

**BY ORDER OF THE
SECRETARY OF THE AIR FORCE**



AIR FORCE MANUAL 32-1040

23 AUGUST 2019

CIVIL ENGINEERING

**CIVIL ENGINEER AIRFIELD
INFRASTRUCTURE SYSTEMS**

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

ACCESSIBILITY: Publications and forms are available for download on the e-Publishing website at www.e-Publishing.af.mil.

RELEASABILITY: There are no releasability restrictions on this publication.

OPR: HQ AF/A4CF

Certified by: SAF/IE
(Hon John Henderson)

Supersedes: AFI 32-1042, 19 Oct 2016;
AFI 32-1043, 4 Mar 2015; AFI 32-1044, 24
Dec 2014

Pages: 20

This publication implements US Air Force (USAF) Policy Directive (AFPD) 32-10, *Installations and Facilities*. It provides standards and procedures for managing the Civil Engineer (CE) Airfield Marking, Aircraft Arresting Systems (AAS), and Visual Air Navigation Systems programs. This AFMAN applies to individuals at all levels including Regular Air Force, Air Force Reserve (AFR), Air National Guard (ANG) units and personnel. If a written agreement exists between a host nation and Department of Defense (DoD) requiring the application of an international standard (or similar), that guidance supersedes this manual as per the agreement. Overseas Commands are responsible for establishing any applicable guidance that deviates from this manual to further direct implementation of these standards. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual 33-363, *Management of Records*, and disposed of in accordance with the Air Force Records Disposition Schedule located in the Air Force Records Information Management System. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command. This publication may be supplemented at any level, but all supplements must be routed to the Office of Primary Responsibility listed above for coordination prior to certification and approval. The authorities to waive wing/unit level requirements in this publication are identified with a Tier ("T-0, T-1, T-2, T-3") number following the compliance statement. See AFI 33-360, *Publications and Forms Management*, for a description

of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the requestor's commander for non-tiered compliance items. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

SUMMARY OF CHANGES

This publication has been significantly revised and requires a full review. This new publication consolidates Air Force specific guidance for airfield markings, aircraft arresting systems, and visual air navigation systems.

Chapter 1

OVERVIEW

1.1. This manual defines requirements for installation, maintenance, and repair of Civil Engineer airfield infrastructure systems. Specifically, this manual provides guidance regarding:

- 1.1.1. Airfield marking.
- 1.1.2. Aircraft arresting systems (AAS).
- 1.1.3. Visual air navigation systems.

Chapter 2

ROLES AND RESPONSIBILITIES

2.1. The Assistant Secretary of the Air Force Installations, Environment, and Energy (SAF/IE). SAF/IE is accountable for all doctrine, strategy, policy, guidance, and resource advocacy.

2.2. The Headquarters, United States Air Force, Deputy Chief of Staff for Logistics, Engineering and Force protection, Directorate of Civil Engineers (AF/A4C). AF/A4C shall:

2.2.1. Be responsible for Air Force policy, strategy, doctrine, oversight, directive guidance, and resource advocacy related to airfield infrastructure systems. **Note:** The National Guard Bureau Civil Engineer will maintain and approve National Guard policy.

2.2.2. Be accountable for non-directive guidance related to the Air Force civil engineer owned airfield infrastructure systems (e.g. Civil Engineer Playbooks).

2.3. The Headquarters, United States Air Force, Deputy Chief of Staff for Operations, Plans and Requirements (AF/A3/5). AF/A3/5 shall develop operational policy and oversee execution for airfield infrastructure systems as they relate to specific weapons systems.

2.4. The Headquarters, Air Force Materiel Command (AFMC). AFMC shall:

2.4.1. Manage development of new engineering requirements and oversee initial production of AASs.

2.4.2. Transfer responsibility for item management, engineering, and procurement support to Air Force Life Cycle Management Center once the initial production quantity is complete.

2.5. The Air Force Life Cycle Management Center (AFLCMC). AFLCMC shall:

2.5.1. Provide logistic and engineering support and item management for AASs and components.

2.5.2. Procure AASs and provide oversight of spare parts standards.

2.5.3. Provide technical assistance, configuration control, and consultation on maintenance, product improvement, modifications, testing, inspections, and installation of AASs.

2.5.4. Compile information from the Air Force Civil Engineer Center (AFCEC) reporting process (see [paragraph 2.13.4](#)) to ensure availability for analysis of specific system performance and use.

