U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
National Policy

ORDER 6470.33B

Effective Date:
05/04/2011

SUBJ: Control of Power and Space, and Environment Interfaces at En Route Air Traffic Control Facilities

This order establishes and provides policy, process and requirements for managing interfaces between en route facilities and National Airspace System (NAS) systems. The En Route and Oceanic Services, En Route Facilities Planning and Modernization Group manage changes introduced into en route operational facilities. Significant effort is expended implementing new NAS systems into en route facilities. Similar effort is given to modernize, improve and sustain those facilities. These efforts require standard processes and configurations for maximum efficiency.

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Acting Vice President, En Route and Oceanic Services.

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Initiated By:
AJE- En Route
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Table of Contents

Chapter 1. General Requirements

1. **Purpose of This Order.** This order establishes and provides policy, process, and requirements for managing interfaces between staffed en route operational facilities and NAS subsystems. It defines the standards, constraints, and procedures used in the configuration management of en route facility configuration items, including space, building controls and fire alarm systems. This order also provides an authorization process required for subsystem programs to obtain approval to modify en route facility interfaces. The Acquisition Management System (AMS) has guidelines for the management of administrative space. Sufficient detail is incorporated in this Order to support these guidelines. .Specific details concerning overall ATO administrative space guidelines can be found in the ATO Corporate Real Estate Office document, "Determining Space Requirements for ATO Service Area Offices and Facilities". It provides direction regarding the implementation and management of en route facility programs, and promotes standardization for the benefit of all stakeholders.

2. **Audience.** All ATO headquarters and field organizations that are involved with the operation and support of National Airspace System (NAS) facilities.

3. **Where Can I Find This Order?** You can find an electronic copy of this Order on the Directives Management System (DMS) website: https://employees.faa.gov/tools_resources/orders_notices/

4. **What this Order Cancels.** This order replaces FAA Order 6470.33A, Control of Space at Air Route Traffic Control Centers (ARTCCs) dated September 30, 2005.

5. **Explanation of Policy Changes.** FAA Order 4420.4, Space Acquisition, has been cancelled. This revision updates Order 6470.33A incorporating en route facility administrative space policies, based on AMS Section 2.4.1, Appendix A guidelines, and Configuration Management (CM) procedures and standards. Critical Power suitability testing procedures previously documented herein have been removed in accordance with current organizational agreements and replaced with references to the appropriate Office of Primary Interest (OPI).

6. **Background.**

   a. The policy and procedures provided herein are necessary instruments for effective facility management and primary tools for near-term and future planning. Facility change resulting from the introduction of new subsystems, operating procedures, facility support systems, and facility modernization and rehabilitation generates the need for new or updated Facility Power Panel Schedule Data System (FPPS) data, baseline and as-built drawings, and planning documents such as facility end-state drawings and transition plans.

   b. The benefits associated with configuration management include:

(1) Efficient use of NAS program resources

(2) A degree of assurance that subsystems will operate with the predicted Reliability, Maintainability, and Availability (RMA) needed without interference from or to other NAS subsystems.

(3) Reduced implementation costs from the standardization of facility and program implementation designs, and standardization of facility program and project sequencing.

(4) Better assurance that National Risk Management Plan(s) will work at all En Route Facilities.

(5) Increased personal safety and security through standard configurations and procedures.

7. Definitions. Several primary definitions that may be unfamiliar or which may clarify their usage within this order are included below:

a. En Route Facilities. For the purposes of this order the term “en route facilities” refers to all staffed operational facilities {e.g., ARTCCs (Air Route Traffic Control Center) and CERAPs (Combined Center and Radar Approach Control)} within the en route domain. This order does not pertain to un-staffed non-operational facilities {e.g., Long Range Radars (LRR) and Air Traffic Control Beacon Interrogator (ATCBI)}.

b. Facility Interface Requirements (FIR) Checklist. The FIR Checklist (see Appendix 4) specifies the potential requirements for an interface between a given facility and a given subsystem. Acquisition offices responsible for the implementation of new subsystems or modification of existing subsystems into the en route facility are responsible for preparing an FIR Checklist. The FIR Checklist should be used as an aide in determining facility interface requirements. It provides all necessary information required for space and power NAS Change Proposals (NCPs), HVAC (Heating, Ventilation and Air Conditioning) characteristics, and other physical interfaces required for the operational interface and integration of the proposed NAS subsystem into an en route facility Guidance for NCP submission is provided in paragraph 10a of this order.

c. Controlled Space. Controlled space is a physical area of a facility that is subject to a planning process that reserves and restricts use to specific functions or organizations. Controlled space within en route facilities includes Air Traffic Control (ATC) operational areas, equipment areas in support of the NAS, electronic equipment rooms (including automation and communication equipment rooms), critical and essential power generation and distribution equipment rooms, areas constructed with raised access flooring, and administrative office space. Space management is a function of the En Route and Oceanic Services, En Route Facilities

Planning and Modernization (EFPM) Group (AJE-1A) with independent oversight by the ATO Corporate Real Estate Office (AJF-15).

(1) End-state Space. The controlled space at the completion of a predetermined period of modernization identified in the End-State Equipment Layout Target Year Drawings in the target year specified.

(2) Temporary Space. Temporary space is controlled space available for limited-time use within a modernization period with a different end-state space designation. Temporary space is generally used as subsystem transition space.

(3) Administrative Space. As defined by the General Services Administration (GSA), the Code of Federal Regulations (CFR), and AMS 2.4.1, Appendix A, administrative space is characterized by finished (carpeted or tiled) floor, lighting suitable for or easily adapted to administrative duties, finished walls and ceilings and HVAC, and is generally free from mechanical or industrial noises. In en route facilities, it is the controlled physical area of the facility used by management and support staff for administrative purposes (i.e., offices, cubicles, etc.).

(4) Training Space. Training space should be classified as administrative unless the threshold cost to construct the space is 25% or more above standard administrative space. Training space which costs 25% more to construct is included with the subset of administrative space referred to as “Special Space” (see paragraph 11.b (4)) that is characterized as space with unique architectural/construction features. Those special space areas reserved for training functions will generally be tailored to meet the facilities training requirements.

(5) Operational Space. Operational space is a physical area of the en route facility where control of air traffic and associated ATC support activities occur. This includes the ATC room, E-Complex area, and other areas directly supporting air traffic control operations not included in the administrative space. These areas are managed through the Systems Enhancement Analysis Request (SEAR) and NCP processes with primary needs and requirements determined by local facility operational characteristics.

(6) Equipment Space. Equipment space is a physical area designated for the critical equipment (ATC computers, display generators, communications equipment, weather equipment, etc.) that supports air traffic operations. This is an area that requires specific environmental conditioning and electrical power distribution equipment. Equipment space is generally not identified as administrative or operational space and is usually equipped with raised access flooring, has specific environmental characteristic requirements, and the appropriate power sources needed for NAS equipment.

(7) Support Space. Support space is a physical area required for plant operation that includes areas for chillers, boilers, air handlers, motor control centers, fire

protection equipment, etc., and associated facility storage. Plant operations also include facility environmental, electrical power conditioning/distribution, and fire protection.

(8) E-Complex. The E-Complex is the Technical Operations (AJW) and Air Traffic Operations support area to the en route facility Air Traffic Control (ATC) function. Typical functions found in this area are the Traffic Management Unit (TMU), Central Weather Service Unit (CWSU), Operations Manager in Charge (OMIC), System Operations Center (SOC) and Military Liaison Officer (MLO).

d. Site Plot/Grounds. Site Plot/Grounds are physical areas designated for non-building elements of the facility property. These areas include driveways, parking lots, antenna farms, underground storage tanks, cooling towers, pump house, storage buildings, external security, loading docks, staging areas, utility transformers, etc.

e. Permanent External Buildings. Permanent external buildings are characterized as those having permanent type construction such as basements or full concrete foundations, and are used to perform end-state functions. Permanent exterior buildings include power service buildings, childcare facilities, security guard buildings, etc.

f. Temporary External Buildings. Temporary external buildings have provisional construction such as trailers, modular buildings, etc., and are erected to satisfy temporary short-term needs such as temporary administrative space, contractor trailers, temporary transition space, temporary classrooms, temporary medical facilities, etc.

g. AMS Guidelines. The Acquisition Management System, section 2.4.1, Appendix A, Administrative Space Guidance, provides the basic guidelines for administrative space sizing and definitions. Specific details will be provided in the following chapters, sections, or appendices, as appropriate.

h. Administrative Space Requirements Analysis (ASRA). ASRA is a data compilation process developed by the EFaBS (En Route Facilities and Building Systems) Policy and Configuration Management (PCM) sub team to determine and document current site-specific facility administrative space usage and requirements. It provides the basis for the management of administrative space in a manner that promotes efficiencies for space usage by organization, type, and interrelated functions in compliance with AMS space utilization guidelines. The data collected identifies administrative and administrative support space requirements that can be cross-referenced to facility baseline and site-specific end-state drawings. Changes to the ASRA database are requested through the AJE Document Change Request (DCR) process as outlined in ER-GEN-PRO-00, “Standard Operating Procedures for the En Route and Oceanic Change Control Process”.

i. **Facility Power Panel Schedule Data System (FPPS).** The FPPS is a standardized national database designed to serve as a central management repository of electrical power panel data for operational en route facility power panel configurations.

j. **Critical Air Traffic Control (ATC) Services.** Includes those services which if lost prevent the NAS from exercising safe separation and control over aircraft. In instances where conflicting interpretations exist as to whether the service is critical or essential, the NAS CCB will make the final determination.

k. **Essential ATC Services.** Includes those services which if lost reduce the ability of the NAS to exercise safe separation and control over aircraft.

l. **Critical Bus.** The en route facility Critical Bus is the facility-conditioned power bus that supports critical and essential air traffic control services. In the event of a power outage, critical loads are fed from uninterruptible power supplies until back-up power generators go on-line.

m. **Essential Bus**. The en route facility Essential Bus is the facility power bus that supports facility environmental systems with large motor load demands such as blowers, HVAC, Motor Control Center (MCC) and chillers. Normally, sensitive electronic equipment is not connected to this bus.

