. The system shall include power conditioning capability. The ETVS and DVRS shall not be fed from the UPS since these systems already have battery-backup. They shall, however, be connected to emergency generator power.

2.3.2.5.2 Back-Up Generator

Within the Mechanical Room, include a separate, enclosed and vented room for the back-up generator that supports the technical equipment. Primary access to the generator room shall be from the exterior through a pair of doors. In harsh climates, consider a second door from the RAPCON facility into the Mechanical Room. Provide a portable emergency power connection to the building exterior. The ETVS and DVRS shall be directly connected to emergency generator power.

2.3.2.5.2.1. Generator Fuel Supply

Fuel storage shall be sized as specified in ETL 90-5. Design fuel storage and supply for emergency generators to ensure continuous operation during seismic events. This, for example, requires piping and flexible connections at the tank, building envelope, and generators that remain fuel tight throughout the seismic event and after. Consider the following when locating the tank: protection against damage (intentional or unintentional), protection against fuel spills, and containment of spills.

2.3.2.5.2.2. Generator Capacity

The generator shall be sized to meet critical-technical power loads in addition to technical power loads, described above. These critical-technical power loads shall include power for Ops/IFR, Equipment Room and Simulator Room lighting and HVAC systems serving the those areas.

2.3.2.5.2.3. Power Surge Suppressor

The power bus for non-Ops/IFR, Equipment and Simulator rooms shall be isolated from technical power and critical-technical loads Ops/IFR, Equipment and Simulator rooms to protect such loads from transient voltage variations. Surge protection shall reduce lightning and switching surges to within acceptable quality power limits.

2.3.2.5.3
Emergency Lighting

Emergency lighting shall be incorporated in the overhead fluorescent light system. In the Ops/IFR room, emergency lighting should activate only when there is a power failure including failure of the UPS system. Also provide emergency lighting at the UPS and backup generator systems for reading any operating instructions.

2.3.2.5.3
Backup Radio Poles and Communications Antennae

Provide a minimum of two poles at 25-50 feet from the building and 50 feet from each other for mounting back-up radio antennae. The type and construction of the poles should be verified with the installation's communications squadron. Provide a dedicated panel for troubleshooting lines. A communications antennae shall be provided on poles 25 feet away from the building.

2.3.2.6
Energy Controls

2.3.2.6.1
Energy Consumption

Renewable energy technologies should be used whenever feasible and cost effective. Consider ground-source heat pumps, high-temperature solar, wind, or other energy sources. Specify heating and cooling systems meeting Energy Star program standards. Qualifying products are listed at http://www.energystar.gov/products.

2.3.2.6.2
Energy Management and Control System (EMCS) Monitoring

The RAPCON facility shall be connected to the installation's EMCS system for monitoring by Engineering personnel, but the RAPCON occupants shall be able to environmentally control the facility.

2.3.2.7
Solar Water Heating Systems

Consider solar water heating systems for energy efficiency. Maximize water efficiency by specifying water conserving fixtures, equipment and appliances. Refer to MIL HDBK 1165 for guidance.

2.3.3 Security

2.3.3.1 Communications and Electronic

2.3.3.1.1 The Telephone Room

The Telephone Room shall have access from the interior and exterior.

2.3.3.1.1.1 Provide six each 4" ducts, including 2 ducts for fiber optics.

2.3.3.1.1.2 Provide four each 4" ducts to the communications manhole.

2.3.2.1.1.3 Provide two each 4" ducts to the telemetry (radar, antennae) links.

2.3.3.2 Telephone and LAN

2.3.3.2.1 Telephone and LAN

Telephone and LAN shall be provided throughout the facility to include a pre-wired Digital Voice Recorder System (DVRS). The DVRS system must include connection to the "host" center. The telephone and LAN demarcation boards shall be located in the Telephone Room. Provide a dedicated panel in the Telephone Room, or wherever the telephone connection equipment occurs, for troubleshooting lines.

2.3.3.2.2 Telephone outlets

Telephone outlets are required in the offices of the facility. It is recommended that a minimum of four each (one per wall) "quad" jacks (two each CAT 5 data and two each CAT 5 telephone) be installed at each floor. Conduit for telephones can be stubbed, with bushings provided, above the ceiling where suspended ceilings are used. A cable tray should run from the Telephone Terminal Backboard (TTB) to and along the centerline of the facility when this method of installation is used. Conduit is only necessary for areas where there is no ceiling or there is no access above the ceiling. When conduit is used, it should be prewired. Telephone service to the building will be provided by implementation of a communications scheme.

2.3.3.3 Physical Security

Access control shall be provided at all exterior entries.

2.3.3.3.1 Exterior Entry Doors

The exterior entry doors shall be equipped with non-removable hinges and locking hardware including cipher locks. The main entry area shall also have a telephone, and CCTV camera, and shall be sheltered by a roof eave, or a canopy, or other weather shelter.

2.3.3.3.2 Other Exterior Doors

Other exterior doors shall be equipped with cipher locks.

