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CHAPTER 1. GENERAL

101. Scope.

This document is intended to provide guidance for ensuring the adequacy of navigational aids in a regional multi-national military environment. It contains requirements and information to enable interoperability of flight inspection resources. Where not covered in other published international standards (i.e. ICAO Annex 10, ICAO DOC 8071, etc.), this document is meant to prescribe flight inspection methods, maneuvers, or tolerances.

102. Ownership.

The nation owning/maintaining a navigational aid is totally responsible for its operation, maintenance, flight inspection, and certification of its conformance to applicable standards. When, in a multi-national military operation, NATO Forces assume responsibility for airfields or Air Traffic Control systems in non-NATO countries, the responsibilities for the navigational aids must be clearly assigned. As flight inspection is largely a support function for facility maintenance, the nation assuming maintenance responsibility also assumes flight inspection responsibility.

103. Necessity For Flight Inspection.

It is essential that air navigational aids provide the maximum possible assistance to the users, coupled with a uniform quality of information. Experience has shown that radio/radar navigation aids do not always provide sufficiently accurate information to the aircraft, even when the results of ground checks are satisfactory. The deficiency may be caused by the environmental effects of terrain or man-made obstructions, or by electronic interference.

104. Ground and Flight Testing.

If a facility parameter can be adequately evaluated through ground checks, it is advisable to use that more cost-effective method. This is most appropriate for those parameters that are independent of environmental influence. In-flight evaluation should be limited to those signal characteristics that may change with aircraft distance and position relative to the facility. The flyability and adequacy of en route and terminal instrument procedures shall be evaluated in-flight. Flyability and adequacy of en route and terminal instrument procedures may be inspected in conjunction with inspection of the signal quality.

105. Flight Inspection Systems.

While there is presently no single standard for flight inspection systems and aircraft, an aircraft specifically configured for flight inspection must have high-quality receivers, analysis equipment, and recording capability. This equipment must be calibrated to national calibration standards to avoid providing incorrect or conflicting information to facility maintenance personnel. Flight inspections not requiring calibrated signal analysis can be performed in non-specialized aircraft.

106. Aircrew Qualifications.
Flight inspection personnel should be highly skilled in their individual specialty. Engineers or technicians analyzing signals should have extensive knowledge of the ground systems so that they may determine the need for additional checks to ascertain the true quality of the signals and possible causes of unsatisfactory performance. Pilots shall be trained in flight inspection maneuvers and should have training in the design of instrument flight procedures.

107. Types of Flight Inspection.
There are three types of flight inspection:

a. Commissioning. A comprehensive inspection designed to optimize the system and to obtain complete information of total system performance. It is performed prior to commissioning a system for use. A permanently installed system normally will have all parameters checked to support use throughout the normal service volume. A mobile system deployed to support specific requirements may be commissioned with a less comprehensive check if the unchecked areas or features are documented and notices to airmen (NOTAM)'d as "Unusable".

b. Periodic. A routine, periodical inspection to check for the effects of signal drifting and to ensure continued satisfactory obstacle clearance for instrument procedures. During a periodic inspection, the flight inspector should also observe lighting systems and general airfield conditions that might affect airfield usability.

c. Special. Special inspections are performed outside of the normal periodic interval. They may be performed anytime the accuracy or usability of a facility is questionable. Typical reasons are site evaluation, extensive facility (i.e. antenna) changes or environmental changes, user complaints, or after an aircraft accident or incident where the navigational aid (NAVAID) may have contributed. The extent of inspection depends on the reason for the check and may include any or all commissioning checks. Special checks meeting or exceeding periodic requirements may be used to update periodic scheduling.

108. Reliance on International Civil Aviation Organization (ICAO) Standards and Guidance.
Most navigational aids used in NATO are common to both the civil and military users. System standards for civil systems are addressed in ICAO Annex 10, and ground/flight inspection of these systems is addressed in ICAO Document 8071. ICAO standards for lighting systems are contained in Annex 14 and Document 9157-AN/901. Each nation performing flight inspection should ensure that their policies require applicable navigational facilities to meet ICAO standards and that they are flight inspected in accordance with the general guidelines of Doc 8071, except as specified in this publication. Those systems not full addressed in ICAO documents, such as TACAN, shall be inspected in accordance with the instructions in this publication. Below is a list of applicable ICAO documents:

a. ICAO Annex 10, Volume I, provides the Standards and Recommended

Practices (SARPs) for Radio Navigational Aids. It contains specifications for signals and siting.

b. **ICAO Annex 14, Volume I**, contains the SARPs for airfield design and lighting systems.

c. **ICAO Annex 14, Volume II**, contains the SARPs for heliport design and lighting systems.

d. **ICAO Document 8071, Volume I**, "Testing of Radio Navigation Aids" provides guidance on the ground and flight testing of facilities. It is a comprehensive source of information on flight inspection of standard civil-type systems.

e. **ICAO Document 8071, Volume III,** "Testing of Surveillance Radar Systems" provides guidance for the evaluation of primary and secondary radars.

f. **ICAO Document 9157-AN/901, Part 4**, contains design criteria for airfield lighting.

CHAPTER 2. RESPONSIBILITIES

201. Standardized Flight Inspection Requirements.
To ensure maximum flexibility and responsiveness, it is important that the flight inspection requirements and policies of each country participating in multi-national air operations be as standardized as feasible. The differences in flight inspection procedures should be understood by all involved agencies. Periodic interchange meetings are encouraged.

202. Responsibility for Acquired Facilities.
Unless specified in an Operational Directive, the flight inspection responsibility for a NAVAID rests with the NATO country assuming its maintenance responsibility. Unless sufficient evidence exists to verify its continued usability, it shall be assumed to be uncalibrated and require a comprehensive flight inspection prior to use. The extent of the inspection should be jointly determined by the flight inspection crew and the maintenance personnel. The maintaining country should determine the flight inspection periodicity of these facilities.

203. Requests for Flight Inspection Augmentation.
1. When a nation with primary flight inspection responsibility in accordance with Table 2-1 for a facility is unable to accomplish an inspection, it shall be their responsibility to request flight inspection support from another nation. This nation then assumes the responsibility for the specifically requested check(s). The "Primary" must forward all applicable facility data, instrument procedure information, and any specific inspection requirements to the "Alternate". Requests for flight inspection by an alternate source shall be in the following general format and contain applicable data as specified in Annex C. Requests for support for scheduled exercises should be made with as much advance notice as possible. Countries having more stringent tolerances and flight inspection requirements than this document or ICAO guidelines shall be responsible to inform the responding flight inspection agency of these requirements.
2. The request should be submitted by the responsible flight inspection scheduling office via FAX, e-mail, or message to the scheduling office of the requested nation. If able, attach a copy of the most recent comprehensive flight inspection report.

Table 2-1. Flight Inspection Support Request

REQUEST FOR FLIGHT INSPECTION LOCATION________________________ USER/OWNER_____________________ AIRFIELD IDENTIFIER_____________ FACILITY TYPE____________________ FACILITY IDENTIFIER_____________ FIXED OR MOBILE_________________ TYPE OF FLIGHT INSPECTION REQUESTED A. COMMISSIONING B. PERIODIC C. SPECIAL SPECIAL INSTRUCTIONS: POINT OF CONTACT AND PHONE/FAX NUMBER:

204. Reimbursement for Services.

When an alternate agency performs flight inspections at the request of the country normally responsible for the task, reimbursement for costs involved shall be in accordance with Table 2-2. Nations anticipating using or providing reimbursable services should have pre-arranged agreements.

Table 2-2. Flight Inspection Expense Responsibilities

FACILITY TYPE	FACILITY OWNER Or Location	PRIMARY FLIGHT INSPECTION RESPONSIBILITY	IS THE ALTERNATE FLIGHT INSPECTION REIMBURSABLE ?
Fixed	NATO Member	Owner	Yes
Fixed	Non-NATO Member	NATO Operator/Maintainer	No
Mobile (Joint Exercise)	Member	Owner	No
Mobile (Non-Joint Exercise)	Member	Owner	Yes
Mobile/Ship (NATO Operation)	Member	Owner	No
Mobile/Ship (Non-NATO Operation)	Member	Owner	Yes
SATNAV Procedure Supporting One Nation	Permanent airfield in member nation	User	Yes
SATNAV Procedure Supporting Multiple Nations	Airfield in non-member nation	Airfield Operator	No

205. Coverage Requirements.

Where specific requirements for facility service volumes are not published in ICAO documents, the facility owner/manager is responsible for determining the coverage needs of a facility.

206. Alignment Convention.

The alignment error of VHF omnidirectional range (VOR), TACAN, direction finding (DF), non-directional beacons (NDB), and airport surveillance radar (ASR) shall be computed through algebraic addition. The azimuth reference (Automated Flight Inspection System (AFIS), theodolite, infrared or laser tracker, map) shall always be assigned a Positive (+) value, and the azimuth determined by the ground facility shall always be assigned a Negative (-) value. Thus, with a received VOR radial value of 090.5 and an AFIS/map position of 090.0, the facility error would be –0.5°. Alignment errors may also be referred to as clockwise (positive) and counterclockwise (negative).

207. Periodicity.

1. No one standard for periodicity is appropriate for fixed-base NAVAID's, as different type systems have varied reliability. Periodicity should be based on the maintaining nation's standard for the system and, if not exceeding the standards of Table 2-3, should be independent of sovereignty issues of location unless covered under separate Memorandum of Understanding (MOU). The optimum periodicity for a given facility should be based upon equipment type, age, power stability, maintenance capability, and environmental effects such as vibration, corrosion potential, and screening from natural or man-made features. Newly installed equipment may be checked more often than proven legacy equipment to establish its reliability.

2. Mobile NAVAID's should have increased periodicity based on the uncertain long-term environmental effects upon the signals. For the purpose of determining periodicity, mobile facilities with a record of no discrepancies or reliability problems may be considered as "fixed" after two years without changes to antenna location, radiated characteristics, or significant environmental changes.

3. Facilities overdue the scheduled inspection may be granted up to a 30-days extension, providing ground testing indicates no known discrepancies and past flight inspections indicate stable facility performance.

Table 2-3. Recommended Maximum Periodicities (Days) (4)

TYPE EQUIPMENT	FIXED INSTALLATION	MOBILE INSTALLATION
Ground-Based Approach Procedures (1)	180-Upon Request	180-360
Non-Ground-Based Approach Procedures (1) (6)	Precision 180 – 360 Non-Precision 360 - 720	N/A
Instrument Landing System (ILS) (2)	180-360	90-180
Microwave Landing System (MLS) (2)	180-360	90-180
Precision Approach Radar (PAR) (2)	180-360	90-180
Visual Glide Slope Indicator (VGSI)/ Precision Approach Path Indicator (PAPI)/ Visual Approach Slope Indicator (VASI)	180-Upon Request	90-180
Very High Frequency Omnidirectional Range (VOR) (3)	360-720	90-360

Table 2-3. Recommended Maximum Periodicities (Days) (4) (continued)

TYPE EQUIPMENT	FIXED INSTALLATION	MOBILE INSTALLATION
Tactical Air Navigation (TACAN) (3)	180-720	90-360
Primary Surveillance Radar (PSR)/ Secondary Surveillance Radar (SSR) (3)	360-720	180-360
Non-Directional Beacon (NDB) (3)	360-Upon Request	180-360
Direction Finder (DF)	360-Upon Request	180-360
Approach Lights (5)	360-Upon Request	180-360

NOTES:

(1) Precision and non-precision approach procedures will be inspected at the maximum periodicity for the associated facility. Approach procedures include all published, ground-based instrument approach procedures and procedures not requiring ground signals, i.e., airborne radar, GNSS, FMS, etc.

(2) Precision Approaches: Recommend first check after commissioning 90-day, second check 120 days, then establish normal periodicity from 180 - 360 days.

(3) Non-precision Approaches: Recommend 2 checks after commissioning at a 180 day-interval, then establish normal periodicity between 180 – 720 days.

(4) Periodicity may be reduced as necessary when facility performance is questioned.

(5) Approach/Runway lighting should be checked on a surveillance basis on all inspections of the approaches to that runway. Discrepancies shall be identified to the airfield management.

(6) Periodic flight inspection not required if database integrity and obstacle protection surfaces can be adequately ensured through ground evaluation (see paragraph 407).

CHAPTER 3. GENERAL PRE-FLIGHT INSPECTION PROCEDURES

301. Notification.
The flight inspector or scheduling and dispatch facility shall notify the appropriate facility maintenance personnel of the estimated time of arrival (ETA) of the flight inspection aircraft. As much advance notification as possible shall be provided for inspections requiring maintenance personnel support.

302. Standard Service Volume.
Standard Service Volume (SSV) when not specified by ICAO documents will be defined by owning/maintaining country. For VOR or TACAN, SSV will be 25 nm for terminal and 40 nm for en route NAVAIDS. Signal coverage outside the SSV should be formatted as azimuth, distance, and altitude in relation to the facility, e.g., R090 CW – R160, 65 nm, 4000 – 17000 MSL.

303. Preflight Inspection Preparation.
A thorough and complete understanding between facilities maintenance personnel and the flight inspection crew is essential for a successful flight inspection. The flight inspector and the person in charge of the facility are jointly responsible for the required coordination before, during, and after the flight inspection. The flight inspector will brief the facilities maintenance personnel of intended actions.

304. Facilities Operation and Maintenance Personnel.
Efficient and expeditious flight inspections require preflight preparations and actions of facilities maintenance personnel. These preparations include the following actions:

a. **Provide adequate two-way radio communications equipment** and power source at facility sites.

b. **Ensure that all facility equipment** is calibrated in accordance with technical orders.

c. **Ensure personnel** will be available to make corrections and adjustments.

d. **Provide transportation** to move flight inspection equipment and personnel.

e. **Provide accurate facility data** for new or relocated facilities.

f. **Provide proficient operators** during flight inspections of Radar or Direction Finding systems, to minimize the impact of operator deviations on equipment performance.

g. **Issue appropriate NOTAM** for flight calibration when the facility will be unavailable for use or transmitting Hazardous and Misleading Information (HMI).

h. **Provide translators** as necessary to enable the maintenance personnel to communicate with the flight crew.

305. Flight Personnel.
The following actions shall be accomplished prior to the flight inspection:

a. **Ensure that all flight inspection equipment** is calibrated and operational.

b. Brief facilities maintenance personnel.
c. Conduct crew briefing.
d. Obtain maps, charts, equipment, data sheets, etc.
e. Provide two-way communications when a theodolite or other ground support equipment is required.
f. Review the status, limitations, and characteristics of the facility. Ensure that all publications and records agree with the results of the latest flight inspection, and all applicable restrictions are accurate.
g. Coordinate with air traffic control (ATC) personnel the areas and altitudes to be flown during the flight inspection maneuvers and of possible transmitter changes. Ensure that ATC understands the separation requirements for flight calibration.
h. Confirm appropriate NOTAM is issued for flight calibration.

CHAPTER 4. GENERAL FLIGHT INSPECTION PROCEDURES

401. Standby Equipment.
For systems having more than one transmitter, it is necessary to know which system or transmitter is operating so the performance of each can be determined. The unit can be identified as Transmitter Number 1 or 2, Channel A or B, Serial Number, etc.

402. Standby Power.
1. The flight inspector shall check the facility on standby power, if installed, during a commissioning flight inspection. If a standby power system is installed after the commissioning flight inspection, the flight inspector shall check the facility on standby power during the next regularly scheduled periodic inspection. The flight inspector shall make comparative measurements to ensure that facility performance is not derogated on the standby power system and that all tolerance parameters for the specific inspection are met.
2. Standby power checks are not required on facilities powered by batteries that are constantly charged by another power source.
3. Recheck a facility when the standby power source is changed.

403. On-Station Philosophy.
Flight inspectors shall assist in resolving facility deficiencies and restoring the facility to service prior to departure. It must be a joint decision between facility maintenance and the flight inspection crew to terminate work on a facility.

404. Restrictions.
When facility performance does not fully meet established tolerances or standards, the flight inspector shall perform sufficient checks to determine the usable area of the facility, which will be the basis of restrictions (for example, TACAN coverage restrictions), NOTAM's, and procedural redesign.

405. Adjustments.
Requests for adjustment should be specific. The flight inspection crew will furnish sufficient information to enable maintenance personnel to make adjustments. Adjustments that affect facility performance shall be rechecked by flight inspection. Flight inspection certification shall be based on facility performance after all adjustments are completed.

406. Incomplete Inspections.
When an inspection on a commissioned facility must be halted with the equipment in an abnormal condition due to aircraft malfunction, weather, etc., maintenance personnel and the flight crew shall discuss the facility condition and the remaining checks. If adequate references provide the ability to return to a previously certified setting, the equipment may be returned to service. The inspection will be classified as incomplete until the remainder of the checks are completed. When a prescribed inspection

checklist item cannot be adjusted within tolerance, the inspection will be terminated, facility status changed to unusable, and the inspection classified as incomplete until the remainder of the checks is completed.

407. Obstruction Evaluation.

The evaluation of procedural Obstacle Protection Surfaces is an important part of flight inspection and can take place either or both on the ground or in the air. Ground certification is acceptable when surveys and maps are accurate, construction affecting airspace is tightly controlled and vegetation growth is predictable or controlled. If these conditions are not all met, in-flight evaluation is required. As these conditions can seldom be effectively verified outside of a nation’s own border, all flight inspections performed outside a nation’s own territory should verify obstacle protection. Controlling obstacles in each segment must be confirmed during the initial certification and cyclic review of flight procedures. In general, obstacle assessment should be evaluated to the lateral limits of the procedure design segment. This may require flying the lateral limits for procedures in challenging terrain/airspace, especially for RNAV procedures with demanding Required Navigation Performance (RNP) limits.

CHAPTER 5. POST-FLIGHT PROCEDURES

501. Post Flight Inspection Actions.

1. **Aircrew.** Upon completion of the inspection, the crew shall perform the following actions:

a. **Briefing.** Brief facilities maintenance personnel concerning results of the inspection. Flight inspection shall report all facility outages to appropriate personnel.

b. **Facility Status**. Flight inspection shall assign a status (unrestricted, restricted, or unusable) for the facility and notify the appropriate personnel. This status shall be based upon the suitability of the signal; the owning/maintaining nation is the final authority for placing a facility into service. In that flight inspection supports the ground maintenance organization or host nation aviation authority, care should be taken not to mistake the facility status assigned by a flight inspection as the last and only step required for authorizing a facility for use. There is potential for confusion, especially when ownership of a facility and maintenance responsibility is transferred to the non-NATO host nation in which it is located, and flight inspection services are still being provided by a NATO country.

c. **NOTAM.** If the results of the flight inspection indicate a need for NOTAM action, prescribe to the proper agency the issuance and/or cancellation of a NOTAM. Within 24 hours the flight inspector should confirm NOTAM publication.

d. **Reports**. Flight inspection reports shall be accurate and describe facility performance and characteristics. The flight inspector should discuss the report with facility operations and maintenance personnel to ensure they understand the report.

e. **“Alternate” Nation Reports.** The “alternate” nation organization performing the flight inspection will use their internal forms. The “alternate” nation shall provide an executive summary describing inspection results, using the format in Figure 5-1.

f. **Flight Information**. The flight inspector shall provide information to the facility manager for publication and review the published information for accuracy.

g. **Historical Analysis.** The owning flight inspection authority should correlate current facility performance with past results to establish a facility trend analysis, if possible.

2. **Facility Management.** Upon completion of the inspection, the facility manager shall perform the following actions:

a. **Results Correlation.** Check correlation of ground and flight check results. These results are used to enable some validation of facility performance using ground checks.

b. **NOTAM.** Issue appropriate NOTAM as required.

TO: (Organization Maintaining the Facility)
FROM: (Flight Inspection Organization)
REFERENCE: NATO STANAG 3374 AS
SUBJECT: FLIGHT INSPECTION REPORT
A flight inspection of the ____________ NAVAIDS facility and/or instrument procedures was/were conducted by our organization on (dd/mm/yyyy) in accordance with the provisions of NATO STANAG 3374 AS.
The facility was found to be (Unrestricted/Restricted/Unusable). If restricted, the restriction is (existing/new). The following NOTAM's were issued through ________________________ on (dd/mm/yyyy).
Applicable NOTAM number is ________________.
Remarks:

The attached flight inspection report provides detailed results.

____
____
(signature of flight inspector) (dd/mm/yyyy)
Attachment: Flight inspection report

Figure 5-1. Alternate Nation Executive Summary

CHAPTER 6. SPECIFIC FACILITY REQUIREMENTS

601. Introduction.

The charts below contain the minimum checks required to certify a facility. Where available, specific references to ICAO documents are provided. Recommended checklists only reference commissioning and periodic requirements.

602. Very High Frequency Omnidirectional Range (VOR).

The guidance in ICAO Document 8071, Volume I, is adequate to ensure facility adequacy. Recommended tolerances are contained in Table I-2-3 of ICAO Document 8071. Table 6-1 contains the minimum checks required to certify a VOR facility.

Table 6-1. VOR Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Radial Alignment	X	X	3.3.3.2 Gnd	2.3.9
(Pattern Accuracy) Reference Radial	X	X		2.3.26
Coverage	X		3.3.4.1	2.2.9
Course Structure	X	X		2.3.12-14
Airways/Routes	X			2.3.33
Modulations	X	X	3.3.5.1	2.2.11/12/15-18
ID/Voice	X	X	3.3.6	2.2.26
Sensing & Rotation	X	X	3.3.1.1 3.3.1.3	2.3.3 2.3.4
Approaches	X	X		2.3.36
Receiver Checkpoints	X	X		2.3.26
Polarization	X	X	3.3.3.2	2.3.5
Azimuth Monitor	X		3.3.7.1	2.2.32

603. Instrument Landing System Localizer (LLZ).

The guidance in ICAO Document 8071, Volume I, is adequate to ensure facility adequacy. Recommended tolerances are contained in Table I-4-7 of ICAO Document 8071. Table 6-2 contains the minimum checks required to certify a localizer facility.

Table 6-2. Localizer Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Course Alignment Accuracy	X	X	3.1.3.6	4.3.26 to 4.3.28
Course Structure	X	X	3.1.3.4	4.3.29 to 4.3.33
Identification/Voice	X	X	3.1.3.8 3.1.3.9	4.3.12 &.13
Modulation	X	X	3.1	4.3.14 &.15
Polarization	X	X	3.1.3.2.2	4.3.37
Course/Clearance Ratio	X		3.1.3.3.4	
Displacement Sensitivity/Width	X	X	3.1.3.7	4.3.16 to 4.3.20
Off Course Clearance	X	X	3.1.3.7.4	4.3.21 &.22
Coverage	X		3.1.3.3	4.3.34 to 4.3.36
Monitoring	X	X	3.1.3.11	4.3.38
Procedure/ Flyability	X	X		

604. Instrument Landing System Glide Slope (G/S).

The guidance in ICAO Document 8071, Volume I, is adequate to ensure facility adequacy. Recommended tolerances are contained in Table I-4-8 of ICAO Document 8071. Table 6-3 contains the minimum checks required to certify a glide slope facility.

Table 6-3. Glide Slope Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Angle Alignment	X	X	3.1.5.1.2	4.3.45 & .46
Course Structure	X	X	3.1.5.4.2	4.3.52
Modulation	X	X	3.1.5.5	4.3.3.53 & .54
Reference Datum Height	X		3.1.5.1.4 & 5	4.3.81
Displacement Sensitivity/Width	X	X	3.1.5.6	4.3.47 to 4.3.49
Below Path Clearance	X	X	3.1.5.6.5	4.3.50
Monitors	X	X	3.1.5.7	4.3.57 & .58
Coverage	X		3.1.5.3	4.3.56

605. Marker Beacons.

The guidance in ICAO Document 8071, Volume I, is adequate to ensure facility adequacy. Recommended tolerances are contained in Table I-4-9 of ICAO Document 8071. Table 6-4 contains the minimum checks required to certify a marker facility.