2.6. The Air Force Flight Standards Agency (AFFSA). AFFSA shall:

2.6.1. Provide guidance to the Air Staff on operational issues relating to AASs. **(T-0).**

2.6.2. Coordinate with the local Airfield Operations office on modifications to local AASs. **(T-0).**

2.7. The MAJCOM Director of Operations (MAJCOM/A3). MAJCOM/A3 shall:

2.7.1. Oversee MAJCOM execution for airfield infrastructure systems as they relate to specific weapons systems and impacts to current and future missions and exercises.

2.7.2. Be the approval authority on waiver requests for the application of non-standard airfield markings and deviations from published guidance. **Note:** Non-standard markings are those not defined within any DoD, Air Force, Department Of Transportation, Federal Aviation Administration (FAA), Federal Highway Administration, International Civil Aviation Organization (ICAO), Air Standardization Coordinating Committee, or North Atlantic Treaty Organization (NATO) standard appropriate for application at the given installation.

2.8. The Air Force Installation and Mission Support Center (AFIMSC). AFIMSC shall:

2.8.1. Support the development of policy, strategy, doctrine, directive guidance, oversight, and resource advocacy for airfield infrastructure systems.

2.8.2. Be responsible for the development of airfield infrastructure systems non-directive publications.

2.8.3. Manage the AAS program as a part of the Transportation Networks and Pavements Activity Management Plans (TNAP AMP) process and appoint an AAS Manager to work with the TNAP AMP manager to provide program and asset management.

2.8.4. Coordinate on waivers for non-standard airfield infrastructure systems.

2.8.5. Develop a phased AAS overhaul schedule to prevent unnecessary runway closures and waiver requests that forecasts future requirements. **Exception:** National Guard Bureau, Civil Engineer Operations (NGB/A4OC) performs this function for ANG.

2.8.5.1. Include all AASs, to include those with war reserve materiel designation, such as the mobile aircraft arresting system (MAAS).

2.8.5.2. Provide a copy of this schedule to the Ground Support Equipment Division at the Air Force Life Cycle Management Center (AFLCMC/WNSEC).

2.8.5.3. If the schedule requires depot overhauls, send a copy to the depot at least two years before the anticipated overhaul date.

2.8.5.4. Provide AFLCMC/WNSEC with annual updates. Preferable time frame for updates is 1-31 January.

2.9. The Air Force Aircraft Arresting System (AAS) Manager. The AAS manager shall:

2.9.1. Oversee the execution of the AASs program.

2.9.2. Review contracts for the performance of AAS maintenance operations. Ensure contracts include standards of competency for maintenance personnel by referencing this manual and other appropriate guidance.

2.9.3. Establish and maintain a record of AAS overhauls that include a brake change for all Air Force arresting systems. **Exception:** NGB/A4OC manages this process for ANG.

2.9.4. Review new AAS installation drawings. All new installations must be in compliance with siting criteria in this manual, Unified Facilities Criteria (UFC) 3-260-01, *Airfield and Heliport Planning and Design*, Facility Criteria (FC) 3-260-18F, *Air Force Aircraft Arresting System (AAS) Installation, Operation, and Maintenance*, the applicable 35E8-series Technical Orders (TO), and the typical installation drawings for the specific system. NGB/A4OC reviews all drawings for ANG.

2.9.5. Review all waivers prior to submission to the approval authority. Ensure programming of corrective actions for any non-temporary waivers. NGB/A4OC reviews all waivers for Air National Guard prior to submitting to the approval authority if the authority is outside of the National Guard Bureau.

2.9.6. Coordinate Air Force Equipment Management System (AFEMS) requests (formerly AF Form 601, *Equipment Action Request*) with MAJCOM/A3 and AFCEC Operations Directorate (AFCEC/CO) submission and authorization of new systems. NGB/A4OC coordinates this function for ANG.

2.9.7. Review and approve plans for installation of BAK-12s. Only consider below grade installation when above grade installation is not feasible due to topography or airfield operational limitations. **Note:** Air National Guard may approve below grade installations upon coordination between NGB/A4OC, the unit, the civilian airfield authority, and the Federal Aviation Administration.

2.9.8. Schedule replacement of all BAK-12/MAAS gas rewind engines, and MAAS gas hydraulic power units with diesel engines/units, concurrent with ten-year overhaul trade out. **Exception:** NGB/A4OC will perform this function for ANG AASs and will replace the gas engines by attrition at the time of overhaul.

2.9.9. Recommend, and provide contact information, to units for appropriate subject matter experts (SME) where deemed appropriate or beneficial to assist with installation of arresting systems.

2.10. The Air Force Civil Engineer Center (AFCEC). AFCEC shall:

2.10.1. Support the development of policy, strategy, doctrine, directive guidance, oversight, and resource advocacy related to airfield infrastructure systems.