NOTE: The Anchorage ARTCC, Guam CERAP and San Juan CERAP each have two Essential Busses and do not have a Building Service Bus.

n. **Building Service Bus.** The en route facility Building Service Bus is the facility power bus that supports building power requirements such as non-critical and non-essential lighting and office equipment. Sensitive electronic equipment may be connected to this bus if it does not qualify for connection to the critical bus, and the effects of load shedding and possible undesired power loss are considered and acceptable.

o. **Key Site.** A key site is a facility used for proof of concept assessment or initial deployment validation of a subsystem. Key sites utilize a non-critical bus for initial power-up testing.

p. **End-state Equipment Layout Drawings.** End-state drawings are facility drawings reflecting anticipated future space usage and configuration at a designated point in time. They contain administrative, equipment, and operational space management projections and become the goal for the stated target year facility configuration. The update periodicity for end-state drawings is based on new and/or revised requirements for facility space based upon programmatic changes. It is expected that end-state drawing generation will occur approximately every three years, with the generation process lasting between one and two years. Copies of end-state drawings are available in ProjectWise. The two types of end-state drawings are:

(1) **Standard End-state Equipment Layout Drawing.** Standard end-state drawings contain national space management projections and become the goal for a stated target year generic facility configuration. The drawings are based upon consultations with acquisition offices, ATO Corporate Real Estate and facility representatives who collectively negotiate space requirements for their individual programs and facilities.

(2) **Site-Specific End-state Equipment Layout Drawings.** The standard end-state drawings are coordinated with each site individually resulting in the generation of site-specific end-state drawings. Site-specific end-state drawings indicate individual facility differences from the standard, where conformance to the standard may not be possible prior to the proposed target year. In general, the site-specific end-state drawings are an agreement between AJE-1A and the facility on an interim configuration that will be a stepping stone towards the standard configuration. The generation process for the site-specific end-state drawings serves as a formal CM space audit procedure for each facility.

q. Facility Baseline Drawings. The facility baseline drawings are documents that indicate the current state of the en route facility and contain details concerning all building elements, administrative space and equipment placement and orientation. Updates of these drawings are required as projects are implemented to formally document facility equipment, space and infrastructure changes in accordance with a service level agreement between AJE and AJW. These drawings serve as a basis for facility transition planning efforts. Copies of current facility baseline drawings are available in ProjectWise.

r. En Route Facilities and Building Systems Team (EFaBS). EFaBS is a team composed of individuals from various functional stakeholder organizations that propose and analyze new requirements for recommendation to AJE-1A. This team is chartered to provide effective cross-functional strategic planning and life cycle management to meet en route facilities and building systems safety and capacity needs.

s. Environmental Interfaces. Includes the building automation activities which control and monitor the operation of air handlers, fans, chillers, cooling towers, distribution boxes, fire detection/notification/suppression systems, et al. The goal is to standardize the environmental interfaces at all en route facilities.

t. Distribution. This order is distributed in Washington Headquarters at Group level in System Operations (AJR), Operations Planning (AJP), Technical Operations (AJW), En Route and Oceanic Services (AJE), and Finance (AJF); to appropriate levels in the Technical Operations Service Areas; and to all Technical Operations field offices with a standard distribution.

Chapter 2. Policy

1. Applicability.

a. Scope. The requirements and direction of this order apply to NAS subsystems integrated into staffed operational en route facilities, including NAS subsystems that have reached the requirements development stages on the effective date of this order. The order also applies to new NAS subsystems, including subsystems advanced under any development process (normal or accelerated variations) or subsystems being substantially modified. The administrative space requirements delineated in this order apply to all en route facilities and are applied for any event that requires change based on facility needs, administrative staffing, or relocation of agency personnel.

b. Implementation. This order provides the procedures that a facility, acquisition office, or organization must initiate to implement a space usage change or major project. It defines the processes for managing the change elements associated with subsystem-to-facility interfaces and reconfiguration or modernization of administrative space. Under extreme and unusual circumstances (e.g., a need for rapid deployment) the acquisition office may initially be granted a temporary exemption to this order to accomplish its task. However, the acquisition office must comply with all requirements in this order prior to permanent connection to any critical power source.

c. Processes. NAS programs and facilities must incorporate the requirements and processes of this order into NAS subsystem, environmental system, and administrative space implementation plans and documentation. The information provided through the processes defined in this order assist the service areas in establishing and maintaining facility power panel, environmental interfaces, and space configuration management.

2. Facility Space Interfaces.

a. General Policy. This order establishes a process for management of space at en route facilities. The space within the perimeter of an en route facility site plot is managed through the joint efforts of AJE-1A, and the Air Traffic and Technical Operations facility managers. Space available in most en route facility areas is assigned on a priority basis, and obtained through the SEAR and/or NCP processes. When existing space within the en route facility or grounds is inadequate or unavailable to support new requirements, refer to the AMS Administrative Space Guidance Section 2.4.1, Appendix A and “Determining Space Requirements for ATO Service Area Offices and Facilities” for further guidance.

b. Change Process. Proposals for changes to en route facility Configuration Items (CI) or functions that constitute a new requirement are first submitted to the AJE Domain Enhancements Review Group (DERG) via the System Enhancement Analysis

Request (SEAR) tool. The DERG is empowered to validate that the perceived need, judged against agency goals and standards, represents a shortfall or opportunity that should be pursued. DERG recommendations are forwarded to the En Route & Oceanic Requirements Board (EORB) for formal approval and identification of possible funding sources, if required. As recommended by the EORB, a NAS change proposal may then be forwarded to the appropriate Configuration Control Board (CCB) for formal approval in accordance with the procedures of FAA Order 1800.66, Configuration Management Policy. Refer to ER-GEN-PRO-00, Figure 5.1, for documentation submission sequence/requirements. In the event of a dispute regarding the need for a space or power NCP, the Power Systems, Facilities and Infrastructure (PSF&I) CCB and the ERO (En Route and Oceanic) CCB, as appropriate, must make the final determination. Specific details concerning change processes for facility equipment and administrative space, fire life safety systems, and building automation systems are outlined in Chapter 3, “Procedures”, of this Order.

c. Controlled Space. Controlled space is to be used exclusively for the intended functions. No other permanent activity or equipment is permitted without prior approval of the ERO CCB. Space identified as temporary space, but used for extended periods is considered controlled space, and falls under the processes and procedures defined in this order.

d. Configuration Control Boards. All facility infrastructure type Configuration Items are under the control of the ERO and PSF&I CCBs.

(1) The ERO CCB as chartered and delegated by the NAS CCB, the national configuration management organization, and in accordance with the procedures of FAA Order 1800.66, Configuration Management Policy, controls the following en route facility CIs:

(a) ARTCC Air Route Traffic Control Centers (End State drawings)

(b) ARBAC ARTCC Building Automation Controls

(c) ARFAS ARTCC Fire Alarm Systems

(d) BLD Facility Baseline Equipment and Administrative Space Layout Drawings

(e) CERAP Combined Center Radar Approach Control Facilities

(f) FPPSE Critical Power Breaker Assignment for En Route Facilities

(g) CCMS Central Control and Monitoring System

(2) The Power Systems Facilities and Infrastructure (PSF&I) CCB, as chartered and delegated by the NAS CCB, the national configuration management organization,

and in accordance with the procedures of FAA Order 1800.66, Configuration Management Policy, controls the Power Configuration Item (CI) which authorizes connection to a NAS Power System at En Route facilities.

3. Administrative Space Guidelines

a. Administrative Space. En route facility administrative space allocations are based on AMS Administrative Space Guidance for all administrative office space in FAA-owned, -leased and -controlled facilities. Space is allocated to the permanent residents and tenants based on these requirements. Appendix 3 of this document provides maximum square foot allowances as derived from AMS documentation and guidance developed by the EFaBS Policy and Configuration Management (PCM) sub team. (Note: The administrative space guidelines listed below and associated space allowances outlined in Appendix 3 apply to new, non-baselined administrative space construction and reconfiguration initiatives planned and scheduled for implementation subsequent to approval of this order revision.)

b. AMS Administrative Guidelines. The administrative space standard is a calculation involving the number of personnel, the circulation factor, and the following types of space: all office areas (closed or open), shared workstations, conference rooms, reception/waiting areas, copy rooms, meeting areas, file areas, central storage areas, processing areas, and library and reference areas. Below is the method to calculate the utilization rate for originating office requirements per AMS 2.4.1 Appendix A.

(1) Utilization Rate. AMS defines the average space allocated per person, including administrative support space and circulation within that space as not to exceed 152.5 occupiable square feet per person. The 152.5 square feet per person maximum is based on the peak number of persons to be housed by Line of Business/Staff Office (LOB/SO) during a single 8-hour shift (AMS 2.4.1.III.12). The 152.5 utilization rate is an average per person, however the square footage for any specific individual may vary up or down from the average.

(a) Administrative Office Space Utilization Rate. The average administrative office space utilization should not exceed 125 square feet per person. The 125 square feet per person is the utilization rate for the primary office area. Administrative office space is all office areas where normal operational functions are performed by personnel. This square footage standard applies regardless of the types of furniture options (free-standing, modular or systems). Circulation allowances are included in this number.

(b) Administrative Support Space Percentage. The support space should not exceed 22 percent of the primary office space. Allowances may be made for those unique functions that require additional support space above the primary support factor of 22 percent. Administrative support spaces are identified as the following areas: reception/waiting areas, meeting areas, copy

rooms, file areas, central storage areas, processing areas, mail areas, work areas, conference rooms, library and reference areas, and aisles and corridors.

(2) Occupiable Square Feet. The method of measurement for en route facility office space, per FAA AMS guidelines, is as follows:

(a) If the space is on a single tenancy floor, compute the inside gross area by measuring between the inside finish of permanent exterior building walls or from the face of convectors (pipes or other wall-hung fixtures) if the convector (heating or cooling) occupies at least 50 percent of the length of exterior walls.

(b) If the space is on a multiple tenancy floor, measure from the exterior building walls as above and to the room-side finish of fixed corridor and shaft walls or the center of tenant-separating partitions.

(c) In either case, make no deductions for columns and projections enclosing the structural elements of the building and deduct the following from the gross area including these enclosing walls: toilets, lounges, stairwells, elevators, escalator shafts, building equipment, service areas, entrance lobbies, stacks shafts, and corridors in place or required by local codes and ordinances.

(3) Total Utilization Rate Formula The calculation formula for the average amount of administrative office and support space per person is as follows: 125 sq. ft. + (125 sq. ft. X 22%) = an average of 152.5 Occupiable Square Feet (OSF) per person.

(4) Special Space. This type of facility space is characterized as that which has unusual architectural/construction features, requires the installation of special equipment, costs significantly more to construct than the costs specified in the customer general allowance (i.e., the threshold cost to construct the space is 25% or more above standard administrative space construction cost for features such as raised floors, hardened floors, sound proofing, supplementary air conditioning requirements, conditioned power, etc.), or that costs less to construct than general administrative space (i.e., the threshold cost to construct the space is 25% or more below standard administrative space construction costs for features such as bare concrete floor, utility lighting, limited or no HVAC, etc.). It is not the type of space provided that makes it special space, but it is the total cost to construct that determines whether the space as constructed is special space. Areas identified as special space are exempt from administrative space area calculations. Additional exceptions outside this clarification will be determined on a case-by-case basis.

