Change 22
16 May 2003

APPENDIX K
ARMY AVIATION FACILITIES

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1. GENERAL.

a. General and Specific Criteria. The specific criteria contained in this appendix are applicable to the design of Army aviation facilities. The general criteria contained in the preceding chapters also apply, except as modified by this appendix. Therefore, this appendix must be used with the chapters contained in this document.

b. Aviation Facilities. Army airfields and heliports are examples of a large aviation facility. Helipads and short fields are examples of small aviation facilities. Aviation Facilities are supported by a network of four distinct functional land use areas. The four land use areas consist of the:

1) landing and takeoff area
2) aircraft ground movement and parking area
3) aircraft maintenance area
4) aviation operations support areas.

c. The landing and takeoff area is a required land use area. However, the rest of the land use areas are not necessarily required to make the aviation facility complete and usable (operational). A general description of each land use area is provided later in this Appendix.

c. Planning and Technical Criteria, UFC 3-260-01 (reference K-1), Support Facility Annexes (SFAs), and the Master Planning Instructions (MPI) (reference K-~~3~~2), will be consulted whenever planning Army aviation facilities. The tri-service criteria contained in UFC 3-260-01 should be used when planning Power Projection Platforms for Crisis Response because aircraft of all military services may be using Army facilities. (See MPI Chapter 6 for instructions regarding the mobilization component.) SFA 95 should be used when planning Tactical Unmanned Aerial Vehicle (TUAV) facilities.

d. Aero Clubs. Criteria for aero clubs are provided in Appendix D.

e. Land Area. Aviation facilities need substantial airspace and land area for safe and efficient operation and to accommodate future growth or changes in mission support (Also see MPI Chapter 3). Facilities in direct support of aircraft operations and maintenance should have sufficient land area for expansion because of the changing equipment and training needs in support of Force Modernization from the Legacy Force to the Objective Force.

f. Functional Proponent. The functional installation proponent responsible for developing the scope and requirements for Army aviation facilities is usually assigned to the Aviation Division, Directorate of Plans, Training and Mobilization (DPTM) of the installation staff or the Operations Section (G/S-3) of the senior aviation organization. At locations where there is no DPTM or G/S-3 office, facility planners must coordinate with the commander of the aviation unit(s) to be supported. The DPTM, as primary functional proponent, is responsible for determining mission support requirements for aviation facilities, operations, safety and air traffic.

g. Facility Planning System (FPS).

(1) The FPS provides military planners with the means to compute facility space allowances for 37 category codes for TOE units, 21 category codes for TDA organizations and 27 category codes under mobilization criteria. These category codes represent the most frequently occurring unit-driven facilities. Computations are based upon the Table of Organization and Equipment (TOE) or the Table of Distribution and Allowances (TDA) for

each organization examined. Facility allowances are calculated in accordance with current Army planning criteria as provided in the Army Criteria Tracking System (ACTS). In addition to computing facility space allowances, FPS provides military planners with other capabilities, e.g., to obtain a personnel and equipment list for an organization, or to search personnel or equipment lists for MOSs, LINs, or keywords, or to search TOE/TDA titles for keywords.

(2) Systems Interface. The FPS is no longer available under the PAX menu. FPS is available through the INTERNET at http://rkeng.com/. The primary source data used by the FPS are the TOE documents (from TRADOC), the TDA documents (from DA), and category code criteria (from ACTS). The FPS is designed to function as a stand-alone system. A link to the Support Facility Annex (SFA) application alerts FPS users to the presence of SFA reports applicable to the TOEs entered for FPS analysis. Allowances calculated by the FPS are used to support ACTS, RPLANS and HQRPLANS. Proponency transitioned to the Assistant Chief of Staff for Installation Management on 1 October 1996. In some cases, SFAs are also available from the USACE proponent for those systems not included in FPS. A listing of additional SFAs is available from the Project Manager, Engineering Services, HQUSACE (CRST), 441 G St, NW, Washington, DC 20314-1000; 202-761-8817; or email: gordon.g.velasco@usace.army.mil, pending re-establishing electronic linkages to revised SFAs under the Army System-of-System Management/Unit Set Fielding initiative.

(4) ACSIM Points of Contact for HQRPLANS, RPLANS, ACTS, and FPS, :

Program Integration Office
Randy Klug, Acting Chief 703 692-9219
Randy.Klug@hqda.army.mil

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Stu Grayson, Program Integrator 703 428-6012
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h. Support Facility Annexes (SFA). The SFA identify impacts associated with the fielding of new aircraft and aircraft support equipment. These impacts usually affect about 70 percent of the facilities identified in this appendix. SFAs may be obtained as described in paragraph 1.g(2) above.

2. FUNCTIONS OF AN AVIATION FACILITY.

a. General. The aviation facility should be organized to permit operational efficiency and to provide safe conditions for takeoff/landing operations and ground movement of aircraft. The boundaries of the operational, safety, and environmental (noise) clearance areas should be depicted in accordance with references K-1 through K-2 to ensure that subsequent facility sites will not be in violation of these clearance areas which could render the facility inoperable. Master planning of the land use areas must also ensure that expansion of operational capabilities are maintained while encroachment from activities on and off post are minimized.

b. Description. The description of the functional activities within each aviation facility and the allowance of facility types within each area follow a sequential analysis process. This sequence should be followed closely because horizontal and vertical operational safety clearances must be applied to each area prior to addressing the next. As an example, a well-designed hangar is functionally excellent but was improperly sited and constructed too close to an active runway. The facility is now in violation of basic safety clearance criteria. A waiver may be requested for this example; however, waivers are temporary in nature and may not be granted when they jeopardize the certification of the airfield.

c. Airside and Landside Facilities. The descriptions provided below are intended to highlight the major areas associated with the aviation airside and landside facilities. The airside facilities are necessary to ensure safe aircraft operations and control in flight and on the ground. The landside facilities are necessary to support general aviation support activities. The areas are not intended to be all-inclusive.

(a) Airside Facilities

(1) Landing and Takeoff Area.

(2) Aircraft ground movement and parking areas.

(d) Landside Facilities.

(3) Aircraft maintenance areas.

(4) Aviation Operations support areas.

(2) Required facilities within these areas, by construction category code types, are dependent upon the aviation mission(s) and organization(s) to be supported. The scopes of these facilities are dependent upon the fielding of equipment or materiel (type, size, and amount) that belong to that organization.

(3) Each facility area includes ancillary equipment and infrastructure support requirements that are usually provided along with that area such as navigational aids and lighting.

d. Aviation Module Development Methodology. The methodology, rationales, and considerations used to develop the space modules for this appendix are provided in Section 7 - Aviation Module Development Methodology. Section 7 provides a general perspective in determining the functions that were considered and included in the lump space for the modules. The methodology may also be applied in cases were no criteria exist to support changes in materiel fielding or special requirements.

3. LANDING AND TAKEOFF AREA.

a. General. The landing and takeoff area is comprised of the landing/takeoff surface (either a runway, , short field, training assault landing zones, helicopter landing lane , helipad -, or hoverpoint (Category Code 111). Ancillary support necessary to maintain safe operations may include navigational aids (NAVAIDS) (Category Codes 133 and 134), airfield lighting (category code136) air traffic control (ATC), communications, lighting, utilities, and physical security. These types of facilities are normally required for Army Airfields (AAF) and Army Heliports (AHP) and are optional for helipads and hoverpoints. This area also includes numerous vertical, horizontal and airspace mandatory safety clearances and environmental zones. Airspace criteria is defined in UFC 3-260-01(Reference K-1).

(1) The Aviation Division, Directorate of Plans, Training and Mobilization (DPTM) of the installation staff has general responsibility for determining the adequacy of the facilities comprised in this area. .

(2) AAF supports both fixed-wing and rotary-wing operations. AHP support only rotary-wing operations. When support to both types of operations is required, an AAF will be provided. An AHP will suffice only if rotary-wing aircraft support is required. AAF and AHP combinations may be required to enhance operational safety and efficiency at a facility with large numbers of air traffic operations. Facilities supporting initial flight training will normally augment AAF and AHP with training assault strips due to the air traffic density and increased

need for safety in a training environment. An AAF nor a AHP will be provided specifically for Unmanned Aerial Vehicle operations.

b. Flight Control Tower (Category Code 133-10).

(1) One control tower will be provided for each airfield or heliport qualified in accordance with AR 95-2 (reference K-3 -).

(a) Standards for control towers can be obtained from ATZQ-ATC-F B.

(b) The recommended control tower design to be used is the Fort Huachuca Control Tower, File Number 223-25-360, SPK Specification 5422, dated 15 April 1980 (reference K 5) available from the Sacramento District Engineer Office but modified to meet the requirements contained in TB 95-1 (reference K- 4).

(2) The siting and height of the tower cab will be such as to permit a clear view of the entire runway and taxiway system. Control towers may be combined with airfield operations buildings or fire and rescue stations, or both.

(3) At facilities where direct weather support is provided by a U.S. Air Force (USAF) Air Weather Service (AWS) detachment, a separate floor of the control tower may be modified or added to house a representative weather observation station (RWOS) with 37 m^2 [400 ft^2] gross area. An observation platform or catwalk may be provided around the exterior of the RWOS floor.

c. Airfield Operations Buildings (Category Code 141-10).