2.10.2. Provide airfield infrastructure SMEs to be senior consultants for technical issues and requirements.

2.10.3. Consult with SAF/IE and AF/A4C on all non-directive guidance and execution of airfield infrastructure programs.

2.10.4. Perform a technical review of airfield marking waivers and forward packages to the AFIMSC for coordination with host MAJCOM Ground Safety, Weapons Safety, Flight Safety, Airfield Management, and Flight Operations prior to submitting to MAJCOM/A3 for final decision. The AFCEC Comprehensive Planning Division (AFCEC/CPD) is the primary contact for this action. NGB/A4OC will coordinate processing of these waivers for ANG installations.

2.10.5. Appoint a Transportation Network Airfield Pavement Support Systems Sub-Asset Management Plan Manager to act as the primary point of contact for asset management of AASs.

2.11. The Installation Commander. The installation commander shall:

2.11.1. Provide oversight and support of installation airfield infrastructure systems in accordance with DoD, federal, state, and legally applicable host nation laws. **(T-0).**

2.11.2. Be the approval authority for the addition of standardized airfield markings. **(T-2).**

2.11.3. Coordinate on waiver requests for non-standard airfield markings before submitting to AFCEC/PPP for review. For joint bases, the mission commander, as identified in the joint base memorandum of agreement, is responsible for installation support. **(T-2). Exception:** Obstruction marking requirements at joint civilian-military use airfields are not waivable. **(T-0).**

2.11.3.1. A joint civilian-military use airfield is defined as an installation where written agreements exist between the military and a local government agency authorizing the use of the military runways as a public airport.

2.11.3.2. For joint civilian-military use installations, the installation commander shall identify all obstructions as defined within Title 14, Code of Federal Regulations, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, UFC 3-260-01 and ICAO Annex 14, as applicable. **(T-0).** Obstructions must be marked as applicable in accordance with either FAA Advisory Circular (FAA AC) 70/7460-1, *Obstruction Marking and Lighting*, or ICAO Annex 14, as appropriate. **(T-0).**

2.12. The Base Civil Engineer (BCE). BCEs shall:

2.12.1. Provide oversight and support of installation airfield infrastructure systems in accordance with DoD, federal, state, and legally applicable host nation laws. **(T-0).**

2.12.2. Appoint a designated representative to manage each of the three main programs covered by this manual: Airfield Markings, AASs, and Visual Air Navigation Systems. **(T-2).**

2.12.3. Prepare packages for non-operational waivers. **(T-3).**

2.12.4. Coordinate on waivers for airfield infrastructure systems prior to routing to the approval authority and distribute final copies of all adjudicated waiver requests to appropriate installation units. **(T-3).**

2.12.5. Initiate project or work order to correct airfield infrastructure not in compliance with this manual and applicable TOs, Unified Facility Criteria and Facility Criteria. **(T-0).**

2.12.6. Complete AAS certification engagements. **(T-3).**

2.12.7. Budget for shipping costs to execute AAS 10-year overhauls. Coordinate with the AFIMSC Installation Engineering Division (AFIMSC/IZB) and appropriate depot at least 2 years in advance to schedule overhauls. **(T-2). Exception:** NGB/A4OC performs this function for ANG.

2.12.8. Ensure real property records reflect when project accomplishment qualifies for inclusion in the real property record or requires expensing project cost. This includes periodic replacement and decommissioning in accordance with UFC 1-300-08, *Criteria for Transfer and Acceptance of DoD Real Property*. **(T-0).**

2.13. The BCE Designated Aircraft Arresting System (AAS) Representative. AAS representatives shall:

2.13.1. Develop and implement a local operating instruction to define responsibilities of all personnel engaged in AASs activities. **(T-3).** The operating instruction shall include:

2.13.1.1. The roles and responsibilities of power production personnel, firefighters, and any other personnel involved during engagements. **(T-3).**

2.13.1.2. Required coordination with other work centers involved during operations, such as snow and ice control. (T-3).

2.13.1.3. Procedures to clear aircraft from the runway and inspect and reset the system immediately after each engagement. (T-3).

2.13.1.4. An overview of any previously approved non-standard configurations. (T-3).

2.13.1.5. Changes to procedures during non-duty hours. (T-3).

2.13.1.6. Maintenance schedules for any arresting systems not officially placed in service or installed on closed runways. (T-3).

2.13.2. BCE will review and approve the operating instruction annually. (T-3).

2.13.3. Forward to the AFIMSC AAS Manager a signed copy of the operating instruction within 10 days of approval and maintain in the power production section. Upon updating, provide a copy to the AFIMSC AAS Manager. When updated, a copy must be provided to the AFIMSC AAS Manager. NGB/A4OC coordinates this function for ANG. (T-2).