Table 6-4. Marker Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Along Course Coverage	X	X	3.1.7.3	4.3.67 to 4.3.71
Lateral Coverage	X		3.1.7.3.2 Note 1	
Modulation/Keying	X	X	3.1.7.4	4.3.66

606. Precision Approach Radar (PAR).

The guidance in ICAO Document 8071, Volume I, is adequate to ensure facility adequacy. Recommended tolerances are contained in Table I-7-3 of ICAO Document 8071. Table 6-5 contains the minimum checks required to certify a PAR facility.

Table 6-5. PAR Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Course Alignment	X	X	3.2.3.3.1	7.3.5
Angle Alignment	X	X	3.2.3.3.2	7.3.6
Range Accuracy	X	X	3.2.3.3.3	7.3.5 & .6
Coverage	X	X	3.2.3.1	7.3.7
Lateral Coverage	X		3.2.3.2.1	7.3.7
Communications	X	X		
Standby Power	X			
Lower Safe Limit	X	X		

Note: Some radar systems have selectable features that require individual parameters be checked under differing equipment configurations.

607. Microwave Landing System (MLS).

ICAO Document 8071 does not address MLS. MLS System specifications are contained in Annex 10. Table 6-6 contains the minimum checks required to certify an MLS facility.

Table 6-6. MLS Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Data Word Verification	X	X	3.11.4.8	
Azimuth Coverage	X	X	3.11.5.2.2	
Elevation Coverage	X	X	3.11.5.3.2	
Azimuth Alignment	X	X	3.11.4.9.4	
Azimuth Structure	X	X	3.11.4.9.4	
Elevation Alignment	X	X	3.11.4.9.6	
EL Structure	X	X		
Ident	X	X	3.11.4.6.2.1	
AZ/EL Alignment Monitor	X			

608. Distance Measuring Equipment (DME).

The guidance in ICAO Document 8071, Volume I, is adequate to ensure facility adequacy. Recommended tolerances are contained in Table I-3-3 of ICAO Document 8071. Table 6-7 contains the minimum checks required to certify a DME facility.

Table 6-7. DME Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Range Accuracy	X	X	3.5.3.1.3	3.3.9
Coverage	X		3.5.3.1.2	3.3.5 to 3.3.8
ID	X	X	3.5.3.6	3.3.13

609. Tactical Air Navigation (TACAN).

Table 6-8 contains the minimum checks required to certify a TACAN facility.

Table 6-8. TACAN Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Radial Alignment	X	X		
(Pattern Accuracy) Coverage	X			
Course Structure	X	X		
Airways/Routes	X			
Approaches	X	X		
Approach Nulls	X			
Receiver Checkpoints	X	X		
Modulation	X	X		
ID	X	X		
Range Accuracy	X	X	3.5.3.1.3	

610. Non-Directional Beacon (NDB).

The guidance in ICAO Document 8071, Volume I, is adequate to ensure facility adequacy. Recommended tolerances are contained in Table I-5-3 of ICAO Document 8071. Table 6-9 contains the minimum checks required to certify an NDB facility.

Table 6-9. NDB Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Coverage	X		3.4.2	5.3.7
Course Structure	X	X	3.4.2	5.3.7 & .9 & .11
Airways/Routes	X		3.4.2	5.3.9 5.3.10
Approaches	X	X		5.3.11
Station Passage	X	X		5.3.12
ID/Voice	X	X	3.4.5	5.3.3 5.3.4

611. Radio Systema Blishnej Navigazii (RSBN)/ Radio Navigation System for Close Navigation (RSBN).

RSBN equipment is used in Hungary and Poland. Because frequencies and transponders in the aircraft are not interoperable with other NATO equipment, NATO nations using RSBN equipment are responsible for flight inspection of this equipment according to their own national rules.

612. Primary Surveillance Radar (PSR).

Table 6-10 contains the minimum checks required to certify a primary surveillance radar facility.

Table 6-10. Primary Surveillance Radar Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Azimuth Accuracy	X			
Range Accuracy	X			
Vertical Coverage/Tilt	X			
Horizontal Coverage	X			
Video Map Accuracy	X			
Surveillance Approaches	X	X		
Fixed Target Identification	X			
Communications	X	X		
Standby Power	X			

Note: Some radar systems have selectable features that require individual parameters be checked under differing equipment configurations.

613. Secondary Surveillance Radar (SSR).

Table 6-11 contains the minimum checks required to certify a secondary surveillance radar facility.

Table 6-11. Secondary Surveillance Radar Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Azimuth Accuracy	X			
Range Accuracy	X			
Vertical Coverage (Tilt)	X			
Horizontal Coverage	X			
Side Lobe Suppression	X			
Spurious Responses	X			

614. Direction Finder (UHF/VHF DF).

Table 6-12 contains the minimum checks required to certify a direction finder facility.

Table 6-12. Direction Finder Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 10 REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Bearing Accuracy	X	X		
Station Passage	X			
Communication Coverage	X	X		

615. Precision Approach Path Indicator (PAPI).

1. Table 6-13 contains the minimum checks required to certify a VGSI (PAPI) facility.

Table 6-13. VGSI (PAPI) Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 14 REFERENCE	ICAO 9157-AN/901, Part 4 REFERENCE
	Comm	Periodic		
Glide Angle	X	X	VOL I, 5.3.5.25	8.4.1, Figures 8-13 & 8-14
Light Intensity	X	X	VOL I, 5.3.5.32	8.4.11
Symmetry	X		VOL I, Figure 5-16	Figures 8-13 & 8-14
Lateral Coverage	X		VOL I, Table 5-3	
Light Color	X	X	VOL I, 5.3.5.2.5 & 5.3.5.26	8.4.8
Acquisition Range	X	X		
Obstruction Clearance (PAPI)	X	X	VOL I, 5.3.5.37 & 5.3.5.42	8.4.30
Obstruction Clearance (A-PAPI)	X	X	VOL I, 5.3.5.38 & 5.3.5.42	8.4.30
Helipad Obstruction Clearance (A-PAPI)	X	X	VOL II, 5.3.5, Table 5-1 & Figure 5-13	

2. Specific references to Doc 9157 pertain to PAPI’s, additional guidance for other visual glide slope indicators (VGSIs) are contained in Chapter 8 of ICAO DOC 9157.

616. Visual Approach Slope Indicators (VASI).

Table 6-14 contains the minimum checks required to certify a VGSI (VASI) facility.

Table 6-14. VGSI (VASI) Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 14 REFERENCE	ICAO 9157-AN/901, Part 4 REFERENCE
	Comm	Periodic		
Glide Angle	X	X	5.3.5.8	
Light Intensity	X	X	5.3.5.15	
Symmetry	X		Figure 5-11	
Lateral Coverage	X			
Light Color	X	X	5.3.5.8	
Acquisition Range	X	X		
Obstruction Clearance	X	X	5.3.5.21	

The guidance for flight checking “T-VASI” in ICAO Document 9157-AN/901 in Paragraph 8.3.49 is largely applicable to all VGSI’s.

617. Approach Lights.

Table 6-15 contains the minimum checks required to certify approach lights.

Table 6-15. Approach Lights Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX 14 REFERENCE	ICAO 9157-AN/901, Part 4 REFERENCE
	Comm	Periodic/ Surveillance		
Light Intensity	X	X		
Color	X	X		
Lateral Coverage	X			
Aiming	X	X		
Acquisition Range	X	X		

618. Airborne Radar Approaches (ARA).

Table 6-16 contains the minimum checks required to certify an airborne radar approach.

Table 6-16. Airborne Radar Approach Checklist

MEASUREMENT PARAMETER	INSPECTION		ANNEX REFERENCE	ICAO 8071 REFERENCE
	Comm	Periodic		
Controlling Obstacle Verification	X	X		8.3

NOTE: Does not have to be done by a flight inspection aircraft. Can be accomplished by ground survey.

619. Instrument Flight Procedures.

1. An ever increasing percentage of instrument flight procedures are based on Area

Navigation (RNAV) rather than solely on a single type of traditional ground-based NAVAID facility. RNAV is a method of navigation that permits aircraft operation on any desired course within the limits of a self-contained system capability. Flight Management Systems (FMS) with multiple sensors and Global Positioning System (GPS) navigators are most common. RNAV procedures consist of sequenced ARINC-424 coded path and terminators and waypoints. Flight validation of a new or revised RNAV flight procedure is an assessment to confirm that the procedure is operationally acceptable for safety, flyability, and design accuracy, including obstacle assessment and database verification, complete with all required supporting documentation.

2. RNAV procedures supported by a DME/ DME infrastructure must be inspected. Computer models may be used to determine if sufficient DMEs are available, with suitable geometry, to support the RNAV procedure. Models do not guarantee that there is adequate signal coverage or that there are no adverse multipath effects. The adequacy and accuracy of the DME/ DME RNAV position solution is determined primarily by DME facility coverage and geometry to the aircraft as it tracks along the flight procedure. Analysis should include, but is not limited to: failure of any critical (required) DME; coverage (lock-on) and range error for all DME(s) identified by the modeling software for each segment of the procedure; and, pass or fail of required Expanded Service Volume (ESV) coverage.

3. Table 6-17 contains the minimum checks required to certify instrument flight procedures.

Table 6-17. Instrument Flight Procedures Checklist

MEASUREMENT PARAMETER	INSPECTION		ICAO 8071 Vol I REFERENCE	ICAO 8071 Vol II REFERENCE
	Comm	Periodic		
Controlling Obstacle Verification	X	X	8.3	5.1.2, 5.3.1, 5.3.3 to 5.3.5
Signal Coverage/Interference	X	X		5.3.20
Enroute/Terminal Segments (e.g., DP, SID, STAR)	X		8.3.6	5.3.6, 5.3.10, 5.3.12 & .13
IAP Initial/Intermediate Segments	X			5.3.7, 5.3.11
IAP Final Approach Segment	X	X	8.3.7	5.3.7, 5.3.11
Database Integrity/ ARINC 424 Coding	X		8.3.18	5.3.17 & .18
Way-point Accuracy	X		8.3.16	5.3.18, 5.3.20
Survey Verification	X			5.3.17
Circling Area	X		8.3.9	5.3.9
Missed Approach Segment	X	X	8.3.8	5.3.8
Runway Markings, Lighting, and Communication	X	X	8.3.14, 8.3.19 to 8.3.21	5.3.1, 5.3.22 to 5.3.24
Flyability/ Human Factors	X		8.3.19, 8.4	5.3.20, 5.3.22, 5.4.2
Charting/ Publications	X	X		5.3.20
RNAV DME Infrastructure (1)	X		3.4.2 3.4.3	5.3.15

NOTES:

(1) Required for DME/DME RNAV procedures only. It is assumed the DME facilities are subject to standard periodic inspections.

(2) SBAS RNAV procedures have no periodic inspection requirement except for an obstacle verification.

Annex A. TACAN SYSTEMS

1. Introduction.
The techniques and maneuvers to flight inspect are essentially the same as used to evaluate VOR and DME. This annex provides detailed guidance for flight inspection of TACAN. National guidance on TACAN flight inspection may be used, providing the tolerances and minimum inspection items in this document are followed.

2. Preflight Requirements.

a. Facilities Maintenance Personnel. Prepare for flight inspection in accordance with Chapter 3.

b. Flight Personnel. Flight inspection personnel shall prepare charts, plot the position of the facility, and depict the orbit and radial checkpoints that will be used during the evaluations.

3. Flight Inspection Equipment.

a. An approved AFIS is the preferred system for conducting a facility flight inspection using procedures contained in this or appropriate national directives. Flight inspection aircraft without automated capabilities use positioning reference from maps, theodolites, satellites, etc., and measure signal suitability by manual techniques.

b. When using a theodolite to evaluate facility performance, it shall be positioned and operated by a certified operator. The theodolite azimuth bearings shall be referenced to magnetic bearings "from" the facility (i.e., paragraph 6 below).

4. Checklist.
The checklist shown in Table A-1 prescribes the items to be inspected on each specific type of inspection.

5. Detailed Procedures.
The following paragraphs provide guidance on performing the checks required by Table A-1.

Table A-1. TACAN Flight Inspection Requirements

CHECK	REF PARA LAND	REF PARA SHIP	COMM	PERIODIC	SPECIAL				
					SITE EVAL	ANTENNA CHANGE	FREQ CHG	SHIP-BOARD	FACILITY ROTATE (1)
Sensing and Rotation	6	6	X	X	X	X	X	X	X
Reference Radial Check	7		X	X		X	(2)		(2)
Alignment Orbit Differential	8 8g	8, 25d, f	X X	X	X	X X	(2)	X	X X
Terminal Radials	9	9, 25f	X	X	X	X	X	X	X
Apch Nulls	9		X		X	(5)			
En Route Radial Coverage	10	25f	X					X	
Intersection/Fixes Radials	11		X	(3)					(2) (4)
Coverage Orbit (7)	12		X		X	(2), (5)	X		
Monitors	13		(2)			(2)	(2)		(2)
Receiver Checkpoints	14		X	X		X			X
Standby Transmitters	15		X	X		X	X	X	X
Standby Power	16		X						
Associated Facilities	17		X	X					
Identification	18	18	X	X		X	X	X	X
Modulation	19	19	X	X	X	X	X	X	X
Polarization	20	20, 25	X	X	X	X	X	X	X
Course Structure	21	21	X	X	X	X	X	X	X
Signal Strength	22	22	X	X	X	X	X	X	X
DME	23	23	X	X	X	X	X	X	X
Stabilization		25						X	
Spectrum Analysis	24	24	X	X	X	X	X	X	
Antenna Cone Angle	27	27	(6)			(5), (6)			

NOTES:

(1) Required if facility rotation is more than one degree.

(2) Maintenance request.

(3) Fixes depicted on a Standard Instrument Approach Procedure (SIAP) in final approach segment shall be evaluated concurrently with the SIAP.

(4) Facilities which support one or more intersections will require an evaluation of one intersection.

(5) Required if new antenna is of different type or electrical tilt.

(6) May be satisfied if the cone angle of the specific antenna type is known; the check is not required on each antenna of the type.

(7) Revalidate ESVs anytime conditions require a coverage orbit to be flown.

6. Sensing and Rotation.

a. The sensing and the following rotation check are required at the beginning of the flight inspection. The position of the aircraft on a radial from the station must be known. Select the azimuth of the radial being flown. When the crosspointer is centered, the "TO-FROM" indicator will properly indicate "FROM" if sensing is correct. Sensing should be checked before rotation, as incorrect sensing may in itself cause the station rotation to appear reversed.

b. Rotation. Upon completion of the sensing check, conduct a partial counterclockwise orbit. The radial bearings shall continually decrease.

7. Reference Radial Check.

This radial segment or checkpoint will be used as a reference for subsequent checks of course alignment and airborne monitor reference evaluation. When course roughness and scalloping occur during an alignment evaluation, the graphic average of the deviations shall be used. A reference radial shall be established when establishing an orbital reference in accordance with paragraph 8 and evaluated during subsequent checks.

a. AFIS Method. An approach radial is preferred as the reference. When the evaluation is accomplished using an AFIS segment, evaluate at least a 5 nm segment.

b. Non-AFIS Methods. If non-AFIS techniques are used, the radial should lie over a well-defined ground checkpoint.

(1) **Ground Checkpoint Method.** After the checkpoint has been selected, measure it to the nearest tenth degree. Round out to the nearest degree the measured bearing from the antenna which overflies this checkpoint. This will establish a radial which can be selected in the omnibearing selector (OBS). Fly the aircraft along this radial (usually at 1,500’ above the antenna), but deviate temporarily to fly directly over the reference checkpoint. Actuate the event mark directly over the checkpoint to obtain a recording that has an accurate check of course alignment. Determine the alignment error in accordance with Chapter 2, paragraph 206.

(2) Theodolite Method.

(a) Adjust the theodolite to sight along the bearing, which will coincide with the radial. Fly the aircraft along the radial at 1,500 ft above the antenna. The theodolite operator should advise the pilot when the aircraft is drifting right or left of the selected azimuth.

(b) The theodolite operator shall actuate the event marker by means of event tone or verbal mark when the aircraft is observed on the correct bearing. Determine the value of deflection of the crosspointer and compute the alignment error.

(c) The following alternate method may be used. Fly the aircraft on-course with reference to the crosspointer, maintaining a constant altitude. The theodolite operator will track the airplane and mark the recording in the aircraft from the theodolite site. The bearing of the aircraft, as determined by the theodolite, shall be the actual measured magnetic azimuth. The alignment of the radial can then be computed from the recording.

c. Following an antenna change, optimize the orbital alignment, then re-establish the reference.

d. During a periodic evaluation, if the alignment varies more than 1° from that previously established, perform an alignment orbit. If satisfactory, re-establish the reference radial value. Advise maintenance of mean orbital alignment shift beyond 1°.

e. Determine DME accuracy as described in paragraph 23.

8. Alignment Orbit.

Orbit evaluations are used to determine azimuth error distribution and signal quality. Orbit data are used as reference information. Establish reference alignment during commissioning, antenna change, facility rotation, or on any inspection if no orbital reference exists in facility data. Evaluate for deviation from the reference during all subsequent orbital evaluations. The alignment orbit is used to determine the accuracy and optimum error distribution of the azimuth. The evaluation is conducted for 360° of azimuth. The orbit may be flown clockwise (CW) or counterclockwise (CCW), but once established it shall be flown in the same direction, at the same distance and altitude, on each subsequent inspection. Compute a tapeline altitude to fly the orbit at a maximum angle of 6° from the site. The objective of the check is to help facilities maintenance personnel determine environmental problems close in to the facility. The ratio between distance and altitude becomes critical when looking for low angle reflections or shadowing. Altitudes and distance may be modified when conditions prevent establishing the altitude at the recommended 6° value (air traffic requirements, engineering or maintenance support, and site conditions). Indicate deviations from the standard on the flight inspection report.

a. AFIS Method. An orbit radius not less than 5 nm, based upon the AFIS specifications, may be used.

b. Ground Checkpoint Method. Checkpoints are desired every 20° of azimuth; however, acceptable results can be obtained with fewer checkpoints if a precise orbit track is maintained. Ground checkpoints may be established and used at locations where map or chart accuracy is questionable, by verifying accuracy with the theodolite. By establishing such ground checkpoints, the necessity for theodolite on periodic checks can be eliminated. Note the description, radial, and distance of all checkpoints in facility sheets that should be available for later use. Subsequent flight checks can be made using the appropriate chart marked with these ground checkpoints.

c. Theodolite Method. When using theodolite, the orbit radius shall be the maximum visual range for the theodolite operator. Using a theodolite oriented to Magnetic North and suitable communications, advise the flight inspector of the aircraft's precise azimuth position periodically throughout the orbit. Repeat this procedure throughout a complete orbit with an overlap of at least one transition. Station error, corrected for receiver error and theodolite offset, may be determined and plotted. The maximum parallax error caused by theodolite placement 200 ft from the TACAN antenna is 0.4° for a 5 nm orbit and 0.2° for a 10 nm orbit.

d. One orbit may be flown on dual transmitter facilities during any inspection, except commissioning, by requesting transmitter changes. If sufficient transmitter changes cannot be accommodated (at least one in every 90º), fly an orbit on each transmitter.

e. During the orbit, evaluate azimuth alignment, modulations, sensing and rotation, roughness and scalloping, identification, and signal strength. Out-of-tolerance conditions found during an orbital inspection shall be confirmed by a radial evaluation before restricting a facility or issuing a NOTAM. The radial evaluations normally have priority.

f. Course error distribution must be determined prior to rotation (if required) to achieve optimum station balance. It is not necessary to refly the orbit after this facility rotation, provided the direction and magnitude of the adjustment can be confirmed. This is usually accomplished by measuring alignment on the reference radial before and after the adjustment.

g. When optimizing alignment, the mean orbital alignment should be within ± 0.5°, and the system differential between a collocated VOR and TACAN should not exceed 1°. For dual transmitter systems, use the primary transmitter as the reference.

h. **Course Alignment**. On periodics, if a change in mean course alignment of more than 1° is found, contact facilities maintenance. Facilities maintenance will evaluate the system to determine if the change in the facility was caused by a maintenance problem or by an environmental change. When course improvement adjustments require confirming flight inspection, complete the checklist items for facility rotation.

9. Terminal Radials (Approach, Missed Approach).

Evaluate all the radial segments that comprise the approach, arrival, and departure routes. All final segments shall be flown in the direction of intended use. On commissioning inspections, the radials shall be evaluated to include the holding patterns, procedure turns, approach and missed approach, or departure routings. During periodic inspections of approaches, evaluate at least the final segment. Also, fly the missed approach procedure to a point where the flight inspector can identify any obstacles that could be a potential hazard.

a. All evaluations shall be conducted at the procedural altitudes except the final approach segment. This segment is evaluated from the final approach fix (FAF) (or final descent point) descending to 100 ft below the lowest minimum descent altitude (MDA) to the missed approach point (MAP).

b. Due to antenna vertical nulling, the TACAN azimuth may not support a proposed approach procedure. This inability to support a TACAN approach should not incur a facility restriction. A TACAN restriction would be appropriate if level flight is not supported in a given area. If a TACAN parameter is found out of tolerance within the flight inspection standard service volume, a facility restriction and NOTAM shall be required.

c. TACAN Approach Azimuth Null Checks will be flown as follows:

(1) On commissioning inspections, antenna change to a new type or electrical uptilt, new procedures, and changes in FAF altitude of 300 ft or more on existing procedures, null checks are required on the approach radial and 5° either side of the approach radial. The radials will be flown inbound or outbound, on a level flight, from 3 miles outside the final approach fix (FAF) to 3 miles inside the FAF at the lowest minimum altitude for FAF:

(2) Nulls, defined as any repeatable out-of-tolerance crosspointer action or condition of unlock usually accompanied by rapid changes in the automatic gain control (AGC) and oscilloscope indications of a loss or distortion of the 15 and 135 cycle modulation components, are not permitted in the area described in paragraph (1) above. If a null is found, measure the vertical angle by flight in the area described above at an altitude 500 ft above or below the minimum FAF altitude and inform maintenance so that the problem can be corrected if possible. If the null cannot be corrected by antenna change or height adjustment, a new procedure avoiding the affected area may be required. Null checks are required on only one transponder.

d. On commissioning inspections, missed approach and standard instrument departure/departure point (SID/DP) radials for facilities located within the airfield boundary shall be evaluated from overhead the station outbound to the limits depicted for the procedure. If no termination point is depicted, the radial shall be checked to where it joins the en route structure or the expected coverage limit of the facility.

e. Evaluate the radials for signal quality and accuracy. The final approach course shall deliver the aircraft to the desired aiming point. Evaluate modulations, roughness and scalloping, bends, identification, and signal strength when flying the radials.

10. En Route Radials

a. All radials supporting instrument flight procedures shall be checked for signal quality and accuracy. Fly the en route radials throughout the length of the intended use or facility flight inspection coverage requirement, whichever is greater. Fly the coverage radials at a minimum altitude of 1,000 ft (2,000 ft in designated mountainous terrain) above the site elevation, or intervening terrain, to the distance requested for comprehensive coverage. This distance, usually 40-nm or 25-nm, is considered the standard flight inspection coverage distance. If en route radials have coverage requirements beyond the previously mentioned flight inspection coverage distances, the radials shall be inspected to the additional distances at the minimum required altitudes, unless otherwise requested.

b. **Change-Over-Points.** The minimum en route altitude (MEA) for an airway change-over-point (COP) shall be the altitude where usable signals exist from the supporting stations. There is no requirement to check coverage beyond the COP.

c. Evaluate azimuth alignment, modulations, polarization, roughness and scalloping, bends, identification, sensing, and signal strength while flying the desired azimuth.