2.3.3.3.3 Ops/IFR

The Operations/IFR Room shall be equipped with a cipher lock.

2.3.4 Life-Cycle Costs

2.3.4.1 Design Decisions

The design decisions for the project shall be based on consideration of life-cycle cost. The life-cycle cost study and analysis shall examine all practical civil, structural, architectural, mechanical, electrical, plumbing, energy conservation components, and other systems to determine alternatives and associated maintenance and operational costs. Value Engineering shall be done on systems rather than components to ensure the impacts of all costs are considered as a whole system. Alternative choices shall he made on the basis of least life-cycle cost rather than first cost. The A-E shall reference the *Project Manager's Guide for Design and Construction* at http://www.afcee.brooks.af.mil/dc/products/pmguide/pmguide.asp for more information.

2.3.4.2 Equipment decisions

The A-E shall conduct life-cycle cost studies on the mechanical system IAW ETL 94-4. The design should ensure an adequate level of building environmental conditioning at the least life-cycle cost. Alternative choices shall he made on the basis of least life-cycle cost rather than first cost. It is further expected that all mechanical equipment shall be installed with future maintenance needs, such as adequate accessibility, taken into account and that established commercial practices shall be followed. The A-E shall reference the *Project Manager's Guide for Design and Construction* at http://www.afcee.brooks.af.mil/dc/products/pmguide/pmguide.asp for more information.

2.3.5 Sustainable Planning, Programming, Design and Construction

2.3.5.1 Employing Sustainable Practices

2.3.5.1.1 Air Force RAPCONs must incorporate sustainable development principles and reflect regional environmental uniqueness. The goals of sustainability are to conserve energy, water, materials and resources; to protect atmospheric (air and noise) and water quality; to prevent environmental degradation caused by construction, operations, and disposal of facilities; and to create built environments which are livable, healthy, and productive. By carefully analyzing these factors, a RAPCON can achieve a cohesive sense of scale, tradition, and compatibility while sustaining the mission and the environment. For further information and guidance, see the USAF *Environmentally Responsible Facilities Guide* at http://www.afcee.brooks.af.mil/green/ facilitiesguide/erfguide.pdf and the *Whole Building Design Guide* at http://www.wbdg.org.

2.3.5.1.2 A sustainable facility achieves optimum resource efficiency and minimizes damage to the human and natural environments through all the phases of its life cycle. Sustainable development requires an integrated approach to programming, planning, and design. The project team works with six fundamental sustainability principles:

- optimize site potential
- minimize energy consumption
- protect and conserve water

- use environmentally preferable products
- enhance indoor environmental quality, and
- design to minimize the impact of facility O&M practices.

More details can be found in the *Whole Building Design Guide*, http://www.wbdg.org (select "Sustainable" from the "Design Objectives" tab of the home page). Additional guidance can be learned from http://www.usgbc.org/leed.

2.3.5.1.3 The A-E shall also reference the Civil Engineer (CE) Sustainability Policy Memo for guidance.

2.3.5.1.4 Programming. Project programmers work with the design team and environmental management early in the programming process to consider mission requirements and sustainable development principles. This team will establish specific goals and strategies for the project to be carried out through programming, design, and construction.

2.3.5.2. Budget and Life-Cycle Considerations

Project programmers have the opportunity and responsibility to ensure that sustainable development goals are supported in the project budget. The AF goal is to maximize sustainable design within normal facility budgets; however, sustainable methods, materials, or systems will sometimes have higher first costs. Do not automatically exclude design options because of increased cost without further analysis. Additional investment for one building system can often reduce the first costs in other systems through an integrated design approach. For example, the increased cost of energy efficient lighting systems that produce less heat can be offset by downsizing the HVAC system. For further information and guidance, see the USAF *Environmentally Responsible Facilities Guide*.

2.3.5.3 Siting

Develop a site plan that conserves and integrates the site's existing natural resources. Where possible, conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

2.3.5.4 Paving

Consider the use of permeable pavements for parking and walkways, as a technique for recharging groundwater and reducing the contaminated storm water runoff from the site.

2.3.5.5 Grading

Prepare a grading plan that maintains natural runoff patterns to the greatest extent possible. Limit disruption of natural water flows by minimizing storm water runoff, increasing on-site infiltration, and reducing contaminants.

2.3.5.6
Retention Basins

Keep storm water onsite rather than dumping it to collection facilities. As an alternative to large retention basins that could be a hazard to children, control storm water at the source by the use of micro-scale features that are distributed throughout the site. Integrate the landscape design into the storm water management strategy, creating hydroponic planted areas that benefit from storm water while removing pollutants through natural processes.