2.13.4. Submit a report on AAS engagements and missed engagements as soon as reasonably possible to AFCEC via the Aircraft Arresting Reporting System (<https://portal.afcec.hedc.af.mil/CO/AAS/SitePages/Home.aspx>). (T-2).

2.13.5. Establish and maintain an adjusted stock level of critical replacement items for AASs. (T-3). Examples of items that units should consider maintaining at special levels include (but are not limited to) purchase tapes, tape connectors, pendants, control valves, shuttle valves, special fittings, brake sets or kits, and replacement modules for textile brake arresting systems.

2.13.6. Report all deficiencies with AASs and components to base supply. (T-2). Specific procedures for reporting can be found in T.O. 00-35D-54, *USAF Material Deficiency Reporting, Investigation, and Resolution*.

2.13.7. Maintain applicable T.O.s and work cards, Air Force instructions, AFIMSC publications or instructions, and local instructions in the work center and are available for all personnel participating in arresting systems activities. (T-2).

2.14. The BCE Designated Airfield Marking Representative. Airfield marking representatives shall:

2.14.1. Ensure airfield markings comply with this manual, UFC 3-260-04, *Airfield and Heliport Marking*, FAA and ICAO directives as applicable. (T-0).

2.14.2. Ensure airfield markings clearly define closed and hazardous areas, especially during construction. (T-1).

2.14.3. Develop a schedule with local flight safety office and Airfield Manager for monitoring and periodic inspection of airfield markings and obstructions. (T-2).

2.14.4. Schedule maintenance and remarking of airfield and vehicular access roadway pavements. (T-2).

2.14.5. Prepare, coordinate and submit waiver requests and supporting documentation to airfield management, safety (flight, ground, and weapons), and flight operations for

coordination before requesting the installation commander's approval for processing at AFIMSC. (T-2).

2.14.6. Prepare, coordinate, and submit a final copy of waiver requests to all interested offices at the installation, AFCEC/PPP, and Major Command levels. At minimum, the BCE representative must provide copies of waivers to civil engineers, airfield management, and safety. (T-2).

Chapter 3

STANDARDS FOR AIRFIELD MARKINGS

3.1. Regulatory Guidance

3.1.1. All Air Force activities, except those operating at airports owned and controlled by an authority other than the DoD, shall follow this manual in conjunction with UFC 3-260-04 unless an approved waiver is on file. **(T-0)**.

3.1.2. For airports under Department of Transportation and Federal Aviation Administration jurisdiction, installations shall use FAA AC 150/5340-1, *Standards for Airport Markings*. **(T-0)**.

3.1.3. Air Force tenant organizations on civil airports shall use DoD standards on the military portion of the airfield to the maximum extent practicable; otherwise, FAA criteria apply. **(T-0)**.

3.1.4. For DoD facilities overseas, follow DoD standards unless a written host-nation agreement exists between the host nation and DoD. In that case, use the specified NATO, ICAO, or FAA per the agreement. **(T-0)**.

3.1.5. For cases where a Status of Forces Agreement specifically requires international standards, use ICAO Annex 14 to the Convention on International Civil Aviation, Volume I, *Aerodromes Design and Operations* for fixed wing runways or ICAO Annex 14 to the Convention on International Civil Aviation, Volume II, *Heliports* for rotary wing helipads and runways, as appropriate. **(T-0)**.

3.2. Waivers

3.2.1. The MAJCOM/A3 is the approving authority for all non-standard markings.

3.2.2. The installation commander is the approving authority for any additional standard markings but must submit waivers for non-standard markings to AFCEC/CPD for review and coordination with MAJCOM/A3. **(T-2)**.

Chapter 4

MANAGING, OPERATING, AND MAINTAINING AIRCRAFT ARRESTING SYSTEMS

4.1. Aircraft Arresting Systems Installation, Operation, and Maintenance

4.1.1. For detailed information regarding installation, operation and maintenance procedures for AASs, refer to FC 3-260-18F and the 35E-8 series TOs.

4.1.2. FC 3-260-18F provides specific information regarding topics such as grandfathered systems, installation at jointly used airports, use by non-US aircraft, approved configurations, maintenance documentation and records.