11. Intersection Radials/DME Fixes

a. Intersections are used to identify azimuth positions in space. These intersections can be used for navigational fixes, reporting points, DME fixes, COP's, etc. Establish a minimum reception altitude (MRA) for each intersection that does not meet tolerances at the requested altitude. The MRA is the lowest altitude where reliable signals can be received within the procedural design area.

b. All intersections/fixes shall be inspected for azimuth alignment, modulations, identification, roughness and scalloping, and signal strength along the radial track used to define the fix at the proposed procedural use altitude. If the fix is in the final approach segment, it shall be inspected at 100 ft below published altitude.

c. Standalone DME fixes shall be evaluated laterally for coverage ± 4 nm or 4.5° (whichever is greater) at 5 nm greater than the fix distance.

d. When fixes are located within the area of inspected coverage, coverage throughout the fix displacement area can be predicted (evaluation of the entire fix displacement area is not required).

e. If the fix is located beyond the standard flight inspection coverage distance of any facility that supports the fix, the appropriate fix displacement coverage evaluation shall be accomplished for that facility. When establishing a fix that is located beyond the coverage distance, the station(s) are evaluated at the greater of 4 nm or the angular value specified in Table A-2 on the furthest side from the facility of the fix to ensure that usable signals exist. Evaluations shall include modulations, identification, roughness and scalloping, alignment, and signal strength.

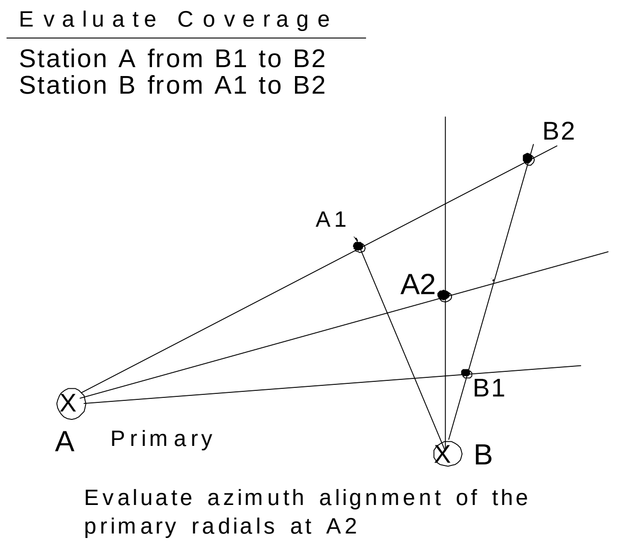


Figure A-1. Intersection Radials/DME Fixes

TABLE A-2. Establishing a Fix Beyond Coverage Distance

Station "A" (Primary) Type	Station "A" Angle	Station "B" (TACAN) Use	Station "B" Angle	Evaluate Station "A"	Evaluate Station "B"
TACAN/VOR	4.5	Primary	4.5	B1 to B2	A1 to B2
TACAN/VOR	4.5	Crossing	3.6	B1 to B2	A1 to B2
NDB	5	Crossing	3.6	B1 to B2	A1 to B2
Localizer	10	Crossing	3.6	NA	A1 to B2

12. Coverage Orbit.

a. This check is conducted to determine the facility's ability to support the required Service Volume (SV). The standard service volume is normally 40 nm; some stations only require coverage to 25 nm. If this service volume is not described in the applicable AIP, note the service volume description by radius and altitudes in the flight inspection report. Coverage at the limit is required at 1,000 ft (2,000 ft in designated mountainous areas) above site elevation or intervening terrain. Flight inspection beyond these distances is required only to validate procedural use. Note the radial(s), distances, and altitudes checked to support this extension of the service volume. Failure of a tactical air navigation (TACAN) to support procedural use, beyond the specified service volume radius requires denial of the procedural use, but not a facility restriction. One complete orbit (one transmitter only) shall be flown at either:

(1) The applicable 1000 or 2000 ft altitude above site elevation.

(2) Altitudes high enough to receive in-tolerance signals. If these altitudes are higher than the altitudes in paragraph (1) above, facility

restrictions and NOTAM action are required.

b. During the orbit, evaluate azimuth alignment, modulations, course structure, identification, and signal strength.

c. Out-of-tolerance conditions discovered during orbital inspections shall be confirmed by a radial inspection before restricting a facility or issuing a NOTAM. An orbit segment used to establish a restriction may be defined laterally by orbital means. Radials flown through the most severe out-of-tolerance area may be used to define the distance and altitude limits of the entire segment. The radial inspection results normally have priority over orbital inspection data. In areas of multiple restricted segments, it may be appropriate to group those segments into larger, easier to understand restrictions. The advantages of this possible over-restriction in some areas must be weighed against user requirements. An arc at the restricted altitude shall be flown through the restricted area at the coverage limit to determine adequate signal coverage.

13. Monitor Reference Evaluation.

a. The monitor reference evaluation determines the minimum amount of azimuth course shift required to activate the ground facility monitor alarm system.

b. Monitor reference may be established either in the air or on the ground. Once established, the check shall become the reference for all subsequent checks. The procedure for establishing a monitor reference is as follows:

(1) With the course in the normal operating condition.

(2) With the course shifted to the monitor reference point.

(3) With the course shifted to the monitor reference point in the opposite direction from step (2) above.

(4) With the course returned to the normal operating condition.

NOTE: Step (4). There is no requirement that the course return to the measurement in Step (1). Monitor shifts of more than 1^{o} will be brought to the attention of appropriate engineering personnel to determine if environmental or equipment related.

In each of these conditions, the course alignment will be compared by reference to recorded data to determine the amount of shift to the alarm point and to verify that it has returned to a normal condition.

c. Facilities that have dual parallel monitors require a monitor evaluation on one transmitter only. Facilities that have two individual monitors require evaluations on each transmitter.

14. Receiver Checkpoints.

Receiver checkpoints are established to allow pilots to check the accuracy of their receivers. Inability of a facility to support receiver checkpoints shall not result in facility restrictions. Receiver checkpoints are only established upon request of the facility or airfield owner.

a. Ground receiver checkpoints may be established on the airport ramp or taxiways at points selected for easy access by aircraft, but where there will be no obstruction of other airport traffic. They normally will not be established at distances less than one-half mile from the facility, nor should they be established on non-paved areas.

(1) Align the aircraft toward the station, with the aircraft antenna over the selected point. Determine the correct facility radial and round off to the nearest whole degree. This radial will be published as the ground receiver checkpoint azimuth.

(2) All azimuth bearings shall be stable and within prescribed azimuth tolerance. Evaluate azimuth alignment, modulations, course structure, identification, and signal strength. If a stable signal and alignment cannot be obtained at a location, select another site or establish an airborne receiver checkpoint.

(3) The ground receiver checkpoint signs and airport surface markings should be as provided in the owners national standard. If there is no known standard, the depiction below may be used. These signs shall be observed for continued maintenance during subsequent inspections of the facility. Slight variances in airport surface markings may be observed, which should not affect their acceptability, unless, in the judgment of the flight inspector, it could affect the usability of the checkpoint.

(a) Airport Surface Markings. The spot selected for the checkpoint should be marked by a painted circle 10 ft in diameter as illustrated in figure A-2.

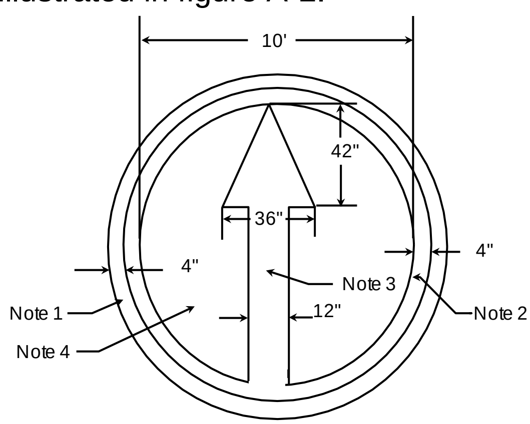


Figure A-2. Airport Surface Markings

NOTES:

1. White (may be bordered on inside and outside with 6-inch blackband, if necessary, for contrast).
2. Yellow (chrome yellow; taxiway aviation yellow).
3. Yellow. Arrow to be aligned toward the facility and extend the full width of the inner edge of the circle.
4. Interior of circle black (concrete surfaces only)

(b) Signs. The receiver checkpoint signs shall show the facility identification, channel, course selected (published) for the check, and the plotted distance from the antenna.

Example:

CJB TACAN
CH 110
147/327 DME 1.5 nm

The signs shall be distinct, easy to read, and shall not constitute a hazard to the operation of taxiing, landing, or departing aircraft.

b. Airborne Receiver Checkpoints. Airborne Receiver Checkpoints shall be designated over prominent ground checkpoints at specific altitudes. Checkpoints should be near an airport so they are easily accessible to users but in an area and altitude that will not interfere with normal traffic patterns.

c. The altitude specified for the receiver checkpoint shall be at least 1,000 ft above ground level (AGL). The checkpoint should not be established at a distance less than 5 miles or more than 30 miles from the facility.

d. Fly the aircraft directly over the selected checkpoint either toward or away from the facility and mark the recording at the checkpoint. Compare the electronic radial recorded with the plotted geographic azimuth.

e. The electronic radial overlying the geographic checkpoint, rounded off to the nearest whole degree, will be the azimuth published as the receiver checkpoint.

f. The actual distance from the airborne receiver checkpoint to the antenna, as determined from a map study, shall be checked against the distance indication received when directly over the checkpoint.

15. Standby Transmitters.

Both transmitters (when installed) shall be evaluated for each required checklist item except coverage orbit or when validating an extended service volume (ESV), which only require a check on one transmitter. Alignment evaluations may be made by changing transmitters during an evaluation and comparing the instantaneous azimuth course shift. Transmitter changes shall not be made inside the final approach fix; however, transmitter changes made before the final approach fix are satisfactory for evaluation purposes. If comparison results are questionable, fly the final approach segment on each transmitter.

16. Standby Power.

a. The following checklist items will be inspected while operating on standby power:

(1) Course alignment (one radial)
(2) Course structure
(3) Identification
(4) Distance accuracy

b. The inspections are to be performed when flying a portion of a radial with the station operating on normal power and then repeating the check over the same ground track with the station operating on standby power.

17. Associated Facilities.

a. Inspect associated facilities concurrently with the inspection of the primary facility. These include lighting aids, communications, etc., which support the en route/approach procedures and landing weather minimums of an associated approach procedure.

b. Conduct inspections of these facilities in conformance with the standard procedures for the system type.

18. Identification (ID) Analysis.

a. This check is made to ensure the identification is correct and is usable throughout the operational service volume. Evaluate the identification during all checks. The facility shall be restricted if the identification is not usable in all areas of required coverage.

b. Approved Procedure. Evaluate the ID signals for correctness, clarity, and to ensure there is no adverse effect on the azimuth course structure. When it is difficult to determine what effect the ID has on the azimuth course structure because of roughness and scalloping, evaluate the same azimuth radial with the ID off and compare the results. The Morse coded ID signals must be identifiable throughout the entire unrestricted coverage area, including expanded service volumes (ESVs). Some flight inspection systems decode and record identification; when this feature is not present or reliable, the flight inspector shall aurally confirm the correctness and readability of the identification. When the identification is unacceptable, take appropriate NOTAM action and notify facility maintenance.

c. For facilities with standby transmitters and separate standby ID equipment, there are at least two methods to differentiate between transmitters. In one method, the number one transmitter has equal spacing between all characters of the coded identification. The spacing between the second and third characters of the number two transmitter is increased by one dot. Another method is an added dot transmitted long enough after the normal ID such that the true ID cannot be misread. Neither method is required.

19. Modulation Levels.

a. Some antenna systems have fixed modulation levels generated by metallic strips imbedded in rotating drums. This “space modulation” is a relatively fixed percentage value but may be corrupted by signal reflections. Other systems use electronically generated modulation that may be subject to misalignment and deterioration but are less affected by reflections.

b. Modulation values should meet operational tolerances throughout the unrestricted service volume. Determine the average modulation values or the graphical average of the recorded modulation values (when available) when fluctuations are encountered. Over-modulation may cause excessive roughness and unlocks particularly when aggravated by signal reflections.

20. Polarization.

a. Polarization causes azimuth course variations whenever the aircraft is banked around its longitudinal axis. It is caused by the radiation of a horizontally polarized signal from the TACAN antennas or other reflective surfaces around the site. The indications are similar to course roughness and scalloping, but normally can be separated by relating the course deviations to the aircraft banking. When roughness and scalloping cannot be separated from polarization, select another radial.

b. Evaluation. Polarization should be evaluated on one radial within 5 to 20 miles (inbound or outbound) from the facility. The preferred method of evaluation is to bank the aircraft 30° around the longitudinal axis (starting on either side) returning to level flight momentarily, bank 30° in the opposite direction and returning to straight and level flight. During the aircraft banking, the tracking and heading changes must be kept to a minimum. The course deviations that occur during the 30° rolls may indicate polarization. The indications of polarization may be influenced by course roughness and scalloping. A confirmation check is required if out-of-tolerance conditions are discovered using this method.

c. Confirmation Procedure. Fly over a prominent ground checkpoint, located 5 - 20 miles from the facility. Execute a 30° bank and turn, holding this attitude through 360°. End this maneuver as close to the same ground checkpoint as possible. Mark the recording at the beginning and end and at each 90° change in azimuth heading. If polarization is not present, the course will indicate a smooth departure from and return to the "on-course" position, deviating only by the amount that the aircraft is displaced from the original azimuth.

21. Course Structure Analysis.

Roughness, scalloping, and bends are displayed on the recorder charts as deviations of the crosspointer (course deviation indicator) recording trace. Roughness will show a series of ragged irregular deviations; scalloping as a series of smooth rhythmic deviations; and the frequency of each is such that it is not flyable and must be “averaged out” to obtain a course. Bends are flyable displacements of the course.

a. The alignment of a radial is the long-term average of the data points derived by eliminating the short-term variations of roughness and scalloping and bends. The measured alignment is influenced by bends and the length of the measurement distance. Flight inspectors must consider the procedural needs of the radial and measure enough of the radial to define alignment in the procedural use area.

b. The displacement of the course by a bend must not exceed 3.5° from either the correct magnetic azimuth or the average “on course” provided by the facility. The following two examples are offered for clarification:

(1) A radial having zero alignment error. The maximum bend tolerance of 3.5° is allowable both sides of the “on course”, whether the bends occur singly or in a series.

(2) A radial having an alignment error of +2.0°. Further displacement of the course by a bend of +1.5° is allowable: this results in a +3.5° displacement from the correct magnetic azimuth. Displacement of the course of -3.5° from the average “on course” is allowable; this results in a -1.5° displacement from the correct magnetic azimuth.

c. In the event of roughness or scalloping, or combination, superimposed on the bend, the average “on course” shall be determined by averaging the total amplitude of such aberrations. This can result in a momentary displacement of the course of 6.5° where ±3.0° of roughness is superimposed on a bend of 3.5°.

22. TACAN Signal Strength.

TACAN Signal Strength is usually not the most valid indicator of suitable coverage and is best used as an indicator of relative signal level. Signal “lock-on”, while not only affected by signal strength, is the best indicator of usable signal level.

23. Distance Accuracy.

Check the accuracy of the distance information during inspection of the radials, orbits, approach procedures, and DME fixes. Compare and record the difference between the indicated DME and the true distance from the facility.

a. **Slant range.** For distances measured at altitudes above a vertical angle of 5°, the slant range to the facility should be used as a reference. For ease of computation, a 5° angle is equivalent to approximately 1,000 ft above the antenna at 2 miles and 5,000 ft above the antenna at 10 miles.

b. **Erroneous Distance Information.** If the ground facility is emitting false reply pulses, erroneous distance information may be present. This condition usually occurs within 25 miles of the antenna. Whenever actual false lock-ons are experienced, the facility shall be removed from service until this condition is remedied.

24. Spectrum Analysis.

a. The TACAN/DME spectrum is less crowded than lower frequencies. Most intereference is co-channel, caused by another station on the same frequency. Some adjacent channel problems are caused by poorly tuned ground transmitters and filters.

b. The TACAN spectrum shall be monitored for undesirable electromagnetic radiation when radio frequency (RF) interference is suspected. Having the TACAN turned OFF may help identify the offending source. When interfering radiation is observed, it is not justification for restricting the facility unless other flight inspection tolerances are exceeded. Undesirable signals shall be reported to facilities maintenance.

25. Shipboard TACAN.

a. Introduction. Due to the deployment of ships, these inspections shall be considered a one-time inspection and shall include all checklist items in paragraph 26f.

b. The flight inspection shall be scheduled upon receipt of the following information:

(1) Date and time of requested inspection
(2) Name and hull number of the ship
(3) TACAN channel
(4) Radio call sign and UHF primary and secondary communication frequencies
(5) Location of ship (latitude and longitude)
(6) Name and phone number of coordinator

c. The inspection shall be conducted with the ship underway and at a distance from shore that is sufficient to preclude interference or shielding of the signal by land mass during radial and orbital inspections.

d. The ship's radar shall be used as a basis to determine alignment. Fire control radar is considered the most accurate and will be used when available. Search combat information center (CIC) radar may be used if fire control radar is not available. Fire control information is given as TRUE bearings, and search radar is MAGNETIC.

e. Due to various antenna mount positions on ships and possible shielding by other antennas, masts, etc., nulls, and/or unusable sectors may occur. Suspected out-of-tolerance conditions shall be confirmed by a second evaluation of the area in question. Any sector of the TACAN that does not provide azimuth or distance information shall be reported immediately to the ship and documented in the flight inspection report.

f. Checks will be completed in accordance with appropriate paragraphs of this section unless modified or changed by the following:

(1) Those items normally inspected during radial flight may be accomplished on a radial to or from the ship or during inspection of the approach radial.

(2) Identification. Shipboard TACAN identification consists of two Morse code letters transmitted every 30 or 37 1/2 seconds.

(3) Coverage. Check a minimum of one radial for coverage to 40 nm during inbound or outbound flight at 700 MSL. Advise the ship if coverage is less than 40 nm.

(4) Frequency Interference. All of the ship's electronic equipment that is normally operating should be activated during the inspection.

(5) Alignment Orbit. The orbit shall be flown beyond 7 nm from the ships and no lower than 700 ft MSL. On those ships using search radar (CIC) for alignment, the orbit shall be flown below 2,000 ft MSL.

(6) Approach Radial. The ship's approach radial is that radial that will guide the aircraft to the stern of the ship and will vary depending on the heading of the ship. Fly the radial from a minimum of 7 nm and 700 ft MSL to pass over the ship at 300 ft MSL. Determine and report radial alignment and structure.

(7) Standby Equipment. Spot check the standby equipment during radial flight by requesting a change from primary to standby equipment.

(8) Stabilization. Stability of the TACAN equipment may be effected during a turn of the ship. Stability will be checked during radial inspections by requesting the ship to turn left 15 degrees and then right 15 degrees. Advise the ship's personnel of any change to azimuth or alignment during the turns.

(9) Polarization. Check as in paragraph 20 above.

26. Oscilloscope Analysis.

The oscilloscope should be used for analysis of TACAN signals. The following are suggested analytical procedures, and no facility restrictions are to be applied if adjustment cannot be made or if maintenance personnel are not available for adjustment. The composite video, when displayed on the oscilloscope, will yield considerable data about the TACAN facility. The oscilloscope may be used to measure the following composite video parameters:

a. Modulation Percentage 135 and 15 Hz. Measure the modulation of each component measured from the composite video and calculate the modulation percentage. Normally expected values are 10 to 30 percent, although antennas with modulation outside these values exist. If no derogation of facility performance exists, these limits may be ignored but maintenance should be advised of the situation.

b. Identification Train. Adjust the oscilloscope to synchronize the ident to the first reference burst. Observe the 100 μsec spacing between ident pulse pairs evenly spaced throughout a 740 μsec pulse timing period.

c. Reflections. Reflected signals may be detected by examining the composite video. Reflections, when present, may duplicate the normal pattern in an image pattern slightly displaced to the right. Reflections may be of sufficient amplitude to cause the pattern amplitude to oscillate or cause the modulation percentage to oscillate at a sine wave frequency dependent on velocity and position of the aircraft.

d. Main Reference Group Size. Size refers to the number of pulse pairs in a group. For “X” channel, there should be 12 pulse pairs in the main reference group spaced 30 μsec apart with spacing of each pulse in a pair of 12 μsec. For “Y” channel, there are 13 single pulses in the MRG spaced 30 μsec apart. Advising maintenance of the condition found will greatly ease their task of correcting the problem.

e. Auxiliary Reference Group Size. Size refers to the number of pulse pairs in an auxiliary reference group. For "X" channel, there should be six pulse pairs spaced 24 μsec apart with spacing of each pulse in a pair of 12 μsec. For "Y" channel, there are 13 single pulses in a group spaced 15 μsec apart.

Advising maintenance of the condition will ease their task of correcting the problem.

f. **Auxiliary Reference Group Count**. Count refers to the number of auxiliary reference groups (eight) between North reference bursts or groups.

27. **Antenna Cone Angles.** Each type of TACAN or DME antenna should be tested to determine the angular size of the “cone of silence. This testing is best done during factory testing but may be accomplished by flight inspection.

a. Fly an even number of inbound and outbound radials at a constant altitude and airspeed between approximately 10 miles and the antenna. The altitude should be high enough (1500 ft recommended minimum) above the antenna to provide accurate indications. Mark recordings at measured distances from the antenna and over the antenna. Record the distances from the antenna when azimuth and or distance indications are lost or acquired. As receiver memory may be inconsistent, other signal cues such as signal strength, or modulation collapse may provide indications of the edge of coverage.

b. The cone angle is determined using the formula:

$$\text{Cone Angle} = 2\left(\arctan\frac{H}{D}\right)$$

Where: H is height above antenna in feet

D is distance from antenna in feet at edge of coverage

Average the results from all the radials to increase accuracy.

28. **Tolerances.**

Facilities that meet tolerances, as shown in table A-3, throughout the flight inspection SSV are classified as UNRESTRICTED. Facilities that do not meet tolerances in the flight inspection SSV are classified as RESTRICTED. Appropriate NOTAM action shall be taken to notify the user of the unusable areas. Facilities which do not meet tolerances beyond the flight inspection SSV shall not be restricted; however, procedural use shall be denied.