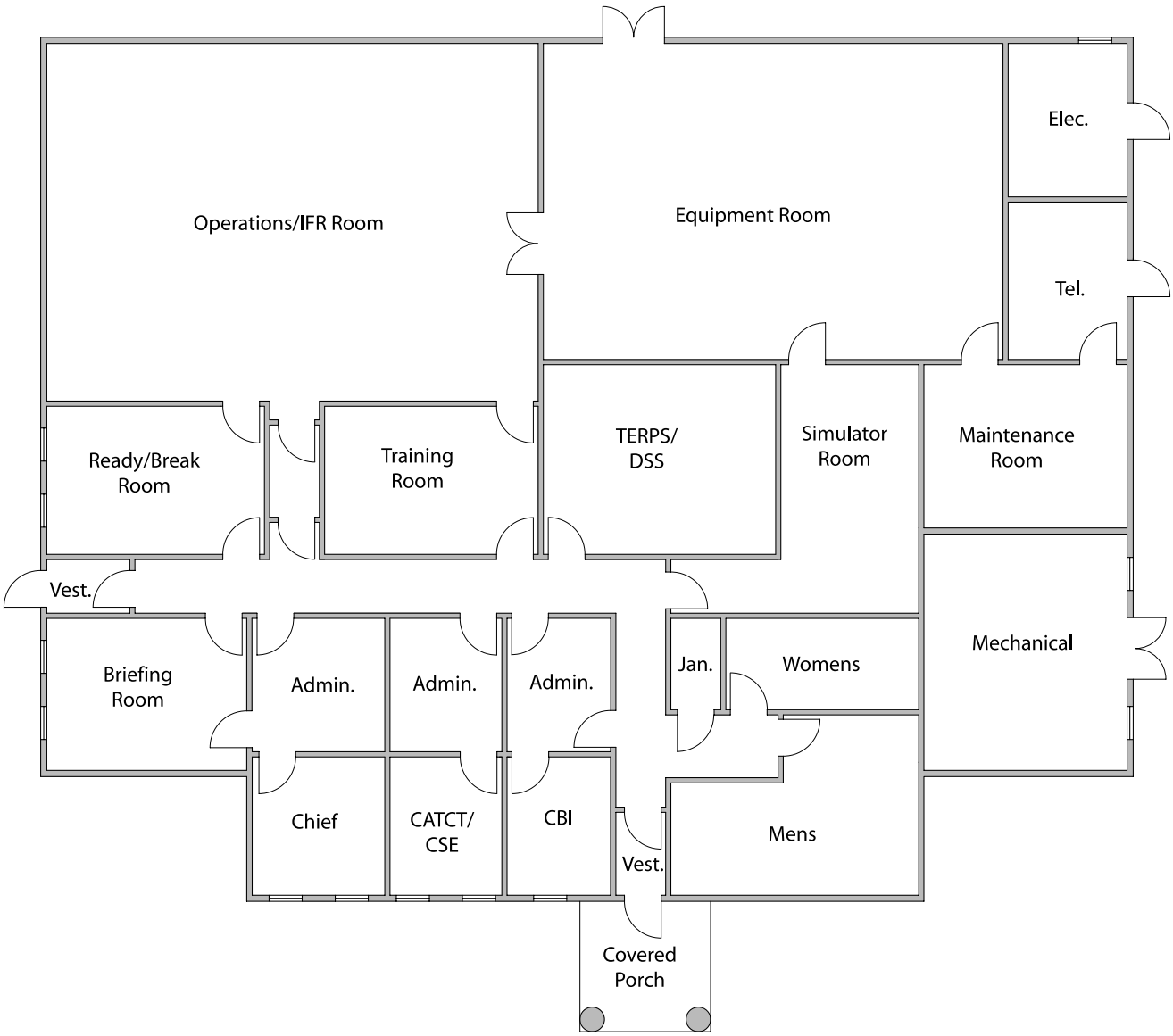
2.3.5.7
Landscaping and Irrigation

Sprinkler irrigation should only be used when rainwater is insufficient to maintain landscaped areas. Select native plants and design the site for natural storm water management. The use of native plants minimizes the need for chemical pesticides and herbicides used in landscape maintenance.

2.3.5.8
Affirmative Procurement

When selecting building materials, consider the recycled content requirements for affirmative procurement of products included in the Environmental Protection Agency's (EPA) list of guideline items. Federal agencies buying these items must buy products made with recycled materials, unless these products don't meet technical requirements, are more expensive than comparable virgin material products, are not available competitively from two or more sources, or are not available in a timely manner. Some of the items in this list related to exterior design and the building shell include insulation, cement and concrete, latex paint, patio blocks, and structural fiberboard. The list changes as EPA adds new items every other year. A complete list of guideline items and their recycled content requirements is located at www.epa.gov/cpg/products.

Notional Floor Plan



Note: The following tables are to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the RAPCON design charrette.

Architectural Program for RAPCONs

Space	Occupants/Visitors	SF	Notes
Admin-Chief Controller			
Admin-CATCT-CSE (Chief, Air Traffic Control and Training; Chief, Standardization and Evaluation)			
Admin-CBI (Computer-based Instruction)			
Admin-Administrative Area			
Male Restroom			
Locker			
Shower			
Female Restroom			
Locker			
Shower			
Mechanical			
ElectricalTelephone Room			
TERPS/DSS (Terminal Procedures/ Data Systems Specialist)			
Operations/Instrument Flight Rules (IFR) Room			
Simulator Room			
Briefing/Conference Room			
Vestibule			
Equipment Room			
Storage Room			
Maintenance Room			
Break Room			
Corridors			
Janitor			
Walls			
Total			

Note: The following table is to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the RAPCON design charrette.