(1) Functional Areas. An airfield operations building will be provided to house the flight operational and administrative functions of the airfield headquarters. Descriptions of the functions and corresponding space allowed in this type of facility are contained in Attachment 3 of UFC 3-260-01 (Reference K-1) and from ATZQ-ATC-FB.).

(2) Location of the Facility. The airfield operations facility may be provided in a separate building; combined with the flight control tower and/or a fire and rescue station; or in some cases, located in administrative spaces of a hangar.

(3) Space Requirements.

(a) Actual space requirements for each facility will be based on a local survey of needs. The office floor area per building occupant will be based on the number of personnel assigned office space and personnel authorizations, and the criteria contained in Attachment 3 of UFC 3-260-01 (Reference K-1) and from ATZQ-ATC-FB.). Special purpose rooms, such as briefing, communications, conference, plotting, and transient waiting will be justified separately by operational requirements. Personnel requiring locker space, but not assigned office space, will not be included as building occupants when computing office space.

(b) Special facility requirements, such as AWS and the flight surgeon, when provided as direct support at an airfield, will be included as indicated in Attachment 3 of UFC 3-260-01 (Reference K-1) without regard to the number of personnel assigned to the special unit.

(c) For planning purposes only, Table K-1 provides the approximate sizes of airfield operations and headquarters buildings without AWS detachment and flight surgeon spaces.

TABLE K-1 AIRFIELD OPERATIONS AND HEADQUARTERS BUILDINGS		
NUMBER OF ASSIGNED AIRCRAFT	GROSS AREA [1]	
	square meters	(square feet)
25 or less	204.5	(2,200)
26 - 50	279	(3,000)
A division and up to 25 additional miscellaneous aircraft.	492	(5,300)
Note [2]	1022 to 1858	(11,000 to 20,000)

[1] Mechanical, electrical and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.
[2] At airfields with approximately 60 personnel and which provide interim facilities for USAF air operations during airlifts, serve other USAF and Army aviation missions, and houses a medical evacuation team. The actual gross area will be based on a detailed survey of requirements.

d. Airfield Fire and Rescue Stations (Category Code 141-11).

(1) General. Army airfield facilities and flight operations will be supported by fire and rescue equipment. The gross areas indicated below will not be exceeded unless the facility has an additional fire protection mission or requirement for special rescue equipment to be stationed in the vicinity of the airfield, and it is economically sound to develop a consolidated or expanded facility.

(2) Space Allowances. One station capable of accommodating equipment apparatus and personnel authorized under the standards set forth in AR 420-90 (reference K-6) will be provided. One-company, two-stall stations will have 280 m^2 [3,000 ft^2] gross area, including mechanical equipment room space. Two-company, three-stall stations will have 430 m^2 [4,600 ft^2] gross area, including mechanical, electrical and electronic equipment room spaces. Standby facilities, when authorized, will be provided at auxiliary locations.

(3) Siting.

(a) Siting of Fire and Rescue Stations. The siting of fire and rescue stations must permit ready access of equipment onto the aircraft operational areas and the road system serving airfield facilities. A site centrally located, close to the midpoint of the runway and near the airfield operations area and air traffic control tower is preferred.

(b) Siting of Rescue and Ambulance Helicopters. With the increasing use of helicopters for emergency rescue and air ambulance service, consideration should be given to providing an alert helicopter parking space on the ground near the fire and rescue station. This space may be located as part of the fire and rescue station or in a designated area on an adjacent aircraft parking apron.

(4) Parking. Privately-owned-vehicle (POV) parking spaces for exclusive use by assigned station personnel will be provided adjacent to each station.

e. Representative Weather Observation Station (RWOS). (Category Code 141-15.)

(1) A RWOS may be required where a USAF AWS detachment is assigned to an airfield for making continued weather observations that are critical to the takeoff and landing operations of aircraft.

(2) The location and requirements for a RWOS will vary at each airfield depending on the results of a survey conducted by the USAF AWS. The location may be a jointly used control tower, rooms in the tower, a separate building, or rooms in an existing building that provide sufficient space for the functions and equipment.

f. Aircraft Lighting Equipment Vault (Category Code 136-40). A single vault, not to exceed 44.5 m^2 (480 ft^2) gross area, will be provided for fixed-wing runway or separate heliport lighting equipment. A combination vault not to exceed 70 m^2 (750 ft^2) gross area will be provided where both fixed-wing runway and heliport lighting is provided. The area may be increased when a standby generator for the airfield lighting system is authorized.

g. Navigation Building, Air (Category Code 133-20). A facility which houses designated types of equipment systems for the exchange of information between airfields and aircraft. Also included are air traffic control facilities which provide approach control services to aircraft arriving, departing, and transitioning the airspace controlled by the airfield or heliport. Unmanned structures containing regulators, relays, emergency generators, service feeder switches, and secondary control panels for lighting at airfields or heliports are also included. Space allowances for Air Navigation buildings are shown in Table K-2.

TABLE K-2 SPACE ALLOWANCES FOR AIR NAVIGATION BUILDINGS

BUILDING TYPE	BUILDING DESCRIPTION	GROSS AREA	
		square meters	[square feet]
0	Equipment room only	14.4	[156]
1	Equipment room plus one (1) generator	32.1	[344]
2	Equipment room plus two (2) generators	42.3	[452]
3	Equipment room plus three (3) generators	52	[560]

h. Radar Buildings (Category Code 133-40). Normally, space for radar equipment is provided in flight control towers. However, when a different location is required, 21 m^2 [225 ft^2] net area will be provided within another building or 25 m^2 [270 ft^2] gross area will be provided in a separate radar building.

i. Aviation Unit Operations Buildings (Category Code 141-12). Aviation units require administration and training support facilities in addition to maintenance shops. This space is provided in the hangar basic shop space allowance. Normally, a separate aviation unit operations building will not be provided for miscellaneous aircraft. In such cases, the administration space requirements should be accommodated in the hangar space.

j. Aircraft Runway Holding Apron (Warm-up Pads) (Category Code 113-50). A paved surface which provides an aircraft holding area that is accessible from a taxiway. Normally, it is located adjacent to the connecting taxiway between the runway and parallel taxiway located at the ends of runways. It is providedfor pre-takeoff engine and instrument checks. From an operational point of view, an apron includes the prepared surface, stabilized shoulders, lighting and lateral clear zones. For inventory purposes, only the prepared surface is included. Aircraft (engine run up) holding aprons are authorized for each runway. The area for the holding apron will be sized to accommodate those assigned and transient aircraft which normally use the runway and should not exceed 3135m^2 [3,750 yd^2] each, without submitting special justification. Holding aprons are usually programmed with, and as a part of, the parallel taxiway system. Figure K-1 provides a sketch indicating aircraft runway holding aprons to runway relationships.