Table A-3. TACAN/DME Tolerances

Parameter	Reference Paragraph	Inspection C	Inspection P	Tolerance/Limit
Identification	18	X	X	Code identification shall be correct, clear, distinct, without background noise, and not affect course characteristics throughout the coverage limits of the facility. TACAN/DME identification shall be correctly sequenced with the VOR identification when collocated.
Sensing and Rotation	6	X	X	Sensing and rotation shall be correct.
Distance Accuracy	23	X	X	0.20 nm

Parameter	Reference Paragraph	Inspection C	Inspection P	Tolerance/Limit
Polarization	20	X	X	Maximum ± 2.0° course deviation caused by horizontal polarization
Radials	9, 10	X	X	
Alignment				Alignment of all approach radials shall not exceed ± 2.0° of the correct magnetic azimuth. Alignment of all electronic radials shall not exceed ± 2.5° of correct magnetic azimuth except: Deviations of the course due to bends shall not exceed 3.5° from the correct magnetic azimuth and shall not exceed 3.5° from the average electronic radial alignment. Roughness/Scalloping/Course Aberrations: Deviations from the course, greater than 3.0° are acceptable, provided the aggregate area does not exceed the following:

Parameter	Reference Paragraph	Inspection C	Inspection P	Tolerance/Limit
Structure	21			0.05 nm in any 1.0 nm segment from the FAF to the MAP. 0.25 nm in any 5 nm segment from sea level up to 10,000 ft MSL. 0.5 nm in any 10 nm segment from 10,001 to 20,000 ft MSL. 1.0 nm in any 20 nm segment above 20,000 ft MSL. Flyability: The effects of any one, or combination of any alignment and/or structure criteria, even though individually in tolerance, shall not render the radial unusable or unsafe. Unlocks: Approach Radials: No condition of azimuth or distance unlock is permitted within the final segment. The only exception would be normal passage through the station cone. En route criteria should be applied to all other segments.
				En route Radials: No more than one condition of azimuth unlock not to exceed 1 nm in a 5 nm segment and/or condition of distance unlock not to exceed 0.5 nm in a 5 nm segment.
				Note: Where airspace procedures depict a 10 DME or greater arc from the station to a final approach radial, en route tolerances shall be applied to both azimuth and range functions, except that no conditions of unlock are permitted 5.0° either side of any radial depicted or proposed for procedural use (i.e., initial approach fix, intermediate approach fix, final approach radial, lead radial, crossing radial, reference, point, etc.

Parameter	Reference Paragraph	Inspection C	Inspection P	Tolerance/Limit
Signal Strength	22	X	X	The expected minimum signal strength is –80 dbm. However, a lesser signal

Parameter	Reference Paragraph	Inspection C	Inspection P	Tolerance/Limit
				shall not be the sole determination for restricting or removing a facility from service if a solid stable DME or azimuth lock-on is present.
Receiver Checkpoints	14	X	X	Receiver Checkpoint alignment shall not exceed ± 1.5° of the published azimuth. Distance shall be within 0.2 nm of the measured distance.
Monitor	13			The transmitter azimuth monitor reference shall not exceed ± 1.0°.
Standby Equipment	15	X	X	Operative standby and primary equipment will meet the same tolerances. The difference in the alignment of the course formed by each transmitter shall not exceed ± 1.5°. Distance differential between transmitters shall not exceed 0.2 nm.
Standby Power	16	X		Tolerances for a facility on standby power shall be the same as those on primary power.
Orbital Alignment	8		X	Notify maintenance if found to exceed ± 1° from the reference.
Antenna Cone Angles	27	X		The “cones of silence” in which distance and course information are lost or prove unreliable shall not exceed 10 degrees and 120 degrees respectively.

Annex B. MICROWAVE LANDING SYSTEM (MLS)

1. Introduction.
This annex details the flight inspection procedures and tolerances to be applied to microwave landing systems (MLS).

2. Coverage Ability.
The MLS is capable of providing approach guidance with pilot selectable azimuth and elevation angles within the limits set by transmitted data words. Within these limits or proportional guidance, CDI deflection is proportional to aircraft deviation from the selected azimuth. Outside the proportional guidance area, the azimuth clearance guidance provides full-scale deflection. The typical service volume provides lateral coverage to 40° each side of antenna boresight, but the standard service volume may extend laterally to 60°. The elevation guidance is proportional throughout its coverage. To mitigate the effects of reflections, the limits of the antenna scan can be reduced laterally and/or vertically. Azimuth, elevation, and DME coverage is normally evaluated concurrently on all checks except some monitor checks.

3. Military Mobile Microwave Landing Systems (MMLS).

a. **The MMLS is** a tactical landing aid designed for rapid installation. MMLS may be installed in a Split-Site Configuration or, more commonly, in a collocated configuration. The Split-Site Configuration is essentially the same as any other MLS installation, requiring no special procedures other than for coverage checks. For Split-Site installations, the standard flight inspection procedures of paragraphs 8 – 15 and 24 - 30 are used.

b. **In the Collocated Configuration**, the Azimuth (AZ) and DME are sited with the elevation (EL) and provide a computed centerline approach for a normal runway or assault landing zone (ALZ). The antenna is typically 150 to 300 ft from centerline with distance from threshold dependent upon desired Minimum Glide Path (MGP). The AZ guidance is boresighted parallel with procedural centerline.

c. **Procedural centerline** is usually runway centerline, but unusual siting conditions may cause an offset situation. The standard flight inspection receiver will see the course as parallel to the procedural centerline and will not be guided to the runway. In the Collocated Configuration, a specialized receiver (e.g., CMLSA or multi-mode Receiver) capable of developing a “Computed Centerline,” uses the AZ and DME to compute a procedural centerline based upon the facility data words. For a collocated facility providing a computed centerline, the procedures of paragraphs 16-23 are used to modify the basic instructions.

d. The MMLS does not transmit a clearance signal and will be restricted laterally if the proportional guidance limits are reduced from the normal ± 40°. MMLS facilities are designed for a 15 nm Service Volume. In addition, the RF power of the MMLS is monitored but not adjustable. The 20 nm checks flown at the normal RF power will simulate the power alarm condition. All MMLS facilities shall be restricted beyond 15 nm. Standard Service Volume and the coverage checks may be further reduced to 2 nm greater than the farthest procedural need; the facility shall be restricted beyond the checked distance. Most restrictions will be due to reflections or signal screening. These restrictions should be placed at the distance of occurrence. If an MMLS is confirmed to have inadequate signal strength, it shall be restricted beyond a distance equal to 0.75 times the distance of the out-of-tolerance signal.

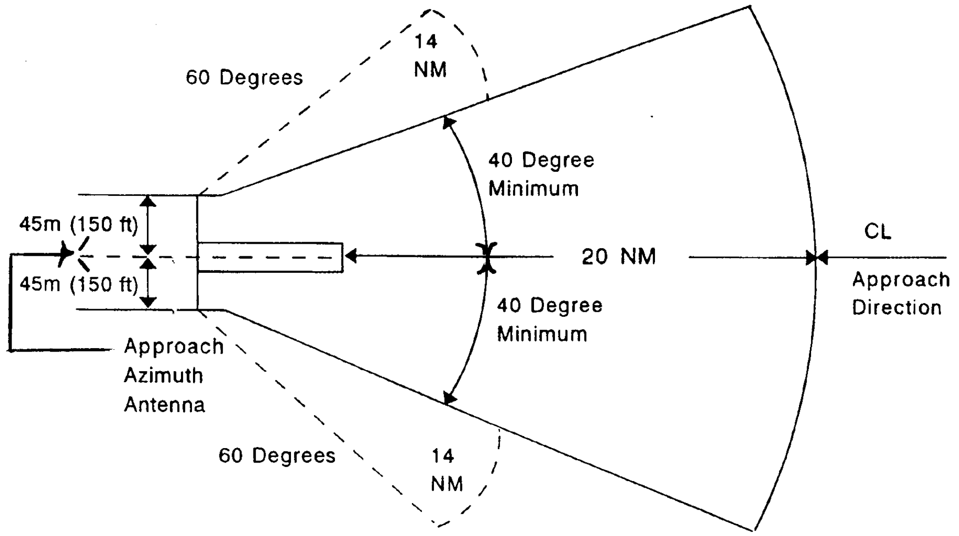
4. MLS Service Volumes.

The MLS standard and optional service volumes are depicted in Figures B-1 and B-2.

5. MLS Zones and Points.

MLS Zones are depicted in Figures B-3, B-4, B-5, and B-6.

HORIZONTAL COVERAGE



dashed lines = optional service volume

VERTICAL COVERAGE

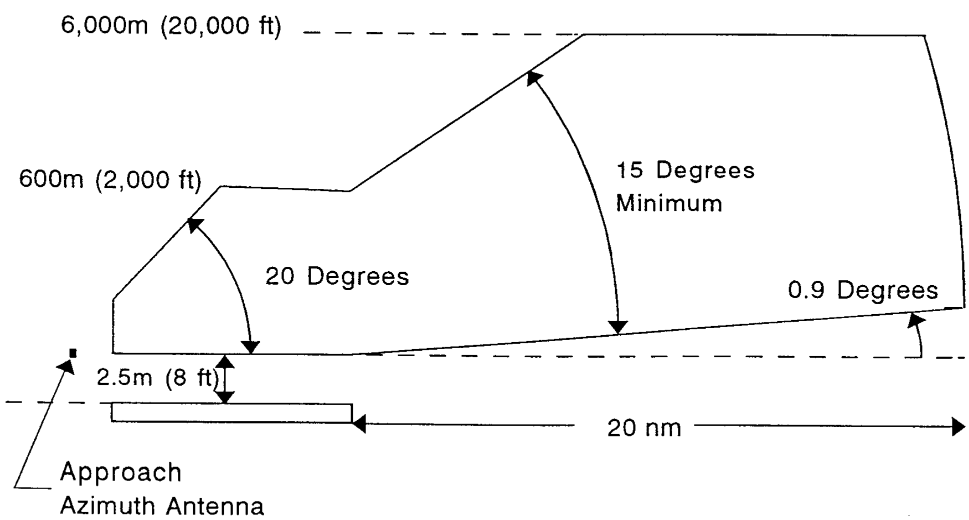
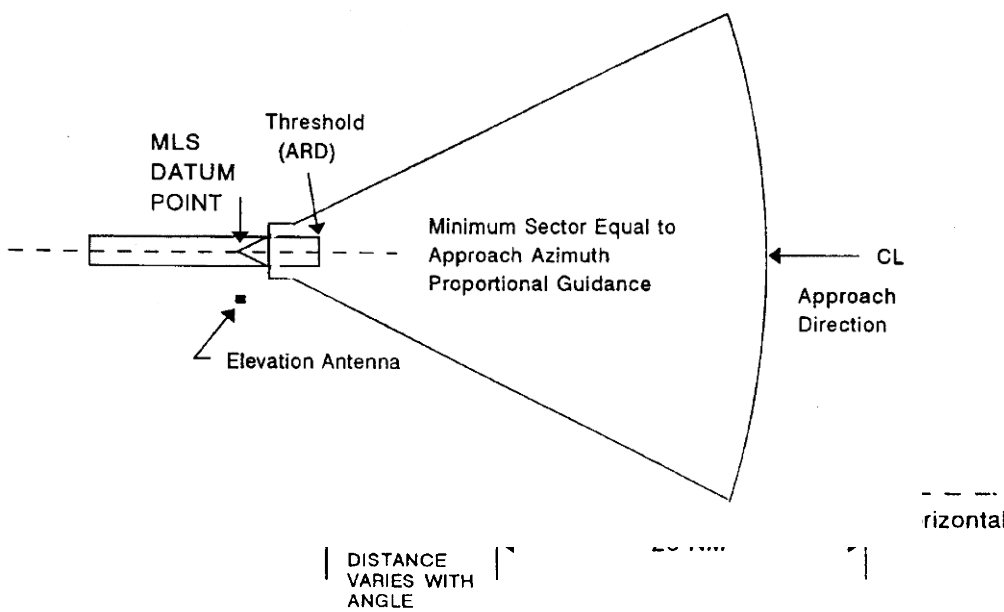


Figure B-1. APPROACH AZIMUTH/DATA COVERAGE.

HORIZONTAL COVERAGE



VERTICAL COVERAGE

Figure B-2. APPROACH ELEVATION COVERAGE

MLS POINTS AND ZONES

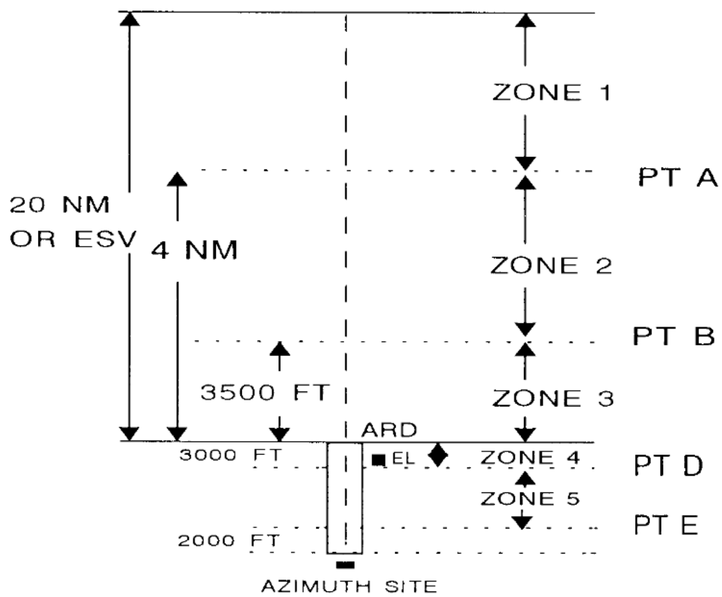
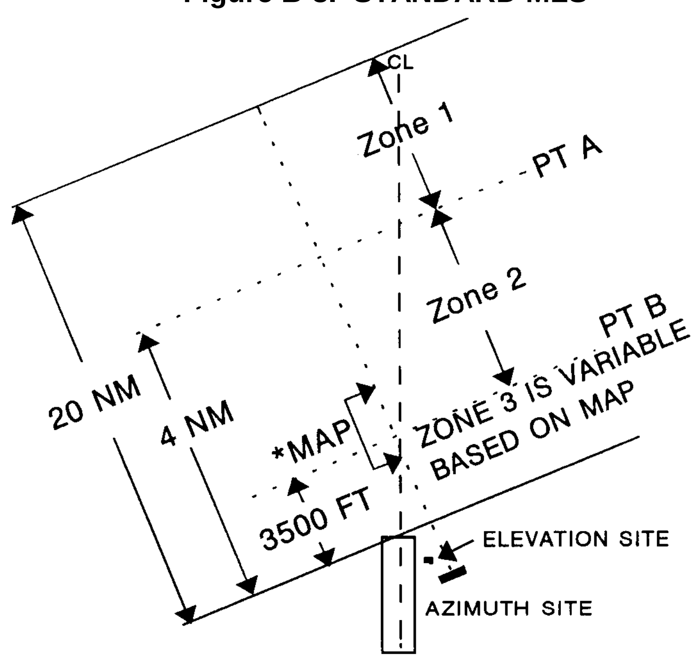


Figure B-3. STANDARD MLS



* MAP IS VARIABLE BASED ON DECISION HEIGHT.

Figure B-4. OFFSET MLS

MLS POINTS AND ZONES, CONTINUED

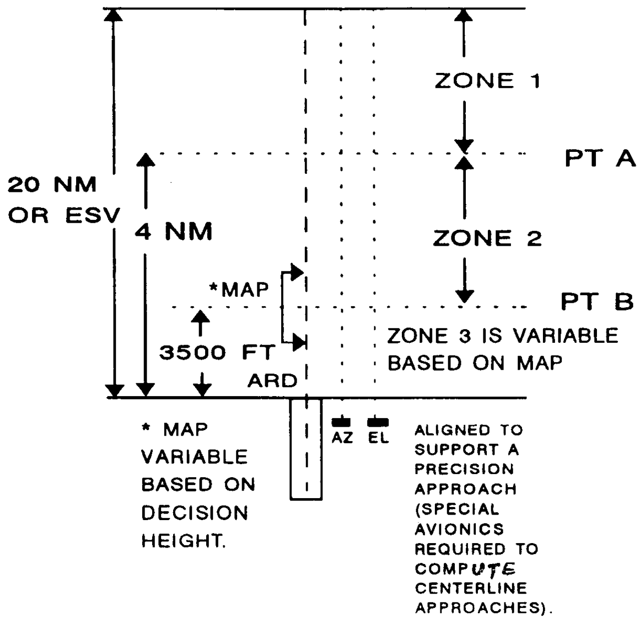


Figure B-5. COLLOCATED MLS

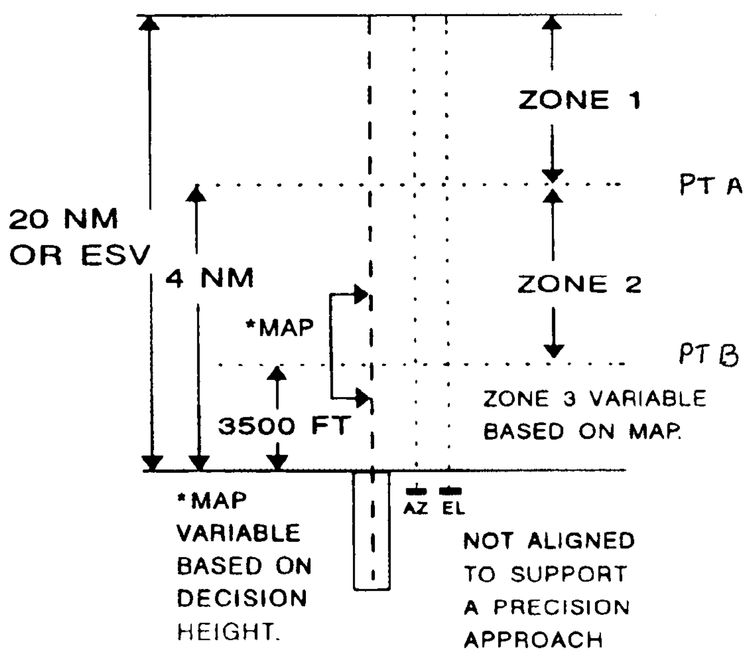


Figure B-6. POINT IN SPACE MLS

6. Preflight Requirements.

a. Review of all facility data and computation of facility error budget.

b. Review of facility horizontal and vertical terrain and obstruction profiles to determine line-of-sight characteristics and areas of possible signal anomalies. These profiles will be provided by installation engineering personnel if obstruction definition is critical to the facility performance.

7. Flight Inspection Procedures.

Table B-1. FIXED MLS CHECKLIST

TYPE CHECK	REF PARA	Inspection			ANTENNA CHANGE		Measurements Required					
		C	P	FC*	AZ	EL	CONFIG	STRUCT	ALIGN	DATA	COVG	CLEAR
Data Word Verification	15	X	X	X	X	X	Norm			X		
Lateral Coverage	8	X			X	X	RF Power	X			X	X
Vertical Coverage	9	X			X	X	RF Power	X			X	
Ref Arc	8b	X	X	X	X	X	Norm	X		X	X	X
Approach AZ	10	X, 2	X	X	X		Norm	X	X	X		
Approach EL	10	X, 2	X	X	X	X	Norm	X	X			
AZ Monitor	11b	X	1				Align Ref		X			
EL Monitor	11b	X X	1 1				HI Angle LO Angle		X X		3	
DME	14	X	X				Norm				X	
OCI Orbit	12	1					Norm			X		X
Ident	13	X	X				Norm				X	

NOTES:

1. Engineering or maintenance request
1. Additional Approach from Service Volume Limits at Minimum RF Power
2. Coverage below path.

* = Frequency Change

Table B-2. MOBILE MLS CHECKLIST

TYPE CHECK	REF PARA	Inspection			ANTENNA CHANGE		CEU Chg 1, 2, 3	DEU Chg	Measurements Required				
		C 2	P 2	FC *	AZ	EL			CONFIG	STRUCT	ALIGN	DATA	COVG
Data Word Verification	15 21	X	X	X	X	X	X		Norm			X	
Lat Covg	8	X			X	X		X (5)	Norm	X			X
Vert Covg	9	X			X	X			Norm	X			X
Ref Arc	8b	X	X	X	X	X			Norm	X		X	X
Approach AZ	10	X,	X	X	X		X	(6)	Norm	X	X	X	
Approach EL	10	X	X	X		X	X	(6)	Norm	X	X		
AZ Monitor	11b	X	1				X		Align Ref		X		
EL Monitor	11b	X X	1 1				X X		Hi Angle Lo Angle		X X		 4
DME	14, 23	X	X					X	Norm				X
Ident	13, 22	X	X				X	X	Norm				X
Computed Centerline Validation	19	X							Norm		X		

NOTES:
1. Engineering or maintenance request
2. Commissioning of MMLS facilities with backup control electronics unit (CEUs), perform “CEU Change” checklist on backup CEU.
3. Complete Periodic requirements on both CEUs.
MMLS Redeployment. If the system was removed and reinstalled in its previous configuration and exact location with no changes, perform a “P” and “CEU Change” Checklist.
4. Coverage below path.
5. 20 nm coverage arc required.
6. Azimuth/ Elevation analysis is not required for a DEU change; evaluate the DME with the aircraft configured on the approach.
*FC = Frequency Change

8. Coverage Arcs.

Coverage Arcs are used to define and certify the lateral and distance limits of AZ, EL, and DME coverage. Evaluate proportional guidance and clearance coverage.

a. Service Volume Arc. A commissioning inspection maneuver to define and certify the operational range, lateral and vertical limits of the MLS service volume. Perform the inspection with the facility operating at the lowest computed power required to establish adequate signal coverage for the intended service volume.

(1) Positioning. Start the arc at the maximum usable distance and 5° outside the edge of the service volume limit. Maintain an altitude equal to the minimum glide path (MGP). If signal coverage of all MLS components cannot be maintained at the MGP, the MLS shall be restricted. There is no requirement to certify the lower, 0.9°, or higher, 20,000 ft, limits of vertical coverage unless procedurally or operationally required. The Optional Service Volume Arc should be flown at a distance of 14 nm.

(2) Inspection:

(a) Evaluate the proportional guidance service volume in 10° increments. There shall be no less than 10° proportional guidance either side of the procedural on course.

(b) While traversing the azimuth proportional guidance sectors, record azimuth and elevation deviation. Deviation crosspointer fluctuations greater than 0.5° that exceed 2° of arc and all MLS receiver unlocks shall be validated by radial flight, using the procedures outlined in paragraph 9 (Vertical Coverage).

b. Reference Arc. A commissioning and periodic arc throughout the proportional guidance area to assure azimuth and elevation signal coverage at the lower edge of elevation deflection sensitivity.

(1) Positioning. At a distance of between 5 and 10 nm from the approach reference datum (ARD), start the arc 5° outside the edge of the service volume. Vertical altitude shall be computed to equal the MGP x 0.75 at the distance flown. The distance and altitude at which the arc is flown on commissioning will be recorded on the facility data sheet. This shall be the reference for periodic evaluations.

(2) Altitudes. The approximate (including earth curvature) arc altitudes above site elevation are computed in table B-3 for selected angles and distance. Maintaining a centered elevation crosspointer at the correct distance will give a more precise altitude and is the preferred method of flying the arcs.

Table B-3. Approximate Arc Altitudes Above Site Elevation

MGP ANGLE	MGP @ 20 nm	MGP x 0.75 @ 5 nm	MGP x 0.75 @ 6 nm	MGP x 0.75 @ 7 nm	MGP x 0.75 @ 8 nm	MGP x 0.75 @ 9 nm	MGP x 0.75 @ 10 nm
2.5	5659	1017	1225	1436	1648	1862	2077
2.6	5871	1056	1273	1491	1711	1933	2157
2.7	6084	1096	1321	1547	1775	2005	2237
2.8	6297	1136	1369	1603	1839	2077	2316
2.9	6509	1176	1416	1659	1903	2148	2396
3	6722	1216	1464	1714	1966	2220	2476
3.1	6935	1256	1512	1770	2030	2292	2555
3.2	7147	1295	1560	1826	2094	2363	2635
3.3	7360	1335	1608	1882	2158	2435	2715
3.4	7573	1375	1655	1937	2250	2507	2794
3.5	7786	1415	1703	1993	2285	2579	2874
4	8851	1614	1942	2272	2604	2937	3273
4.5	9917	1814	2182	2552	2923	3296	3672
5	10985	2013	2421	2831	3243	3656	4071
5.5	12054	2213	2661	3111	3562	4015	4470
6	13126	2413	2901	3391	3882	4375	4870

(3) Inspection.