(5) Agency Facilities Used by the Union. Space for union activities at the facility is allowable per negotiated bargaining agreements. There is no mandate to provide space but is allowable per local agreements with the bargaining unit.

4. Equipment Installation

a. Equipment Space Requirements. Equipment installation in equipment areas must adhere to FAA-G-2100, Electronic Equipment General Requirement and FAA Environmental Occupational Safety and Health (EOSH) Requirements, and the following space requirements:

(1) Working spaces for electrical equipment are to conform to the requirements of the National Electrical Code (NEC) and FAA's Human Factors Design Standard, HF-STD-001.

(2) Per NEC Section 110.126, equipment is not to be placed within three feet of an electrical power panel, air-handling unit or fire detection/control equipment. Per NEC, SEC 110.26, space around electrical power panel equipment requires the minimum working space to be the width of the equipment or 30 inches, whichever is greater. In all cases the work space shall permit at least a 90-degree opening of equipment doors or hinged panels. If the voltage in the power panel is 151 to 600 volts, then the minimum clearance is 4 feet. If the panel voltage is above 600 volts, then the minimum clearance is 5 feet. Electrical power panels with Solid State Static Automatic Transfer Switches (SSSATS) require a clearance of five feet.

(3) ATC console floor plans are to be configured to support and not interfere with future operational configurations as depicted in the facility end-state drawings.

(4) A minimum of 42 inches of clear space in front of each equipment rack is required. Five feet of clear space is preferred to the rear of each equipment rack, but based on space availability and maintenance requirements of the system, it may be reduced to a minimum of three feet. Clear space of adjacent equipment racks may overlap.

(5) Equipment is placed in the allocated space in a manner consistent with facility lighting, and ingress and egress paths.

(6) Eighteen inches of clear space is required adjacent to and within the perimeter of each allocated equipment area boundary depicted in the end-state equipment layout drawings. The resulting space will provide walkways through the equipment rooms and may be used for maintenance access.

(7) Equipment placement must not adversely affect the existing level of facility fire protection.

(8) Equipment installation should not affect the existing facility cabling unless the facility and Engineering Services agree to changes during site survey.

b. Temporary Space Interface Requirements. The deployment of a new subsystem may require temporary office, administrative, and/or contractor/FAA workspace. This space is to be identified by the subsystem's acquisition office and assigned through coordination with the affected facility. Space occupied longer than two years is considered a permanent allocation and shall be identified and formally approved via NCP. During the equipment deployment process:

(1) Equipment deliveries are to be coordinated such that internal and external space is identified in advance and made available to accept deliveries at an established time.

(2) Predefined and approved staging areas are to be used.

(3) Subsystem installation contractors may be assigned space, as available, within the facility or in external trailers/buildings.

5. Subsystem–Facility Power Interface. The subsystem-facility power interface guidance provided in this order is to be used by the responsible organizations in establishing en route facility electrical power configuration and interface requirements for NAS subsystems. Procedures and practices identified within this order, and in the Power/Space Interface NCP Check List, are to be accomplished prior to, and for the purpose of, establishing site power configurations and databases and defining facility preparation or construction activities. Before subsystem deployment, required actions and documentation are to be completed with acceptable results. The following power requirements are only provided as a guideline. AJW-22, Power Systems Group, is the OPR on these requirements.

a. Power Interface Requirements Definition. AJE-1A recommends that subsystem equipment supporting ATC operations be powered by a critical power source. The approval for critical power connectivity is determined by the subsystem function, that is, the subsystem provides an ATC critical or essential service. Generally, the subsystem should be directly involved in the control of air traffic or aid in the quality or efficiency of the control of air traffic, and may be negatively affected by poor electrical power quality. ATC advisory and information services such as weather programs meet the requirements of this approval definition.

(1) All ATC or administrative subsystems that are not assigned critical or essential service status and require high-availability power to prevent long boot-up times due to momentary power loss conditions should consider the advantages of critical power. This configuration is more desirable than the use of numerous Uninterruptible Power Supplies (UPS) and associated battery systems that might be considered an alternative fix. Power NCPs are required for installation of such systems.

(2) The subsystem must be identified in the appropriate section of Order 6950.2, Electrical Power Policy Implementation at NAS Facilities, for critical power connectivity authorization and appropriate power quality testing. NCP approvals must be completed to verify the subsystem's suitability for critical power connectivity. Changes requesting the use of critical power are to be coordinated through AJW's PSF&I CCB and Power Services Group.

b. Power NCP Need Criteria. Power NCPs are necessary for subsystem critical power connectivity authorizations. They are also necessary for:

(1) Changes in source voltage and number of phases required by the subsystem.

(2) Modifications to the subsystem resulting in power characteristic changes (power consumption, power factor, current harmonic distortion, and in-rush current).

(3) Program office upgrades or other subsystem component level changes.

(4) All requests for connectivity to facility critical power systems should be directed to the PSF&I CCB.

c. Facility Power Panel Schedule (FPPS) NCP Need Criteria. An NCP is required for subsystem critical power modification requests for additional or rearrangement of existing branch circuits resulting in the need for new power panels and/or new circuit breaker positions within existing power panels. If an appropriate power panel is not available, the subsystem acquisition office will be responsible for the installation cost of providing new panel(s).

(1) FPPS Database. Following approval of the FPPS NCP, the facility power panel databases are to be updated to capture the changes introduced by the new or modified subsystems. AJE-1A is responsible for updating the FPPS Standard En Route Facility Database if required. Authorized service area personnel are responsible for updating the site-specific FPPS databases as applicable. A procedural flow diagram of the FPPS process is provided in Figure 1, FPPS Procedural Flow Diagram, including portions of the NCP process, virtual panel reservation system, and final documentation.

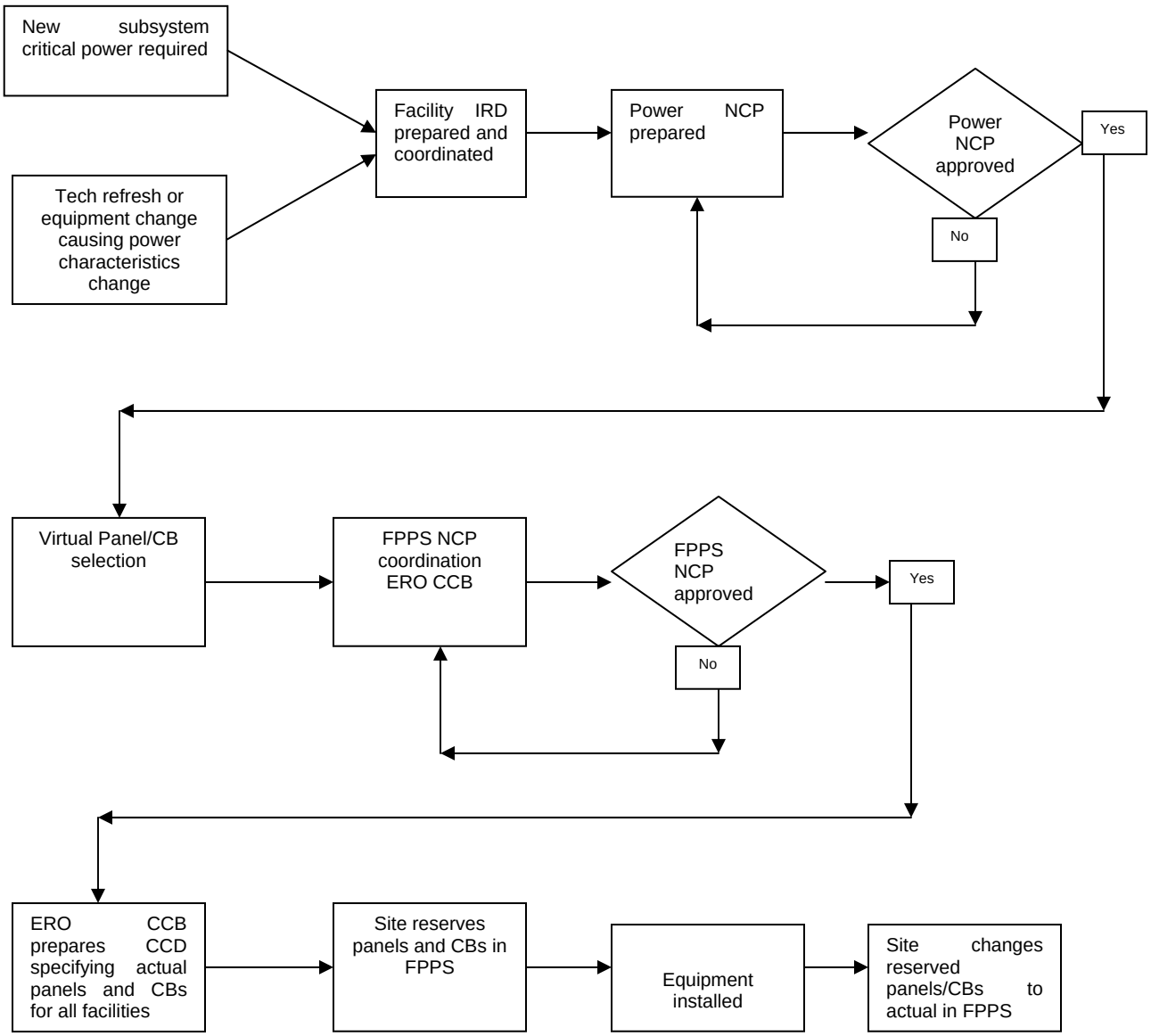


Figure 1: FPPS Procedural Flow Diagram

Note: CB=Circuit Breaker(s)

6. Subsystem-Facility Power Component Requirements. A Service Level Agreement dated 4/4/2008 between AJE and AJW defines the respective responsibilities for managing various levels of the ARTCC Power System. This SLA assigns responsibility for managing power configurations on the load side of the facility power panels to AJE, with the facility power panels being a point of common interest with AJW.

a. Power Wiring. Power wiring must adhere to the requirements of the NEC and Specification FAA-C-1217, Electrical Work, Interior. When conflicts occur between FAA C 1217 and the NEC, FAA-C-1217 must govern. It is suggested that liquid tight flexible conduit be used for under-floor circuits where moisture may be present.

b. Power Cabling. Alternating Current (A/C) power cabling must be segregated from signal/control cable and is to be the lowest tier (i.e. nearest to the cement floor) of cabling under an en route facility access floor. Power wiring must be shielded by use of metallic raceway (e.g. wireway, rigid conduit, flexible metal conduit, etc.) or by any other method permitted by the NEC. A 1-inch standoff from the concrete floor should be used in the installation of power cable raceway to allow air circulation and avoid water contact. Flexible raceway may lie on the floor. Under-floor cabling must comply with NEC 645.5 (D).