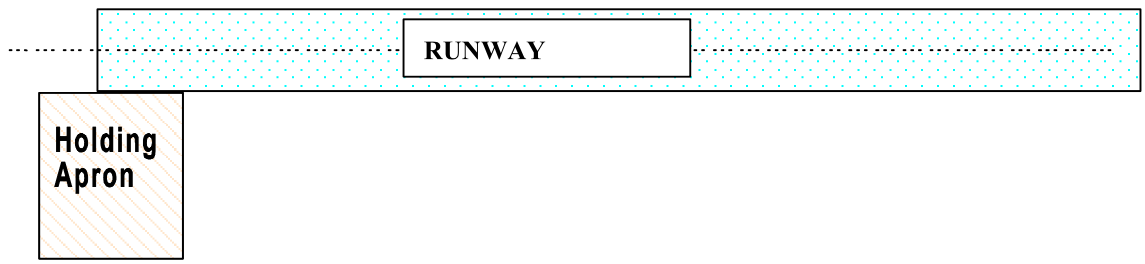


Figure K-1

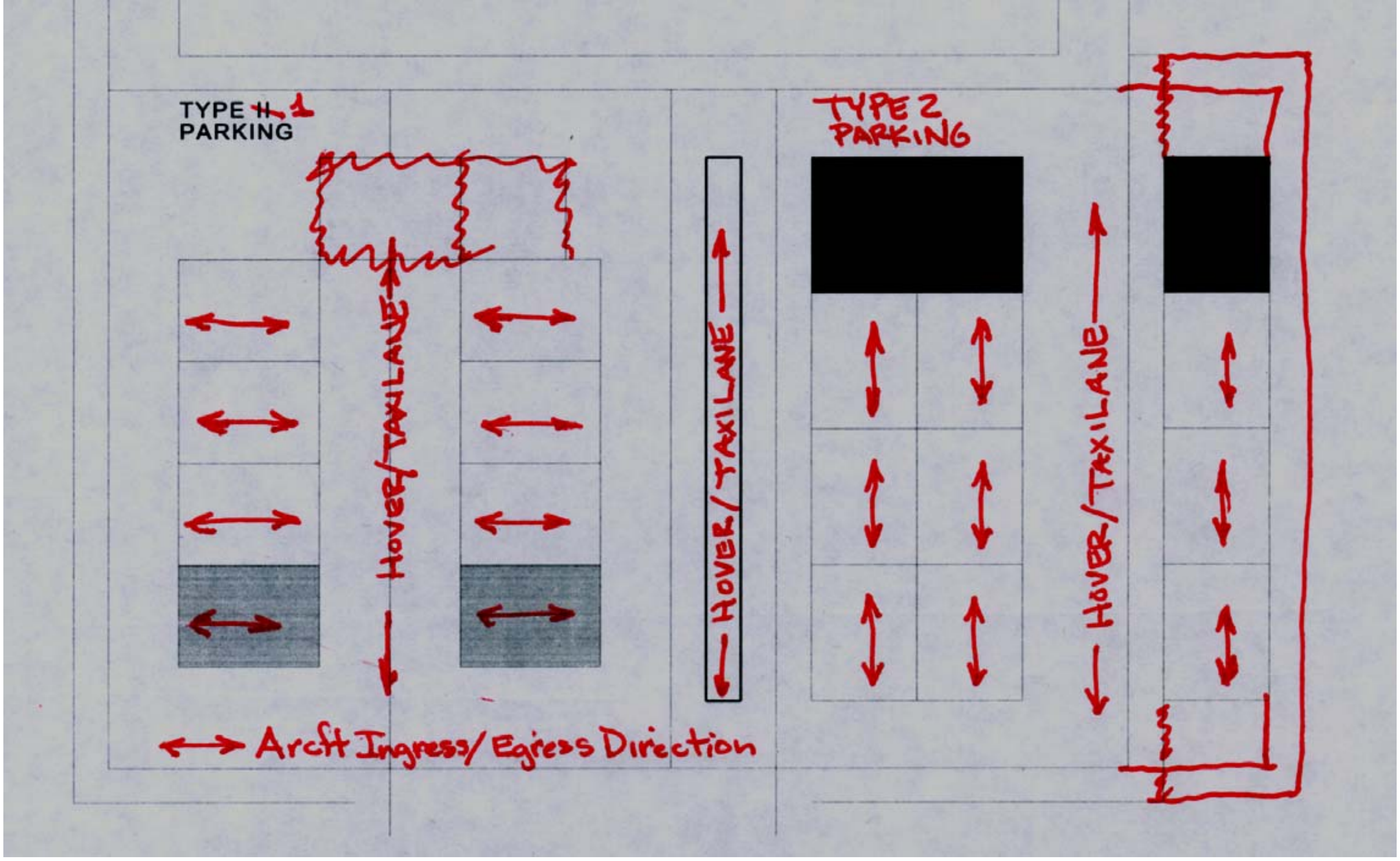
4. AIRCRAFT GROUND MOVEMENT AND PARKING AREAS.

a. General. The aircraft parking area is normally a unit support function and is divided into two major types of parking aprons, fixed and rotary. A modular approach should be utilized for determining the scope of this area which is comprised of parking pads, and hover/taxilanes. The parking areas should be designed and constructed as a continuous mass parking area of concrete composition with each pad and lane identified by painted markings. This parking area must be separated from the nearest fixed or mobile object based on wingtip clearance, as discussed in Chapter 6 of UFC 3-260-01 (Reference K-1). The size of the aircraft parking apron will be based on the type of aircraft, parking module size and parking arrangement, as discussed in Chapter 6 of UFC 3-260-01 (Reference K-1).

b. Fixed-wing Aircraft Parking Modules. Parking modules for fixed-wing aircraft are normally based on the C-12 J (Huron) with a wing span of 17 m [55 ft] and a length of 18.25 m [60 ft]. However, mission requirements may require different aircraft dimensions. Criteria for module clearances and taxilanes are found in Chapter 6 of UFC 3-260-01 (Reference K-1).

c. Rotary-wing Aircraft Parking Modules. Individual parking modules for rotary-wing aircraft are based on the type of aircraft and type of parking arrangement. The module size for a Type 1 parking arrangement for all rotary-wing aircraft except the CH-47 is 30 m [100 ft] long by 25 m [80 ft] wide.   The module size for a Type 2 parking arrangement for all rotary-wing aircraft except skid aircraft is 50 m [160 ft] long by 30 m [100 ft] wide. The module size for a Type 1 parking arrangement of CH-47 aircraft is 30 m [100 ft] wide by 46 m [150 ft] long. The module size for a Type 2 parking arrangement of skid aircraft is 30 m [100 ft] wide by 25 m [80 ft] long.

Figure K-2



d. Parking Arrangement. Rotary-wing aircraft are parked in one of two configurations, referred to as Type 1 or Type 2. In the Type 1 configuration, rotary wing aircraft are parked in a single lane, which is perpendicular to the taxilane. When parked in this configuration, the parking arrangement resembles that of fixed-wing aircraft. This parking arrangement is preferred for wheeled aircraft. In the Type 2 configuration, rotary-wing aircraft are parked in a double lane, which is parallel to the taxilane. This parking arrangement is preferred for skid-gear aircraft. (Figure K-2 provides sketches indicating aircraft parking configurations (Not to scale).

e. Hover/ Taxilanes. Taxilane widths for fixed-wing aircraft will be based on the wing span of the aircraft. Interior taxilane widths for fixed-wing aircraft will be the wing spans of the aircraft plus 6 m (20 feet) for aircraft with wing spans up to 33.5 (110 feet) and 9.1 m (30 feet) for aircraft with wing spans of 33.5 m (110 feet) or more. Through or peripherad taxilanes widths for fixed-wing aircraft will be the wing span of the aircraft plus 9 m (30 feet) for aircraft with wing spans up to 33.5 (110 feet) and a minimum of 15.2 m (50 feet) for aircraft with wing spans of 33.5 m (110 feet) or more. Interior Hover/ taxilane widths for rotary-wing aircraft will be 40 m (120 feet) for all aircraft. Peripheral Hover/ taxilane widths will be 36 m (85 feet) for all aircraft. All the parameters of aircraft design and the associated safety clearances determine the width of the Hover/ taxilanes. The length or depth of the hover/ taxilanes is dependent on the depth of the parking apron relative to the landing surface . Additionally, a hover/ taxilane should be provided on the exterior sides of the parking apron for unobstructed movement of aircraft, whenever feasible.

f. Mooring and Grounding Points for Mass Parking Areas and Hardstands.

(1) General. Provisions will be made to moor aircraft at Army airfields and heliports through the use of tie-down anchors installed for this purpose in parking areas and hardstands.

(2) Fixed-Wing Facilities. Mooring points for fixed-wing aircraft will be installed in mass parking apron areas. Mooring points should be located as recommended by the aircraft manufacturer or as required by the facility.

(3) Rotary-Wing Facilities. Moored parking spaces will be provided for 100 percent of the authorized aircraft. The combined total of apron parking space and hangar parking space should provide sufficient parking for wind protection for all the facilities authorized aircraft and typical transient aircraft. Additional parking spaces with mooring points may be added as necessary to ensure wind protection for all aircraft. The location of these

additional mooring points can be on pavements other than parking aprons. Each rotary-wing aircraft parking space will have six mooring points spaced in a rectangular configuration. Additional discussion on mooring points is found in Attachment 12 in UFC 3-260-01 (Reference K-1).

(4) Both Fixed and Rotary-Wing Facilities. Where it is anticipated that both fixed- and rotary-wing aircraft will use a mass parking apron area, the spacing and configuration of mooring and grounding points for rotary-wing facilities is discussed in Attachment 12 of UFC 3-260-01.

(5) Detail Requirements. Detail information on mooring and grounding point materials castings, requirements, etc is found in Attachment 12 of UFC 3-260-01.

5. AIRCRAFT MAINTENANCE AREAS.

a. General.

(1) The aircraft maintenance area is required when aircraft maintenance is to be performed regularly at an aviation facility. The same modular concept utilized in the preceding paragraphs should be applied to this area. The maintenance concept for aircraft is divided into three levels as follows:

(a) Aviation Unit Maintenance (AVUM).

(b) Aviation Intermediate Maintenance (AVIM).

(c) Depot Maintenance.

(2) For the purposes of this appendix, only AVUM and AVIM requirements are described. However, modifications specific to depot level activities can be accomplished by referencing the methodology described in Section 7 - Aviation Module Development Methodology.

(3) The aircraft maintenance area includes, but is not limited to; aircraft maintenance hangars, special purpose hangars, hangar access aprons, weapon system support shops, aircraft system testing and repair shops, aircraft parts storage, corrosion control facilities and special purpose maintenance pads. The aircraft maintenance area includes utilities, roadways, fencing and security facilities.