(a) Evaluate the proportional guidance volume in 10° increments. There shall be no less than 10° proportional guidance either side of the procedural on course.

(b) While traversing the proportional guidance sectors, record azimuth and elevation deviation. Deviation crosspointer fluctuations greater than 0.5° that exceed 2° of arc and all MLS receiver unlocks shall be validated by radial flight using the procedures outlined in paragraph 9 (Vertical Coverage).

9. Vertical Coverage.

a. Purpose

(1) A commissioning maneuver to evaluate vertical coverage of the azimuth and elevation on the procedural azimuth and at ± 10° each side.

(2) Validate elevation and azimuth deviation crosspointer fluctuations noted on arcs.

b. Positioning. This check will be accomplished by a level run starting at 20 nm or ESV limits, whichever is farthest from the ARD. Start altitude shall be computed to equal the MGP x 0.75 at the FAF. Altitudes up to the MGP are acceptable outside the FAF if required to maintain signal integrity. Inside the FAF, the altitude shall be no higher than that equal to the MGP x 0.75.

c. Inspection. Record deviation, path following error (PFE), path following noise (PFN), and control motion noise (CMN). Observe the azimuth and elevation crosspointers for excessive signal aberrations which may indicate multipath or signal shadowing. Observe the elevation crosspointer for a smooth linear transition terminating between 15 and 20°.

(1) When fluctuations exceed ± 0.5° within ±10° of the procedural on course, fly the approach offset 5° on the affected side(s) of the procedural on course and apply PFN and CMN tolerances. If the 5° offset approach is satisfactory, the approach may be placed in service.

(2) Validation of deviations noted on arcs shall be discussed with maintenance personnel for corrective action. If not correctable, the area in question shall be restricted.

(3) Increases in the minimum EL lower scan limit may present an erroneous crosspointer indication at elevation angles below the scan limit. The elevation coverage should be restricted below the adjusted lower scan limit.

(4) Increases in the minimum EL lower scan limit made after determination of normal path structure shall require a recheck of the EL approach guidance inside the FAF.

10. MLS Approaches.

a. Purpose. The approach should be the first maneuver flown during a commissioning, reconfiguration, or restoration flight inspection, so that the azimuth and elevation course and coverage may be optimized to the desired procedural alignment. This maneuver is performed to verify that the azimuth and elevation facilities will satisfactorily support the proposed or published approach and categories of intended use.

b. Positioning. Approaches shall be evaluated on the designed procedural azimuth and the minimum glidepath, unless otherwise indicated. For the purpose of evaluating structure, optimizing azimuth and elevation alignments, and conducting periodic inspections, start the approach at a distance not closer than the published FAF point or 6 miles from runway threshold, whichever is greater. For commissioning, fly the approach on the MGP from the desired service volume limits at normal power and while the facility is at minimum RF power.

c. MLS Approaches Which Support Azimuth Only Minima. For an azimuth-only approach, the published or proposed procedural altitudes shall be maintained in each segment, except the final segment shall be flown as follows: Upon reaching the FAF inbound, descend at a rate of approximately 400 ft per mile (930 ft per minute at 140 knots; 800 ft per minute at 120 knots) to an altitude of 100 ft below the lowest published MDA and maintain this altitude to the MAP.

d. Inspection.

(1) Azimuth facilities sited along runway centerline shall be evaluated through Zones 1, 2, and 3 (also Zones 4 and 5 if autoland or Cat II/III operations are authorized) on all inspections requiring alignment and structure measurements; elevation guidance on these facilities shall be

evaluated to the ARD. All other facilities shall be evaluated to 100 ft below decision height (DH).

NOTE: During site, commissioning, reconfiguration, categorization, antenna, and/or frequency change inspection—check all of Zone 1. All other inspections (i.e., periodic, periodic with monitors, etc.) evaluate structure from GSI or the FAF (whichever is further) through all other required zones.

(2) Approved radio telemetering theodolite (RTT) and/or AFIS methods shall be used for the approach evaluation. The facility error budget will provide all tolerances to be used during commissioning and periodic flight inspection. Mean course error (MCE) shall be established prior to application of PFE tolerances. Exclude data in areas that are restricted due to facility performance.

(3) For azimuth facilities sited along runway centerline in accordance with Figure B-3, the azimuth MCE shall be determined and reported as found in the 1.0 nm segment ending at the ARD. For other facilities, use the 1.0 nm segment, ending at the MAP. For elevation facilities, determine the glide angle in Zone 2 as defined in Figures B-3, B-4, and B-5.

(4) Visual Autoland or Category II or III Operations Authorized. On commissioning inspections, cross Point C at 100 ft, runway threshold at approximately 50 ft, and continue on the extended glidepath angle to the touchdown point. Continue the landing roll and determine the actual course alignment for Zones 4 and 5. Measure the course structure from the actual alignment. If the actual alignment for Zones 4 and 5 cannot be determined using this method, taxi the aircraft along the runway centerline from abeam the elevation site to Point E. Record the raw crosspointer information and mark, abeam the elevation site, Point D and Point E. Manually calculate the actual course alignment and structure for each of the required zones.

11. Monitor References.

a. Purpose. To provide facility maintenance personnel reference readings to be used in the validation of facility monitoring parameters. Facility discrepancies shall be assigned if the alignment shift results in out-of-tolerance PFE at any distance on the approach.

b. Inspection.

(1) Azimuth monitor references shall be established after the facility is optimized to a MCE within $\pm$ 0.02° of the designed procedural azimuth. After the MCE is established, have maintenance personnel shift the system to one side, record the reference, shift the same amount to the other side, record the reference, then restore to normal. Azimuth monitors can also be established on the ground when parked within proportional guidance, maintaining line-of-sight at the maximum practical distance from

the antenna. When azimuth monitors are checked on the ground, algebraically add the azimuth shift to the reported maximum PFE on the approach.

(2) Elevation monitor references are established airborne and require the MGP to be established within ± 0.02° of the commissioned angle prior to accomplishment. Request an elevation angle change of no greater than 0.10° high, record the reference, have the elevation angle changed to no greater than 0.10° low, record the reference, then restore to normal.

(3) If the elevation lower scan angle limit is increased to improve PFE, recheck normal EL path structure.

c. **Below Path Coverage Evaluation**. Perform this check during a commissioning flight inspection when in low angle alarm. Three runs are required, one on procedural centerline, and at 2° either side of centerline. Fly at an angle equal to [(MGP° x 0.75) - 0.25°]. Ensure that AZ/EL guidance and obstacle clearance can be maintained from the FAF to the MAP.

12. Out-of-Coverage Indication (OCI).

The purpose of the OCI check is to ensure that no false angle decoding occurs outside of proportional guidance coverage areas. This check is done at maintenance request if there are procedural requirements beyond the service volume. Fly an orbit radius of 6 to 10 miles about the azimuth facility for this check. The aircraft will be flown at an altitude as close to the MGP that line of site with the MLS facilities will allow. During the orbit, note the position of any decoded angles lasting longer than 4 seconds or 1.5° of arc, whichever is greater. Return to the area after completing the orbit and manually program the decoded angle into the receiver. If the angle can be locked onto and flown as a radial, even though an OCI signal is present, the problem shall be corrected, or the facility restricted. MMLS does not have OCI capability.

13. Identification.

The purpose of the identification check is to ensure correct identification is received throughout the coverage area. The identification can be validated by listening to the Morse code or recording basic data word 6.

14. DME.

The DME shall be evaluated as a DME/N throughout all areas of coverage. MLS DME is specified by ICAO to transmit the three-letter ID, dropping the preceding M. Evaluate DME accuracy in accordance with Section 201. Currently commissioned facilities transmitting 4-letter on DME (e.g., M-XXX) function shall be left in service.

15. Data Words.

Transmitted data words containing facility siting and approach information are used by the receiver to process AZ and EL angle information, identify the station, and determine crosspointer sensitivity. Basic data words are used for all approaches. Auxiliary data words are used for area navigation (RNAV) or Computed Centerline Approaches. Some stations may not transmit all auxiliary data words. The AFIS, loaded with the correct facility data, is the standard for comparison with transmitted data words. If using non-AFIS equipment, the data words supplied by the facility data sheet are the standard. On commissioning, data word discrepancies shall be resolved with facility maintenance before placing the facility in service; any intentionally missing data words shall be documented on the facility data sheet.

16. Detailed Procedures for Collocated MMLS Providing Computed Centerline Approach.

The procedures for inspecting standard MLS installations contained in 8 through 15 are modified as necessary to support Computed Centerline approaches. Use the procedures of paragraphs 8 through 15 except as directed below.

17. Coverage Arcs.

Arcs are flown only to measure the proportional guidance limits. The minimum limit on the equipment side of the runway is 10° beyond the published front course azimuth. On the other side, the minimum is the greater of either 10° beyond the azimuth from the MAP to the AZ antenna OR 5° beyond the azimuth from the threshold to the AZ antenna (see Figure B-8). EXCEPTION: For ALZ operations where touchdown within 500 ft of threshold is essential, the non-equipment side limit may be decreased, as long as coverage is provided to at least 100 ft below Decision Height. To preclude difficulties with the vertical coverage check if the proportional guidance limit is set to the same value as the 10° past the MAP (or 10° past published azimuth on the equipment side), attempt to widen the proportional guidance at least an additional 2°.

18. Vertical Coverage.

This check will be accomplished by a level run starting at 20 nm from the antenna. The azimuth for the vertical coverage checks on the equipment side of the runway is 10° past the published front course azimuth. On the other side, fly the run 10° past the direct azimuth from the MAP to the azimuth antenna. (See Figure B-8.)

19. Computed Centerline Approaches.

Techniques for checking computed centerline procedures depend on the equipment used for the checks. Some flight inspection equipment is limited to checking only the antenna boresight signal while others can evaluate the computed centerline.

> **a.** If the flight inspection equipment is capable of determining structure and alignment of the computed centerline and elevation signal while flying the approach course, measure these parameters on the computed centerline in accordance with the AFIS manual. The procedural evaluation may be accomplished using the AFIS only if the aircraft can be navigated along the computed centerline by reference to the AFIS.
>
> **b.** If using theodolite or AFIS not capable of measuring the computed

centerline, the azimuth boresight signal must be evaluated. When using theodolite, position the instrument to be in-line with the antenna center and use normal procedures. To inspect the azimuth boresight using AFIS, create a "pseudo runway" (see Figure B-7). The centerline of this "runway" passes through the AZ antenna. Runway updates are through markers on centerline at each end of the "runway". A differential GPS or television positioning system (TVPS) must be used unless suitable visual cues are present to accurately determine centerline and runway ends. Facility data is changed in the AFIS to use the "pseudo runway" and shall be used as the reference for AZ alignment and structure measurements. If using the pseudo runway concept, determine azimuth alignment in 1 nm segment, ending at the MAP. When using AFIS, actual, or "pseudo runway" data may be used for coverage arcs or vertical coverage checks. Coordinates of the "pseudo runway" threshold and updating method used must be documented on the commissioning report and facility data sheet.

c. Elevation. Actual runway data and normal procedures shall be used for all elevation angle and structure validation when using theodolite or AFIS with or without computed centerline capability.

d. Procedural Evaluation. On commissioning and for any change in procedural azimuth or changes in data words affecting azimuth determination, the procedure must be validated using a “computed centerline” receiver or AFIS capable of providing equivalent pilot indications. For periodic inspections including SIAP and COV checks, a standard receiver (using Pseudo Runway procedures) may be used if:

(1) Azimuth PFE is within the tolerances specified in Paragraph 29b(2).

(2) Basic and Auxiliary Data Words critical to computed centerline determination match those used during final approach course certification of the current SIAP. (See Table B-4)

20. Monitors.

Mobile Microwave Landing System (MMLS) AZ and EL monitor limits shall be evaluated at the actual alarm points. Optimize the AZ and EL Mean Course Errors to within 0.05° before checking monitor PFE limits. Figure B-9 depicts the azimuths to be flown for coverage below path evaluations.

21. MMLS Data Words.

The MMLS data words generated by the equipment are calculated from the equipment siting and procedural information input by the installer. The equipment may use an input to generate more than one data word, and some of these words are labeled differently in the MMLS than the received words. Table B-4 translates these words.

Table B-4 -- DATA WORD TRANSLATOR

Word	Description	MMLS Term	Least Signification Bit
Basic 1	AZ ant to Threshold Dist	DATUM/THR (5)	100 mtr
	AZ proportional neg limit	AZ LOW LIM	2°
	AZ proportional pos limit	AZ UPR LIM	2°
	Clearance signal type	(1)	0=pulse/1=scan
Basic 2	Minimum glidepath angle	MIN GP	0.1°
	Apch EL Status	FLD MON	0=abnormal/1=normal
	Apch AZ Status	FLD MON	0=abnormal/1=normal
	Back AZ Status	(1)(4)	0=abnormal/1=normal
	DME Status	DEU/NORM/BYP	(2)
Basic 3	AZ Beamwidth	(1)	0.5°
	EL Beamwidth	(1)	0.5°
	DME Distance	AZ/DATUM DIST	12.5 mtr
Basic 4	AZ Mag Orientation	AZ MAG ORIENT	1° (3)(6)
	Back AZ Orientation	(4)	1°
Basic 5	Back AZ neg prop limit	(4)	2°
	Back AZ pos prop limit	(4)	2°
	Back AZ Beamwidth	(4)	0.5°
Basic 6	MLS Identification	3-letter entry	
AUX 1	AZ antenna offset	AZ OFFSET DIST	1 mtr (8)(6)
	AZ antenna to Datum Point distance	AZ/DATUM DIST	1 mtr (6)
	AZ alignment with Rwy C/L	AZ W/CL	0.01° (8)(6)
	AZ coordinate system	(1)	0=Conical/1=planar
	AZ antenna phase center height	AZ ANT HGT	1 mtr
AUX 2	EL antenna offset	EL OFFSET DIST	1 mtr (8)
	Datum point to threshold distance	DATUM/THR	1 mtr (6)
	EL antenna phase center height	EL ANT HGT	0.1 mtr
	Datum point elevation	DATUM ELEV	1 mtr (9)
	Threshold Height	THRESH HGT	0.1 mtr
AUX 3	DME offset	AZ OFFSET DIST	1 mtr (8)(6)
	DME to datum point distance	AZ/DATUM DIST	1 mtr (6)
	DME antenna height	AZ ANT HGT	1 mtr
	RWY stop end distance	STOP END DIS	1 mtr (9)
AUX 4	Back AZ ant offset	(4)	1 mtr (8)
	Back AZ to datum point distance	(4)	1 mtr
	Back AZ align with rwy C/L	(4)	0.01° (8)
	Back AZ coord sys	(4)	0=Conical/1=Planar
	Back AZ ant phase center height	(4)	1 mtr

NOTES:

1. Factory set, no field input

2. DME status codes:

0 0 DME inoperative or not available

0 1 Only initial approach or DME/N available (normal MMLS status)

1 0 Final approach mode std 1 available

1 1 Final approach mode std 2 available

3. Magnetic orientation is 180° from procedural front course azimuth.

4. Back azimuth not used.

5. Split-site configuration is combined value: AZ/DATUM DIST DATUM/THR

6. Computed centerline critical values

7. Distances and heights are with respect to MLS datum point.

8. Negative number indicates left of C/L looking from threshold to stop end.

9. May be blank (indicated by a received zero) or actual value.

22. Identification.

To preclude confusion with DME indications, ensure the MMLS identification is not the same as any other DME source used for any approach or missed approach guidance.

23. DME.

When the MMLS is placed in an abnormal configuration for monitor checks or adjustments, the DME continues transmitting, but the pulse spacing is changed to 33 microseconds. With the normal "Y" channel DME spacing of 30 microseconds, some receivers may remain locked onto the DME signal. This indication is not hazardous and should be disregarded.

24. Analysis.

a. Azimuth PFE, PFN, and CMN will be evaluated over any 40-second interval of radial flight within the coverage area. Measured parameters shall be in tolerance for no less than 95 percent of the interval measured. PFE tolerances shall only be applied with use of AFIS or RTT.

b. Elevation PFE, PFN, and CMN will be evaluated over any 10-second interval of radial flight within the coverage area when on a selected glide path at or above the MGP. Measured parameters shall be in tolerance for no less than 95 percent of the interval measured. PFE tolerances shall only be applied with use of AFIS or RTT when flown radially.

c. Manual analysis of PFN can be determined by measuring the signal deviations from the mean azimuth or elevation angle that have a duration greater than:

(1) 6.3 seconds for azimuth

(2) 2 seconds for elevation

d. Manual analysis of CMN can be determined by measuring the signal deviations from the mean azimuth or elevation angle that have a duration less than:

(1) 10.4 seconds for azimuth

(2) 6.3 seconds for elevation

(3) CMN filter bandpass frequency overlaps a portion of the PFE bandpass frequency. The resultant CMN signal will be superimposed upon the PFE component, resulting in a larger error than is actually present. CMN shall be reported after subtraction of the PFE component.

e. Monitor limits are determined by the maximum PFE found in the alarm configurations. If monitors are checked airborne, make separate runs, measuring PFE in each configuration. If the AZ alignment monitor is checked on the ground, algebraically add the amount of alignment change to the PFE value found on the normal approach.

25. Tolerances

a. Facility Error Budgets. Due to the unique siting requirements of each MLS installation and the resulting difference in tolerances, a MLS error budget shall be computed for each facility. The location of the azimuth site determines the Reference Point to be used in the computation of the error budget. The EL error budget reference point shall coincide with the AZ.

(1) ARD when the azimuth is sited along or within 1.00° of runway centerline. (See Figure B-3).

(2) MAP when the azimuth is:

(a) Offset. (See Figure B-4).

(b) Co-located azimuth with elevation. (See Figure B-5).

(c) Heliports which are considered to be those facilities with less than 2,300 ft between the azimuth and the approach reference datum when sited along runway centerline.

(d) Non-precision approach aid terminating at a point in space and not aligned with a precision runway. (See Figure B-6.)

26. Application of Tolerance Degradation Factors.

Tolerances are specified as the calculated or standard value at the reference point, either ARD or MAP. These tolerances may be widened (in most cases to an indicated maximum value) by the indicated degradation factors with increasing distance, lateral, or elevation displacement from the reference point. To calculate azimuth tolerance at a given point, use the following steps, in order:

a. Determine the tolerance at the reference point, using the following formula:

MLS PFE/PFN/CMN Angular Tolerance

$$\theta = \arc\tan \frac{Tf}{D}$$

Where:

θ = Angular Tolerance at measure point

Tf = PFE/PFN/CMN Tolerance in feet

D = Distance in feet from Azimuth antenna to Tolerance reference Point (ARD or MAP).

b. Define the measurement point in distance, lateral angle, and elevation angle from the reference point

c. Centerline (C/L) Distance Degraded Tolerance

(1) Multiply the tolerance at the reference point by the distance degradation factor. This gives the maximum boresight tolerance at 20 nm.

(2) Subtract the tolerance at the reference point from the tolerance at 20 nm. This gives the Maximum Degradation.

(3) Divide the maximum degradation by 20, giving the degradation increment (degrees per nm).

(4) Multiply the degradation increment by the mileage from ARD of the measurement point, then add the original tolerance at the reference point. The result is the tolerance on C/L (boresight) at the distance of the measurement point.

d. Laterally Degraded Tolerance

(1) Multiply the distance degraded tolerance from Step c(4) above by the off-course degradation factor, giving the maximum degradation at 40 (60)° at the specified distance.

(2) Subtract the C/L value from the value at 40°. The result is the maximum degradation.

(3) Divide the maximum degradation by 40 to get the degradation Increment (degrees per degree).

(4) Multiply the Degradation Increment by the number of degrees off-course at the measurement point; add this value to the value from Step c(4) above. This gives the tolerance at the measurement distance and lateral offset.

e. Vertically Degraded Tolerance (above 9° only).

(1) Multiply the distance and laterally degraded tolerance from Step d(4) above by the vertical degradation factor, giving the maximum tolerance at 15° elevation at the specified distance and lateral offset.

(2) Subtract the distance and laterally degraded value (Step d (4)). The result is the maximum degradation.

(3) Divide the maximum degradation by the number of degrees difference from the MGP and 15° to get the degradation increment (degrees per degree).

(4) Multiple the degradation increment by the number of degrees above the MGP at the measurement point; add this value to the value from d(4). This gives the tolerance degraded by all three factors.

f. The tolerance to be applied is the greater of either the value calculated above, or the maximum, as listed in the individual facilities listed below.

EXAMPLE:

Given: AZ to ARD distance – 7,965 ft, MGP – 3.0°
PFE tolerance at ARD from 220.5a(1) – 20 ft

Find: AZ PFE tolerance at 14 nm from ARD, @ 10° off-course, @ 12°

Table B-5 – Applied Tolerance

step	Calculation	Result	Definition
a	Arctan (20 / 7,965)	0.1438	Tolerance at ARD
c(1)	(0.1438 x 1.2)	0.1726	Tolerance @ 20 nm on C/L @ 3.00°
c(2)	(0.1726 – 0.1438)	0.0288	Maximum Degradation
c(3)	(0.0288 / 20 nm)	0.0014 per nm	Degradation Increment
c(4)	(0.0014 x 14 nm) + 0.1438	0.01634	Tolerance @ 14 nm on C/L @ 3.00°
d(1)	(0.1634 x 1.5)	0.2451	Tolerance @ 14 nm @ 40°
d(2)	(0.2451 – 0.1634)	0.0817	Maximum Degradation
d(3)	(0.0817 / 40°)	0.0020 per degree	Degradation Increment
d(4)	(0.0020 x 10°) + 0.1634	0.1834	Tolerance @ 14 nm @ 10° @ 3.00°

e(1)	(0.1834 x 1.5)	0.2751	Tolerance @ 14 nm @ 10° @ 15°
e(2)	(0.2751 – 0.1834)	0.0917	Maximum Degradation
e(3)	(0.0917 / 12°)	0.0076	Degradation Increment
e(4)	(0.0076 x 9°) + 0.1834	0.2518	Tolerance @ 14nm @ 10° @ 12°

27. Standby Equipment.
Standby Equipment shall meet the same tolerances as the primary equipment.

28. Alignment.
Alignment shall be reported as the average flight inspection angle. Facilities shall not be NOTAMed unless the PFE allowance at the reference point is exceeded.

29. Individual System Tolerances.
a. Standard Facilities

(1) Centerline Azimuth Facilities (see Figure B-5)

Table B-6 – Individual System Tolerances

Parameter	Ref. Para	Inspection		Tolerance/Limit at ARD	Maximums	Degradation Factors
		C	P			
Alignment (MCE)	 10d	X X	 **X**	0.02 0.05 Military non-autoland only **PFE tolerances apply**		
PFE Cat I Minima	 10d	X X	X X	20 ft not to exceed 0.25° 30 ft not to exceed 0.25°	<9° EL=0.25° >9° EL=0.50°	(1)
PFN Cat I Minima	 10d	X X	X X	11.5 ft not to exceed 0.25° 17.2 ft not to exceed 0.25°	<9° EL=0.25° >9° EL=0.50°	(1)
CMN (Autoland Authorized)	10d	X	X	10.5 ft not to exceed 0.10° within 10° from C/L More than 10° from C/L = .20	0.10°	(2)
Runway Area (Autoland Authorized)	10d	X	X	Zones 4 and 5 PFE/PFN/CMN tolerances are equal to the linear (footage) values at the ARD.		
CMN (Cat I Minima)	10d	X	X	0.10° within 10° of rwy C/L 0.20° beyond 10° from rwy C/L	0.10° 0.20°	
Alignment Monitor	11	X	X	PFE tolerances apply		

NOTES:

(1) On C/L at 20 nm = 1.2 x ARD value
At 40° off course = 1.5 x C/L value at same distance from ARD.