c. Power Cable Routing. Power cables are routed from the facility power panels to the subsystem equipment. Close proximity between power and signal cables is undesirable and it is recommended that parallel runs of power and signal cables be separated by 24 inches. When the vertical planes of power and signal cable intersect, the desirable intersecting angle is 90 degrees. It is realized that adherence to this separation recommendation is not always possible. It is the responsibility of the subsystem implementers to verify that any signal degradation caused by close proximity to power cables is acceptable to the operation of any affected subsystem.

d. Branch Feeders. For connection to loads, power wiring may be terminated in either junction boxes or at receptacles. Locking receptacles must be used under access flooring for critical power. It is recommended that twist lock receptacles be used for essential power. The obvious identification that the receptacle is critical power should be accomplished by either letter identification or color-coded face plate as agreed to at the facility. The receptacles should be chosen such that physically unique types are used for the various power services. Notice that straight blade receptacles are permitted for use under raised floor when connected to Building Services Power.

e. Isolated Ground Receptacles. Isolated ground receptacles are not supported by the facility electrical system and should not be used.

f. Rack Power Receptacles. Where permitted by the NEC, it is permissible to power equipment from a re-locatable power tap (i.e. power strip) connected to critical power. If the power strip uses straight blade receptacles, access to them must be restricted by the equipment's cabinet or some other means to ensure that unauthorized equipment or other loads are not connected to critical power. Obvious identification that the receptacle is a critical power source must be provided. Permanent labeling in 1/4-inch letters is preferred but a facility-coordinated, color-coded faceplate is permissible. Non-critical power receptacles are normally provided in racks for powering of test equipment and tools.

g. **Power Panels.** Power panels are to be selected as early as possible and as consistently as possible for all en route facilities. Power panel identification (FPPS assignment) should be made in the initial power NCP for the subsystem. Subsystem implementers are to survey the non-standard facilities for power panel selection and include non-standard facility power panel selections in the power NCP.

h. **Power Panel Balance.** The multiple-phase current load required by the subsystem equipment is to be analyzed to ensure that the subsystem power source does not become overloaded or unbalanced due to application of the subsystem load. Refer to FAA-G-2100 for acceptable limits.

i. **Grounding.** Grounding of data cables, cable trays and equipment must comply with FAA-C-1217, FAA-STD-019, and the NEC. FAA grounding requirements often exceed those of the NEC. Installations must comply with FAA-C-1217 and FAA-STD-019 when the requirements exceed the NEC requirements.

j. **Color coding of circuits.** Color coding of circuits must conform to the requirements of FAA-C-1217. For 480 volt systems: Phase A is yellow; Phase B is brown, Phase C is orange and the neutral is grey.

7. **Subsystem-Facility Signal Cabling Requirements.**

a. **Information Technology Areas.** NAS Communications, Navigation, Surveillance, Weather, and all other electronic equipment areas directly supporting facility ATC operations are considered Information Technology areas and are subject to the wiring practices for such areas as defined in the NEC. Facility operational and operational support areas may also be considered Information Technology areas. Due to the large numbers of operational personnel, under-floor wiring in those areas is to be plenum-rated, if the cable (both power and data) is not installed in a raceway (e.g. conduit, including flexible conduit). Under-floor wiring must comply with NEC 645.5(D).

b. **Grounding.** Power interface cables and equipment must comply with FAA-C-1217, FAA-STD-019, and the NEC. Installations must comply with FAA-C-1217 and FAA-STD-019 when the FAA requirements exceed NEC requirements. Article 250 of the NEC defines grounding requirements for equipment cables and cable trays.

c. **Signal Cabling.** Signal or control cabling for new subsystems must be installed in cable trays. When planned in an orderly manner and installed properly, cable trays ensure full access to under-floor cables because the cable trays are located in areas designated as non-equipment or aisle areas. Where available, a facility cable tray plan will permit vendors to review the exact path for their cables and not be concerned with interfering with under-the-floor fire detection systems and other obstructions. It is the responsibility of the subsystem acquisition office to install additional cable trays if there is insufficient space in existing cable trays to

accommodate required cabling for the equipment/system to be installed. Data interface requirements are defined in FAA-STD-025.

d. Cable Tray Hardware. Selected cable tray hardware is to be compliant with the NEC Article 392, FAA-C-1217, and FAA-STD-019. The cable tray system is to permit tray elevation changes and accommodate access to vertical risers. Cable tray standard widths of 6, 12, or 18 inches are acceptable.

e. Cable Tray Fill. Cables may be placed in cable trays without being tied down or secured. This permits easier removal of old cables and installation of new cables. It is permissible to bundle cables of the same source and destination. New cable tray installations are to be sized to accommodate the planned cable volume plus 25 percent. Existing cable trays shall not exceed 100% of capacity. Cable tray fill for multi-conductor cables is defined in Section 392.9(E) of the NEC.

f. Under-Floor Cable Tray Routing. Cable run areas are typically located behind the equipment racks or consoles, along aisles, and in other areas where space has not been allocated to subsystems. Generally, cable trays should be centered under the 24" x 24" floor panels. It is acceptable, and may be necessary, in accordance with the NEC, to provide a double (side-by-side) cable tray run to accommodate large numbers of cables. Cable tray installation requirements are defined in Article 392 of the NEC.

8. Subsystem-Facility Environmental Interface Requirements. The environmental impacts and concerns of new subsystems are to be addressed in accordance with Order 1050.1, Policies and Procedures for Considering Environmental Impacts, and the National Environmental Policy Act of 1969 (NEPA).

a. New subsystems are to comply with the energy and water conservation mandates of 42 USC 8252-8261, National Energy Conservation Policy Act of 1978, Executive Order 13423, Strengthening Federal Environmental, Energy and Transportation Management and Order 1053.1, Energy and Water Management Program for FAA Buildings and Facilities.

b. New subsystems are to comply with the fire detection and fire suppression requirements of the National Fire Protection Association (NFPA).

c. New subsystems are to use the existing under-floor cooling ventilation and environmental cooling at all locations. If new subsystem requirements for under-floor cooling air exceed the available cooling capacity, the subsystem acquisition office is responsible for funding engineering and installation of upgrades to the cooling system.

d. New subsystem equipment must comply with seismic design guidelines developed by the National Earthquake Hazards Reduction Program (NEHRP) and contained in NEHRP recommended "Provisions for Seismic Regulations for New Buildings and

Other Structures", Federal Emergency Management Agency (FEMA) seismic code requirements applicable to the site installation. In addition, FEMA Documents referencing, "Reducing the Risks of Nonstructural Earthquake Damage", are to be used as a practical guideline for installation of nonstructural components.

e. The subsystem interfaces with the facility through physical attachment to the structural floor or access flooring. The subsystem should introduce a dead load of no more than 125 pounds per square foot.

f. Exceptions. Signature authority over any action deemed appropriate is granted to the Air Traffic Facility Manager or CCB Secretariat after a catastrophic failure due to environmental or man-made conditions. However, after this action, NCP coordination as determined by the ERO and PSF&I CCBs is required.

9. Removal of Obsolete Interfaces. When equipment is replaced by new equipment or deemed obsolete, a disposition plan for the obsolete equipment and site restoration for the former space is to be originated by the subsystem acquisition office. The disposition plan is to identify the restoration funding source, schedule, and responsibilities. The replaced systems have obsolete facility interfaces that require removal and a concerted effort to restore the areas to safe, usable and aesthetic conditions. This effort should be a part of the disposition plan.

a. Acquisition Offices. Acquisition offices providing the new subsystem are responsible for removal of obsolete equipment and restoration of vacated areas, and will submit a disposition plan to AJE-1A for approval.

b. Disposition Plans. Disposition plans address the removal of obsolete/excess equipment and cables, as well as actions needed to return the vacated area to a safe condition. Unused electrical circuits are to be removed from the circuit end outlet to the power source. Remove conduit and raceways for obsolete equipment unless a local Point of Contact (POC) requests all or part of the conduits/raceways remain intact. Vacated areas resulting from the equipment removal process are to be restored to a condition that is compliant with Occupational Safety and Health Administration (OSHA) safety standards and aesthetically equivalent to the immediate adjacent areas. All penetrations through walls, ceilings, and floors are to be patched and sealed to maintain facility fire ratings. All steel tie-down angle connections (studs, bolts, et al) are to be removed as part of the restoration effort. Equipment removal and site restoration activities must be conducted in a manner that will not affect air traffic operations, impede access to critical areas, disturb lighting and must control dust, noise and excess traffic into critical areas.

Chapter 3. Procedures

1. General Processes and Procedures.

a. New Subsystems. Acquisition offices are to enter into an FIR Checklist development process with the initiation of a Facilities Interface Working Group (FIWG). FIWG is to coordinate new requirements through the EORB via the SEAR process. The completed FIR Checklist will provide sufficient information for analysis by the EORB, and for development of space, power and FPPS NCPs as recommended by the EORB. Space and FPPS NCPs are processed through the ERO CCB, while power NCPs are processed through the PSF&I CCB. SEARs are to be developed in accordance with the guidelines outlined in ER-GEN-PRO-00, "Standard Operating Procedures for the En Route and Oceanic Change Control Process". NCPs must be developed in accordance with Order 1800.66, National Airspace System Configuration Management, and are mandatory for the deployment of new subsystems.

b. Existing Subsystems. Modifications to existing subsystems require an update to an existing FIR Checklist or a revision of current documentation and submission of appropriate NCPs.

c. Administrative Space Changes. Requests for new space, temporary or permanent, and changes to existing base-lined space configurations or usage are subject to review by the EORB via the SEAR process, and ERO CCB via the NCP process, in accordance with Order 1800.66, to obtain formal approval prior to initiation of any implementation activities. All requested changes are to follow FAST administrative space guidelines and office space allowances documented in Appendix 3 to this order.

(1) Requests to relocate non-resident employees/organizations to any En Route facility are to be based on a comprehensive business case that fully analyzes all associated cost benefits. The final version of the business case is to be signed by AJE-1A En Route Facilities Planning and Modernization, AJF-15, ATO Corporate Real Estate, the corresponding service area Directors of Operations and the Director En Route and Oceanic Systems Program Operations (AJE-1).