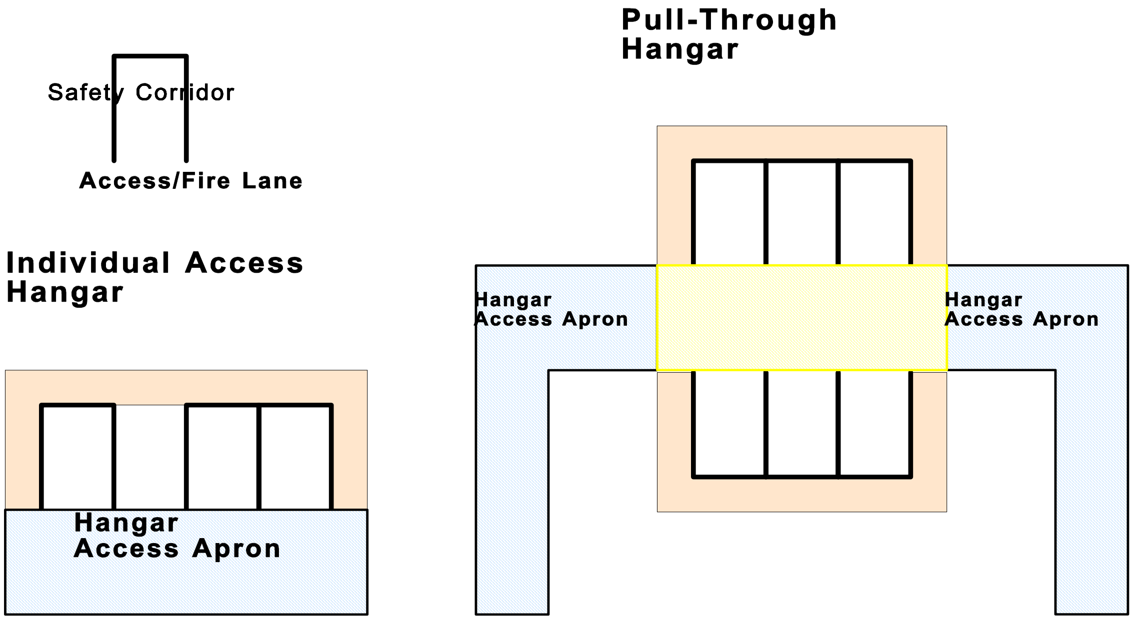
(4) Functional requirements and associated space allowances are based on the unit or units to be supported within the hangar. There is a significant difference in the type, orientation, and quantity of space required between AVUM and AVIM functions. Consolidated hangars (more than one unit within a single hangar structure) should be limited to units with like type maintenance capabilities. Where a single unit has both AVUM and AVIM capability, close coordination with the using agency throughout the planning, design, and construction phases is required. A method of determining the space allowances for a hangar is furnished below for the major hangar components described in the Space Requirements Analysis. This method includes computation algorithms and instructions for each step.

b. Hangar Bay Modules. The maintenance level to be performed is determined by the inherent maintenance capability of the organization or activity, overall aircraft dimensions to be supported, landing gear configuration or type, and number of main rotor blades or wing span. Hangar floor space will be determined by multiplying the authorized number of aircraft maintenance spaces times the aircraft space module for each type of aircraft and then adding the required aircraft and fire access space and a 1.5 m [5 ft] wide perimeter safety corridor to circumvent the area.

(1) Access Lanes.

(a) Aircraft and fire access lanes should be 20 m [65 ft] wide for multi-blade rotary-wing or fixed-wing aircraft hangars, and 10 m [30 ft] wide for UH-1 (two-blade) type aircraft hangars.

(b) Access lanes will be provided when hangars are the pull-through type design or when aircraft maintenance spaces (bays) do not have direct access to hangar doors. Hangars with direct outside access for all bays are preferred so that access lanes are not required. Figure K-3 provides sketches that indicates aircraft parking and circulation patterns for hover/taxilanes .



(c) Aircraft Module Computations and Assumptions. Table K-3 displays module dimensions that were derived for multiple module applications (modules placed side by side). This allows for the joint use of safety and operational buffer areas by adjacent modules. When single modules are provided (no adjacent module), an additional 3 m (10 ft) will be added to the width of the module. The module sizes provided in this appendix and UFC 3-260-01 (reference K-1) support basic airframes. Special mission type aircraft configurations may affect the module dimensions in which cases the SFA will be the governing criteria.

c. Hangar Shop Space.

(1) Hangar shop space is the space other than hangar floor space. The basic shop space includes areas such as aircraft parts storage, aircraft weapons repair and storage, flammable storage, maintenance administration, unit flight operations, technical shops, unit TOE storage, and utilities. Additional or special shop space may be required, such as special equipment repair and storage (such as, weapons and target acquisition equipment repair, medical supplies for MEDEVAC units, or special kit maintenance, repair of storage); or the additional requirements of a medium helicopter company, or a combination of all three.

(2) The same factors which determined the hangar bay module also affect hangar shop space allowances along with the number of engines and mission equipment packages (for example, medical, armament, and extended fuel tanks) associated with the aircraft to be supported.

(3) The hangar bay module also provides a limited contingency for inclement weather storage (see Section 7 - Aviation Module Development Methodology). For example, the rotary-wing module which supports multi-bladed aircraft (UH-60A) is based on the main rotor blade 90 degrees to the centerline. By turning the main rotor blade 45 degrees to the centerline, approximately 40 to 50 percent of the assigned aircraft can be provided with temporary covered storage. In the case of a two-bladed aircraft, the space provided for auxiliary lift or component removal can be used in the same manner with an estimated storage capability of 50 to 65 percent of the assigned aircraft. These estimates assume that sufficient time will be available to manually maneuver aircraft into positions allowing for maximum coverage under the roof.

d. Storage.

(1) Supply and logistics space allowances are generally categorized along maintenance levels. The associated supply storage space (Category Codes 442-10,-11, and -12) should be provided within the hangar structure or immediately adjacent to the hangar commensurate with the maintenance level to be performed. For example, Category Code 442-12 is associated with AVUM maintenance and should be provided for each organization or activity with an inherent AVUM capability. Category Codes 442-10 and -11 are associated with AVIM maintenance and should be provided for an AVIM activity. When two or more activities are provided within the same hangar, each activity is authorized the corresponding supply and logistic space. Safety and environmental clearances normally associated with aviation facilities necessitate their siting a substantial distance away from normal bulk supply areas of a facility (for example, light industrial areas). The repair parts and supply contained in these facilities are required for day-to-day maintenance performance and should be collocated with the facility in which that maintenance is to be performed.

(2) Additional consideration on where to provide storage space for support equipment, such as maintenance platforms or stands, mobile cranes, shop vans and ground power units, may have a significant bearing on the external layout of hangars and pavement design requirements. This equipment will be collocated, in lieu of the unit motor pool. Adequate space to accommodate these requirements will be provided while ensuring that safety clearances are not violated.

(3) Aircraft Space Modules. Space allowances for aircraft space modules are shown in Table K-3.

TABLE K-3 SPACE ALLOWANCES FOR AIRCRAFT SPACE MODULES*

TYPES OF AIRCRAFT	DIMENSIONS				MODULE AREA	
	length		width			
	meters	[feet]	meters	[feet]	m^2	[ft^2]
UH-1,** AH-1, OH-58 (2 blades)	23.5	[77]	9.1	[30]	215	[2,310]
UH-1 (4 blades)	23.5	[77]	16.5	[54]	386	[4,158]
UH-60 (4 blades)	25.6	[84]	19.5	[64]	499	[5,376]

TABLE K-3 SPACE ALLOWANCES FOR AIRCRAFT SPACE MODULES*						
TYPES OF AIRCRAFT	DIMENSIONS				MODULE AREA	
	length		width			
	meters	[feet]	meters	[feet]	m^2	[ft^2]
AH-64 (4 blades)	23.5	[77]	18.3	[60]	429	[4,620]
OH-58 (4 blades)	23.5	[77]	13.7	[45]	322	[3,465]
CH-47 (6 blades - tandem)	33.5	[110]	21.3	[70]	715	[7,700]
C-12 Fixed Wing *	19.5	[64]	0 19.8	[65]	386	(4,160]

* Aircraft space modules shown in the table have been derived by adding approximately 6m [20 ft] to the aircraft width and length dimensions, thus providing a 3m [10 ft] wide buffer/work space around each aircraft.

** Equate aircraft such as U-6, U-8 and U-21 to C-12; equate C-23 to C-12; equate AH-15 to UH-1 (4 Blades).

e. AVUM and AVIM Hangars (Category Codes 211-10 and -11).

(1) General.

(a) The criteria provided in the following subparagraphs are applicable to most normal types of hangar facility designs. However, Army Table of Distribution and Allowances (TDA) organizations also provide aircraft maintenance support in addition to Table of Organization and Equipment (TOE) organizations at many locations. This support is normally provided by the Directorate of Logistics (DOL) at Army facilities. When this requirement exists, coordination with the DOL should be accomplished to determine which aspects of the following criteria apply.

(b) Hangars supporting a single organization with less than 50 aircraft should be designed to utilize an individual access design configuration. The vast majority of AVUM hangars fall into this category. Individual access hangars preclude the need for two hangar access aprons and the access space described in this appendix. This type of design also reduces the amount of linear feet of overhead lifting cranes required to adequately cover the hangar maintenance bay areas.

(c) For those hangars supporting more than 50 aircraft, a pull-through design configuration should be provided. This usually occurs with AVIM hangars. When two or more units are consolidated into a single hangar facility, a pull-through configuration may be necessary.

(2) Aviation Unit Maintenance (AVUM) Hangars.

(a) Definition. AVUM is defined as activities staffed and equipped to perform high frequency "on aircraft" maintenance tasks required to retain or return aircraft to a serviceable condition.

(b) General. AVUM hangars will be designed to support the daily routine of operational and safety inspections and will provide space for arms repair and storage, parts storage, records maintenance, storage of flammable materials, technical library, and unit (AVUM) maintenance shops. In addition, space will be provided to support administrative, training, and unit operational functions.

(c) Allowances.

1/ AVUM hangars are authorized aircraft maintenance spaces (modules) for 20 percent of each type of aircraft authorized in a unit. This 20 percent is based on a factor of 25 percent of the unit aircraft undergoing unit maintenance and 80 percent of these requiring hangar space. Army aviation facilities work sheets are shown as Figures K-4 through K-10.

2/ The basic shop space authorized for a unit in an AVUM hangar is 697 m^2 [7,500 ft^2] gross area, within additional 348 m^2 [3,750 ft^2] gross area allowed for special shop space. The total gross area is 1,045 m^2 [11,250 ft^2], not including mechanical, electrical and electronic equipment room space which must be added.