At 60° off course = 2.0 x C/L value at same distance from ARD.
From +9 to +15° EL = 1.5x value at same distance and direction

(2) Linear increase to 0.10° at 20 nm

(2) Offset Azimuth, Azimuth Collocated with Elevation, and Heliport Azimuth Facilities

Table B-7 – Azimuth Tolerances (Precision Approach)

Parameter	Ref. Para	Inspection		Tolerance/Limit @ Reference Point	Maximums	Degradation Factors
		C	P			
Alignment (MCE)		X		0.02°		
	10d		X	PFE tolerances apply		
PFE	10d	X	X	28 ft not to exceed 0.50	0.50°	(1)
PFN	10d	X	X	14 ft not to exceed 0.50	0.50°	(1)
CMN	10d	X	X	0.20°	0.20°	
Alignment Monitor	11	X	X	PFE tolerances apply		

NOTES:

(1) On procedural C/L at 20 nm=1.2 x Reference Point value
At 40° off course = 1.5 x procedural C/L value at same distance from Reference Point
From +9 to +15° EL = 1.5 x value at same distance and direction from Reference Point

(3) Azimuth and Elevation Facilities Not Aligned as a Precision Approach Aid to a Runway

Table B-8 -- Azimuth Tolerances (Not Precision Approach)

Parameter	Ref. Para	Inspection		Tolerance/Limit @ Reference Point	Maximums	Degradation Factors
		C	P			
Alignment (MCE)	10d	X	X	(1)		
PFE	10d			No requirements		
PFN	10d	X	X	0.50°		None
CMN	10d	X	X	0.20°		None

(1) Alignment shall be considered satisfactory when the flight inspector determines that the azimuth on course and elevation rate of descent allow safe completion of the procedure as published.

(4) Elevation

Table B-9 – Elevation Tolerances

Parameter	Ref. Para	Inspection		Tolerance/Limit @ 3.0° @ Reference Point	Maximums	Degradation Factors
		C	P			
Alignment (MCE)		X		0.02°		
	10d		X	PFE tolerances apply		
PFE	10d	X	X	0.133		(1) (2) (5)
(Cat I Minima)		X	X	0.20		
PFN	10d	X	X	0.087		(1) (2) (5)
(Cat I Minima)		X	X	0.133		
CMN (autoland authorized)	10d	X	X	0.05	Within 10° of rwy C/L = 0.10° Beyond 10° of rwy C/L = 0.20°	(3) (4)
CMN (Cat I minima)	10d	X	X	0.10	Within 10° of rwy C/L = 0.10° Beyond 10° of rwy C/L = 0.20°	
Alignment Monitor	10d	X	X	PFE tolerances apply		

NOTES:

(1) On C/L at 20 nm = 1.2 x ARD value

(2) At 40° off course = 1.2 x C/L value at same distance from Reference Point
At +15° EL = 2.0 x value at same distance and direction from Reference Point

(3) Linear increase to 0.10° at 20 nm

(4) At 40° off course = 2.0 x C/L value at same distance from Reference Point

(5) With decreasing elevation angle: The PFE and PFN limits from +3° (or 60% of the MGP, whichever is less) to the coverage extreme, are degraded linearly by a factor of 3 times the value at the Reference Point.

b. MMLS Facilities Authorized for no Lower than Category I Minima Use by NATO Nation Military Use Only

(1) Split-Site Centerline Azimuth

Table B-10 – Split-Site Centerline Azimuth Tolerances

Parameter	Ref. Para	Inspection		Tolerance/Limit at ARD	Maximums	Degradation Factors
		C	P			
Alignment (MCE)		X		0.05°		
	10d		X	PFE tolerances apply		
PFE	10d	X	X	28 ft not to exceed 0.50°	0.50°	(1)
PFN	10d	X	X	14 ft not to exceed 0.50°	0.50°	(1)
CMN	10d	X	X	0.20°		
Alignment Monitor	11b	X	X	PFE tolerances apply		

On C/L at 20 nm = 1.2 x MAP value

(2) Azimuth Collocated with Elevation

Table B-11 -- Azimuth Collocated with Elevation Tolerances

Parameter	Ref. Para	Inspection		Tolerance/Limit @ Reference Point	Maximums	Degradation Factors
		C	P			
Alignment (MCE)	19	X		0.05°		
	10d		X	PFE tolerances apply		
PFE	10d, 19	X	X	35 ft not to exceed 0.50°	0.50°	(1) (2)
PFN	10d, 19	X	X	66% of allowable PFE	0.50°	(1) (2)
CMN	10d, 19	X	X	0.20°	0.20°	None
Alignment Monitor	11b	X	X	PFE tolerances apply		

On C/L at 20 nm = 1.2 x Reference Point value
At 40° off course = 1.5 x C/L value at same distance from Reference Point

(3) Elevation

Table B-12 – Elevation Tolerances

Parameter	Ref. Para	Inspection		Tolerance/Limit @ Reference Point	Maximums	Degradation Factors
		C	P			
Alignment (MCE)	10d 19	X	 X	0.05° PFE tolerances apply		
PFE	10d, 19	X	X	0.30°	0.30°	None
PFN	10d, 19	X	X	0.133°	0.133°	None
CMN	10d, 19	X	X	0.20°	0.20°	None
Alignment Monitor	11	X	X	PFE tolerances apply		

30. Data Words.

The AFIS is the reference for the correctness of the received data words (data sheet for non-AFIS). Due to calculation rounding and feet/meter conversion, some apparent errors occur. When the received data words do not match the AFIS expected values, the differences must be resolved with facility maintenance. The transmitted data words from the MMLS facility shall be correct. The following data words, if transmitted, have acceptable tolerances; all other values must match.

Table B-13 – Data Words

a. Basic Data Words

Word	Description	Tolerance
Basic 1	AZ to threshold distance	± 1 Meter
Basic 3	DME distance	± 1 Meter

b. Auxiliary Data Words

Word	Description	Tolerance
AUX 1	Az to Offset	± 1 Meter
	Az to MDPT	± 1 Meter
	Az Ant Height	± 1 Meter
AUX 2	El Ant Offset	± 1 Meter
	MDPT Distance	± 1 Meter
	El Ant Height	± 0.1 Meter
	MDPT Height	± 1 Meter
	Threshold Height	± 0.1 Meter
AUX 3	DME Offset	± 1 Meter
	DME to MDPT Distance	± 1 Meter
	DME Ant Height	± 1 Meter
	Rwy Stop End Distance	± 1 Meter

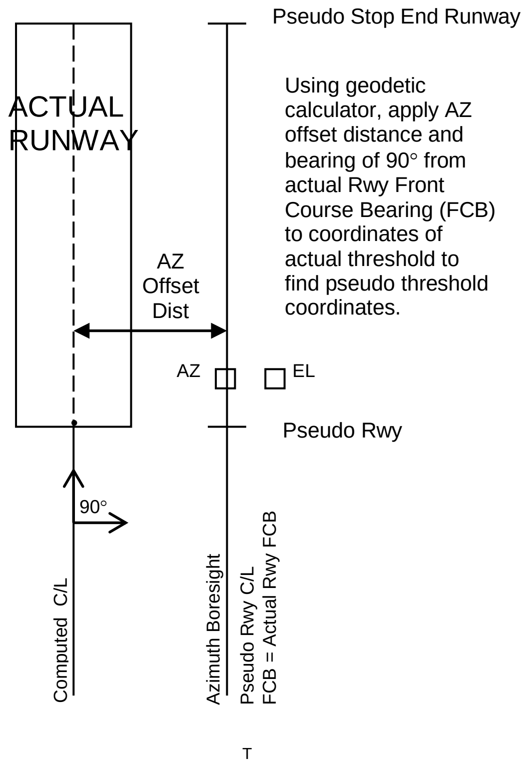


Figure B-7. Pseudo Runway

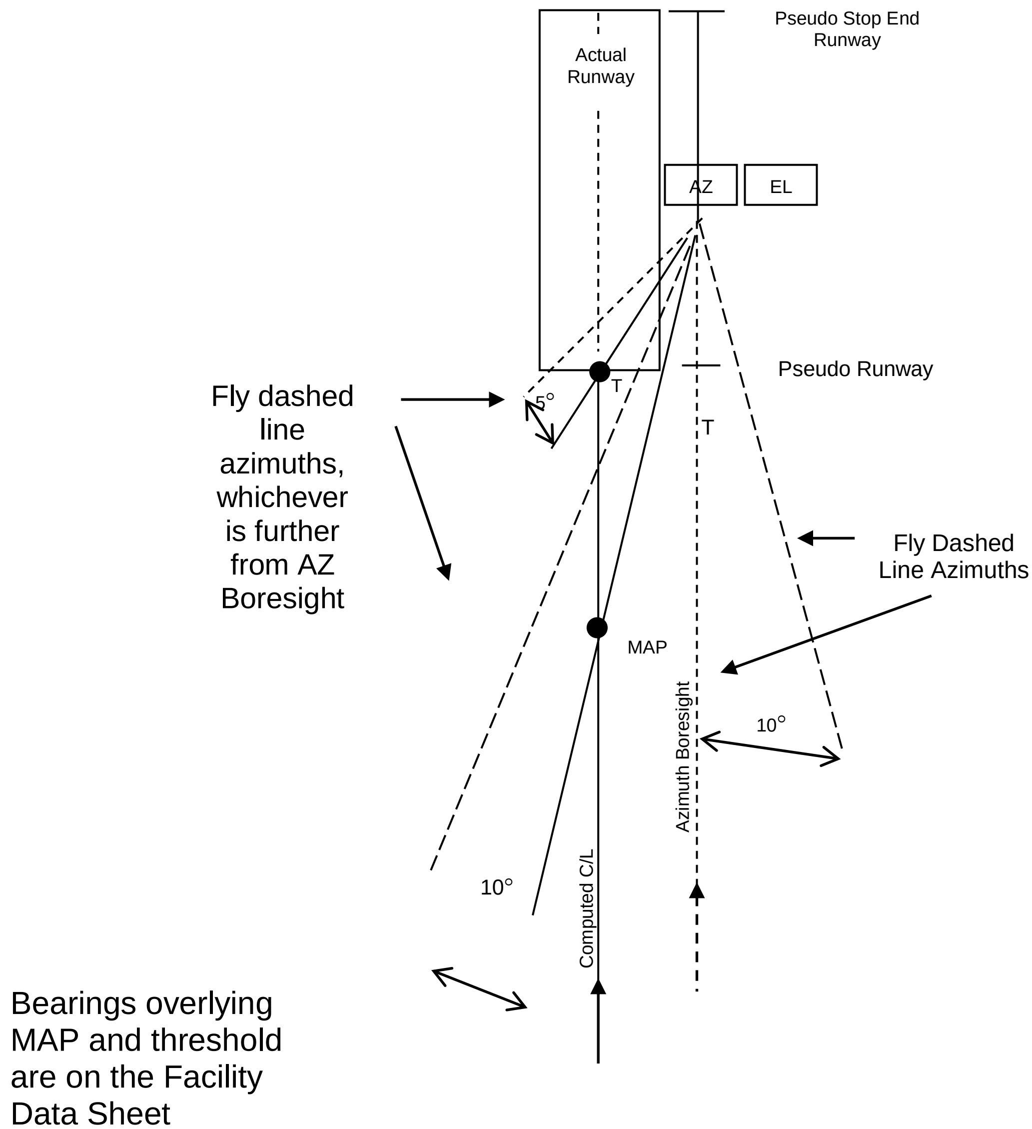
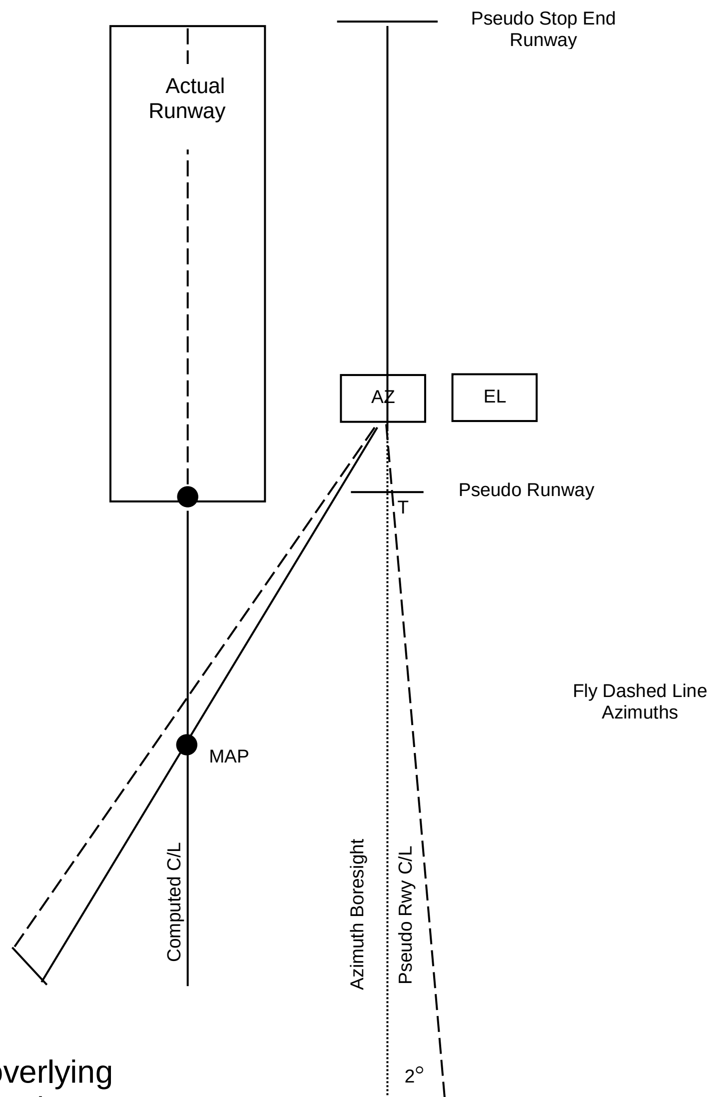


Figure B-8. MMLS Coverage Validation and Minimum Proportional Guidance



Bearings overlying
MAP are on the
Facility Data Sheet

Figure B-9. Azimuths for Coverage Below Path (Computed Centerline Facilities)

Annex C. FACILITY DATA SHEETS
INSTRUCTIONS FOR COMPLETION OF FACILITY DATA:

1. Purpose and Distribution.
Information required on this sheet is used to prepare computer programs for flight inspection aircraft. This data must be kept valid and current. Submit a new facility data sheet when any of the information is changed (e.g. frequency change, antenna replacement, equipment change, etc.). Do not report temporary changes in facility restrictions or inoperative components. Forward the original copy to the agency responsible for flight inspection of the facility.

2. Scope of the Sheet.
Complete the appropriate sections of the Facility Data Sheet for the NAVAID requiring a flight inspection, as follows:

a. Instrument Landing System (ILS). Report the localizer, glide path, runway data, and supporting NAVAID for an ILS flight inspection, using the example in Figure C-1. Figure C-8 provides a pictorial representation of data requirements.
b. MLS. Report the azimuth, elevation, runway data, and supporting NAVAIDS for an MLS flight inspection, using the example in Figure C-2 and C-2-1. Figure C-8 provides a pictorial representation of data requirements.
c. TACAN, VORTAC, VOR/DME and DF. Report the information as required using the example in Figure C-3. DME and azimuth functions of VORTAC and VOR/DME facilities may be reported together if the antennas are collocated. Collocation of antennas, for facility data reporting only, is defined as 10 feet or less.
d. PAR. Report the information as required using the example in Figure C-4. If the PAR serves more than one runway, complete a separate sheet for each runway served by the PAR. Include runway data for all PAR flight inspections.
e. ASR. Complete data as required in Figure C-5.
f. VGSI. Provide the information for any type of VGSI, using the example in Figure C-6. Include runway data.
g. NDB. Complete data as required in Figure C-7.
h. Control Towers/Communications Sites. Forms will not be required for control towers or transmitter /receiver sites unless they contain a direction finding (DF) or ultra high frequency (UHF) beacon.

3. Information Not Applicable to the NAVAID.
When completing a required section, leave any block blank when not applicable.

4. Measurement Reference.
All heights, except where indicated to be in feet, shall be in meters. All distances shall

be referenced in meters or nautical miles; for conversion purposes, one foot = 0.3048 meters and one nautical mile = 1,852 meters.

5. Decimal Accuracy.
When using trigonometry functions for computations, report values to the nearest hundredth. For other accuracies, see the reporting instructions by block.

6. True Bearing.
References to true bearing imply true azimuth in degrees and hundredths of degrees.

7. Geographic Coordinates.
All latitude and longitude coordinates shall be referenced to World Geodetic System (WGS) 1984. The reference system used shall be specified with each set of coordinates. When entering coordinates, precede the latitude with “N” or “S” and the longitude with “E” or “W”.

8. Displaced Threshold.
When preparing a form on a facility that supports a runway having a displaced threshold, enter all distances relative to the beginning of the actual landing area of the runway. Displaced thresholds, due to temporary (less than 90 day) construction projects or runway repairs, should not be reported unless a precision approach touchdown point has been or being changed.

9. Data.
General Requirements:

a. Latitude and longitude coordinates to the nearest 1/100th of a second and in WGS-84 or equivalent datum. NAVAID coordinates to be at center of antenna.

b. All elevations to the nearest 1/10th of a foot. Clearly indicate that the measurements used are feet. Also, vertical datum of elevations must be clearly indicated. NAVAID elevations to be at base of antenna unless indicated otherwise.

c. All distances to the nearest 1/10th of a meter. Clearly indicate that the measurements used are meters.

d. Complete the corresponding numbered field on the data sheet with the information provided in Table C-1.

Table C-1. Facility Data Sheet Fields

Field	Description
1. Airport Name, Location, Country	The name of the city, airport and country where the NAVAID is located
2. Assigned NAVAID Identifier	The identifier the NAVAID system will broadcast
3. Airport Identifier (ICAO)	The ICAO identifier assigned to the airport; leave blank if no code is assigned
4. Runway served	The number of the runway the NAVAID system is set up to serve
5. Category (I, II, or III)	The category of the ILS
6. NAVAID Owner	Organization owning the facility
7. NAVAID Maintainer	Organization maintaining the facility. This is the organization responsible for providing data and flight inspection.
8. Horizontal Datum	Horizontal datum of the coordinates submitted
9. Vertical Datum	Vertical datum of the elevations submitted
10. Control Station and Frequency	The voice call sign of the station normally having remote control or monitor capability of a facility and the primary frequency on which to establish contact.
11. Mag Var to Be Used And Epoch Year	Magnetic variation utilized in the instrument procedure and the year of the magnetic variation value
12. Threshold Latitude	Latitude of the runway threshold at the centerline
13. Threshold Longitude	Longitude of the runway threshold at the centerline
14. Threshold Elevation	Mean sea level elevation at the runway threshold
15. Displaced Threshold Latitude	Latitude of the displaced runway threshold at the centerline, if applicable
16. Displaced Threshold Longitude	Longitude of the displaced runway threshold at the centerline, if applicable
17. Displaced Threshold Elevation	Mean sea level elevation at the displaced runway threshold, if applicable
18. Runway End Latitude	Latitude of the runway stop end at the centerline
19. Runway End Longitude	Longitude of the runway stop end at the centerline
20. Runway End Elevation	Mean sea level elevation at the runway stop end
21. Runway Length/Width	Runway length (end to end disregarding blast pads and overruns) and width
22. Displaced Threshold Distance	Distance from displaced threshold to approach end of runway
23. Runway Landing	Runway landing length (threshold or displaced threshold

Field	Description
Length	to runway end)
24. Equipment Type	The manufacturer and model of NAVAID equipment
25. Antenna Type	The antenna type of the NAVAID
For Localizer: Enter 1F (single frequency) or 2F (dual frequency	
For Glide Slope:	

CE	CAP-EFF	NE	NERA
ED	ENDFIRE-STD	NR	NULL-REF
EH	ENDFIRE-SHORT	OT	OTHER
EU	ENDFIRE-UPSLOPE	SR	SIDE-REF
MC	MODIFIED CAPTURE EFFECT	WG	WAV-GUIDE
MR	MOD-SREF		

Field	Description
26. Frequency	the licensed broadcast frequency of the NAVAID
27. Single Or Dual Transmitters	enter ‘single’ or ‘dual’
28. Type Of Standby Power	commercial, battery, generator, or other
29. Course Width	the commissioned course width of the localizer
30. Site Ground Elevation	Mean sea level elevation at the base of the NAVAID antenna
31. Antenna Latitude	Latitude of the NAVAID antenna
32. Antenna Longitude	Longitude of the NAVAID antenna
33. NAVAID to Stop End Of Rwy	Distance from the NAVAID antenna to the stop end of the runway measured along centerline or extended runway centerline to a point on the centerline or extended runway centerline at a ninety degree (90°) angle to the component.
34. Antenna Back Course Bearing	The true bearing on which the localizer/azimuth signal is broadcast (back course)
35. Antenna Offset Distance and Direction (Left/Right; Ref inbound)	The distance from NAVAID antenna to the runway centerline or extended runway centerline as measured along a line extending from centerline at a ninety degree (90°) angle to the NAVAID
36.	If Localizer not past stop end, please indicate where it is: enter a description of the position of the localizer. Examples: ‘In front of approach end’ or ‘Beside runway on west side’.
37. G/P Angle	commissioned angle of the glide slope path to the 100th of a degree
38. Centerline Abeam G/P Elevation	Mean sea level elevation at runway centerline abeam the ILS glide slope or MLS elevation antenna.
39. Antenna to	Distance from the NAVAID antenna to the designated

Field	Description
Threshold Distance	threshold (use displaced threshold, if applicable) as measured along centerline or extended runway centerline to a point on the centerline or extended runway centerline at a ninety degree (90°) angle to the component.
40. Phase Center Elevation	Mean sea level elevation at the phase center of the NAVAID antenna.
41. RPI Value	Distance from the designated threshold (use displaced threshold, if applicable) to the runway point of intercept (with the glide path).
42. Elevation used to compute procedure data	enter 'CROWN' if the runway centerline abeam glide slope antenna elevation was used to compute TCH or 'SITE' if the glide slope antenna site elevation was used to compute TCH.
43. Threshold Crossing Height	the height the glide path is directly above the approach end threshold or displaced threshold.
44. Channel	the channel the NAVAID is being broadcast on.
45. FAF distance	Distance from the final approach fix or glide path intercept to the designated threshold (use displaced threshold, if applicable).
46. Class (terminal/low/high)	enter service class of NAVAID 'terminal', 'low', or 'high'.
47. Doppler (Y/N)	Is the VOR a Doppler-type? enter 'yes' or 'no'.
48. Voice (Y/N)	Does the equipment have live voice? enter 'yes' or 'no'.
49. Radio Class	Radio Class Code of NDB such as MH, H, LOM.
50. Ground point of intercept (GPI) elevation	Elevation at the ground point of intercept.
51. GPI distance to threshold	Distance ground point of intercept to designated threshold (use displaced threshold, if applicable).
52. GPI Latitude	Latitude of ground point of intercept.
53. GPI Longitude	Latitude of ground point of intercept.
54. Antenna Angle	Angle radar antenna set at to the hundredth of a degree.
55. Antenna Tilt	Enter 'Fixed' or 'Varied'.
56. Video-Map	Does the radar have a video map? Enter 'Yes' or 'No'.
57. Channel Available	Enter 'Single' or 'Dual'.
58. Moving target indicator (MTI)	Does radar have MTI? Enter 'Yes' or 'No'.
59. System type (PAPI/VASI/VGSI, etc.)	Enter type of lighting system.
60. Runway reference point (RRP) distance to threshold	Distance from runway reference point to designated threshold (use displaced threshold, if applicable).
61. RRP Elevation	Runway point of intercept elevation.