4.1.3. Personnel performing maintenance on an AAS shall be task-certified, 3-level or higher power production personnel (AFSC 3E0X2) or the civilian equivalent (WG-5378). **(T-2).**

4.1.4. Personnel performing an after-arrestment inspection and/or certifying an AAS back in service shall be task-certified, 5-level or higher power production personnel (AFSC 3E0X2) or the civilian equivalent (WG-5378). **(T-2).**

4.1.5. Personnel certifying a system in service after an installation or major civil works that could impact system alignment shall be task-certified, 7-level or higher, power production personnel (AFSC 3E0X2) or the civilian equivalent (WG-5378). **(T-2).**

4.1.6. The BCE will specifically designate in writing personnel other than power production (AFSC 3E0X2) or civilian equivalent (WG-5378) to assist with daily inspections or during engagements. **(T-3).** Additionally, the designated lead power production technician or the civilian equivalent (WG-5378) must certify these personnel annually. **(T-3).**

4.1.6.1. Installations shall develop local procedures and lesson plans to train all personnel (including non-power production personnel) who use, operate, or maintain an AAS. **(T-3).** Training shall be to the appropriate task level in the 3E0X2 Career Field Education and Training Plan and ensure all personnel are task-certified for their assigned duties. **(T-3).**

4.1.6.2. Document training and certification on each individual's AF Form 623, *Individual Training Record Folder*, Supervisor's Employee Brief-971, or other training records, as appropriate. **(T-3).** Provide a record of training to the trainee's regular duty section.

4.1.7. Submit waivers to deviate from the 35E8-series TO to AFIMSC/IZB. **(T-2).** AFIMSC will forward reviewed waivers to the Air Force Life Cycle Management Center (AFLCMC) at Robins Air Force Base. **Exception:** Air National Guard units should send TO waiver requests to NGB/A4OC.

4.1.8. Installations may request AFIMSC/IZB conduct a site visit to ensure compliance with all applicable requirements. A site visit can include an assessment of the condition, operation and maintenance of arresting systems, as well as a review of training, reporting and maintenance records. A site visit will address any installation issues. NGB/A4OC coordinates this function for Air National Guard.

4.2. Obtaining new Aircraft Arresting Systems

4.2.1. Send requests for new systems to the AFIMSC/IZB AAS Manager or Major Command AAS Manager (copy AFCEC/COSC). Coordinate requirements at least two years in advance, or as soon as new requirements are known, to allow sufficient lead-time for budgeting, contracting actions, manufacturing, and delivery. **(T-2).** **Exception:** NGB/A4OC coordinates this function for ANG. **(T-2).**

4.2.2. The AFIMSC/IZB AAS Manager or MAJCOM AAS Manager for AFR and ANG shall coordinate new requirements with the host MAJCOM's Operations Directorate (A3) and Flight Safety prior to approving or denying an installation's request. Upon MAJCOM endorsement receipt and system approval by AFIMSC/IZB, the installation shall submit an Air Force Equipment Management System (AFEMS) request to the base equipment management office. **(T-3).**

4.2.3. Upon approval of the Air Force Equipment Management System request, the BCE's representative shall requisition the system and any other components not included in the government-supplied equipment kit, such as the pendant. **(T-3).**

4.3. Aircraft Arresting System Installation

4.3.1. The BCE's AAS representative shall review the construction drawings and contract specifications at the 35 percent and 65 percent completion stages and approve at the 90 percent design completion phase. **(T-2).**

4.3.2. Designs shall be sent to the AFIMSC/IZB AAS Manager or MAJCOM Manager for AFR and ANG for review at the 35, 65 and 90 percent stages. **(T-2).**

4.3.3. Provide drawings to other organizations such as Airfield Operations, Safety, and MAJCOM/A3 as required for input throughout the design and construction process. **(T-3).**

4.3.4. Coordinate siting with Airfield Operations, the Operations Group (or equivalent), and Flight Safety. **(T-3).** NGB/A4OC coordinates this function for Air National Guard. **(T-2).**

4.4. Aircraft Arresting System Certification

4.4.1. Complete operations, maintenance, inspections and certifications of new and existing AASs in accordance with FC 3-260-18F and applicable 35E8-series T.O.s. **(T-0).**

4.4.2. The minimum aircraft speed for certification engagement is 75 knots. **Exception:** For BAK-12 and mobile aircraft arresting systems (MAAS), aircraft speeds less than 75 knots are acceptable if using the hydraulic system. To qualify as a valid certification engagement, each hydraulic selector valve must shuttle from static pressure to pump pressure.