FIGURE K-4 STATIONING
ARMY AVIATION FACILITIES WORK SHEET NO. 1

Step 1 - Aircraft Stationing
INSTRUCTIONS: Determine the actual and projected aircraft stationing quantities by type.

Aircraft (ACFT) Types	Quantity of Aircraft per Type
1. UH-1, AH-1, OH-58A-C	____________
2. OH-58D (4 blades)	____________
3. AH-64 (4 blades)	____________
4. UH-60 (4 blades)	____________
5. CH-47A-D (3 blades tandem)	____________
6. CH-54 (6 blades)	____________
7. C-12, U-21, U-8 (all)	____________
8. OV-1	____________
9. Other	____________
TOTAL	____________

FIGURE K-5 HANGAR MODULES
ARMY AVIATION FACILITIES WORK SHEET NO. 2

Step 2 - Hangar Floor Space Modules
INSTRUCTIONS: The required hangar floor space is predicated by the maintenance capability of the unit.

AVUM - 20 percent of the number of assigned aircraft projected by type.
AVIM - 10 percent of the number of supported aircraft by type.
AVUM/AVIM - 15 percent of the number of supported aircraft by type.

When aircraft require 100 percent covered storage due to physical security and equipment sensitivity protection, they will not be included in the percentage factor computation. Modular requirements will be added to the quantity requirement by type of aircraft to determine the total quantity required.

ACFT Type	Module Net Area			Number Required
	Maximum Dimensions	Net Area		
	Length X Width	square meters	[square feet]	
1.	23.5 m [77 ft] X 9.1 m [30 ft]	242	[2,310]	________
2.	23.5 m [77 ft] X 13.7 m [45 ft]	322	[3,465]	________
3.	23.5 m [77 ft] X 18.3 m [60 ft]	429	[4,620]	________
4.	25.6 m [84 ft] X 19.5 m [64 ft]	499	[5,376]	________
5.	33.5 m [110 ft] X 21.3 m [70 ft]	715	[7,700]	________
6.	33.5 m [110 ft] X 24.4 m [80 ft]	817	[8,800]	________
7.	19.5 m [64 ft] X 19.8 m [65 ft]	386	[4,160]	________
8.	19.5 m [64 ft] X 17.7 m [58 ft]	345	[3,712]	________
9.	_____ m [____ ft] X _____ m [____ ft]	________	[________]	________

FIGURE K-6 AIRCRAFT FLOOR SPACE
ARMY AVIATION FACILITIES WORK SHEET NO. 3

Step 3 - Area "A" Net Space (Module Times Required Number Equals Net Floor Space)
INSTRUCTIONS: (Area A) Multiply the quantities in Step 2 (Figure K-5) by the Module Net Area below to determine the "Net ACFT Floor Space."

ACFT Type	Module Net Area		Number Required	Net ACFT Floor Space
	square meters	[square feet]		
1.	242	[2,310]	X __________ =	__________
2.	322	[3,465]	X __________ =	__________
3.	429	[4,620]	X __________ =	__________
4.	499	[5,376]	X __________ =	__________

FIGURE K-6 AIRCRAFT FLOOR SPACE
ARMY AVIATION FACILITIES WORK SHEET NO. 3

Step 3 - Area "A" Net Space (Module Times Required Number Equals Net Floor Space)
INSTRUCTIONS: (Area A) Multiply the quantities in Step 2 (Figure K-5) by the Module Net Area below to determine the "Net ACFT Floor Space."

ACFT Type	Module Net Area		Number Required	Net ACFT Floor Space
	square meters	[square feet]		
5.	715	[7,700]	X __________ =	__________
6.	817	[8,800]	X __________ =	__________
7.	386	[4,160]	X __________ =	__________
8.	345	[3,712]	X __________ =	__________
9.	________	[________]	X __________ =	__________

FIGURE K-7 ACCESS/FIRE LANE SPACE
- ARMY AVIATION FACILITIES WORK SHEET NO. 4

Step 4 - Area "B" Access and Fire Lane - Optional by Design
INSTRUCTIONS: (Area B) Access and fire lanes are optional by design. If the hangar is a pull-through design, an access lane will be provided. The access lane is a central corridor with maintenance modules (bays) on either side. This lane will be 20 m [65 ft] wide, except when the hangar supports two-bladed helicopters only or if alternate means of ingress and egress are provided for multi-bladed (three or more) helicopters and fixed-wing aircraft. A 10 m [30 ft] wide dimension will be used in this latter case.

20 m [65 ft] wide X [____________ m [ft] long + 3 m [10 ft] buffer] = ____________ m^2 [ft^2]

FIGURE K-8 HANGAR SPACE W/O SHOPS
ARMY AVIATION FACILITIES WORK SHEET NO. 5

Step 5 - X times Y Hangar Space Without Shops
INSTRUCTIONS: The X dimension equals the total width of the aircraft maintenance modules (including the access and fire lane option) plus a 3 m [10 ft] safety corridor (1.5 m [5 ft] on either side).
The Y dimension equals the total length (depth) of the aircraft maintenance modules plus a 3 m [10 ft] safety corridor (1.5 m [5 ft] on either side).
For computation simplicity, several (X) and (Y) dimensions may be used in order to determine the total floor space requirement.

X1 ____________ meters [feet] times Y1 ____________ meters [feet] = ____________ m^2 [ft^2]
X2 ____________ meters [feet] times Y2 ____________ meters [feet] = ____________ m^2 [ft^2]
X3 ____________ meters [feet] times Y3 ____________ meters [feet] = ____________ m^2 [ft^2]

FIGURE K-8 HANGAR SPACE W/O SHOPS ARMY AVIATION FACILITIES WORK SHEET NO. 5
X4 ____________ meters [feet] times Y4 ____________ meters [feet] = ____________ m^2 [ft^2] X times Y TOTAL = ____________ m^2 [ft^2]

FIGURE K-9 SHOPS FLOOR SPACE ARMY AVIATION FACILITIES WORK SHEETS NO. 6
Step 6 - Area "C" Shop Space INSTRUCTIONS: (Area C) Shop floor space is predicated on the maintenance capability of the unit. Whenever two units with separate maintenance capabilities are utilizing the same hangar, the total shop floor space will be the combined total (for example, two CSAC with AVUM equals 697 m^2 [7,500 ft^2] each or a hangar of 1393 m^2 [15,000 ft^2]. The basis for authorization is as follows: AVUM - 697 m^2 [7,500 ft^2] basic NOT MORE THAN 1045 m^2 [11,250 ft^2] with justification (weapons systems repair storage, medical supplies, special avionics). AVIM - 1393 m^2 [15,000 ft^2] basic NOT MORE THAN 2090 m^2 [22,500 ft^2] with justification as with the AVUM additional space. No maintenance capability organic - 325 m^2 [3,500 ft^2] basic NOT MORE THAN 488 m^2 [5,250 ft^2] with justification as with the additional space. Justification for allocations greater than stated above will be submitted to HQUSACE, ATTN: CECW-EW, Washington, D.C. 20314-1000.
Type Capability _______________ = Total square meters [feet] _________________ m^2 [ft^2]

FIGURE K-10 TOTAL HANGAR NET SPACE ARMY AVIATION FACILITIES WORK SHEET NO. 7
Step 7 - Hangar Net Area Summary INSTRUCTIONS: The total requirement is determined by combining steps 5 and 6 (Figures 8 and 9). If step 5 can't be determined, the total from step 3 (Figure 6) can be used as an estimated value. This total does not include the square meters [feet] for areas such as break rooms, locker rooms, and toilet facilities, other than maintenance and operations administrative functions (such as classrooms, conference rooms) or support equipment (such as environmental controls, transformers).
Total Step 5 (Figure 8) _______________ square meters _______________ [square feet] Total Step 6 (Figure 9) _______________ square meters _______________ [square feet] TOTAL _______________ m^2 _______________ [ft^2]

(3) Aviation Intermediate Maintenance (AVIM) Hangars.

(1) Definition. AVIM is defined as units that provide mobile, responsive "one-stop" maintenance and repair of equipment for return to the user.

(2) General. AVIM hangars will be designed to include technical shops to conduct repair and replacement of assemblies and components; for the storage and issue of parts; to provide technical assistance to user units; and for administration and training functions of the unit.

(3) Allowances.

1/ AVIM hangars are authorized aircraft maintenance spaces (modules) for 10 percent of each type of aircraft authorized to be supported.

2/ The basic shop space in an AVIM hangar is 1,394 m^2 [15,000 ft^2] gross area, with an additional 697 m^2 [7,500 ft^2] gross area allowed, if required, for special shop space. The total gross area is 2,090 m^2 [22,500 ft^2], not including mechanical, electrical and electronic equipment room space which must be added.

f. Other Types of Hangars (Category Code 211-90).

(1) Security and storage hangars are limited use hangars. They do not normally require all of the features provided in AVUM and AVIM hangars since any maintenance performed is extremely limited. Therefore, security and storage hangars will not be designed with high-bay ceilings or overhead moving cranes, unless specifically justified and approved. All requests for approval will be forwarded to HQUSACE (CECW-EW) for coordination.

(2) Security hangars are authorized up to 325 m^2 [3,500 ft^2] gross area of shop space.

g. Avionics Maintenance Shops (Category Code 217-40).

(1) A facility for the repair of electronic gear used in aircraft and in aviation facilities. This category code should be used only at depot level. At other levels of aircraft maintenance use 21110 or 21117.