Field	Description
62. RRP Latitude	Latitude of runway point of intercept.
63. RRP Longitude	Longitude of runway point of intercept.
64. NAVAID Distance To MLS Datum Point	The distance from NAVAID antenna to the MLS Datum Point measured along centerline or extended runway centerline to a point on the centerline or extended runway centerline at a ninety degree (90°) angle to the component.
65. AZ to Runway Angle	Angle between AZ signal bearing and runway bearing (Runway bearing minus azimuth bearing).
66. MLS Coordinate Convention (Conical or Planer)	usually will be conical.
67. MLS Usable Distance/Altitude	usable distance described in altitude (in feet) and distance (in nm).
68. Proportional Limit (Left/Right; Ref inbound)	Proportional guidance service volume expressed in degrees.
69. Clearance Coverage (Left/Right; Ref inbound)	Clearance Coverage expressed in degrees.
70. MLS Datum Point Distance to Threshold	The distance from the designated threshold (use displaced threshold, if applicable) to the MLS Datum Point measured along centerline.
71. MLS Datum Point Latitude	Latitude of MLS Datum Point.
72. MLS Datum Point Longitude	Latitude of MLS Datum Point.
73. MLS Datum Point Elevation	Runway crown elevation at MLS Datum
74. Distance MAP To Threshold	The distance from the missed approach point to the designated threshold (use displaced threshold, if applicable), measured along centerline or extended runway centerline to a point on the centerline or extended runway centerline at a ninety degree (90°) angle to the component.
75. Lower scan limit	the lower limit placed on the EL signal to the 100th of a degree.
76. Scope Location, Country	Location of DF or ASR/secondary surveillance radar (SSR) scope or indicator.

For MLS Data Words, please refer to Annex B, Table 2, ‘Data Word Translator’. Provide the Data Words as programmed to be transmitted prior to commissioning. For a commissioned facility, provide the Data Words determined to be correct upon

DATA REQUIRED FOR ILS/LOC FLIGHT INSPECTION
Numbers in parentheses refer to data item definition

Submit in WGS/84 datum.
Coordinates to the hundredth of a second.

Elevations to the tenth of a foot.
Distances to the nearest tenth of a meter .

Airport Name, Location, Country (1)	

Assigned NAVAID Identifier (2)		Category (I, II, or III) (5)	
Airport Identifier (ICAO) (3)		Horizontal Datum (8)	
Runway served (4)		Vertical Datum (9)	
NAVAID Owner (6)		Control Station and Frequency (10)	
NAVAID Maintainer (7)		Mag Var to Be Used And Epoch Year (11)	
* * * Runway Data * * *		* * * Glide Slope * * *	
Threshold Latitude (12)		Equipment Type (24)	
Threshold Longitude (13)		Antenna Type (25)	
Threshold Elevation (14)		Single Or Dual Transmitters (27)	
Displaced Threshold Latitude (15)		Type Of Standby Power (28)	
Displaced Threshold Longitude (16)		G/P Angle (37)	
Displaced Threshold Elevation (17)		G/P Site Ground Elev. (30)	
Runway End Latitude (18)		Centerline Abeam G/P Elevation (38)	
Runway End Longitude (19)		G/P Latitude (31)	
Runway End Elevation (20)		G/P Longitude (32)	
Runway Length/Width (21)		G/P To Approach End Of Rwy Distance (39)	
Displaced Threshold Distance (22)		G/P Offset Distance And Direction (35)	
Runway Landing Length (23)		**FOR END FIRE GLIDE SLOPE, ALSO NEED:**	
		Phase Center Elevation (40)	
* * * Localizer * * *		RPI Value (41)	
Equipment Type (24)			
Antenna Type (25)		* * * Procedures * * *	
Frequency (26)		Elevation used to compute procedure data: CROWN or SITE (42)	
Single Or Dual Transmitters (27)		Threshold Crossing Height (43)	
Type Of Standby Power (28)			
Course Width (29)		* * * OUTER MARKER/FAF * * *	
LOC Site Ground Elev. (30)		FAF distance (45)	
LOC Latitude (31)		Marker To Threshold Distance (39)	
LOC Longitude (32)		Marker Latitude (31)	
LOC To Stop End Of Rwy Distance (33)		Marker Longitude (32)	
For Offset Localizer Also Need:		If compass locator - need frequency (26)	
LOC Back Course Bearing (34)			
LOC Offset Distance And Direction (35)		* * * MIDDLE MARKER * * *	
		Marker To Threshold Distance (39)	
If Localizer not past stop end, please indicate where it is (36)		Marker Latitude (31)	
		Marker Longitude (32)	
		If compass locator - need frequency (26)	
* * * DME * * *			
Channel (44)		* * * INNER MARKER * * *	
Single Or Dual Transmitters (27)		Marker To Threshold Distance (39)	
DME Latitude (31)		Marker Latitude (31)	
DME Longitude (32)		Marker Longitude (32)	
Site Elevation - ground (30)			

commissioning.

Figure C-1. ILS/LOC Flight Inspection

DATA REQUIRED FOR MLS FLIGHT INSPECTION - Page 1
(Numbers in parentheses refer to data item definition)

Submit in WGS/84 datum.
Coordinates to the hundredth of a second.

Elevations to the tenth of foot.
Distances to the nearest tenth of a meter.

Airport Name, Location, Country (1)	

Assigned NAVAID Identifier (2)		Horizontal Datum (8)	
Airport Identifier (ICAO) (3)		Vertical Datum (9)	
Runway served (4)		Control Station and Frequency (10)	
NAVAID Owner (6)		Mag Var to Be Used And Epoch Year (11)	
NAVAID Maintainer (7)			

*** Runway Data ***		** Elevation ***	
Threshold Latitude (12)		EL Antenna Latitude (31)	
Threshold Longitude (13)		EL Antenna Longitude (32)	
Threshold Elevation (14)		EL Phase Center Elevation (40)	
Displaced Threshold Latitude (15)		EL Glide Path Angle (37)	
Displaced Threshold Longitude (16)		El Offset Distance And Direction (35)	
Displaced Threshold Elevation (17)		MLS Datum Point Latitude (71)	
Runway End Latitude (18)		MLS Datum Point Longitude (72)	
Runway End Longitude (19)		MLS Datum Point Elevation (73)	
Runway End Elevation (20)		Threshold Crossing Height (43)	
Runway Length/Width (21)		GPI Distance To Threshold (51)	
Displaced Threshold Distance (22)		RPI Distance To Threshold (60)	
Runway Landing Length (23)		Distance MAP To Threshold (74)	
		Lower scan limit (75)	

** Azimuth ***		** DME***	
AZ Antenna Latitude (31)		DME Antenna Latitude (31)	
AZ Antenna Longitude (32)		DME Antenna Longitude (32)	
AZ Phase Center Elevation (40)		DME Phase Center Elevation (40)	
AZ Antenna Ground Elevation (30)		DME Distance To Threshold (39)	
AZ Distance To MLS Datum Point (64)		DME Distance To MLS Datum Point (63)	
AZ Distance To Threshold (39)		DME Offset Distance And Direction (35)	
AZ Offset Distance And Direction (35)		DME Channel (44)	
AZ True Direction (34)		Single Or Dual Transmitters (27)	
AZ to Runway Angle (Runway bearing – AZ bearing)(65)			
Equipment Type (24)			
Single Or Dual Transmitters (27)			
AZ Antenna (conical or planer)(66)	conical		
MLS Usable Distance/Altitude (67)			
Proportional Limit (Left/Right; Ref inbound)(68)			
Clearance Coverage (Left/Right; Ref inbound)(69)			
Channel (44)			

Please turn page over to enter MLS data words

Figure C-2. MLS Flight Inspection

DATA REQUIRED FOR MLS FLIGHT INSPECTION - Page 2

MLS DATA WORDS

ITEM	VALUE (FEET/METERS)	DATA WORD
AZ-TO-TH-DISTANCE		BASIC 1
AZ-PROP-CVG		BASIC 1
CLRNCE-SIGNAL-TYPE		BASIC 1
MIN-GLIDE-PATH		BASIC 2
AZ-STATUS		BASIC 2
EL-STATUS		BASIC 2
DME-STATUS		BASIC 2
AZ-BEAMWIDTH		BASIC 3
EL-BEAMWIDTH		BASIC 3
DME-DISTANCE		BASIC 3
AZ-ZERO-DEG-PLANE (MAG)		BASIC 4
GROUND-EQUIP-IDENT		BASIC 6
AZ-ANT-OFFSET		AUXILIARY 1
AZ-TO-DATUM-POINT		AUXILIARY 1
AZ-ANT/RWY-ALIGN		AUXILIARY 1
AZ-ANTENNA		AUXILIARY 1
AZ-ANT-HGT		AUXILIARY 1
EL-ANTENNA-OFFSET		AUXILIARY 2
TH-TO-DATUM-POINT		AUXILIARY 2
EL-ANT-HGT		AUXILIARY 2
DATUM-POINT-ELEV		AUXILIARY 2
TH-HGT		AUXILIARY 2
DME-OFFSET		AUXILIARY 3
DME-TO-DATUM-POINT		AUXILIARY 3
DME-HGT		AUXILIARY 3
RE-TO-DATUM-POINT		AUXILIARY 3

Figure C-2-1. MLS Flight Inspection (continued)

DATA REQUIRED FOR VOR/TAC/DME/DF FLIGHT INSPECTION
(Numbers in parentheses refer to data item definition)

Submit in WGS/84 datum.
Coordinates to the hundredth of a second.

Elevations to the tenth of foot.
Distances to the nearest tenth of a meter.

Airport Name, Location, Country (1)			
DF Scope Location, Country (76)			
Assigned NAVAID Identifier (2)		Horizontal Datum (8)	
Airport Identifier (ICAO) (3)		Vertical Datum (9)	
Runway served (4)		Control Station and Frequency (10)	
NAVAID Owner (6)		Mag Var to Be Used And Epoch Year (11)	
NAVAID Maintainer (7)			

*** VOR/DF ***		*** TAC/DME ***	
Class (terminal/low/high) (46)		Equipment Type (24)	
Equipment Type (24)		Channel (44)	
Frequency (26)		Single Or Dual Transmitters (27)	
Single Or Dual Transmitters (27)		TAC/DME Latitude (31)	
VOR/DF Latitude (31)		TAC/DME Longitude (32)	
VOR/DF Longitude (32)		TAC/DME Site Ground Elev. (30)	
VOR Site/DF Ground Elev. (30)			
Doppler (Y/N) (47)			
Voice (Y/N) (48)			
If on field:		**If on field:**	
Antenna To Approach End Of Rwy Distance (39)		Antenna To Approach End Of Rwy Distance (39)	

Figure C-3. VORTAC/DF Flight Inspection

DATA REQUIRED FOR PAR FLIGHT INSPECTION
(Numbers in parentheses refer to data item definition)

Submit in WGS/84 datum.
Coordinates to the hundredth of a second.

Elevations to the tenth of foot.
Distances to the nearest tenth of a meter.

Airport Name, Location, Country (1)	

Assigned NAVAID Identifier (2)		Horizontal Datum (8)	
Airport Identifier (ICAO) (3)		Vertical Datum (9)	
Runway served (4)		Control Station and Frequency (10)	
NAVAID Owner (6)		Mag Var to Be Used And Epoch Year (11)	
NAVAID Maintainer (7)			
*** * * Runway Data * * ***		*** * * PAR * * ***	
Threshold Latitude (12)		Equipment Type (24)	
Threshold Longitude (13)		Frequency (26)	
Threshold Elevation (14)		Single Or Dual Transmitters (27)	
Displaced Threshold Latitude (15)		Type Of Standby Power (28)	
Displaced Threshold Longitude (16)		PAR Antenna Latitude (31)	
Displaced Threshold Elevation (17)		PAR Antenna Longitude (32)	
Runway End Latitude (18)			
Runway End Longitude (19)		*** * * Procedures * * * For each Approach**	
Runway End Elevation (20)		PAR antenna offset distance and direction (35)	
Runway Length/Width (21)		Angle (37)	
Displaced Threshold Distance (22)		GPI elevation (50)	
Runway Landing Length (23)		Threshold Crossing Height (43)	
		GPI distance to threshold (51)	
		GPI Latitude (52)	
		GPI Longitude (53)	

Figure C-4. PAR Flight Inspection

DATA REQUIRED FOR SURVEILLANCE RADAR FLIGHT INSPECTION
(Numbers in parentheses refer to data item definition)

Submit in WGS/84 datum.
Coordinates to the hundredth of a second.

Elevations to the tenth of foot.
Distances to the nearest tenth of a meter.

Airport Name, Location, Country (1)	
Scope Location, Country (76)	

Assigned NAVAID Identifier (2)		Horizontal Datum (8)	
Airport Identifier (ICAO) (3)		Vertical Datum (9)	
NAVAID Owner (6)		Control Station and Frequency (10)	
NAVAID Maintainer (7)		Mag Var to Be Used And Epoch Year (11)	

*** * * PSR * * ***

ASR Antenna Latitude (31)		Equipment type (24)	
ASR Antenna Longitude (32)		Video-Map (Yes/No)(56):	
ASR Antenna ground elevation (30)		Channel Available (Single/Dual)(57):	
Antenna Angle (54)		MTI (Yes/No)(58):	
Tilt (55)		Type Of Standby Power (28)	

*** * * SSR * * ***

SSR Antenna Latitude (31)		Equipment type (24)	
SSR Antenna Longitude (32)		Video-Map (Yes/No) (56):	
SSR Antenna ground elevation (30)		Channel Available (Single/Dual) (57):	
Antenna Angle (54)		MTI (Yes/No)(58):	
Tilt (55)		Type Of Standby Power (28)	

Figure C-5. PSR/SSR Flight Inspection

Figure C-6. VGSI Flight Inspection

DATA REQUIRED FOR VGSI FLIGHT INSPECTION

(Numbers in parentheses refer to data item definition)

Submit in WGS/84 datum.
Coordinates to the hundredth of a second.

Elevations to the tenth of foot.
Distances to the nearest tenth of a meter.

Airport Name, Location, Country (1)	

Assigned NAVAID Identifier (2)		Horizontal Datum (8)	
Airport Identifier (ICAO)(3)		Vertical Datum (9)	
Runway served (4)		Control Station and Frequency (10)	
NAVAID Owner (6)		Mag Var to Be Used And Epoch Year (11)	
NAVAID Maintainer (7)			

*** Runway Data ***		*** PAPI/VASI/VGSI ***	
Threshold Latitude (12)		System type (PAPI/VASI/VGSI, etc.)(59)	
Threshold Longitude (13)		Angle (37)	
Threshold Elevation (14)		Threshold Crossing Height (43)	
Displaced Threshold Latitude (15)		RRP distance to threshold (60)	
Displaced Threshold Longitude (16)		RRP Elevation (61)	
Displaced Threshold Elevation (17)		RRP Latitude (62)	
Runway End Latitude (18)		RRP Longitude (63)	
Runway End Longitude (19)			
Runway End Elevation (20)			
Runway Length/Width (21)			
Displaced Threshold Distance (22)			
Runway Landing Length (23)			

DATA REQUIRED FOR NDB FLIGHT INSPECTION
(Numbers in parentheses refer to data item definition)

Submit in WGS/84 datum.
Coordinates to the hundredth of a second.

Elevations to the tenth of foot.
Distances to the nearest tenth of a meter.

Airport Name, Location, Country (1)	

Assigned NAVAID Identifier (2)		Horizontal Datum (8)	
Airport Identifier (ICAO) (3)		Vertical Datum (9)	
Runway served (4)		Control Station and Frequency (10)	
NAVAID Owner (6)		Mag Var to Be Used And Epoch Year (11)	
NAVAID Maintainer (7)			

*** * * NDB * * ***

NDB Antenna Latitude (31)		Radio Class (49)	
NDB Antenna Longitude (32)		Frequency (26)	
NDB Antenna ground elevation (30)		Single Or Dual Transmitters (27)	
If on field:			
Antenna To Approach End Of Rwy Distance (39)			
Antenna Offset Distance And Direction (35)			

Figure C-7. NDB Flight Inspection

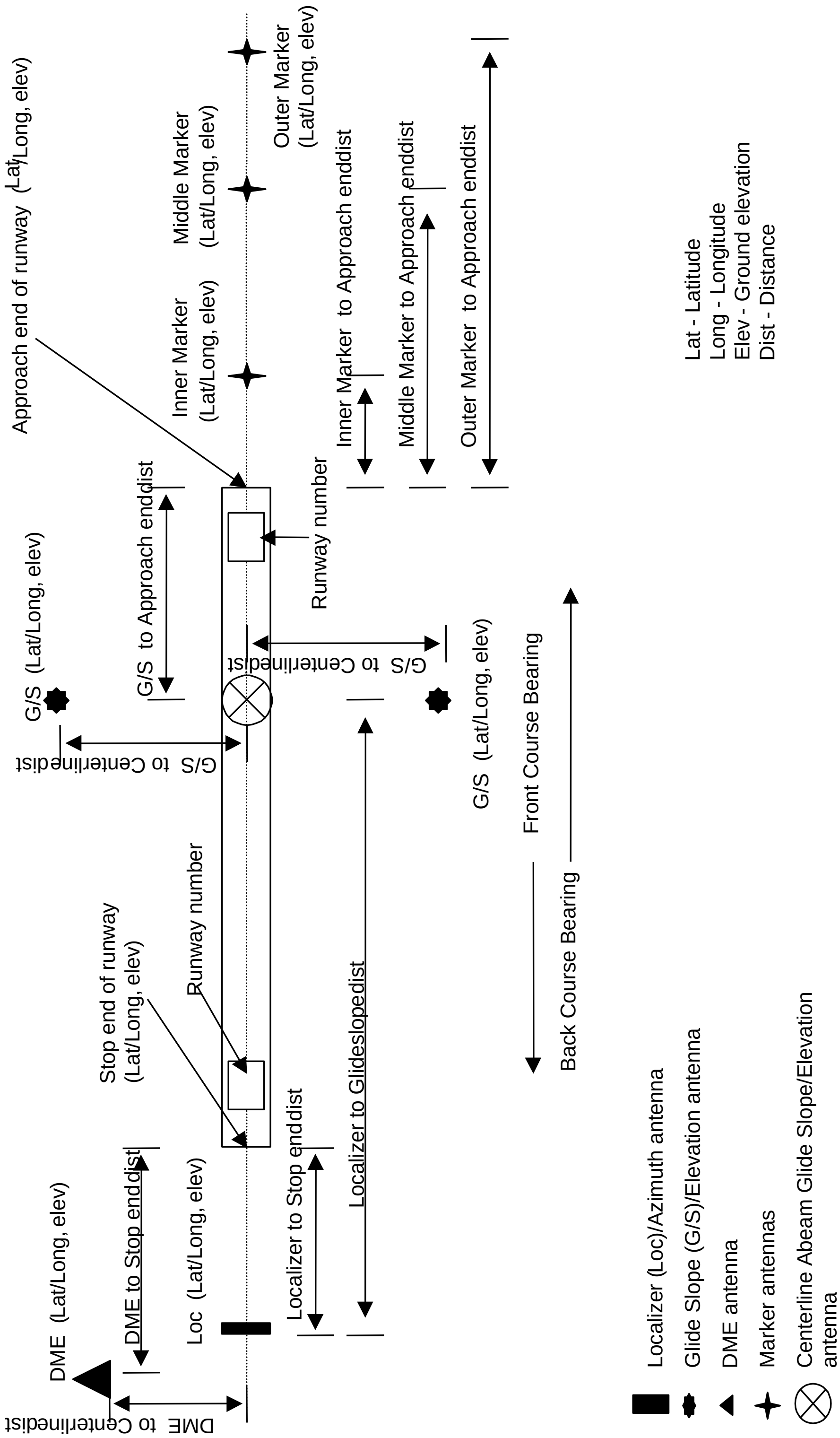


Figure C-8. ILS/MLS Data Requirements

Annex D. Flight Inspection Capabilities for NATO Support

This data supplied by individual countries and posted here for interoperability purposes

The data in Table D-1 indicates the capabilities of each nation and the positioning reference (1) normally used to perform flight inspections on the types of facilities listed.

NOTES:

(1) Flight Inspection System Positioning Reference: The codes below indicate the type of flight inspection equipment and associated methods normally used. This data may be used to determine the appropriate agency to perform an inspection.

- T - Theodolite, manual
- R - Radio Telemetering Theodolite
- L - Laser tracking Theodolite
- D - Differential GPS
- I - Inertial Reference System
- /g – Inertial updated by GPS
- /d – Inertial updated by DME
- IR- Infrared tracking Theodolite
- G-GPS not updating Inertial
- M-Multilateral DME not updating Inertial
- N- Procedural check only, no positioning system used
- Z- Not capable of inspecting this system

(2) Indicates the minimum dry runway length (Meters) required to land/takeoff the flight inspection aircraft at normal gross weights on a standard day (Runway 2000ft MSL). For agencies using more than one type of aircraft, indicate the type of aircraft for each entry.

(3) Indicates the normal maximum range (NM) of the flight inspection aircraft. For agencies using more than one type of aircraft, indicate the type of aircraft for each entry.

(4) Indicates the national document used for flight inspection procedures.

(5) A "P" indicates full capability to certify the suitability of a procedure produced in accordance with Procedures For Air Navigation Services (PANS-OPS). An "X" indicates full capability to certify the suitability of a procedure produced in accordance with U.S TERPS.

(6) No deployable flight inspection capability

(7) No national flight inspection capability.

(8) Peacetime only.