Equipment Table for RAPCONs

Space	Contractor-Furnished Equipment	Government-Furnished Equipment	Notes
Admin-Chief Controller			
Admin-CATCT-CSE (Chief, Air Traffic Control Training, Chief, Standardization and Evaluation)			
Admin-CBI (Computer-based Instruction)		Carrels Computers	
Admin-Administrative Area			
Male Restroom			
Locker			
Shower			
Female Restroom			
Locker			
Shower			
Mechanical			
Electrical			
Telephone Room			
TERPS/DSS (Terminal Procedures/ Data Systems Specialist)		CADD Computer Plotter	
Operations/Instrument Flight Rules (IFR) Room		STARS DASR,GPS	65 dB ambient
Simulator Room			
Briefing/Conference Room			
Vestibule Directory			
Equipment Room Recorder	Equipment cabinets	Enhanced Terminal Voice Switch Digital Voice Host Connection	
Storage Room			
Maintenance Room	Equipment cabinets, workbench		
Break Room			
Corridors			
Janitor			

Note: The following table is to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the RAPCON design charrette.

Room Finish Schedule for RAPCONs

Space	Floor	Walls	Ceiling
Admin-Chief Controller	Carpet	Paint or vinyl wall covering	Suspended Acoustical Ceiling Tile (SACT)
Admin-CATCT-CSE (Chief Air Traffic Control Training, Chief Standardization and Evaluation)	Carpet	Paint or vinyl wall covering (VWC)	SACT
Admin-CBI (Computer-based Instruction)	Carpet	Paint or VWC	SACT
Admin-Administrative Area	Carpet	Paint or VWC	SACT
Male Restroom	Ceramic Tile (CT)	CT	Gypsum board (GYP)
Locker	Carpet	Paint	GYP
Shower	CT[1]	CT[1]	GYP
Female Restroom	CT	CT	GYP
Locker	Carpet	Paint	GYP
Shower	CT[1]	CT[1]	GYP
Mechanical	Concrete (Conc)	Paint	Exposed (Exp)
Electrical	Conc	Paint	Exp
Telephone Room	Conc or Vinyl Tile Composition (VCT)	Paint	Exp
TERPS/DSS (Terminal Procedures/ Data Systems Specialist)	Carpet	Paint	SACT or Exp
Operations/Instrument Flight Rules (IFR) Room	Raised floor w/ integrated carpet	Paint	Exp or SACT[2]
Simulator Room	Raised floor w/ integrated carpet	Paint	Exp or SACT[2]
Briefing/Conference Room	Carpet	VWC	SACT
Vestibule	Carpet	Paint or VWC	SACT
Equipment Room	Raised floor w/linoleum	Paint	Exp or SACT[2]
Storage Room	Conc	Paint	Exp
Maintenance Room	Conc	Paint	Exp or SACT[2]
Break Room	Carpet or VCT	Paint or VWC	SACT
Corridors	Carpet	Paint or VWC	SACT
Janitor	Conc or VCT	Paint	GYP

[1] Can also use prefabricated shower stalls
[2] Specify a 9'-0" ceiling height minimum, if SACT used

Note: The following table is to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the RAPCON design charrette.

Lighting for RAPCONs

Space	Level (fc)	Type	Notes
Admin-Chief Controller	40-60	Fluorescent	
Admin-CATCT-CSE (Chief, Air Traffic Control Training, Chief, Standardization and Evaluation)	40-60	Fluorescent	
Admin-CBI (Computer-based Instruction)	40-60	Fluorescent	
Admin-Administrative Area	40-60	Fluorescent	
Male Restroom	40-50	Fluorescent	
Locker	40-50	Fluorescent	
Shower	40-50	Fluorescent	
Female Restroom	40-50	Fluorescent	
Locker	40-50	Fluorescent	
Shower	40-50	Fluorescent	
Mechanical	40-60	Fluorescent	
Electrical	40-60	Fluorescent	
Telephone Room	40-60	Fluorescent	
TERPS/DSS (Terminal Procedures/ Data Systems Specialist)	40-60	Fluorescent	
Ops/IFR Room	0-50	Fluorescent	Dimmable
Simulator Room	0-50	Fluorescent	Dimmable
Briefing/Conference Room	0-50	Fluorescent	Dimmable
Vestibule	10-20	Fluorescent	
Equipment Room	40-60	Fluorescent	
Storage Room	40-60	Fluorescent	
Maintenance Room	40-60	Fluorescent	Provide task lighting at workbench
Break Room	30-50	Fluorescent	
Corridors	10-20	Fluorescent	
Janitor	10-20	Fluorescent	
Exterior Area	0.5	HPS	
Exterior Service Area	0.5	HPS	
Exterior Parking Area	0.5	HPS	

Note: The following table is to be used as a tool to be filled out when developing the Project Definition Customer Concept Design (CCD) and to be utilized at the RAPCON design charrette.