(2) The Senior Level ATO Facility Managers (Air Traffic Manager and Technical Operations Manager) for each resident line of business have the latitude to exchange spaces for administrative functions they oversee within the current administrative space identified on the facility baseline and end-state drawings.

d. Facility Staffing Levels in Office Space Areas. An ASRA conducted at each en route facility in 2008, established a baseline of facility staffing levels for employees requiring office space and provided a formal means to manage changes to office

space requirements at each site. All subsequent changes to baseline ASRA data must be approved by Senior Level ATO Facility Managers (AJE Managers and AJW District Managers) at the impacted facility, and submitted to AJE-1A for incorporation via the AJE Document Change Request process.

e. Fire Alarm System (FAS) System Changes. Changes to baselined FAS systems are to be formally requested via the NCP process in accordance with Order 1800.66. FAS system NCPs are processed through the ERO CCB.

f. Building Automation Controls (BAC) Changes. Changes to baselined BAC systems are to be formally requested via the NCP process in accordance with Order 1800.66. BAC system NCPs are processed through the ERO CCB.

2. En Route Facility Space Audits.

a. Facility Configuration Audits. The Facility Configuration Audit (FCA) is a means of formal examination of all en route facility CIs for compliance verification. All FCAs are coordinated by AJE-1A and AJV Planning and Requirements (P&R) Resource Planning Teams in each Service Area. The audits are conducted per guidance provided in "The National Configuration Management Standard Procedure Document for Conducting Formal Configuration Audits of Operational Facilities".

(1) National Facility Audit Requirements. AJE-1A or designated representatives are responsible for accurate recording, tracking and reporting of all real and perceived system problems identified during national configuration audits of en route facility CIs. Facilities are to be audited with relation to national space management standards and end-state space requirements documented in standard and site-specific end-state drawings, and related facility ASRA documentation. Checklists are to be developed to perform the incremental activities. Deviations will be recorded, along with the action required to attain compliance.

(2) Annual Facility Configuration Audits. The AJV organizations are responsible for conducting yearly configuration audits of all staffed en route facilities within their respective service areas. The yearly audits focus on verification of completed implementation activities for approved new requirements outlined in associated configuration control decisions (CCDs). The audits also document progress demonstrated toward reaching target year end-state configurations specified in standard and site specific end-state drawings, and corresponding site-specific ASRA datasheets. Data compiled during the audits is used to update the corresponding site-specific facility baseline drawings and ASRA documentation as required.

b. CM Drawing and ASRA Updates. Updates to standard and site-specific end-state drawings, site-specific facility baseline drawings and ASRA documentation are to be accomplished in coordination with and based on information obtained from facility FCAs. It is expected that site-specific end-state drawing generation will occur

approximately every three years, with the generation cycle lasting between one and two years. Facility baseline drawings and site-specific ASRA documentation shall be updated on a yearly basis as a minimum or as new requirements are identified and approved.

3. Overview of the FIR Checklist and Associated Processes.

a. Initial Phase. Acquisition offices that desire space or power connectivity for proposed subsystems within the en route environment are to forward a memo to AJE-1A specifying the known need and intent. The memo is to be submitted during subsystem conceptual phases or during the development of the initial Facility Interface Requirements Checklist. (See Appendix 4 of this order).

(1) Facilities Interface Working Group (FIWG). The acquisition office is to initiate a FIWG to develop and submit an initial FIR Checklist to AJE-1A. The FIR Checklist will be considered interim until the final iteration is completed and submitted with the Power/FPPS, BLD and ARTCC NCPs as outlined in ER-GEN-PRO-00, "Standard Operating Procedures for the En Route and Oceanic Change Control Process". As a member of the FIWG, AJE-1A will assist in developing and coordinating the final FIR Checklist. Acquisition offices must provide copies of all FIR Checklist iterations to AJE-1A for facility integration, transition, and end-state planning.

(2) Initial FIR Checklist. The initial FIR Checklist will contain minimal information. The information provided will be expanded during the subsystem development period. AJE-1A will use the initial FIR Checklist as the preliminary planning document for site preparation activities, national transition, and end-state planning.

b. Mid-Maturity Phase. Following the initial phase, the acquisition office must provide primary and intermediate updates to the FIR Checklist to reflect the latest knowledge of the proposed system and initiate the disposition plan and the power requirements determination.

(1) FIR Checklist. The FIR Checklist must be amended to include:

(a) Refined space requirement (i.e., operational, equipment room, transition, storage and maintenance space requirements) at all locations within the facility.

(b) Critical and non-critical power panel requirements, with indications of voltages, breaker size or load, and number of pole positions required.

(c) Power panel requirements (single phase, three phase, 480 volt panel, et al).

(d) Physical cooling/heating requirements.

(e) Floor loading values.

(f) Anticipated noise generation levels.

(g) If known, the acquisition office is to advise AJE-1A of any cable length/proximity dependencies or restrictions that pinpoint the need for specific subsystem locations within the facility and drive the final end-state drawing locations and changes.

(h) Responsible organizations are to perform subsystem power quality testing in accordance with the processes and procedures outlined under "Power Interface Testing" procedures of this order. This information is necessary for the completion of the appropriate power NCPs required prior to deployment.

(2) Disposition Plan. The Disposition Plan should be initiated during the program's Mid-Maturity Phase. The Disposition Plan must be approved prior to the In-Service Decision (ISD) and must be coordinated with all affected facilities and AJE-1A. The subsystem acquisition office will be responsible for generating the Disposition Plan.

(3) Power Requirements Determination. The subsystem acquisition office will develop the subsystem electrical power requirements and negotiate an agreement with AJE-1A and AJW, Power Services Group as required, regarding the facility power source. To assure that power sourcing will satisfy the subsystem's RMA requirements, acquisition offices are to contact AJE-1A and AJW, Power Services Group, to discuss and determine the best means of powering the subsystem prior to finalizing the power source configurations and developing power and FPPS NCPs for submission.

(4) Distribution Panels. To minimize the impact of a Distribution Panel (DP) failure on air traffic activities, acquisition offices are to develop an analysis of a branch circuit configuration scheme such that the loss of power to a Critical Power Center (CPC) or DP would have the least possible impact on air traffic control capability.

(a) Like equipment within a subsystem is to be distributed among facility CPCs and DPs on the critical bus to avoid total loss of a subsystem.

(b) Equipment at adjacent ATC operational sectors is to be connected to a different power center distribution panel to avoid simultaneous loss of adjacent sectors in the event of a CPC/DP failure.

(c) A subsystem whose operation is dependent upon the operation of another subsystem must be powered by the same CPC to reduce the number of possible power failure points.

(d) Subsystems requiring redundant power at the subsystem or subsystem power supply level are to have the primary and secondary defined power loads connected to different power centers, via appropriately selected distribution panels.

(e) Additionally, power loads are to be balanced between chosen distribution panels and phases as much as practical.

(5) NAS Power Change Proposal Development. The NAS subsystem acquisition office is responsible for requesting authorization for the critical power connectivity of the subsystem via an NCP. In order to develop the NCP the following should be considered:

(a) Basic power sourcing configuration to satisfy the subsystem reliability, maintainability and availability (RMA) requirements.

(b) Facility power redundancy configuration to support subsystem redundancy configuration requirements.

(c) Minimum power transfer time requirements of the subsystem.

(d) Subsystem redundancy configuration.

(e) Identification of any special power transfer requirements.

(f) Effect of subsystem dual power supplies, if applicable.

(g) Consequences of the subsystem going off-line.

(h) Re-boot time and impact to service.

(i) Electrical power test data or test methodology employed to ensure compliance with the requirements of Order 6950.2.

(6) FPPS Change Proposal Development.

(a) The Subsystem Acquisition Office or NCP originator should make a recommendation of the specific power panels to be used which may include power panels and circuit breakers for all specific en route facilities and the virtual facility database. The NCP is to contain, at a minimum, the power panel recommendation for the virtual facility FPPS power panel database.

(b) Upon agreement of the planned subsystem configuration, AJE-1A will update the FPPS virtual facility database by marking the approved power source circuit breakers as “RESERVED FOR [subsystem]”. These breaker positions

are to be made available to the subsystem and the CCB for use or reference in the Configuration Control Decision (CCD).

(c) ARTCC/CERAP Environmental Support Unit (ESU) personnel will be responsible for ensuring site power panel breaker assignments are in accordance with the FPPS.

(7) NAS Operations/Hardware Space Change Proposals. A space NCP is to be initiated during this phase. The NCP originator will initiate an ARTCC case file when new subsystem boundaries are to be placed on end-state drawings. A BLD case file should be initiated to change the configuration of subsystem equipment within existing baseline space boundaries. In order to develop the space NCP the following should be considered:

(a) Proposed location and proximity to other required equipment interfaces.

(b) Equipment orientation.

(c) Dimensional limits.

(d) Access requirements.

(e) Security and safety.

(f) Total space required, including storage and work area requirements.

(g) Environmental requirements.

(h) Restrictions on location based on potential interference with or from other subsystems, noise, etc.

(i) Size and number of required power panels.

c. Deployment Phase. Implementation activities will be required prior to and following the subsystem deployment. The acquisition office will be responsible for the following:

(1) Pre-Deployment.

(a) The acquisition office is to:

1) Prepare the final FIR Checklist along with power and space NCPs to support the proposed subsystem for completion and final approval prior to subsystem deployment.

2) Provide AJE-1A with information relating to any necessary equipment relocation requirements or any other site preparation requirements essential to the subsystem installation.

(b) AJE-1A is to:

1) Develop rough order-of-magnitude financial estimates for facility modifications required to successfully install the subsystem.

2) Determine the organization(s) responsible for funding the required facility modifications.

3) Analyze the proposed facility interface requirements of the subsystem and the target installation areas.

4) Analyze the proposed subsystem for conformance to the facility interface and other facility standards.

5) Identify and recommend power panels and space for the acquisition office NCPs.

(c) AJW must prepare the facility for the installation of the new subsystem equipment.

(2) Post-Deployment.

(a) The acquisition offices must:

1) Remove and dispose of obsolete equipment, electrical circuits, cables, etc., resulting from the subsystem's installation in accordance with the subsystem's specific disposition plan.

2) Restore the area vacated by obsolete equipment to a safe and aesthetic condition in accordance with the disposition plan. The disposition plan should be coordinated with each impacted facility prior to implementation.

(b) AJE-1A is responsible for the following:

1) Place the equipment footprint in the proposed end-state drawing.

2) Update the FPPS virtual power panel database.

(c) Technical Operations (AJW) and the Field Engineering Services must update facility baseline drawings and facility FPPS databases.