(2) A minimum of 56 m^2 [600 ft^2] gross area will be provided in a hangar or in a separate building adjoining an aircraft maintenance apron for an avionics maintenance shop. The facility will be provided with humidity control and suitably equipped to support the repair and storage of electronic gear of aircraft and aviation facilities. Test areas may be shielded to reduce radio frequency interference. Space allowances for avionics maintenance shops

are shown in Table K-4.

TABLE K-4 SPACE ALLOWANCES FOR AVIONICS MAINTENANCE SHOPS

NUMBER OF AIRCRAFT	GROSS AREA [1]	
	square meters	[square feet]
1 to 30	56 [2]	[603]
31 to 50	Up to 111 [3]	[Up to 1,200]
51 to 100	Up to 228 [4]	[Up to 2,450]
101 to 150	Up to 321 [5]	[Up to 3,450]
151 to 450	Up to 432 [6]	[Up to 4,650]
451 and above	Note [7]	Note [7]

[1] Mechanical, electrical and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.
[2] Space generally located in a hangar shop.
[3] Space based on 2.8 m^2 [30 ft^2] for each additional aircraft above 30.
[4] Space based on 2.3 m^2 [25 ft^2] for each additional aircraft above 50.
[5] Space based on 1.9 m^2 [20 ft^2] for each additional aircraft above 100.
[6] Space based on 0.37 m^2 [4 ft^2] for each additional aircraft above 150.
[7] Space will be justified and based on specific requirements.

(3) Aggregate space provided for electronics repair will be taken into account in programming separate and new avionics maintenance facilities at airfields and heliports in order to eliminate duplication of existing facilities. However, consideration will be given to economy and efficiency gained where these functions are performed in one central facility. These are space generally utilized in flight control towers, aircraft maintenance hangars, and for radio parts storage in aircraft unit parts storage buildings, as well as other available facilities.

h. Aircraft Washing Apron (Category Code 113-70).

(1) A rigid pavement area for aircraft washing and cleaning. It normally includes electrical and water service, drainage, and waste water collection equipment. From an operational point of view, an apron includes the prepared surface, stabilized shoulders, lighting and lateral clear zones. For inventory purposes, only the prepared surface is included. Standard washing apron sizes are provided in Figure K-11.

(2) Washing aprons should be sited immediately adjacent to hangars to minimize the cost associated with providing compressed air, electrical (110 VAC), and water (one inch service) accessibility which are provided in the hangars. Environmental considerations in accordance with environmental requirements must be provided for detergent and oil particulate waste by-products. AR 200-1 (reference K- 7) and AR 200-2 (reference K- 8) requirements will govern as the minimum acceptability standards.

FIGURE K-11 ACFT WASH APRON SPACE ARMY AVIATION FACILITIES WORK SHEET NO. 8

Step 8 - Area "D" Wash Aprons INSTRUCTIONS: Wash aprons will be provided for each hangar by

FIGURE K-11 ACFT WASH APRON SPACE ARMY AVIATION FACILITIES WORK SHEET NO. 8		
maintenance capability and largest aircraft type supported. One wash apron will be provided for each unit with AVUM or AVIM capability. AVIM units may require two different types of wash aprons or a gross total of these aprons when supported aircraft have a significant disparity in size (for example, UH-60 and CH 47). Additionally, adverse weather and environmental considerations may require more than one apron (for example, high salt or sand environments). Units with no organic maintenance capability, but have a 100 percent covered storage requirement, will also be provided with one wash apron per storage hangar. The basis for the wash apron size is the aircraft dimensions with a buffer area. Small-size aircraft buffer areas will be 1.5 m [5 ft] per aircraft to be serviced, wing tip-to-wing tip, and 1.5 m [5 ft] from the nose and tail of the aircraft to the end of the pavement. 1.5 m [5 ft] will also be provided from the hangar wall-to-wing tip when the wash apron is immediately adjacent to a hangar. Medium and Large-size aircraft will be provided with 3 m [10 ft] buffers. **Table doesn't match UFC 3-260-01, Table 6.4.**		
Aircraft Size	Length Times Width Equals the Required Area	Example Aircraft
Small	26 m [85 ft] X 16 m [52 ft] = 416 m^2 [4,420 ft^2 or 492 yd^2]	two OH-58
Medium	42 m [138 ft] X 23 m [74 ft] = 966 m^2 [10,212 ft^2 or 1,135 yd^2]	two UH-60
Large	45.5 m [150 ft] X 36.5 m [120 ft] = 1660.5 m^2 [18,000 ft^2 or 2,000 yd^2]	two CH-47

i. Hangar Access Apron (Category Code 113-40). Hangar access aprons provide a stabilized circulation path between the hangar and the parking area of an aviation facility. The width dimensions of the apron are dependent upon the actual hangar configuration and size to be supported (see subparagraph 5.a., above). The depth of the hangar access apron is dependent on the type of Aircraft and class of runway. For example, individual access hangars for Class B fixed-wing aircraft will normally have access aprons as long as the total hangar door length and 40 m [125 ft] deep. Pull-through hangars for Class B fixed-wing aircraft are normally provided with two hangar access aprons 20 m [65 ft] long (width of access/fire lanes) and 40 m [125 ft] deep. *Verify statement is correct as not in UFC 3-260-01??* The hangar, at Army facilities, must be located beyond the clearance distance from the apron edge to fixed or mobile obstacles. This type of apron is normally a concrete surface to preclude pavement degradation associated with fuel contact on bituminous pavement. The space criteria work sheet for aircraft hangar access aprons is at Figure K-12.

FIGURE K-12 HANGAR ACCESS APRONS ARMY AVIATION FACILITIES WORK SHEET NO. 9
Step 9 - Area "E" Hangar Access Apron INSTRUCTIONS: Hangar access aprons will be predicated on the hangar design. The minimum length of apron is based on type of aircraft and class of runway. This area will normally be portland cement for individual bay access.

FIGURE K-12 HANGAR ACCESS APRONS
ARMY AVIATION FACILITIES WORK SHEET NO. 9

Length times width equals required area, therefore:
Individual Access Hangar

Fixed-Wing Class A Runway:	Access Apron____ meter [feet] long X 30 m [100 ft] depth = __ m^2 [___ft^2]
Fixed-Wing Class B Runway:	Access Apron____ meter [feet] long X 40 m [125 ft] depth = __ m^2 [___ft^2]
Rotary-Wing Aircraft, Except H-53 Helicopters:	Access Apron ____ meter [feet] long X 23 m [75 ft] depth = ___ m^2 [___ft^2]
H-53 Helicopters:	Access Apron____ meter [feet] long X 30 m [100 ft] depth = __ m^2 [___ft^2]

Pull Through Hangar **(Verify the correctness of the remaining computations as not in UFC 3-260-01).**

Fixed-Wing Class A Runway:	Access Apron__23__meter [75 feet] long X 20 m [65 ft] depth =_460_ m^2 [_4875_ft^2] Access Taxiway =___ m^2 [___ft^2]
Fixed-Wing Class B Runway:	Access Apron__27__meter [75 feet] long X 20 m [65 ft] depth =_460_ m^2 [_4875_ft^2] Access Taxiway =___ m^2 [___ft^2]

6 AVIATION OPERATIONS SUPPORT AREAS.

a. General. The aviation operations support areas are comprised of major distribution, transfer, physical security, bulk storage, and transportation facilities necessary for support to one or more of the three functional areas previously identified. If flight simulation training devices are required, this is the area where they should be located.

b. Bulk Fuel Storage (Group Category Code 41 or 411?). Bulk fuel storage requirements are determined by the fuel capacity, fuel consumption rate, and the DA Flying Hour Program for aircraft systems. The method of calculation requires coordination with either the Directorate of Logistics or the Aviation Division, DPTM of the installation staff, since the DA Flying Hour Program is determined by the available training funds which change periodically based on the PPBES process. Detailed information on aircraft systems currently in production or under development may be obtained from various aircraft SFA. Additional data on most systems already fielded may also be obtained from SFA when a comparison against these aircraft is published (for example, the UH-60A SFA also includes UH-1H data since the UH-60A replaces many UH-1H aircraft).

c. Flight Simulator Buildings (Category Codes 171-10 and 171-12). May be authorized in accordance with the DA approved basis of issue plan and should conform to the following standard type facilities and scopes as shown in Table K-5.

(1) Table K-5 should be used as a guide only when determining the sizes for flight simulator buildings. These sizes may be adjusted as needed to meet actual project and equipment requirements.

(2) When two or more flight simulator facilities are being planned, consideration should be given to locating them on the same or adjacent sites. The allowances shown in Table K-5 provide space to accommodate flight planning, administrative and instructor spaces, and classrooms in each facility type. These types of spaces could be joint usage with collocated facilities; therefore, the total space should be reduced accordingly. An assessment of actual training loads (student and instructor training time in the simulators and classrooms, and the number of students to be trained), and the size of the staffs needed to operate and maintain the simulators should be considered.

(3) Specific projects should be coordinated with the Aviation Division, DPTM at Army facilities during the planning, programming, and design stages to determine the type of simulator, administrative and classroom space requirements, and siting parameters.