Note for Internet documents listed below that are located on the Construction Criteria Base (CCB) site at http://www.ccb.org: Users without access to CCB should contact HQ AFCEE Design Group at (210) 536-3547 to obtain a CCB password.

10 CFR 435, CH. 2, SUBPART 8.3.1	HEATING EQUIPMENT EFFICIENCIES
1842 EEG/EEISG (AFCC) SKETCH LDBWS00008GS000	EQUIPOTENTIAL GROUND PLANE FOR SIGNAL REFERENCE SUBSYSTEM (ATCH 3, TWO PAGES). LATEST INFORMATION WILL BE SENT UPON REQUEST.
1842 EEG/EEISG (AFCC) SKETCH SK 86-1	TOWER RADAR DISPLAY INSTALLATION DETAILS (ATCH 2, ONE PAGE). LATEST INFORMATION WILL BE SENT UPON REQUEST.
38 MSS/EGD SKETCHES SK SCCS-3	AIR TRAFFIC CONTROL TOWER WRAP AROUND CONSOLE (see Part 4 of Chapter 1 of this Guide, 8 pages). LATEST INFORMATION WILL BE SENT UPON REQUEST.
41 CFR, CH 101	FEDERAL PROPERTY MANAGEMENT REGULATION. Available as an appendix to the DoD *Energy Managers' Handbook*
	ACCESS FOR PEOPLE WITH DISABILITIES, SECRETARY OF DEFENSE LETTER DATED 20 OCT 93, http://www.afcee.brooks.af.mil/dc/dcd/afada/policy%2020oct93.pdf
	ACCESSIBILITY STANDARDS, DEPUTY ASSISTANT SECRETARY OF DEFENSE LETTER DATED 29 JUN 87, http://www.afcee.brooks.af.mil/dc/dcd/afada/policy%2029jun87.pdf
AFH 32-1084	FACILITIES REQUIREMENTS, http://afpubs.hq.af.mil/pubfiles/af/32/afh32-1084/afh32-1084.pdf
AFI 13-203	AIR TRAFFIC CONTROL, http://afpubs.hq.af.mil/pubfiles/af/13/afi13-203/afi13-203.pdf
AFI 13-216	EVALUATION OF AIR TRAFFIC CONTROL AND LANDING SYSTEMS (ATCALS), http://afpubs.hq.af.mil/pubfiles/af/13/afi13-216/afi13-216.pdf
AFI 13-218	AIR TRAFFIC CONTROL SYSTEM EVALUATION PROGRAM, http://afpubs.hq.af.mil/pubfiles/af/13/afi13-218/afi13-218.pdf
AFI 31-101	PROTECTION OF CONTROLLED AREAS
AFI 32-1044	VISUAL AIR NAVIGATION SYSTEMS, http://afpubs.hq.af.mil/pubfiles/af/32/afi32-1044/afi32-1044.pdf
AFI 32-1054	CORROSION CONTROL, http://afpubs.hq.af.mil/pubfiles/af/32/afi32-1054/afi32-1054.pdf
AFI 32-1062	ELECTRIC POWER PLANTS AND GENERATORS, http://afpubs.hq.af.mil/pubfiles/af/32/afi32-1062/afi32-1062.pdf
AFI 32-1063	ELECTRIC POWER SYSTEMS, http://afpubs.hq.af.mil/pubfiles/af/32/afi32-1063/afi32-1063.pdf
AFI 32-1065	GROUNDING SYSTEMS, http://afpubs.hq.af.mil/pubfiles/af/32/afi32-1065/afi32-1065.pdf