4. Power Interface Testing.

a. The test procedures and responsibilities associated with the introduction of new or modified subsystems requiring the utilization of en route facility power system interfaces ensures that facility and NAS subsystem configurations are implemented appropriately with their assigned missions. The tests determine compliance with applicable sections of Order 6950.2, Electrical Power Policy Implementation at National Airspace Facilities and Order 6030.20 Electrical Power Policy for any portion of subsystem equipment scheduled for installation within an en route facility. These tests provide assessments of the effects of the subsystem on the en route facility's critical power source to ensure that there are no negative impacts to the power system or other subsystems sharing the power source.

b. Specific Testing Processes. Procedures for critical power testing are under the purview of the AJW, Power Services Group, and the PSF&I CCB. These organizations are to be coordinated with for guidance and approval of specific critical power testing procedures for new or modified subsystems. Organizations with testing responsibility will ensure that testing is fully documented as required by Order 1800.66 and submitted to the PSF&I CCB and subsystem acquisition offices. Associated baseline data will be added to the FPPS.

c. Subsystem acquisition offices have the overall responsibility for testing. First site or "key site" critical bus testing is a responsibility of the subsystem acquisition office, but requires the assistance and cooperation of facility personnel. Subsystem acquisition office personnel will perform power-up testing prior to any connection to facility critical power panels. Subsystems will then be connected to the critical bus with the assumption that the subsystem power quality characteristics are acceptable, based on key or first site testing.

(1) Facility personnel have the responsibility to conduct or oversee facility critical bus baseline testing. Acquisition offices must include facility baseline testing procedures in the facility integration schedule for each site.

(2) Facility testing is a critical event since operational equipment connected to critical power panels may be affected in the testing process.

d. Specific Facility Testing Requirements.

(1) Facility Power-Up Testing. Power-up testing is on-site testing performed by the subsystem acquisition office on a facility non-critical bus to assure that the equipment has not suffered damage during shipping or installation.

(a) Prior to connection of a new subsystem to the ARTCC facility critical bus, the subsystem program office is to perform power-up testing to assure that the equipment has not undergone any damage during shipping or installation. Power-up testing is to be performed with the subsystem connected to a facility

non-critical bus. The subsystem must be powered on and allowed to reach normal operating temperatures and conditions. Observe the subsystem for abnormal physical conditions, system error, or failure indications, etc. Successful power-up testing is achieved when the subsystem reaches normal operating temperatures and is observed as normal and stable.

(2) Facility Baseline Testing. Critical bus baseline testing for new equipment is performed at each site to assure that the effects of new equipment are as predicted at each ARTCC, and to establish and maintain site-specific power quality baselines.

(a) Facility or AJE Field Support personnel perform the baseline testing of all critical power panels interfacing with the new subsystem. During the installation process at each site, facility personnel perform and record before (not necessary if current data is available) and after baseline critical panel test data. After testing results indicate the bus power quality change that has occurred within the power subsystem and results in a new facility integrated system baseline interface with the critical bus. Baseline testing is most effective when facility and acquisition office personnel coordinate and cooperate in the installation process.

(3) Facility Power Quality Measurement Requirements. A progressive comparison of power quality characteristics is to be used to determine the subsystem's effect on the facility power system. The following processes must be used to measure the subsystem power quality values and assess standards compliance.

(a) First or Key Site Power Quality Reference Baseline (Non-critical Bus). Test the condition of the existing non-critical bus power system at the unloaded power panel to determine the power quality reference baseline. Take pre-subsystem measurements of the Power Panel Balance, Power Factor (PF), and Total Harmonic Distortion (THD). Valid no-load power quality data for the existing non-critical bus power configuration may be used for the power quality reference baseline. The resulting no-load measurements for the Power Panel Balance, PF and THD must be documented.

(b) First or Key Site Incremental Power Quality Change (Non-critical Bus). At the first or key site, test the subsystem incrementally as each equipment part of the subsystem is powered to the non-critical bus. The final test increment is at normal operating conditions, providing the total load distribution baseline. This information is used in a final evaluation to determine if the subsystem can be safely connected to the critical bus. This non-critical bus procedure is necessary only for key or first site testing to assure that prior acceptability tests will be replicated on a facility ACEPS system.

1) Connect subsystem equipment to the non-critical bus power panel. Activate the equipment, one breaker at a time and observe the steady-

state voltage, current, watts and volt-amperes, Power Balance, PF and THD (Voltage and Current) using the test instruments for each incremental change.

2) When the final breaker is closed, measure and record the above data as the total incremental change for the non-critical bus. Perform the same process on additional panels (if available). Document the resulting non-critical bus measurements for the Power Balance, PF, and THD.

3) Satisfactory results signify that the equipment is acceptable for connection to a critical power bus.

(c) Initial Power Quality Baseline Test Procedure (Critical Bus, All Sites).

1) Perform this test at all subsystem deployment sites on all critical power panels populated with new circuits.

2) Acquisition offices are to include this procedure in the facility integration schedule for each site. The procedure is similar to the non-critical bus test procedure stated above and may be eliminated if valid before-testing or baseline testing values are on record and available for comparison.

3) With all new equipment breakers in the “OFF” position, measure the phase values for Power Balance, PF, and THD (voltage and current) at the source input of each power panel. Record the data for reference.

(d) Incremental Power Quality Change (After) Measurements (Critical Bus). The following processes are to be used to measure the subsystem power quality values and assess standards compliance on all critical power panels populated with new circuits. This testing is a progressive comparison of power quality characteristics to determine the subsystem’s effect on the facility critical power system. The test will culminate in a revised facilities power panel baseline.

1) Physically connect the equipment to be tested to the critical panel circuit breakers with all new breakers in the “OFF” position and assure that the power quality measurement equipment is connected and functioning.

2) Using the test equipment, observe the steady-state voltage, current, watts and volt-amps, Power Balance, Power Factor (PF), and Total Harmonic Distribution (THD) (voltage and current) as each new breaker is activated. If any test value indicates an out of tolerance condition, then immediately terminate the test and initiate corrective action. Once the final breaker is switched on and all equipment is integrated into each power panel, record the final power quality characteristics, Power Balance, PF, and THD as the new baseline measurements.

(e) Results Documentation. Non-critical bus test measurements and critical bus test measurements must be documented for each new subsystem power panel configuration and stored locally. Branch circuit information, including power quality, is recorded in the FPPS database upon completion of the test procedures.

Chapter 4. Responsibilities

1. Responsibilities.

a. AJE, Director of En Route Program Operations. The Director of En Route Program Operations has the overall responsibility for En Route and Oceanic acquisition services and operational system support for 21 Air Route Traffic Control Centers and two offshore CERAP facilities.

b. Acquisition Office(s). The Acquisition Office is responsible for the preparation of NCPs for identification of required en route facility space, critical power connectivity, development of FIR Checklists for new subsystems, and disposition plans for obsolete interfaces and equipment. The Acquisition Office is also responsible for obtaining any additional authorizations required for prototype space and power use considerations.

c. En Route Facilities Planning and Modernization (AJE-1A). AJE-1A manages the modernization and configuration of all en route facilities, and is the Office of Primary Responsibility (OPR) for this Order. AJE-1A performs future planning and configuration management for en route facilities on a national basis. Future planning includes establishment of standard end-state designs and functions for en route facilities. Configuration management responsibility includes management of en route facility configuration items, including facility space and power in the current, transitional, and end-state, and maintaining currency of all ASRA-related documents.

d. Service Center (AJV), Planning and Requirements (P&R). P&R Service Center teams provide support for development and prioritization of Service Area (SA) requirements, preparation of associated cost estimates, initiation of changes, requesting project seed money and monitoring and management of all SA requirements from initial development to closure.

(1) P&R Resource Planning Team organizations are responsible for all configuration management activities within each respective Service Areas. These responsibilities include operation and management of SA CCBs, coordination of all required SA NCP and Web Configuration Management (WebCM) processes, annual ASRA data updates and coordination of all SA facility baseline drawing activities including yearly on-site audits. As part of the yearly audit, validation of changes made by turn-key and facility projects should be accomplished.

(2) Program Implementation Management Teams are part of AJV, P&R organizations, and are responsible for coordination of all project implementation activities related to the modernization and sustainment of en route facilities.

e. Technical Operations Services (AJW).

(1) Engineering services

(a) En Route Engineering organizations are responsible for construction services, site adaptation, and project management that provides for timely readiness and implementation necessary to accommodate new sub-systems at en route facilities.

(b) Engineering Support Groups are responsible for the update and maintenance of en route facility baseline drawings for incorporation of project implementation and yearly facility audit data, management of the en route facility baseline drawing release process utilizing ProjectWise, and configuration status accounting.

(2) The Power Services Group is responsible for providing electrical power of a quality, reliability and availability that fully supports the operational requirements of NAS. Specific to the en route facilities, the Power Services Group manages, modernizes, and sustains the facility electrical power systems. This responsibility is shared with AJE-1A, with the demarcation of responsibility at the individual power circuit breaker panels. The Power Services Group reviews en route power NCPs and FIR Checklists as must-evaluators. When in the role of an acquisition organization, the Power Services Group is considered to be a development acquisition office and must comply with this Order as such.

f. En Route Facilities and Building Systems Team (EFaBS). The En Route Facilities and Building Systems Team is responsible for making recommendations on behalf of facility stakeholders to AJE-1A relative to en route facilities strategic planning, national level en route facilities configuration management planning and national level transition planning.

g. Headquarters Configuration Control Boards. The ERO CCB performs all en route facility configuration items and CM functions as described in the respective CCB charter and operating procedures. The PSF&I CCB perform CM functions pertaining to critical power bus connectivity at en route facilities.

h. En Route and Oceanic Services (AJE), En Route Field Support. AJE, En Route Field Support at the William J. Hughes Technical Center is responsible for the overall testing of new en route subsystems, including initial power quality tests, and key (or first site) site testing.

i. Facility Managers. Senior-level ATO Facility Managers (AJE Managers and AJW District Managers) are responsible for supporting the day-to-day activities associated with the implementation and integration of new subsystems, as well as the ongoing

configuration management of their facilities and adherence to national standards. In the event of a dispute the ERO and PSF&I CCBs, in coordination with Service Area and Service Center Directors, AJE-1A and the Power Services Group as appropriate must make the final determination. AJW District Managers are responsible for assuring that the FPPS databases are current.

j. ATO Corporate Real Estate Office (AJF-15). AJF-15 provides independent oversight of all ATO space to ensure the proper utilization of all ATO real estate assets, and the appropriate application of space standards and guidelines.

Chapter 5. Administrative Information

1. **Distribution.** This order is distributed in Washington Headquarters at Group level in System Operations (AJR), Operations Planning (AJP), Technical Operations (AJW), En Route and Oceanic Services (AJE), and Finance (AJF); to appropriate levels in the Technical Operations Service Areas; and to all Technical Operations field offices with a standard distribution.