	BEL	CAN	CZE	DNK	FRA	DEU (8)	GRC	HUN	ISL
VOR			G		G, M	I/g, I/d, D	T		
TACAN			Z		G, M	I/g, I/d, D	T		
ILS			T, R, D		I R	I/g, I/d, L, D	R		
MLS STRAIGHT-IN			Z		Z	I/g, I/d, L, D			
MLS COMPUTED CENTERLINE			Z		Z	I/g, I/d, L, D			
NDB			D, N		N	I/g & I/d			
DME			D, M		G, M	I/g, I/d, D			
ASR			D, N		G, M	I/g, I/d, D			
SSR			G, N		G, M	I/g, I/d, N, D			
PAR			D, R		T	I/g, I/d ,T	T		
DF/VHF			Z		G, M	I/g, Id, L			
DF/UHF			Z		G, M	Ig,I/d, L			
VGSI			T		T	I/g, I/d, D	T		
NON-PRECISION GPS			Z		M&IR	I/, I/d, D			
PRECISION GPS			Z		Z	Z			
ARA			Z		Z	Z			
SIAP(5)			P		P	N/A			
GOVERNING DOCUMENT	8071	8071	CAA-D-004-1/02	UK 670 8071	1800 & 214	7-100			
ACFT #1 RWY (2)			L-410 750		FA-20 1500	B350 1000	YS-11 5000		
ACFT #1 MAX RNG (3)			L-410 1050		FA-20 1100	B350 2000	YS-11 650		
ACFT #2 RWY (2)						LR-35 1500			
ACFT #2 MAX RNG (3)						LR-35 3000			

Table D-1. Flight Inspection Capabilities by Nation

	ITA	LUX	NLD	NOR	POL	PRT	ESP	TUR	GBR	USA
VOR	I/d		Z	N				T	I/g, I/d	I/g, I/d
TACAN	I/d		I/g	I/g				T	I/g, I/d	I/g, I/d
ILS	I/d		I/g, I/d, L, D	N				T	I/g, I/d, L	I/g, I/d
MLS STRAIGHT-IN	Z		Z	Z				Z	Z	I/g, I/d
MLS COMPUTED CENTERLINE	Z		Z	Z				Z	Z	I/g, I/d , R
NDB	I/d		Z	N				N	I/g, I/d	N
DME	I/d		Z	Z					I/g, I/d	I/g, I/d
ASR	N		N	N					I/g, I/d	I/g, I/d
SSR	N		N	Z					I/g, I/d	I/g, I/d
PAR	T		T	T				T	I/g, I/d, L	I/g, I/d
DF/VHF	T		N	I/g				Z		I/g, I/d
DF/UHF	T		N	I/g						I/g, I/d
VGSI	T		T	Z				T		I/g, I/d
NON-PRECISION GPS	Z		Z	Z				Z		N
PRECISION GPS	Z		Z	Z				Z		I/g, I/d
ARA	Z		Z	Z						N
SIAP(5)	P		P	Z						X
GOVERNING DOCUMENT	SMA 642		AeTP-1(C)	AeTP-1(C)					UK670 8071	FAA 8200.1
ACFT #1 RWY (2)	G-222 600		SA 226-TC / 1200	FA-20 1500			FA-2 1500	C-500 1006m	BE-200	BAe-800 1500
ACFT #1 MAX RNG (3)	G-222 1920		SA 226-TC / 1200	FA-20 1700				C-500 1400	C-414	BAe-800 2200
ACFT #2 RWY (2)			B200t / 1000						C-414	CL-601 2200
ACFT #2 MAX RNG (3)			B200t / 1800							3000

Table D-1. Flight Inspection Capabilities by Nation (continued)

Annex E. MILITARY EMERGENCY AND NATURAL DISASTER FLIGHT INSPECTION PROCEDURES

1. Introduction.

The potentially catastrophic consequences of a major natural disaster or the need to respond quickly to a military emergency necessitate advanced planning and definition of operational requirements. In such circumstances, military flight inspection resources will become critical in the restoration of navigational aids. The ability to provide sustained flight inspection support for the numerous and diverse requirements which may exist will be predicated upon the use of abbreviated flight inspection procedures.

2. Purpose.

The guidance, procedures, and tolerances contained in this section describe the minimum facility performance standards when emergency situations require deviation from normal standards. Basic flight inspection requirements and methods of taking measurements apply to the emergency section unless specific guidance or tolerances are given. Facilities which have been placed in operation using these procedures shall be re-inspected to normal standards when circumstances permit.

3. Authority.

a. The authority to implement these provisions may be exercised by the authority having operational control of the affected airspace.

b. Flight inspection personnel, performing facility inspection and certification using the provisions of this section, must be authorized and qualified to perform flight inspection duties.

4. Preflight Requirements.

a. Aircraft and Equipment

(1) If necessary, equipment which has exceeded calibration due dates may be used or flight inspections performed under this annex. Calibrated equipment shall be used when the facility is subsequently inspected using standard procedures.

(2) The use of other than a flight inspection-configured aircraft may be necessary. Aircraft and equipment used must be currently suitable for IFR flight using the facilities undergoing flight inspection. Examples of test methods available to verify the accuracy of uncalibrated flight inspection systems or aircraft not equipped with a flight inspection system are:

(a) Comparison with a facility verified by maintenance, or another flight inspection aircraft, as operating normally.

(b) Comparison with two or more facilities in operation.

Use of a radiated test signal.

b. Types and Priorities of Emergency Flight Inspection

(1) Only special and emergency commissioning flight inspections will

be conducted using the procedures contained in this section.

(2) Priorities shall be established at field level. Conflicts will be resolved by the authority having operational control of the affected airspace.

c. Pre-inspection Requirements.

(1) Prior to arriving on location, the flight inspector or central scheduling and dispatch facility shall contact the air traffic control manager and the facility maintenance supervisor in order to coordinate the following items:

(a) Arrival time

(b) Emergency operational requirements as defined by the air traffic control manager.

(c) Airspace requirements for conducting the flight inspection profile.

(d) Anticipated support such as refueling, ground transportation for a theodolite operator, etc.

(2) The air traffic control manager shall accomplish the following prior to arrival of the flight inspection aircraft.

(a) Make final determination regarding emergency operational requirements for the facilities and instrument procedures requiring flight inspection, and be prepared to brief changes on initial contact.

(b) Coordinate airspace requirements and obtain necessary clearances from appropriate airspace control authorities for conducting the inspection.

(c) If required, designate and brief an air traffic controller to work the flight inspection aircraft.

(d) Provide current facility data in accordance with Annex C for each facility to be inspected.

(3) The facility maintenance supervisor shall:

(a) Ensure adequate radio communications are available and operational.

(b) Assigned qualified maintenance personnel to support the flight inspection of the equipment being inspected.

(c) Assist the Air Traffic Control Manager in obtaining facility data for each facility to be inspected.

(4) Arrange for ground transportation for the theodolite operator if necessary.

5. Approach Procedures.

a. The minimum flight inspection required to certify a published approach is the inspection of the final approach and missed approach segments.

b. If an approach must be established, the flight inspector may be responsible for establishing final and missed approach procedures. Both segments of the procedure shall be flown and recorded to establish and document flyability, accuracy, reliability, and obstacle clearance. The flight inspector shall record the emergency approach procedures on the flight inspection report and provide air traffic control with adequate details for issuance of the NOTAM.

c. In all cases, the flight inspector shall determine, through visual evaluation, that the final and missed approach segments provide adequate terrain and obstacle clearance.

d. If a circling maneuver is desired, the flight inspector must verify that proposed circling maneuvers are safe and sound for the category of aircraft proposed. Otherwise, a NOTAM stating that circling is not authorized must be issued.

6. En route and Transition Coverage.

If there is a need for facility coverage to provide en route and transition to terminal environment guidance, air traffic control may use aircraft of opportunity to fly the transition procedure. Pilot reports of satisfactory cockpit instrument performance and controller evaluation of radar target strengths are sufficient for air traffic control to determine usability.

7. Facility Status and NOTAM's.

a. Prior to beginning the inspection, the flight inspector shall ascertain from air traffic control the intended operational use of the facility. After completing the inspection, the inspector shall determine the facility status for emergency use and advise air traffic control prior to departing the area.

b. Upon being advised of the status, the air traffic control supervisor must ensure issuance of applicable NOTAM(s). As a minimum, the NOTAM must include who can use the procedure and any limiting conditions. Lengthy NOTAM(s) which describe NAVAID(s) in great detail will not be issued. The flight inspector must subsequently record the NOTAM text in the Remarks section of the applicable flight inspection report. NOTAM example: Kandahar AB, Afghanistan, KAF TACAN, restricted to OPERATION ENDURING FREEDOM. HI TACAN RWY 3 approach.

c. The flight inspector has the authority and responsibility for determining that a NAVAID can safely and adequately support the operations intended under emergency conditions. However, military installation commanders have final authority and responsibility for operation of military facilities, and may elect to use those facilities FOR MILITARY MISSIONS In all such cases, the military installation commander is responsible for issuance of an appropriate NOTAM advising that the NAVAID is in operation "For Military Emergency Use Only" to support emergency operations.

8. Flight Inspection Documentation and Reports.

a. Flight inspection recordings shall be retained until the facility can be inspected using normal procedures and tolerances. In the event that flight inspection equipment is inoperative or not available, flight inspections will continue to meet standards under this annex until replacement or repair is practical. Under these circumstances, the flight inspection pilot and airborne electronic technician are jointly responsible for documenting all of the applicable data displayed by instrumentation at their crew duty positions. All such manually-acquired data shall be identified in the remarks section of the flight inspection report. The facility/procedure shall be reflown with operational flight inspection equipment when conditions permit.

b. Completion and distribution of flight inspection reports are secondary to the accomplishment of emergency flight inspection. At the conclusion of the inspection, the flight inspector shall pass the facility status to the air traffic control on an air traffic frequency. This will suffice as the official report until the written report has been completed and distributed.

c. The flight inspector shall ensure that flight inspection reports are completed and submitted for processing. Each parameter specified in the emergency flight inspection procedures checklists contained herein shall be reported. Flight inspection reports may be handwritten using ink that can be clearly photocopied.

d. Recordings and reports shall reflect that the inspection was accomplished using MILITARY EMERGENCY AND NATURAL DISASTER FLIGHT INSPECTION PROCEDURES. If only the final and missed approach segments of instrument approach procedures were inspected, annotate the facility is in operation for “approach use only.”

9. Flight Inspection Procedures/Tolerances.
a. ILS--Glide Slope

Table E-1. ILS--Glide Slope Procedures/Tolerances

Checks Required	Tolerances/Procedures (1)
Modulation	The modulation and carrier energy level is such that the flag is hidden in the area identified as usable.
Angle	$\pm$ 0.5^0 of desired or commissioned angle.
Coverage	Minimum 15 µV signal, reduced service volume to 2 nm outside OM or FAF and 150 µA fly up
Clearance (Below Path)	Signal provides minimum 150µA (full scale) fly up through to 1,000 ft from threshold, and clears all obstructions.
Width, Symmetry, and Structure Below Path. (2)	(Level Run) Width 0.7° ± 0.2; Symmetry 67 – 33%; Structure Below Path: 190µA point occurs at or above 30% of the commissioned angle. If can't meet Structure Below Path tolerance, clearance procedures and tolerances will be applied.
Course Structure	45µA from graphical average for all zones if restricted to manual approaches. Standard tolerances apply if used for coupled approaches.
Flyability	Any condition that may induce confusion will render the facility unusable.
PAR Coincidence	0.2^0. If PAR/ILS coincidence cannot be established, a NOTAM shall be issued.

NOTES:

(1) These tolerances and procedures are valid for Category I minimums only.
(2) When supporting an operation that may require long-term use of the same facility before normal inspection procedures can be used, a clearance-below-path check is not required on subsequent inspections of the same ILS facility provided no changes have been made to the system that would require a clearance-below-path check under normal procedures. A significant shift in Structure Below Path location from previous inspections should be investigated further, including flying a clearance-below-path check.

b. ILS—LOCALIZER

Table E-2. ILS-Localizer Procedures/Tolerances

Checks Required	Tolerances/Procedures
Identification	Sufficient information to identify the facility. ID shall not render the facility unusable.
Modulation	The modulation and carrier energy level is such that the flag is hidden at all times in the area identified as usable.
Coverage	15 nm minimum coverage area with 5μV minimum signal, not less than 10^0 each side of on-course position.
Course Structure	+45μA from graphical average for all zones if restricted to manual approaches. Standard tolerances apply if used for coupled approaches.
Alignment	30μA from designated procedural azimuth.
Clearance	150μA minimum throughout established coverage area
Obstructions	Evaluate obstruction effect on procedure
Flyability	Any condition that may induce confusion will render the facility unusable.
Polarization	+30μA

NOTE: These tolerances and procedures are valid for Category I minimums only.

c. Marker Beacon

Table E-3. Marker/Beacon Procedures/Tolerances

Checks Required	Tolerances/Procedures
Identification/	Correct/sufficient to illuminate the proper bulb modulation
Coverage	
Minor Axis	
Outer marker	3000 ft +2000 ft or 14.8 Sec ± 9.8 Sec at 120 kts Ground Speed
Middle marker	No limit
Inner marker	No limit
Fan marker	3000 ft +2000 ft if used for obstacle clearance; otherwise, no limit

NOTES: These tolerances and procedures are valid for Category I minimums only.
If an operational marker or beacon is not available for establishing aircraft position in relation to runway threshold, other methods of position identification (DME fix, radar fix or crossing radial) may be substituted.

d. VOR

Table E-4. VOR Procedures/Tolerances

Checks Required	**Tolerances/Procedures**
Identification	Sufficient information to identify the facility. ID shall not render any parameter unusable.
Sensing and Rotation	Correct
Polarization	$\pm 4.0^{o}$
Modulation	9960 Hz: 20% - 35% with voice; 20% - 55% without voice, 30 Hz AM 25% - 35%, 30 Hz FM Deviation Ratio: 14.8-17.2
Approach	Alignment within $\pm$ 2.5^{0}. Structure not to exceed $\pm 6.0^{0}$. Inspect from FAF to MAP.
Missed Approach	Meets flyability constraints until clear of obstructions and course is established.
En Route	Alignment within $\pm 4.0^{0}$. Structure not to exceed $\pm$ 6.0^{0}.
Monitors	To be set and checked by maintenance. Flight inspection will verify when practical.
Standby Equipment	Will be checked by transmitter change on approach and en route radials.
Coverage	Sufficient to support requirements.
Flyability	Any condition that may induce confusion will render the procedure or facility unusable.
Voice	Voice shall not render any parameter unusable.

NOTES: Crosspointer, FLAG, and AGC shall be checked during all flights to and from the facility or starting point of the inspection.
Final approach segments may be inspected inbound or outbound.
Alignment orbit, coverage orbit, transmitter differential, and inspection of radials 5° each side of final approach radial are not required.

e. TACAN

Table E-5. TACAN Procedures/Tolerances

Checks Required	Tolerances/Procedures
Identification	Sufficient information to identify the facility. ID shall not render any parameter unusable.
Sensing and Rotation	Correct
Polarization	± 4.0^0
Distance Accuracy	3% of charted value or 0.2 nm, whichever is greater
Approach	Alignment within ± 2.5^0. Structure not to exceed ±6.0^o. ¼ nm aggregate azimuth, DME unlock, or out-of-tolerance structure permitted. Inspect from FAF to MAP.
Missed Approach	Meets flyability constraints until clear of obstructions and course is established.
En Route	Alignment within ±4.0^o. Structure not to exceed ±6.0^o. 1.0 nm aggregate azimuth, DME unlock, or out-of-tolerance structure permitted in any 5 nm of radial flight.
Monitors	To be set and checked by maintenance. Flight inspection will verify when practical.
Standby Equipment	Will be checked by transponder change on approach and en route radials
Coverage	Sufficient to support requirements.
Flyability	Any condition that may induce confusion will render that procedure or facility unusable.

NOTES: Crosspointer, FLAG, and AGC shall be checked during all flights to and from the facility or starting point of the inspection.
Final approach segments may be inspected inbound or outbound.
Alignment orbit, coverage orbit, transmitter differential, and nulls are not required.

f. Shipboard TACAN. The flight inspection profile will include inspection of the approach radial from 20 nm to 3/4 nm. Any radial may be inspected outbound from approximately 10 nm while the ship makes required turns for stabilization check.

Table E-6. Shipboard TACAN Procedures/Tolerances

Checks Required	Tolerances/Procedures
Identification	Sufficient information to identify the facility. ID shall not render any parameter unusable.
Sensing and Rotation	Correct
Polarization	±4.0
Distance Accuracy	3% or 1.0 nm, whichever is greater
Approach	Alignment within ±2.5°. Structure not to exceed ±6.0°· ¼ nm aggregate azimuth, DME unlock, or out-of-tolerance structure permitted. Inspected from FAF to MAP.
En Route	Alignment within ±4.0°. Structure not to exceed ±6.0°. 1.0 nm aggregate azimuth, DME unlock, or out-of-tolerance structure permitted in any 5 nm of radial flight.
Equipment Stability	Stability will be checked during radial inspection by requesting the ship to turn left 15° and then right 15°. Advise the ship's personnel of any change in azimuth or alignment during the turns (Annex A, Paragraph 25).
Standby Equipment	Will be checked by transponder change on approach and en route radials
Flyability	Any condition that may induce confusion will render that procedure or facility unusable

g. PAR.

Table E-7. PAR Procedures/Tolerances

Checks Required	Tolerances/Procedures
Course Alignment	Sufficient to guide an aircraft down the runway centerline extended, within ±50 ft of runway centerline at threshold. Helicopter-only approaches require delivery to within 50 ft either side of desired touchdown point.
Glidepath Alignment	±0.5° of the commissioned angle. If PAR/ILS coincidence (±0.2°) cannot be established, a NOTAM shall be issued.
Lower Safe Limit	An approach or visual measurement at 0.5° below the "on-path" angle must clear all obstacles. The 0.5° value is not required if the controller can satisfactorily guide the airplane at an angle below which missed approach instructions would normally be issued.
Coverage	Sufficient to meet operational requirements.
Range Accuracy	5% of true range and sufficient to determine when aircraft is over threshold
Flyability	Any condition that may induce confusion will render the facility unusable.

h. PSR/SSR RADAR.

Table E-8. PSR/SSR RADAR Procedures/Tolerances

Checks Required	Tolerances/Procedures
Azimuth Accuracy	En route within $\pm 5^{o}$ Approaches: 1. Straight-in within 500ft of the edges of the runway at the MAP. 2. Approach to airport/ circling within a radius of the MAP which is 5% of the aircraft-to-antenna distance or 1000 , whichever is greater.
Range Accuracy	Approach and en route within 5% of fix-to-station distance or 500 ft whichever is greater.
Coverage	Sufficient to support requirement. Targets of opportunity may be used by air traffic personnel. Standard vertical and horizontal coverage profiles not required.

i. Homing Beacons.

Table E-9. Homing Beacon Procedures/Tolerances

Checks Required	Tolerances/Procedures
Identification	Sufficient information to identify the facility.
Coverage	En route $\pm 15^{o}$ needle swing. Approach $\pm 10^{o}$ needle swing. Sufficient signal to support required use.
Station Passage	Approximately over the station at all altitudes
Flyability	Any condition that may induce confusion will render the procedure or use unusable.

j. Communications.

Conduct communications inspection concurrently with other inspections. User aircraft may be used.

k. Microwave Landing System.

Table E-10. MLS Procedures/Tolerances

Checks Required	Tolerances/Procedures
Horizontal Coverage	5° each side beyond procedural use at 3 nm beyond procedural use
Vertical Coverage Alignment/Angle	3 nm beyond furthest procedural use at 0.75 MGP; only required on procedural azimuth 0.10° from optimum
Path Following Error	AZ 0.50°/EL 0.40°
Control Motion Noise	Approach AZ/MGP 0.30°, if used for manual approaches. Standard tolerance for coupled use. Other areas, 0.8°.
Low Angle EL Clearance	Fly 0.75 MGP, adequate AZ and EL guidance and obstruction clearance FAF to MAP on procedural AZ, observe each side for obstructions within 2° laterally.
Data Words	Multiply normal tolerances by a factor of 3.0.
DME	No unlocks in final approach segment, accuracy 3.0% of charted distance, or 0.2 nm, whichever is greater
IDENT	Correct as published
PAR/ILS Angle Coincidence	0.20°. If coincidence cannot be established, a NOTAM shall be issued.

I. Visual Glide Slope Indicators (VGSI).

Table E-11. VGSI Procedures/Tolerances

Checks Required	Tolerances/Procedures
Glidepath Alignment	Actual angle need not be determined but must be safe and adequate to support requirements as determined by flight inspector. If angle is measured, ± 0.5° of the commissioned angle. Angle must be suitably coincident with PAR/ MLS/ ILS to preclude pilot confusion or must be NOTAMed as non-coincidental.
Lower Safe Limit	Clear all obstacles to threshold.
Coverage	Sufficient to meet operational requirements.
Transitions	All light boxes must transition from red to white in the correct sequence.
Flyability	Any condition that may induce confusion will render the facility unusable.

m. Area Navigation (RNAV) Instrument Procedures.

Table E-12. RNAV Instrument Procedures

Parameter	Tolerances/ Limit
Procedure Design (FMS or Flight Inspection System calculated values)	
Route/ DP/ SID/ STAR True Course to next waypoint Distance to next waypoint	 ± 1° ± 0.1° nm
Initial/ Intermediate Approach Segment True Course to next waypoint Distance to next waypoint	 ± 1° ± 0.1° nm
Final Approach Segment True Course to next waypoint Distance to next waypoint	 ± 1° ± 0.1° nm
Missed Approach Segment True Course to next waypoint Distance to next waypoint	 ± 1° ± 0.1° nm
Vertical Path	± 0.1°
FMS/ GPS	
GPS Integrity	RAIM
DME Supported RNAV	
DME Accuracy	≤ 0.20 nm

Annex F. Related Documents

FAA Order 8200.1, United States Standard Flight Inspection Manual

FAA Order 8240.36, Instructions for Flight Inspection Reporting

NATO STANAG 4184, Microwave Landing System (MLS)

ICAO Annex 10

ICAO Annex 14

ICAO DOC 8071

ICAO DOC 8168-OPS/611 Procedures for Air Navigation (PANS-OPS)

ICAO DOC 9684-AN/951 Manual of the Secondary Surveillance Radar

Annex G. Glossary

AFIS	Automated Flight Inspection System
AGC	Automatic Gain Control
AGL	Above Ground Level
ALZ	Assault Landing Zone
ARD	Approach Reference Datum
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
AZ	Azimuth
C/L	Centerline
CCW	Counterclockwise
CEU	Control Electronics Unit
CIC	Combat Information Center
CMLSA	Commercial Microwave Landing System Avionics
CMN	Control Motion Noise
COP	Change-Over-Point
CW	Clockwise
DF	Direction Finding
DH	Decision Height
DME	Distance Measuring Equipment
DP	Departure Point
EL	Elevation
ESV	Expanded Service Volume
ETA	Estimated Time Of Arrival
FAF	Final Approach Fix
FCB	Front Course Bearing
GPI	Ground Point Of Intercept
ICAO	International Civil Aviation Organization
ID	Identification
ILS	Instrument Landing System
MAP	Missed Approach Point
MCE	Mean Course Error
MDA	Minimum Descent Altitude
MEA	Minimum En Route Altitude
MGP	Minimum Glide Path
MLS	Microwave Landing System
MMLS	Military Mobile Microwave Landing Systems
MOU	Memorandum Of Understanding
MRA	Minimum Reception Altitude
MSL	Mean Sea Level
MTI	Moving Target Indicator
NATO	North Atlantic Treaty Organization
NAVAID	Navigational Aid

NDB	Non-Directional Beacons
Nm	Nautical Mile
NOTAM	Notices To Airmen
OBS	Omnibearing Selector
OCI	Out-Of-Coverage Indication
PANS-OPS	Procedures For Air Navigation Services
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
PFE	Path Following Error
PFN	Path Following Noise
RF	Radio Frequency
RNAV	Area Navigation
RRP	Runway Reference Point
RTT	Radio Telemetering Theodolite
SARP	Standards And Recommended Practices
SIAP	Standard Instrument Approach Procedure
SID	Standard Instrument Departure
SSR	Secondary Surveillance Radar
SSV	Standard Service Volume
STANAG	Standardization Agreement
SV	Service Volume
TACAN	Tactical Air Navigation
TERPS	Terminal Instrument Procedures
TLS	Transponder Landing System
TVPS	Television Positioning System
UHF	Ultra High Frequency
VASI	Visual Approach Slope Indicator
VGSI	Visual Glide Slope Indicator
VHF	Very High Frequency
VOR	Vhf Omnidirectional Range