(4) Current designs maintained by the Program Manager, Training Devices (PM TRADE) should be used for initial flight simulator designs. HVAC loading should be based on computations normally associated with computer hardware installations. Until standard designs for flight simulators under the DA Facilities Standardization Program are developed, geographical design agencies should coordinate specific design requirements with PM TRADE, Naval Training Center, ATTN: NTSC FE, Orlando, FL 32813. Additional information has been published in SFA (Various Aircraft Systems), available on the PAX computer system under the Facilities Planning System or the Trainer Facility Report from PM TRADE.

TABLE K-5 SPACE ALLOWANCES FOR FLIGHT SIMULATOR BUILDINGS

TYPES OF AIRCRAFT SIMULATOR	GROSS AREA [1]	
	square meters	[square feet]
UH-1 FS (2B24) [2]	669	[7,200]
CH-47 FS (2B31) [2]	1607	[17,30]
AH-1 FS (2B33) [2]	2127	[22,900]
UH-60 FS (2B38) [2]	2081	[22,400]
AH-64 FWS (2B40)	2072	[22,300]
UH-1/UH-60 (2B24/38)	1951	[21,000]
CH-47/AH-1 (2B31/33)	2648	[28,500]
CH-47/UH-60 (2B31/38)	2806	[30,200]
AH-1/UH-60 (2B33/38)	3512	[37,800]
CH-47/AH-1/UH-60 (2B31/33/38)	4543	[48,900]

FS = FLT SIMS; FWS = FLT & WPN SIM
[1] Mechanical, electrical and electronic equipment room space as required will be added to the gross areas shown when determining a single gross area figure for each facility.
[2] Definitive drawings for these facilities may be obtained thru HQDA (DAEN-ECE-A).

d. Personnel Loading Apron (Category Code 113- 80). This type of apron will be provided to support transient and Very Important Persons (VIP) aircraft operations and normally sited immediately adjacent or in proximity to the airfield operations building. It may also be used to size and support medical evacuation (MEDEVAC) operations. In the latter case, proximity to the MEDEVAC unit hangar or the quickest ground vehicular access to the flight line, or both, will be the determining factor for siting and the number of loading aprons to be provided on an aviation facility.

e. Aircraft Special-Purpose Apron (Category Code 113-82). Special purpose aprons may be authorized for providing safe areas for arming and/or disarming aircraft weapons; loading and unloading ammunition; special handling and/or decontamination facilities for CBR warfare items; and for special security areas. Special-purpose aprons required to conduct defueling operations will be provided at Army aviation facilities. Design will be predicated on the largest aircraft and adequate space for fire support equipment and defueling vehicle and apparatus. Grounding points will be provided. The scope of the apron area and the type of the supporting facilities for these special-purpose aprons will be individually justified on the basis of the mission requirements. Safety clearances, appropriate to the requirements of the apron will be observed. Airfield maps and plans will identify the purpose of the apron and show the required safety clearance distances. Explosive clearances are discussed in UFC 3-260-01 -Attachment 10 (Reference K-1).

f. Aircraft Compass Swing Base (Category Code 116-10). One compass calibration pad may be provided at Army airfields or heliports where fifteen or more aircraft are permanently assigned, and at Army depots where aircraft maintenance missions are assigned (AR 750-1). The compass calibration pad is a paved area which should be located in an electronically quiet zone of the airfield. Compass calibration pads are typically circular and are sized to accommodate one of the assigned or mission aircraft.

7. AVIATION MODULE DEVELOPMENT METHODOLOGY.

a. Fixed-Wing Aircraft Parking Module. This module is based on the C-12 J aircraft. The module length is 18.25m (60 ft.) and 17m (55 ft.) The baseline aircraft dimension is 13.4 m [44 ft] long by 16.8 m [55 ft] wide. The module length is derived by rounding off the aircraft length to 14 m [45 ft] and adding 4.25 m [15 ft]. This will provide a circulation path for refueling or support vehicles, 2268 kg or 4536 kg [2 1/2 or 5-ton] chassis, to park at 90 degrees to the aircraft centerline, and provides a safety clearance between the aircraft centered in the parking module and aircraft taxiing in the hover or taxilanes. This separation between modules provide separation as noted in Chapter 6 of UFC 3-260-01 (Reference K-1) from wing tip to wing tip from the next adjacent parked aircraft clearance and an alternate refueling position with safety clearances. The separation distance provides an area for work stands, tool boxes, and components removed during the performance of maintenance outdoors without interference with adjacent or operational aircraft.

b. Rotary-Wing Aircraft Parking Modules. Rotary-wing parking modules are based on the landing gear configuration and prop wash characteristics of the aircraft.

(1) Landing Gear Configurations. Skid configured aircraft must hover for movement. Wheel configured aircraft taxi like fixed-wing aircraft. The safest method of movement in and around fixed or movable objects is accomplished by positive ground contact. Therefore, wheel configured aircraft taxi on the ground like fixed-wing aircraft and parking modules are established accordingly.

(2) Prop Wash. Prop wash dynamics affect clearance requirements during power-on operations. The prop wash dynamics include several factors, such as engine power, blade diameter, and the number of blades. In general, these factors can be categorized into three basic configurations. The remaining configurations by the type of aircraft can be accommodated within the basic configurations. The basic configurations are:

(a) Two-bladed rotors, single main rotor head (for example, UH-1H type aircraft).

(b) Multi-bladed rotors, single main rotor main rotor head.

(c) Multi-bladed rotors, multi-rotor heads.

c. Aircraft Hangar Bay Modules.

(1) Rotary-Wing Hangar Bay Modules. Rotary-wing aircraft hangar module dimensions will be derived for multiple module application (for example, modules placed side by side). This will allow for sharing of safety and operational clearance areas with adjacent modules. The rationale for this approach is that only highly specialized requirements or situations would justify the construction of an entire hangar to support a single aircraft. However,

should this situation arise, 3 m [10 ft] will be subtracted from the multiple module width since no adjacent safety clearance will be required. In all cases other than the UH-1 module, the aircraft width is actually the main rotor diameter. This methodology was chosen since current Army aircraft are not designed to fold blades in other than airlift transport situations. Therefore, repetitive folding of main rotor blades to accomplish routine maintenance increases maintenance down time and risk to incidental damage not normally required or accommodated by the system design.

(a) UH-1 Aircraft (UH-1H Baseline Aircraft, Includes AH-1S and OH-58 A-C Aircraft). The UH-1H aircraft is 17.4 m [57 ft] long by 3 m [10 ft] wide. The module is derived by adding 6 m [20 ft] to the actual length of the aircraft. The module width is derived by adding 6 m [20 ft] to the width of the aircraft. This provides a buffer area around the aircraft for wrecker vehicle, 2268 kg or 4536 kg [2-1/2 or 5-ton] chassis, secondary support requirements during landing gear maintenance. The buffer area also provides space for jack stands, tool boxes, work stands, and components removed to perform maintenance activities.

(b) OH-58D Aircraft (OH-58D Baseline Aircraft (formerly described as YOH-58). The OH-58D aircraft is 12.5 m [41 ft] long by 10.7 m [35 ft] wide. The module length is the same as the UH-1 module length for two reasons. The first reason is discussed in the subparagraph for AH-64 aircraft. The second reason is in anticipation of the development of a new family of scout helicopters which preliminary indications are that the aircraft dimensions will be somewhere between the OH-58D and UH-60A. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. As with the UH-60 and AH-64, the OH-58D incorporates a four-blade design and the space underneath the blades is assumed to be sufficient. Maximum flexibility of the module can be obtained by placing two OH-58D aircraft tail-to-tail. Two OH-58D modules can support three UH-1H aircraft as well.

(c) AH-64 Aircraft (AH-64A Baseline Aircraft). The AH-64A aircraft is 18 m [59 ft] long by 14.6 m [48 ft] wide. The UH-1 module length of 23.5 m [77 ft] has been adopted for modular planning and to simplify any modifications to existing hangars (the AH-64A replaces most of the AH-1S fleet). The module width is derived by rounding off the width of the aircraft to 15 m [50 ft] and adding 3 m [10 ft]. This approach has also been adopted to maximize the UH-1 module width. Since the AH-64A was also designed with work stands as an integral part of the airframe, safety clearance could be achieved in the same manner as with the UH-60 module. This approach provides the maximum flexibility by providing space for either one AH-64 or two AH-1S aircraft. Two adjacent AH-64 modules can support either two AH-64A, one AH-64A and two UH-1H, or two OH-58D and one UH-1H aircraft simultaneously.

(d) UH-60 Aircraft (UH-60A Baseline Aircraft). The UH-60A aircraft is 19.5 m [64 ft] long by 16.5 m [54 ft] wide (rotor blades 90 degrees to the aircraft centerline). The module length is derived by adding 6 m [20 ft] to the length of the aircraft. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. This provides the same buffer area as described above for the UH-1 module, except that work stands are an integral part of the UH-60A airframe. The area underneath the multi-blades is sufficient for component removal and the 3 m [10 ft] addition to the width of the module merely provides sufficient clearance between the blades of the adjacent modules. The blades may be rotated 45 degrees to the centerline of the aircraft to allow sufficient clearance for the wrecker support operations.

(e) CH-47 Aircraft (CH-47C-D Baseline Aircraft). The CH-47C-D aircraft is 30.2 m [99 ft] long by 18.3 m [60 ft] wide. The module length is derived by rounding off the length of the aircraft to 30 m [100 ft] and adding 3 m [10 ft]. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. The space provided underneath the blades is considered to be sufficient as in the case of the UH-60 aircraft module. The cabin top of the CH-47C-D provides some work stand area and the 18.3 m [60 ft] rotor system diameter has sufficient height clearance except for the forward rotor immediately in front of the nose which can be rotated out of the way.