4.4.3. If extenuating circumstances prevent certification by engagement, perform a certification inspection or remove the system from service. **(T-3).** The AFIMSC/IZB designated representative or MAJCOM AAS designated representative for AFR and ANG must perform the certification inspection; assigned AAS maintenance personnel may not perform the inspection. **(T-2).** Do not substitute certification inspections for initial installation certification engagements. **(T-3).**

4.4.4. For annual certification accomplished by inspection, the inspection should be on or before the anniversary of the last system engagement. **(T-3).** The inspection shall include (but is not limited to) all requirements in Section 5 of the applicable 35E8-series TO **(T-1).**

4.4.5. The installation commander may direct that new systems are placed in service. The installation commander may direct keeping those overdue for certification in service for up to one year beyond the original required certification date. If the period between aircraft engagements exceeds 24 months, take the system out of service. **(T-2)**. If such an order is given, it shall be documented in the maintenance records and notification given to AFIMSC/IZB AAS Manager or MAJCOM AAS Manager for AFR and ANG, and airfield operations prior to overdue date. **(T-2)**.

4.5. Aircraft Arresting System Decommissioning

4.5.1. If the mission or mission aircraft assigned to an installation no longer require an AAS(s), installations shall consider decommissioning the system(s). **(T-2)**.

4.5.2. Installations shall notify the owning MAJCOM/A3 of the request to decommission and copy the A4C. **(T-2)**. The MAJCOM will notify AF/A3, AF/A5/8, AF/A4C, and AFIMSC/IZB of the intent to decommission. ANG units should notify NGB/A4OC.

4.5.3. AF/A3 and AF/A5/8 will solicit comments on impacts of decommissioning to operations from Air Combat Command, as the Combat Air Forces lead command, as well as any other potentially impacted MAJCOMs or sister services.

4.5.4. After inputs are received, AF/A3O will review the recommendations in coordination with AF/A4C and AF/A5/8 to provide a consolidated recommendation to AF/A3, AF/A5/8 and AF/A4.

4.5.5. As a minimum, the following areas/subjects shall be considered by Headquarters Air Force before making a decommissioning recommendation:

4.5.5.1. Review Operation Plans, Memorandums of Understanding, Memorandums of Agreement, Letters of Agreement, and contingency plans to identify any requirements from other organizations.

4.5.5.2. Input from flying units regularly using the airfield for daily operations, emergency diverts, routine local training, en-route stop for deployments, hurricane evacuation base, etc.

4.5.5.3. Any fiscal challenges impacting the ability to keep the AAS operational.

4.5.5.4. If located on a joint-use field, input of local airfield management and/or the FAA.

4.5.6. Upon decommissioning approval:

4.5.6.1. ACC/A3 will notify the host Airfield Manager, who will in turn submit the appropriate Notice to Airman (NOTAM) and update the appropriate DoD Flight Information Publications (FLIP) before removing the system from service.

4.5.6.2. The responsible installation will program and prioritize projects to remove all AAS structures and infrastructure. **(T-2)**. Examples may include arresting system enclosures, concrete foundations, ultra-high-molecular-weight polyethylene panels, or subsurface BAK-14 and Type H hook cable systems.

4.5.6.3. Restore the area to grading standards in UFC 3-260-01 unless waived in accordance with the UFC. **(T-0)**.

4.5.6.4. The BCE shall ensure the update of the real property records upon removal of the AAS. **Exception:** NGB/A4OC coordinates this function for ANG. **(T-1).**

4.5.6.5. Equipment disposition instructions shall be requested from the AAS item manager (AFLCMC/WNZCA) using AFTO Form 375, *Selected Support Equipment Repair Cost Estimate*. Units should remove equipment from the base's Custody Authorization/Custody Receipt Listing and Allowance Standard after the item manager provides disposition instructions. **(T-2).** **Exception:** NGB/A4OC coordinates all disposition of ANG arresting systems. **(T-2).**

Chapter 5

VISUAL AIR NAVIGATION SYSTEMS

5.1. Overview

5.1.1. The term “visual air navigation systems” refers to all lights, signs, symbols, and other visual aid devices located on and in the vicinity of an airfield. These systems provide a visual reference and guide to pilots and ground crew. These systems supplement the guidance from electronic aids such as Tactical Air Navigation (TACAN), Precision Approach Radar (PAR), and Instrument Landing Systems (ILS).

5.1.2. Standardize all visual air navigation facilities for operational safety. Standardization means that the configuration and color of the lights at each airfield are identical and have the same meaning.

5.1.3. The Air Force generally follows FAA standards as directed by 14 CFR Part 77.

5.1.4. Exceptions may exist for certain international standards, construction in foreign nations, and requirements that are unique to the Air Force. Units should consult UFC 3-535-01, *Visual Air Navigation Facilities*, for the specific precedence for these requirements and prior to any changes to visual navigation systems.