Appendix A. Abbreviations and Acronyms

AJE	En Route and Oceanic Services
A & P	Airspace & Procedures
A/C	Alternating Current
AJW	Technical Operations
AMS	Acquisition Management System
ARBAC	ARTCC Building Automation Controls
ARTCC	Air Route Traffic Control Center
ASRA	Administrative Space Requirements Analysis
ATC	Air Traffic Control
ATCBI	Air Traffic Control Beacon Interrogator
ATO	Air Traffic Organization
BAC	Building Automation Controls
BLD	Facility Baseline Equipment and Administrative Space Layout Drawings
CAEG	Computer-Aided Engineering Graphics
CB	Circuit Breaker
CBI	Computer-Based Instruction
CCB	Configuration Control Board
CCD	Configuration Control Decision
CERAP	Combined Center Radar Approach Control Facility
CFR	Code of Federal Regulations
CI	Configuration Item
CM	Configuration Management
CNS	Communications Navigation and Surveillance
CPC	Critical Power Center
CWSU	Central Weather Service Unit
DCR	Document Change Request
DERG	Domain Enhancements Review Group
DP	Distribution Panel
DYSIM	Dynamic Simulator
EDMS	Engineering Drawing Management System
EFaBS	En Route Facilities and Building Systems
EFPM	En Route Facilities Planning and Modernization
EOF	Emergency Operations Facility
EORB	En Route and Oceanic Requirements Board
ESU	Environmental Support Unit
EOS	En Route and Oceanic Service
ERO CCB	En Route and Oceanic Configuration Control Board
FAC	Facility
FAS	Fire Alarm System
FAST	Federal Aviation Administration Acquisition System Toolset
FCA	Facility Configuration Audit
FEMA	Federal Emergency Management Agency

FIR	Facility Interface Requirements
FIWG	Facility Interface Working Group
FLM	Front Line Manager
FPPS	Facility Power Panel Schedule
GSA	General Services Administration
HQ	Headquarters
HVAC	Heating, Ventilation and Air Conditioning
IRD	Interface Requirements Document
ISD	In-Service Decision
IVT	Interactive Video Training
LAN	Local Area Network
LOB	Line of Business
LRR	Long Range Radar
MCC	Motor Control Center
MCI	Master Configuration Index
MLO	Military Liaison Officer
MOA	Memorandum of Agreement
NAS	National Airspace System
NCO	NAS Coordination Office
NCP	NAS Change Proposal
NEC	National Electrical Code
NEHRP	National Earthquake Hazards Reduction Program
NEOF	National Emergency Operations Facility
NEPA	National Environmental Policy Act of 1969
OMIC	Operations Manager in Charge
OPI	Office of Primary Interest
OPR	Office of Primary Responsibility
OSF	Occupiable Square Feet
OSHA	Occupational Safety and Health Administration
P & R	Planning and Requirements
PCM	Policy and Configuration Management
PF	Power Factor
POC	Point of Contact
PSF&I	Power Systems, Facilities and Infrastructure
QA	Quality Assurance
RMA	Reliability, Maintainability and Availability
SA	Service Area
SEAR	System Enhancement Analysis Request
SLA	Service Level Agreement
SO	Staff Office
SOC	Service Operations Center
SSSATS	Solid State Static Automatic Transfer Switches
THD	Total Harmonic Distortion
TMU	Traffic Management Unit
UBC	Uniform Building Code
UPS	Uninterruptible Power Supply

V-A	Volt-Amp
WebCM	Web Configuration Management
WJHTC	William J. Hughes Technical Center

Appendix B. Related Publications

FAA Orders

Order 1050.1	Policies and Procedures for Considering Environmental Impacts
Order 1053.1	Energy and Water Management Program for FAA Buildings and Facilities
Order 1800.66	National Airspace System Configuration Management Policy
Order 6030.20	Electrical Power Policy
Order 6950.2	Electrical Power Policy Implementation at National Airspace System Facilities
Order 6950.27	Short Circuit Analysis and Protective Device Coordination Study

Configuration Management Standard Procedures

The National Configuration Management Standard Procedure Document for Conducting Formal Configuration Audits of Operational Facilities, distributed 10/12/1999.

Configuration Management of Critical Power Connections and Panel Breaker Assignments, distributed 5/1/2002.

MIL-HDBK-61	Configuration Management Guidance
EIA 649	National Consensus Standard for Configuration Management
ER-GEN-PRO-00	Standard Operating Procedures for the En Route and Oceanic Change Control Process

Configuration Management Enroute Facility Service Level Agreement dated 4/4/2008

FAA Standards

FAA-STD-002	Engineering Drawing Preparation & Support
FAA-STD-019	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities
FAA-STD-025	Preparation of Interface Documentation
FAA-STD-058	Standard Practice - Facility Configuration Management
HF-STD-001	Human Factors Design Standard

FAA Specifications

FAA-G-2100	Electronic Equipment, General Requirements
FAA-C-1217	Electrical Work, Interior

Other

NAS MCI, NAS-MD-001	NAS Master Configuration Index (MCI) Database
NEC	National Electrical Code
Executive Order 13423	Strengthening Federal Environmental Energy and Transportation Management
NFPA	National Fire Protection Act
NEPA	National Environmental Policy Act
42 USC 8252-8261	The National Environmental Policy Act of 1969 (NEPA)
AMS	Acquisition Management System current as of 9/1/2008
ProjectWise	CAEG Drawing Management System

Earthquake Publications and tools

Determining Space Requirements for ATO Service Area Offices and Facilities

Appendix C. Administrative Space Survey/Audit Guidelines

The following tables include space allowance maximums in compliance with FAST AMS Real Estate guidelines. Administrative space is allocated based on the total number of authorized personnel (permanent, temporary, part-time, seasonal employees, and approved FAA contractors) occupying open or closed office work areas.

A. Administrative Primary Office Space

Primary Administrative Space is the personnel occupied area in which an activity's normal office functions are performed.

Note: Office space is not dedicated for non-supervisory Technical Operations and Air Traffic personnel who work rotating shifts.

1. Primary Office Space Allowances

Personnel	Maximum Space Allowance (sq. ft.)	Notes
Senior AT Manager/District Office Manager	192	
Assistant AT Manager/GNAS Manager	150	
Supervisor	120	Includes ATO Supervisors, SSC Managers, Contractor Supervisors, POFM, Ops Managers, Training Mgrs, Staff Managers
Staff	64	Includes: Admin Officers, Personnel Officers, Senior Management Analyst, Program Analyst, Coordinators, Automation Specialist, Telco Specialist
Contractors	64	All contractor staff

2. Primary Office Space Allowances for Shift Workers and Contractors

Personnel	Maximum Space Allowance (sq. ft.)	Notes
Front Line Managers (FLMs)	120 per functional area	Multiple, Shift work, one shared desk per Area
Contract Training Instructors	64	Multiple, part-time, one shared desk per 4 instructors
All other shift workers	64	Multiple, shift work, one shared desk per 3 employees

NOTE:
Office space for union activities at the facility is allowable per negotiated bargaining agreements. There is no mandate to provide space, but is allowable per local agreements with the bargaining unit.

3. Special Allowances

Function	Maximum Space Allowance (sq. ft.)	Notes
Cartographer	300	
QA Team (Playback Room)	100	
FAST Workroom	200	
FAST Test Lab	120	
FAST Storage	110	
Computer Specialist	100	

4. Training Space Allowances

Function	Maximum Space Allowance (sq. ft.)	Notes
AT CBI	500	
AJW CBI	200	
AT Classrooms	See below	
AJW training storage	100	
AT training storage	100	
Manual Lab/Classroom	400	
DYSIM	Based on Current Operational and Program Requirements	
Debrief Area	125	

NOTE:
Classroom allocation is calculated by applying a Training Space Formula as follows: S = A (W)/52, where S = square feet of space, A = number of square feet allowed per student and W = annual training load in student weeks. Normal classroom size should accommodate 12 students, an instructor and AV equipment.

5. **Operational Support Space** Operational support space is defined as space dedicated to support the direct functions of the AT Operations Floor and employees assigned ATC Operations particular functions. That space may include:

Function	Maximum Space Allowance(sq ft)	Notes
Dining Area	2000	
AJW break/ready room	400	
AJW drafting workroom	64	
Nursing mother's room	100	
AJE reading/break room	600	
OMIC counseling area	100	
Controller briefing rooms	110 square feet per Area	660 square feet for 6 areas and 770 square feet for 7 Areas

NOTE:
Nursing Mother's Room is provided in accordance with the Patient Protection and Affordable Care Act (PPACA) section 4207.

6. **Locker Rooms**
Locker Room allocations were calculated assuming all ATO personnel not assigned permanent administrative space are allocated locker space, and individual locker space is allocated on the basis of a 1 ft x 1 ft locker plus a 1 ft x 3 ft standing area which equals 4 square feet. The allocation also includes a 4 foot aisle between the lockers.

B. Restrooms

The restroom space allocations are determined from existing available restroom space at each facility. Per Uniform Building Code (UBC) specifications it has been determined that each facility has more than adequate restroom facilities to satisfy requirements based on population and/or square footage.

C. Storage Space

Storage space that is classified as "Special Space" is that which is not constructed to office type standards and is only suitable for storage purposes. This type of space generally consists of concrete, woodblock, or unfinished floors, bare block or brick interior walls; unfinished ceiling; and similar construction containing minimal lighting and heating including: supply rooms, storerooms, and file rooms that are not finished to office standards. Storage space is typically located in the basement or garage of a building.

Function	Maximum Space Allowance (sq. ft.)	Notes
Logistics Storage	4500	

Appendix D. Facility Interface Requirements Checklist

Facility Interface Requirements (FIR) Checklist Content requirements

- Develop/submit draft FIR Checklist including all of the applicable requirements listed in Physical requirements, Subsystem Power testing, Facility Power Panel Schedule Power Requirements NCP and Administration Space requirements.

- A sample checklist is included in Appendix 4 for guidance.

- Submit FIR Checklist along with all supporting documentation to AJE-1A for review and approval.

Physical Requirements

- Space[1]
  - Sample Space Distribution Diagram (Figure 1)
  - User Subsystem Space Requirements Table (Figure 2)
  - ARTCC Facility-to-User Subsystem Interface Diagram (Figure 3)
- Electrical[2]
  - Inrush current and power factor requirements
  - Load balance requirements
  - Harmonics requirements
  - Overload protection requirements
  - Grounding and bonding
  - Input power conditions
  - Electrical power availability/maintainability requirements
  - Critical/Essential Bus requirements
  - Single-line wiring diagrams
- Environmental[3]
  - Thermal/Cooling requirements
  - Noise level requirements
  - Lightning requirements
- Project Unique Requirements[4] (Figure 4)
  - Structural requirements
  - Grounding, shielding, lightning protection
  - Power conditioning requirements
  - Raised floor requirements
  - Cable length limitations

[1] Per FAA-STD-025, Paragraph 4.6.4
[2] Per FAA-STD-025, Paragraph 4.6.5 and FAA-G-2100
[3] Per FAA-STD-025, Paragraph 4.6.6, and FAA-G-2100
[4] Per FAA-STD-025, Paragraph 4.6.7

Subsystem Space Requirements NCP[5] (ERO CCB)

- Case File based on the space requirements specified in the FIR Checklist.
- Attach a copy of the approved FIR Checklist with supporting documentation.
- Attach a copy of the impacted baseline drawing(s) or end-state drawing(s) or a detailed sketch of proposed equipment location.
- Attach the Safety Risk Management Decision Memo.