AFJMAN 32-1013, VOLUME 1	AIRFIELD AND HELIPORT PLANNING AND DESIGN
AFJMAN 32-1070, CH. 4	PLUMBING (Army TM 5-810-5), http://www.usace.army.mil/inet/usace-docs/armytm/tm5-810-5/entire.pdf
AFJMAN 32-1080	ELECTRICAL POWER SUPPLY AND DISTRIBUTION (ARMY TM 5-811-1), http://www.usace.army.mil/inet/usace-docs/armytm/tm5-811-1/entire.pdf
AFJMAN 32-1083	ELECTRICAL INTERIOR FACILITIES ENGINEERING (ARMY TM 5-683), http://www.usace.army.mil/inet/usace-docs/armytm/tm5-683/entire.pdf
AFMAN 32-7046	ENGINEERING WEATHER DATA
AFM 32-1123(I)	AIRFIELD AND HELIPORT PLANNING AND DESIGN, http://afpubs.hq.af.mil/pubfiles/af/32/afman(i)32-1123/afman(i)32-1123.pdf
AFM 32-1013, VOLUME 2 (FORMERLY AFR 86-5)	PLANNING CRITERIA AND WAIVERS FOR AIRFIELD SUPPORT FACILITIES
AFM 88-3, CH. 13	SEISMIC DESIGN FOR BUILDINGS (Army TM 5-809-10), http://www.ccb.org/pdf/06/24/020/TM580910.PDF
AFM 88-4, CH. 9	RAISED FLOOR SYSTEMS (Army TM 5-805-13), http://www.ccb.org/pdf/06/24/020/TM580513.PDF
AFM 88-9, CH. 3	
AFMAN(I) 32-1050	SEISMIC DESIGN GUIDELEINES FOR UPGRADING EXISTING BUILDINGS (Replaces AFM 88-3, Chapter 13, Section B) (Army TM 5-809-10-2), http://www.usace.army.mil/inet/usace-docs/armytm/tm5-809-10-2/
AFMAN(I) 32-1123	AIRFIELD AND HELIPORT PLANNING AND DESIGN, http://afpubs.hq.af.mil/pubfiles/af/32/afman(i)32-1123/afman(i)32-1123.pdf
AFPAM 32-1097	SIGN STANDARDS PAMPHLET, http://afpubs.hq.af.mil/pubfiles/af/32/afpam32-1097/afpam32-1097.pdf
	AIR FORCE INTERIOR DESIGN GUIDES, http://www.afcee.brooks.af.mil/dc/dcd/interior/intdespu.htm
AIR FORCE POLICY DIRECTIVE (AFPD) 13-2	AIR TRAFFIC CONTROL, AIRSPACE, AIRFIELD AND RANGE MANAGEMENT, http://afpubs.hq.af.mil/pubfiles/af/13/afpd13-2/afpd13-2.pdf
AIR FORCE POLICY DIRECTIVE (AFPD) 32-10	INSTALLATIONS AND FACILITIES, http://afpubs.hq.af.mil/pubfiles/af/32/afpd32-10/afpd32-10.pdf
	AMERICANS WITH DISABILITIES ACT (ADA)and ADA ACCESSIBILITY GUIDELINES (ADAAG), http://www.access-board.gov/adaag/html/adaag.htm
ANSI C84.1, 1982	FOR ELECTRIC POWER SYSTEMS AND VOLTAGE RATINGS (60 HZ)
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ARMY TI 809-4	SEISMIC DESIGN FOR BUILDINGS, http://www.ccb.org/pdf/06/16/021/TI809_04.PDF
ARMY TM 5-815-3	HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS, http://www.usace.army.mil/inet/usace-docs/armytm/tm5-815-3/
ASCE 7	MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
ASHRAE 62-89	
ASME/ANSI A17.1 & A17.3	SAFETY CODE FOR ELEVATORS AND ESCALATORS
ASTM C 1036-85	STANDARD SPECIFICATIONS FOR FLAT GLASS

AWWA C502	AMERICAN WATER WORKS ASSOCIATION
	DESIGN STANDARDS FOR ACCESSIBILITY TO DISABLED PERSONS, HQ USAF/CE LETTER DATED 7 NOV 94, http://www.afcee.brooks.af.mil/dc/dcd/afada/policy%207nov94.pdf
	DESIGN STANDARDS FOR ACCESSIBILITY TO DISABLED PERSONS, HQ USAF/CE LETTER DATED 1 JUL 96, http://www.afcee.brooks.af.mil/dc/dcd/afada/policy%201jul96.pdf
	ENVIRONMENTALLY RESPONSIBLE FACILITIES GUIDE, http://www.afcee.brooks.af.mil/green/facilitiesguide/erfguide.pdf
ETL 00-5	SEISMIC DESIGN FOR BUILDINGS AND OTHER STRUCTURES, http://www.afcesa.af.mil/Publications/ETLs/ETL00-5Final.pdf
ETL 88-4	RELIABILITY AND MAINTAINABILITY (R&M) DESIGN CHECKLIST, http://www.ccb.org/pdf/06/24/012/ETL88_4.PDF
ETL 90-5	FUEL AND LUBE OIL BULK STORAGE CAPACITY FOR EMERGENCY GENERATORS, http://www.ccb.org/pdf/06/24/012/ETL90_5.PDF
ETL 90-6	ELECTRICAL SYSTEM GROUNDING, STATIC GROUNDING AND LIGHTNING PROTECTION, http://www.ccb.org/pdf/06/24/012/ETL90_6.PDF
ETL 93-5	FIRE PROTECTION ENGINEERING CRITERIA - ELECTRONIC EQUIPMENT INSTALLATIONS, http://www.ccb.org/pdf/06/24/012/ETL93_5.PDF
ETL 94-2	UTILITY METERS IN NEW AND RENOVATED FACILITIES, http://www.ccb.org/pdf/06/24/012/ETL94_2.PDF
ETL 94-4	ENERGY USEAGE CRITERIA FOR FACILITIES IN THE MILITARY CONSTRUCTION PROGRAM, http://www.afcesa.af.mil/Publications/ETLs/ETL%2094-4.pdf
FAA ADVISORY CIRCULAR NO. 150/53453D	SPECIFICATION FOR L 821 PANELS FOR REMOTE CONTROL OF AIRPORT LIGHTING, 8 AUG 86
FAA ORDER 6480.7C	FAA STANDARD SPECIFICATION FOR TRANSPARENT PLASTIC WINDOW SHADES FOR USE IN AIRPORT CONTROL TOWER (ATCT) CABS
FAA-E-2470B	TRANSPARENT PLASTIC WINDOW SHADES SPECIFICATION
FIPS PUB 94	FEDERAL INFORMATION PROCESSING STANDARDS (FIPS) PUBLICATION 94, GUIDELINE ON ELECTRICAL POWER FOR ADP INSTALLATIONS
	FORCE PROTECTION DESIGN GUIDE, http://www.afcee.brooks.af.mil/dc/dcd/arch/force.pdf
	GENERIC REQUIREMENTS DOCUMENT http://www.afcee.brooks.af.mil/dc/products/generic.htm
MIL HDBK 1002	STRUCTURAL ENGINEERING — GENERAL REQUIREMENTS, http://www.ccb.org/pdf/06/12/004/1002_1.PDF
MIL HDBK 1008C	FIRE PROTECTION FOR FACILITIES ENGINEERING, DESIGN AND CONSTRUCTION, http://www.ccb.org/pdf/06/08/004/1008C.PDF
MIL HDBK 1190	FACILITY PLANNING AND DESIGN GUIDE, http://www.ccb.org/pdf/06/12/004/MH1190.PDF
MIL HDBK 1165	WATER CONSERVATION, http://www.afcesa.af.mil/Directorate/CES/Civil/Water/1165.pdf
MIL STD 1472D	HUMAN ENGINEERING DESIGN CRITERIA FOR MILITARY SYSTEMS EQUIPMENT AND FACILITIES