5.2. Light Emitting Diode (LED) Fixtures

5.2.1. LED fixtures are approved for use on Air Force installations in both enduring and contingency applications with the following exceptions **(T-1)**:

5.2.1.1. Medium- and high-intensity runway edge lighting

5.2.1.2. Approach lighting

5.2.1.3. Obstruction lighting

5.2.2. The FAA-approved third-party certification body must approve all LED fixtures. **(T-2)**.

5.2.3. The latest FAA-certified equipment list, the list of certified airport lighting equipment manufacturers, and the list of third-party certifiers can be found in the Addendum to FAA AC 150/5345-53D, *Airport Lighting Equipment Certification Program*.

5.2.4. LED fixtures must contain integral, multi-level surge protection, and be capable of in-house repair. **(T-3)**.

5.2.5. For additional requirements regarding LED fixtures, refer to UFC 3-535-01.

5.3. Solar Airfield Lighting

5.3.1. Solar airfield lighting inherently implies the use of LED fixtures. Use the UFC 3-535-01 waiver process when using LED fixtures for edge lights, threshold lights, taxiway edge lights, distance remaining markers, and obstruction lights (only for known navigational objects below 35 feet). **(T-0)**. Only use solar lights when one of the following conditions apply **(T-1)**:

5.3.1.1. Continuous electric power for airfield lighting is not available or reliable outside of the US;

5.3.1.2. Where airfield and ranges are used only for deployment training purposes; or,

5.3.1.3. Where interim measures are needed to accomplish airfield repairs for which no temporary lighting sources can be obtained.

5.3.2. Any solar lighting used for other areas must meet the requirements of UFC 3-535-01. **(T-0).**

5.3.3. For airfields in a deployed theater of operations and temporary locations, solar lighting may be used and this necessarily entails LED use where not normally approved. The waiver authority in this case is the Combined Forces Air Component Commander (CFACC).

5.3.4. Do not install solar visual air navigation equipment or configurations for permanent or fixed, long-term bases in active theaters of conflict, that do not comply with this manual and UFC 3-535-01 without an approved waiver. **(T-0).**

5.4. Use of Non-Standard Equipment

5.4.1. Alternative equipment implementing new technology shall:

5.4.1.1. Have Air Force Civil Engineer Center approval. **(T-1).**

5.4.1.2. Satisfy requirements of this manual and UFC 3-535-01. **(T-0).**

5.4.1.3. Not compromise safety, reliability, maintainability, availability, cost-effectiveness, and service life. **(T-2).**

5.4.1.4. Be maintainable with adequate training and logistic support without the requirement for proprietary maintenance. **(T-2).**

5.4.2. Consider and analyze the effects of the alternative equipment and new technology on the entire system prior to solicitation, installation, or use. **(T-2).**

5.4.3. In emergency situations where a significant delay in facility restoration due to the non-availability of replacement parts will occur, units may substitute equipment that does not comply with the intent of this manual and/or UFC 3-535-01. BCEs, airfield operations, and flying safety offices must coordinate on these substitutions, and notify the MAJCOM/A3 and A4C, or equivalents. **(T-2).** Remove substitute equipment from service upon completion of approved replacement equipment installation. **(T-1).**

WARREN D. BERRY, Lieutenant General, USAF
DCS/Logistics, Engineering & Force Protection

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

Title 14, Code of Federal Regulations, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*

Title 14, Code of Federal Regulations, Part 91, *General Operating and Flight Rules*

UFC 1-300-08, *Criteria for Transfer and Acceptance of DoD Real Property*, 1 August 2011

UFC 3-260-01, *Airfield and Heliport Planning and Design*, 17 November 2008

UFC 3-260-04, *Airfield and Heliport Marking*, 16 May 2018

FC 3-260-18F, *Air Force Aircraft Arresting System (AAS) Installation, Operation, and Maintenance*, 28 October 2015

UFC 3-535-01, *Visual Air Navigation Facilities*, 7 March 2018

Technical Order 00-35D-54, *USAF Deficiency Reporting, Investigation, and Resolution*, 1 September 2015

Technical Order 35E8-2-5-1, *Operation and Maintenance Instructions – Aircraft Arresting System Model BAK-12*,

FAA AC 70/7460-1, *Obstruction Marking and Lighting*, 8 October 2016

FAA AC 150/5345-53D, *Airport Lighting Equipment Certification Program*, September 2018

ICAO Annex 14 to the Convention on International Civil Aviation, Volume I, *Aerodromes Design and Operations*, July 2018

ICAO Annex 14 to the Convention on International Civil Aviation, Volume II, *Heliports*, July 2013