(f) CH-54 Aircraft (CH-54B Baseline Aircraft). The CH-54A-B aircraft is 27.1 m [89 ft] long by 21.9 m [72 ft] wide. Since the CH-54A-B is only found in Reserve Component (RC) organizations, no attempt has been made to adopt modular considerations with the CH-47 module. The modular length is derived by rounding off the length of the aircraft to 27 m [90 ft] and adding 6 m [20 ft]. The module width is derived by rounding off the width of the aircraft to 21 m [70 ft] and adding 3 m [10 ft]. The rotor system height is more than adequate to allow for the performance of maintenance.

(g) RAH-66 Aircraft (formerly Light Helicopter LH). The RAH-66 is a developmental aircraft. Current dimensional data indicates that the RAH-66 can be accommodated by using the OH-58D module. However, since the RAH-66 is currently configured as a 5-bladed aircraft, there may be a need to either modify the OH-58D module or use the UH-60 module depending on the maintenance procedures which are being developed. The need to modify or upgrade will be validated as the system develops. Until the aforementioned procedures and criteria are developed, the OH-58D module should be used for planning purposes.

(2) Fixed-Wing Hangar Bay Modules. The same basic approach will be used for fixed-wing aircraft as indicated above, except that the wing span of the aircraft will be substituted for the main rotor blade diameter.

(a) C-12 Aircraft (C-12A-C Baseline Aircraft). The C-12A-C aircraft is 13.4 m [44 ft] long by 16.8 m [55 ft] wide. The module length is derived by rounding off the length of the aircraft to 13.5 m [45 ft] and adding 6 m [20 ft] for buffer areas. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. This will provide maintenance and equipment space as provided in the rotary-wing hangar modules. Maximum space within the module may be obtained by placing the aircraft at a 45-degree angle when necessary.

(b) OV-1 Aircraft (RV1-D Baseline Aircraft). The RV/OV-1C-aircraft is 12.5 m [41 ft] long by 14.6 m [48 ft] wide. The module length is derived by rounding off the length of the aircraft to 13 m [44 ft] and adding 6 m [20 ft] in order to maximize the modular development of the C-12 module. The module width is derived by adding 3 m [10 ft] to the width of the aircraft. Space considerations for this module are the same as for the C-12 module.

(c) Hybrid Aircraft. The only hybrid aircraft under consideration by the Army is the V-22 Osprey (tilt-rotor). Dimensional data and characteristics of the V-22 indicate major revisions to current aircraft space allowances. DRAFT modular data have been developed and are currently under going criteria validation and verification approval process at the Army Staff level. This information will be provided upon approval. Pending a decision by the Army, the only application of the DRAFT criteria developed for the V-22 would be at those facilities intended to support USN, USMC, or USAF aircraft of this type (for example, hospital MEDEVAC helipads). Information may be obtained from HQUSACE (CEMP-ET).

d. Hangar Access and Fire Lanes. Hangars are generally designed in two basic configurations: Pull-Through and Individual Access.

(1) When a hangar design utilizes a pull-through configuration, aircraft modules will be located on either side of a center corridor. This corridor is considered to be an access and fire lane. The corridor width is dependent on safety clearances as well as aircraft dimensions (blade static). Utilization of this corridor for individual access hangar designs is not normally considered.

(2) For UH-1 category aircraft, a corridor width of 10 m [30 ft] is adequate. The corridor length is dependent on the number of aircraft modules to be provided within the hangar. The 9.1-m [30-ft] wide corridor should be provided only when there is no current or future plan to support multi-blade aircraft.

(3) For OH-58D, AH-64A, UH-60A, CH-47C-D, and fixed-wing aircraft, the corridor should be 20 m [65 ft] wide.

e. Safety Corridor, Hangar Bay Area. Personnel who pass-through the maintenance floor area within a hangar require corridors which do not interfere with on-going maintenance or subject personnel not involved in actual maintenance functions to potential safety hazards. Therefore, a 1.5-m [5-ft] wide safety corridor will be provided around the perimeter of the maintenance floor (all aircraft hangar modules). If a hangar access and fire lane is provided, this corridor will be provided to the outside perimeter of the maintenance floor only.

f. Hangar Shop Space.

(1) General.

(a) The methodology utilized in determining shop space within maintenance hangars for administrative, supply, repair, and storage functions is based on the organic maintenance capability of an organization. Hangar shops are categorized by the level of maintenance.

(b) Additional space (special shop space) may be provided for functions which are peculiar to the mission of the organization and not normally associated with an equivalent maintenance capability (for example, weapons and armament, improved avionics, CEWI equipment, medical evacuation, and special navigation systems maintenance, supply and storage functions). Basic shop space includes maintenance and operations administration, common supply and equipment storage, technical shops, and flammable storage functions.

(c) Space allocation for mechanical equipment (HVAC), electrical and electronic equipment, classrooms, briefing rooms, lockers, toilet facilities, or other similar requirements are not included.

(2) Aviation Unit Maintenance (AVUM). AVUM is defined as on-aircraft maintenance and limited to component removal. The maximum basic shop space allowance is 700 m^2 [7,500 ft^2] gross area. The maximum special shop space allowance is an additional 350 m^2 [3,750 ft^2] gross area. A maximum allowance merely indicates what will be acceptable during facility programming and design without special justification.

(3) Aviation Intermediate Maintenance (AVIM). AVIM is defined as major component removal and repair (DS/GS) maintenance. The maximum basic shop space allowance is 1,400 m^2 [15,000 ft^2] gross area. The maximum special shop space allowance is an additional 700 m^2 [7,500 ft^2] gross area. The limitation or definition of maximum allowable space applies to AVIM as it does to AVUM.

(4) Organizations With No Organic Maintenance Capability. If no organic maintenance capability exists, aircraft will normally be maintained by another related organization. Hangar requirements or allocations will be supported by detailed justifications.

g. Aircraft Wash Aprons. A minimum of one wash apron should be provided for each maintenance hangar. Ground handling of aircraft in this area is required. Maintenance procedures for engine flushing require environmental controls to be placed on the waste water distribution of the wash apron. In addition, utility connections for electricity and compressed air are required. Therefore, the siting of wash aprons adjacent to hangars provides a common source for utilities. There are three sizes of wash aprons as follows:

(1) Light to Medium Helicopters (UH-60 Baseline). The wash apron width will be derived by adding 3 m [10 ft] to twice the width of the aircraft. This will provide a minimum clearance of 1.5 m [5 ft] between rotor blades (rotor tip to rotor tip) on the centerline of the aircraft. The wash apron length will be derived by adding 6m [20 ft] to the length of the aircraft. This will ensure that a clearance o 3.0 m [10 ft] to the front and rear of the aircraft is provided and that runoff from all parts of the airframe could be adequately collected. The maximum capacity is two UH-60A aircraft simultaneously or organizations equipped with smaller aircraft. *This is not in accordance with UFC 3-260-01 Table 6.4.*

(2) Heavy Helicopters (CH-47 Baseline). The wash apron width will be derived by adding 6 m [20 ft] to twice the width of the aircraft. This will provide a rotor separation minimum clearance of 3 m [10 ft]. The wash apron length will be derived by adding 3 m [10 ft] to the length of the aircraft as in the case with the UH-60 wash apron. The maximum capacity is two CH-47C-D aircraft simultaneously or one CH-54A-B aircraft. *This is not in accordance with UFC 3-260-01 Table 6.4.*

(3) Fixed-Wing Aircraft (C-12 Baseline). Due to the size of fixed-wing aircraft, a single fixed-wing wash apron size will be provided. The wash apron width will be derived by adding 6 m [20 ft] to twice the width of the aircraft. This will provide a minimum of 3 m [10 ft] separation from wing tip to wing tip. The wash apron length will be derived by adding 3 m [10 ft] to the length of the aircraft for the same considerations as utilized in the rotary-wing wash aprons. Maximum capacities for this type of wash apron are two C-12 series, two RV/OV-1 series, or one UV-18A at an oblique angle *This is not in accordance with UFC 3-260-01 Table 6.4.*

8. REFERENCES.

K-1 UFC 3-260-01TM 5-803-7, Airfield and Heliport Planning and Design
K-2 TM 5-834-2, Geometric Design for: Airfields, Heliports, and Helipads
K-32 Master Planning Instructions (MPI) issued by HQUSACE (CEMP-E), latest edition
K-43 AR 95- 2, Air Traffic Control, Air Space, Airfield Flight Facilities and Navigational Aids
K-54 TB 95-1, US Army Air Traffic Control and NavAid Facility Standards, 15 Sep 1979
K-65 Fort Huachuca Control Tower, File Number 223-25-360, SPK Specification 5422, dated 15 April 1980, available from the Sacramento District Engineer Office
K-76 AR 420-90, Fire Prevention and Protection, 1 Feb 1985
K-87 AR 200-1, Environmental Protection and Enhancement, 15 June 1982
K-98 AR 200-2, Environmental Effects of Army Actions, 1 September 1981
K-109 DoD Standard 6055.9-STD, DoD Ammunition and Explosives Safety Standards, July 1984, authorized by DoD Directive 6055.9, November 25, 1983
K-1110 AR 385-64, Ammunition and Explosives Safety Standards, 15 March 1982