MIL STD 188-124B	GROUNDING, BONDING AND SHIELDING
	NATIONAL ELECTRIC CODE (NEC)
	NEPA (NATIONAL ENVIRONMENTAL POLICY ACT)
NFPA 101	NATIONAL FIRE PROTECTION ASSOCIATION LIFE SAFETY CODE
NFPA 13	SPRINKLER SYSTEMS
NFPA 30	FLAMMABLE AND COMBUSTIBLE LIQUIDS CODE
NFPA 72	NATIONAL FIRE ALARM CODE
	UNIFORM BUILDING CODE (UBC)
	UNIFORM FEDERAL ACCESSIBILITY STANDARDS (UFAS) http://www.access-board.gov/ufas/ufas-html/ufas.htm
	USAF LANDSCAPE DESIGN GUIDE, http://www.afcee.brooks.af.mil/dc/dcd/land/ldg/index.html
	USAF PROJECT MANAGER'S GUIDE FOR DESIGN AND CONSTRUCTION, http://www.afcee.brooks.af.mil/dc/products/pmguide/pmguide.asp
	WHOLE BUILDING DESIGN GUIDE, http://www.wbdg.org.

A-E	Architect-Engineer
AF	Air Force
AFCEE	Air Force Center for Environmental Excellence (www.afcee.brooks.af.mil)
AFCESA	Air Force Civil Engineer Support Agency
Affirmative Procurement	The program that requires Federal agencies to buy recycled-content and other environmentally preferable products. Also see the Environmentally Responsible Facilities Guide at http://www.afcee.brooks.af.mil/eq/ap/gg/guide.asp
AFFSA	Air Force Flight Standards Agency
AFH	Air Force Handbook
AFI	Air Force Instruction
AFM	Air Force Manual
AFPD	Air Force Policy Directive
AFJMAN	Air Force Joint Manual (Interservice)
AFMAN(I)	Air Force Manual (Interservice)
AFPAM	Air Force Pamphlet
AIA	American Institute of Architects
AMC	Air Mobility Command
AMSL	Above Mean Sea Level
ANSI	American National Standards Institute
AOF	Airfield Operations Flight
AOF/CC	Airfield Operations Flight Commander
AOF/DO	Airfield Operations Flight Operations Officer
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASR	Airport Surveillance Radar
ASTM	American Society for Testing and Materials
ATC	Air Traffic Control