Facility Power Panel Schedule (FPPS)[6] NCP (ERO CCB)

- Identify and document the appropriate Facility Critical Power Panel(s).
- Identify and document the appropriate breakers.
- Update FPPS Database with the subsystem name and power panel name as required.
- Attach the Safety Risk Management Decision Memo.

Critical Power Requirements NCP (PSF&I CCB)

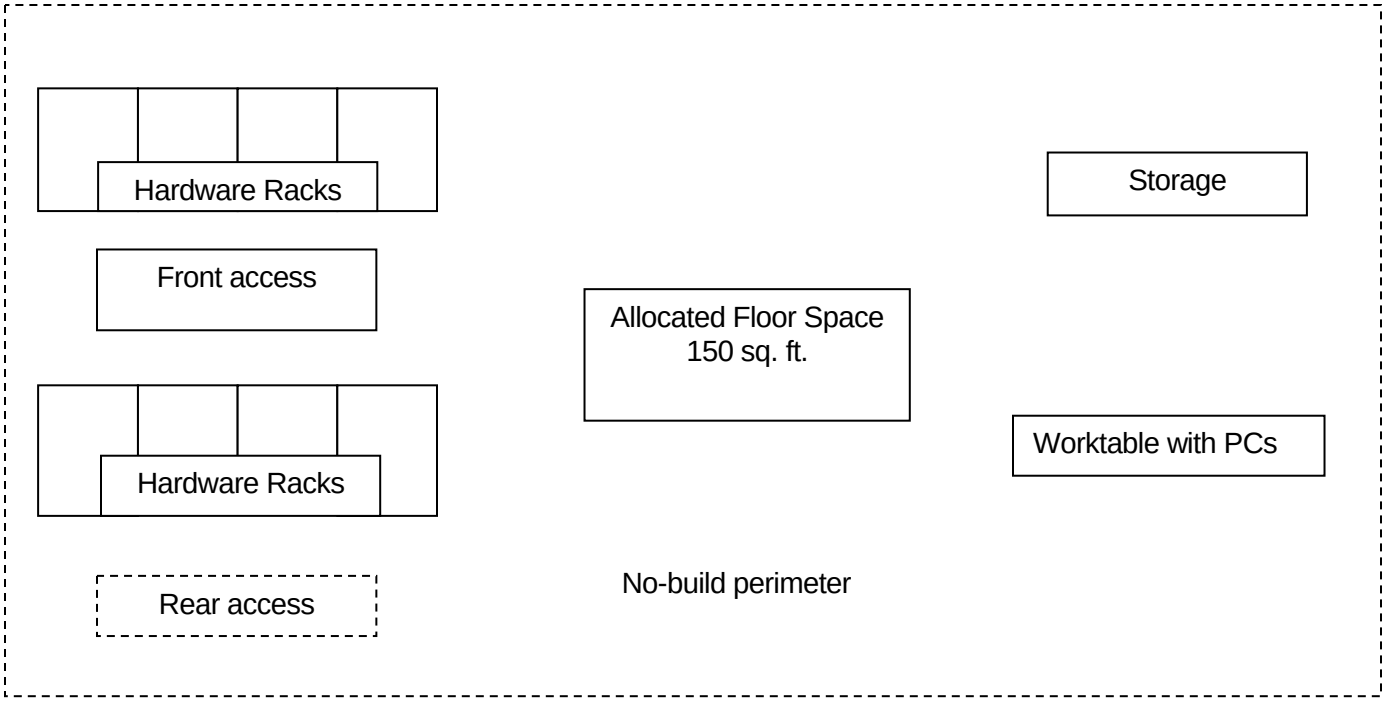
- Reference/Attach the WJHTC Critical Power Bus Test Report.
- Attach a copy of the impacted Baseline Drawing(s).
- Attach the Safety Risk Management Decision Memo

Administrative Space Requirements[6] SEAR/NCP (DERG/ERO CCB)

- Administrative Space Allocation requirements per appendix 3 in Order 6470.33B.
- For new administrative space requirements requiring the relocation of personnel a business case must be submitted to AJE-1A for review and approval per 6470.33B, paragraph 18c (1).
- Attach a drawing or sketch of the impacted area to the relevant business case, SEAR or NCP as appropriate.
- Attach the Safety Risk Management Decision Memo for all NCP requests

5 See Figure 5.1, Change Management Flow in ER-GEN-PRO-00
6 Based on Order 6470.33B, Appendix 3

FIR Checklist Space Provisioning

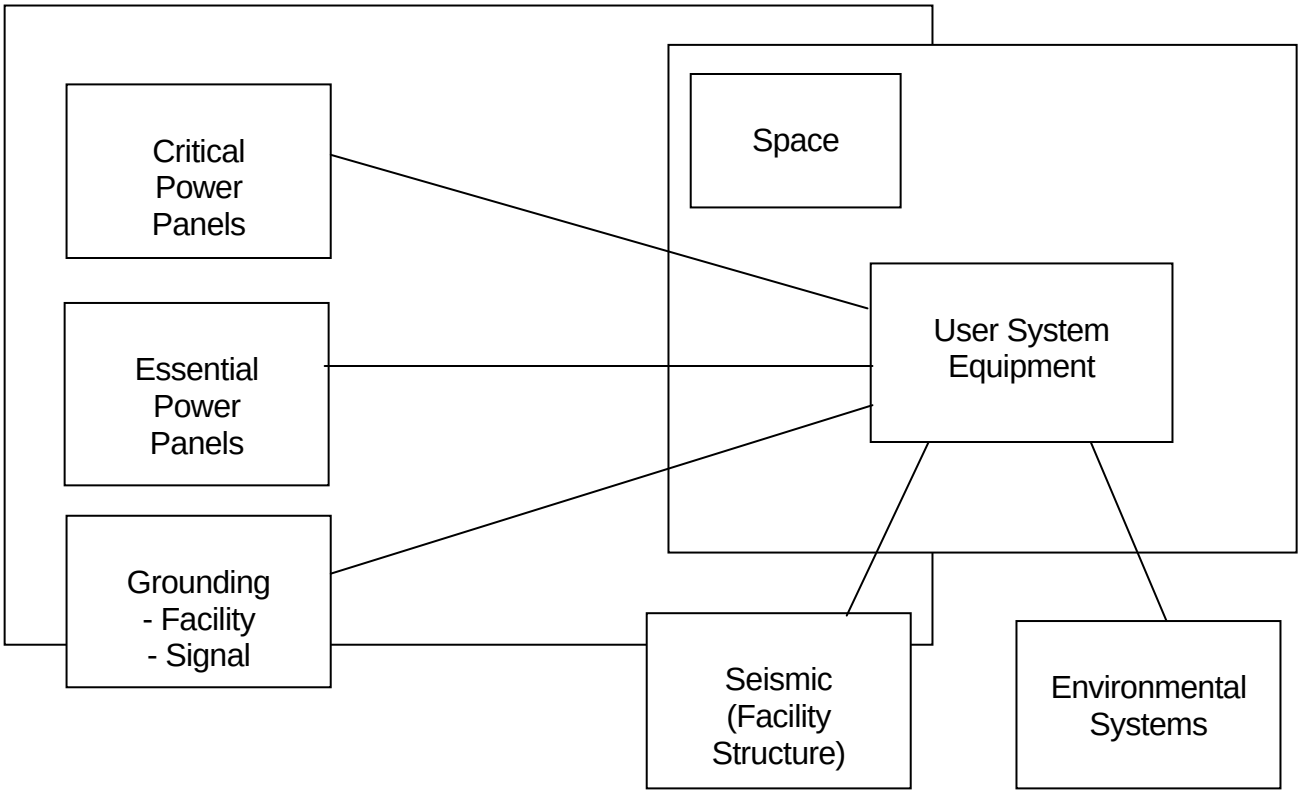


(Sample Space Distribution Diagram Figure 1)

Qty.	Width (inches)	Depth (inches)	Height (inches)	Front Clear (inches)	Rear Clear (inches)	Unit Space (sq. ft.)	Total Space* (sq. ft.)	Weight

* Includes all access and "no-build" buffer space.

(User Subsystem Space Requirements Table Figure 2)



(ARTCC Facility-to-User Subsystem Interface Diagram Figure 3)

Project-Unique Requirements

Category	Requirement	Applicable Document	Special Instructions/ Designs
Structural	Seismic		
	Life/Safety & Fire Protection		
	Floor Loading		
	Room Access		
	Sound/Vibrations		
Ground/Shielding/Bonding	Facility		
	Signal		
	Multipoint		
	Single-point		
Lightning/ Transient Protection			
Power Conditioning			
Raised Floor			
Cable Length Limitations	X.25		
	RS-232		
	Ethernet		

(Sample Unique Requirements Table Figure 4)

NOTE: The “Category” and “Requirement” columns have typical items in them, and are not all inclusive.

Facility Power Panel Schedule Assignments Table

FAC Type	FAC ID	Subsystem Name	Power Panel Name	Room Number	Building Location	Wall	Panel Breaker(s)
ARTCC	ZAU	FDIO	C10AD	10A	AUTO BSMT	E	CB 7,9,11

(Sample FPPS Table Entries Figure 5)

NOTES:

1) If an appropriate power panel is not available, the subsystem acquisition office will be responsible for the installation cost of providing new panel(s).

2) Power Panel Name should be part of the initial power NCP for the subsystem.

FIR Checklist

Requirement	Applies	Doesn't Apply
Space Factors		
Sample Space Diagram		
User Subsystem Space Requirements		
ARTCC Facility-to-user Subsystem Interface Diagram		
Electrical Factors		
Inrush current and power factor requirements		
Load balance requirements		
Harmonics requirements		
Overload protection requirements		
Grounding and bonding		
Input power conditions		
Electrical power availability/maintainability		
Critical/Essential Bus Requirements		
Single Line Wiring Diagram		
Environmental Factors		
Thermal/cooling requirements		
Noise level requirements		
Lighting requirements		
Unique Factors		
Structural requirements		
Grounding/shielding/lightning protection		
Raised floor requirements		
Cable length requirements		

NOTES:

1) Refer to Appendix 4 in FAA Order 6470.33B for additional guidance.

2) Only attach documentation for those issues that are marked as "Applies".