AFI 33-360, *Publications and Forms Management*, 1 December 2015

AFMAN 33-363, *Management of Records*, 1 March 2008

AFPD 32-10, *Installations and Facilities*, 4 March 2010

Prescribed Forms***Adopted Forms***

AF Form 847, *Recommendation for Change of Publication*

AF Form 601, *Equipment Action Request*

AF Form 623, *Individual Training Record Folder*

AFTO Form 375, *Selected Support Equipment Repair Cost Estimate*

Abbreviations and Acronyms

AC—FAA Advisory Circular

ACC—Air Combat Command
AFCEC—Air Force Civil Engineer Center
AFCEC/CO—AFCEC Operations Division
AFCEC/CPP—AFCEC Comprehensive Planning Division
AFIMSC—Air Force Installation and Mission Support Center
AFIMSC/IZB—AFIMSC Installation Engineering Division
AFEMS—Air Force Equipment Management System
AFLCMC—Air Force Life Cycle Management Center
AFLCMC/WNZEC—AFLCMC Ground Support Equipment Division
AFMAN—Air Force Manual
AFPD—Air Force Policy Directive
AFR—Air Force Reserve Command
AAS—Aircraft Arresting System
ANG—Air National Guard
BCE—Base Civil Engineer
CFACC—Combined Forces Air Component Commander
CFR—Code of Federal Regulation
FAA—Federal Aviation Administration
FC—Facilities Criteria
FLIP—Flight Information Publication
ICAO—International Civil Aviation Organization
ILS—instrument landing system
LED—Light Emitting Diode
MAAS—Mobile Aircraft Arresting System
MAJCOM—Major Command
NGB—National Guard Bureau
NGB/A4OC—NGB Civil Engineer Operations Division
NOTAM—Notice to Airmen
OPR—Office of Primary Responsibility
PAR—precision approach radar
SME—Subject Matter Expert
TACAN—tactical air navigation

T.O.—Technical Order

UFC—Unified Facilities Criteria

WG—Wage Grade

Terms

Aircraft Arresting System (AAS)—A series of components used to engage and absorb the forward momentum of a routine or emergency landing or an aborted takeoff.

BAK—12 - The USAF's operational standard AAS. With a full description available in T.O. 35E8-2-5-1, *Operation and Maintenance Instructions – Aircraft Arresting System Model BAK-12*, the typical installation drawing set 67F2013A provides installation guidance. Mounting the BAK-12 energy absorbers on trailers turns the system onto a MAAS.

Effective Pendant Height—The vertical distance in inches from the underside of the pendant cable to a projected surface representing undamaged runway surface.

Instrument Runway—A runway with instrument aids providing directional guidance adequate for a straight-in approach. Further classifications may include:

Category I Precision Approach Runway—A runway with an ILS, a Microwave Landing System, or a precision approach radar (PAR) and visual aids for operations down to 60 meters (200 feet) decision height, and down to a runway visual range on the order of 720 meters (2400 feet). These criteria also apply to visual lighting aids supporting Air Force PAR approaches down to a decision height of 30 meters (100 feet) and an runway visual range on the order of 360 meters (1200 feet).

Category II Precision Approach Runway—A runway with ILS or a Microwave Landing System, or a PAR and visual aids for operations down to 30 meters (100 feet) decision height and down to an runway visual range on the order of 360 meters (1200 feet).

Nonprecision Instrument Approach Runway—A runway with a nonprecision aid (such as TACAN or Very High Frequency Omnidirectional Range with TACAN) providing directional guidance adequate for a straight-in approach.

Joint Civilian—Military Use Airfields - Military airfields where written agreements exist between the military and local authorities that allow general aviation use of airfields, or portions of airfields, for which both parties have executed a joint-use agreement granting equal privileges.

Missed Engagement—Any unsuccessful attempt to engage an AAS hook cable with a successfully deployed aircraft tailhook.

Mobile Aircraft Arresting System (MAAS)—A self-contained, trailer- mounted, BAK-12 AAS that accommodates rapid installation during contingencies.

Non-standard Markings—Airfield markings not defined within any DoD, Air Force, Department Of Transportation, Federal Aviation Administration (FAA), Federal Highway Administration, International Civil Aviation Organization (ICAO), Air Standardization Coordinating Committee, or North Atlantic Treaty Organization (NATO) standard appropriate for application at the given installation.

Pendant—The part of an AAS that spans the runway surface or flight deck landing area and is engaged by the aircraft arresting hook.

Visual Air Navigation Systems—All lights, signs, symbols, and other visual aid devices located on and in the vicinity of an airfield. These systems provide a visual reference and guide to pilots and ground crew. They supplement the guidance from electronic aids such as Tactical Air Navigation (TACAN), Precision Approach Radar (PAR), and Instrument Landing Systems (ILS).