ATCALS	Air Traffic Control and Landing Systems
ATCSS	Air Traffic Control Systems Specialist (also see "AUS" below)
ATCT	Air Traffic Control Tower
AUS	Air Traffic Control Automation Specialist (will change to ATCSS, Air Traffic Control Systems Specialist)
AWWA	American Water Works Association
BCE	Base Civil Engineer
BTU/H	British Thermal Units Per Hour
C4	Command, Control, Communications, and Computers
CAM	Chief, Airfield Management
CATCA	Chief, Air Traffic Control Automation
CATCT	Chief, Air Traffic Control Training
CATV	Cable Television
CBI	Computer-Based Instruction
CBO	Chief, Base Operations
CC	Commander
CCB	Construction Criteria Base
CCD	Customer Concept Design
CCTLR	Chief Controller
CCTV	Closed Circuit Television
CE	Civil Engineer (used interchangeably with Base Civil Engineer, or BCE)
CFCI	Contractor Furnished, Contractor Installed
CFR	Code of Federal Regulations
Charrette	An intensive conceptual design work session, usually at the customer site. A charrette usually last several days and is attended by the customer, A-E, construction agent, the project management team, and sometimes representatives from regulatory agencies. The term comes from the French word for a small wheeled cart, a "charrette." In the days of the Beaux Arts, a renowned Parisian architecture school, students were often still working when their work was due. At the deadline, a cart came through the student communities to collect the drawings and take them back to the school to be judged. As the drawings were loaded on the cart, students sometimes got on the cart to add finishing touches to their designs. They were "on charrette." Today, architects working long hours say they are "on charrette." Also see *USAF Project Manager's Guide for Design and Construction* at http://www.afcee.brooks.af.mil/dc/products/pmguide/pmguide.asp
Conc	Concrete
CONUS	Continental United States
cm	Centimeters
CMU	Concrete Masonry Unit

CSE	Chief, Standardization and Evaluation
CT	Ceramic Tile
DAAS	Department of Defense (DoD) Advanced Automation System [DAAS is the requirement, STARS is the implementation to the requirement. For the purposes of this Guide, the terms “DAAS” and “STARS” may be used interchangeably.]
DASR	Digital Airport Surveillance Radar
dB	Decibel
DoD	Department of Defense (also DOD)
DSS	Data Systems Specialist
DVRS	Digital Voice Recorder System
E&I	Engineering and Installation
EARTS	En-route Automated Radar Tracking System
EIAP	Environmental Impact Analysis Process
EIFS	Exterior Insulation Finish System
EMCS	Energy Management and Control System
EPA	Environmental Protection Agency
ETL	Engineering Technical Letter
ETVS	Enhanced Terminal Voice Switch
Exp	Exposed
FAA	Federal Aviation Administration
FIPS	Federal Information Processing Standards
ft	Foot
GAC	Ground Approach Control
GFCI	Government Furnished, Contractor Installed
GFE	Government Furnished Equipment
GFGI	Government Furnished, Government Installed
GFI	Ground Fault Indicator
GPS	Global Positioning System
Gyp	Gypsum Board
HPS	High Pressure Sodium
HVAC	Heating Ventilation Air Conditioning
H_z	Hertz
IAW	In Accordance With
IFR	Instrument Flight Rules

in	Inch
kg	Kilograms
LAN	Local Area Network
lbs	Pounds
LCC	Life-Cycle Cost
LCU	Local Communications Unit
lx	Lux
m	Meter
MAJCOM	Major Command
MicroEARTS	Micro-processor (controlled) En-Route Automated Radar Tracking System
MILCON	Military Construction
MIL HDBK	Military Handbook
MIL STD	Military Standard
mm	Millimeters
mph	Miles Per Hour
NAS	National Air Space
NAVAIDs	Navigational Aids
NCOIC	Non-Commissioned Officer in Charge
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
O&M	Operations and Maintenance
OG	Operations Group
Ops	Operations
PAR	Precision Approach Radar
PD	Project Definition
PE	Professional Engineer
PIDP	Programmable Indicator Data Processing
psf	Pounds (lbs) per Square Foot
PVC	Polyvinyl Chloride
R&M	Reliability and Maintainability
RA	Registered Architect

RAMP	Requirements and Management Plan. Also see the *Generic Requirements Document* at http://www.afcee.brooks.af.mil/dc/products/generic.htm
RAPCON	Radar Approach Control
RFC	Radar Final Control
SACT	Suspended Acoustical Ceiling Tile
SC	Senior Controller
SF	Square Feet
SIE	Systems Integration Engineer
SOF	Supervisor of Flying
SOI	Statement of Intent
STARS	Standard Terminal Automation Replacement System [DAAS is the requirement, STARS is the implementation to the requirement. For the purposes of this Guide, the terms "DAAS" and "STARS" may be used interchangeably.]
STEM	Systems Telecommunications Engineering Management
Sustainable Development	The process of planning, designing, and construction facilities that causes no overall environmental burden. Sustainable development achieves the "best fit" of the built environment to the natural environment.
TERPS	Terminal Procedures
TERPS NCO	Terminal Procedures Specialist
TDW	Tower Display Workstation
TI	Technical Instruction (Army)
TM	Technical Manual (Army)
TRV	Tower Restoral Vehicle
TSN	Chief, Air Traffic Control Training and Standardization
TTB	Telephone Terminal Backboard
UBC	Uniform Building Code
Universal Design	Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. The intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities.
UPC	Uniform Plumbing Code
UPS	Uninterruptible Power Supply
USAF	United States Air Force
VCSS	Voice Communication Switching System
VFR	Visual Flight Rules
VWC	Vinyl Wall Covering

W	Watts
WBDG	Whole Building Design Guide (www.wbdg.org)
WS	Watch Supervisor