GHANA
CIVIL AVIATION AUTHORITY

ADVISORY CIRCULAR
AC-23-004

FLIGHT AND GROUND TESTING OF RADIO NAVIGATION AIDS

SECTION 1 - GENERAL

1. PURPOSE

A. This Advisory Circular (AC) is issued to provide guidance provide guidance necessary for the flight inspection of radio navigational aids, including inspection types and facilities subject to inspections as prescribed in Part 23 of Ghana Civil Aviation (ANS) Directives.

B. The terms testing, Inspection and Calibration of Radio Navigation Aids (NAVAIDS) are used interchangeably to mean the examination and assessment of radio navigation aids to determine their operability within ICAO acceptable tolerances For example, Flight testing, Flight inspection or Flight Calibration mean the same activity involving the use of a flight inspection aircraft to perform the assessment.

2. STATUS OF THE ADVISORY CIRCULAR

This AC is an original issuance.

3. BACKGROUND

The provisions in the Ghana Civil Aviation (ANS) Directives require Air Navigation Services Providers (ANSP) to ensure that the Radio navigation aids they have installed and available for use by aircraft engaged in international air navigation shall be the subject of periodic ground and flight tests.

4. APPLICABILITY

This AC is applicable to Air Navigation Service Providers (ANSPs) and Aerodrome Operators who have installed Radio Navigation Aids with

specifications covered under the Subpart 23.1 of Part 23 of Ghana Civil Aviation (ANS) Directives.

5. RELATED DIRECTIVIES

A. This AC is related to the following Parts of the Ghana Civil Aviation (Air Navigation Services) Directives:

i. Part 22 – Units of Measurement for Air Ground Operations

ii. Part 23 – Aeronautical Telecommunication of Ghana Civil Aviation (ANS) Directives (Subpart 23.1 – Radio Navigation Aids)

6. RELATED READING MATERIAL

A. ICAO Annex 10 volume 1 – Radio Navigation Aids

B. ICAO DOC 8071 – Manual on Testing of Radio Navigation Aids (Volume 1 – 3)

7. ACRONYMS

AC	-	Advisory Circular
ANS	-	Air Navigation Service
ANSP	-	Air Navigation Service Provider
GCAA	-	Ghana Civil Aviation Authority
GCAD	-	Ghana Civil Aviation Directives
DG	-	Director General
SRD	-	Safety Regulation Department
CNS	-	Communication, Navigation and Surveillance
ATM	-	Air Traffic Management
VOR	-	VHF Omnidirectional Range
DME	-	Distance Measuring Equipment
ILS	-	Instrument Landing System
NDB	-	Non Directional Beacon
NAVAID	-	Navigation Aid

SECTION B - GUIDANCE AND PROCEDURES

8. PRE- FLIGHT INSPECTION PREPARATIONS

A. Ground CNS Technician/Engineers shall make preparations prior to a flight inspection to ensure that the flight inspection is efficiently conducted.

B. Ground CNS Technician/Engineers shall complete equipment adjustments and other technical preparations for the radio navigation aid in question.

C. The following are the points to be observed during preflight inspection preparation:

i. Ensure that the result of all possible ground calibration and checking equipment are correct.

ii. Competent maintenance personnel are available to make corrections and adjustments during flight inspection.

iii. Availability of dedicated transport for equipment and personnel is ensured during the entire course of flight check.

iv. Ensure all special tools and instruments are available at the site.

v. Availability of last flight inspection report.

vi. Any requirement of special investigation during flight inspection shall be submitted in advance and followed up with Authority during flight inspection.

vii. In case the facility is not expected to be ready as per the regular scheduled inspection, the Authority must be advised accordingly.

viii. NOTAM for withdrawal of facility during Flight Inspection shall be issued without fail in coordination with local ATC.

9. COORDINATION DURING FLIGHT INSPECTIONS

A. When equipment needs to be adjusted while flight inspection is in progress, the ground technical staff shall notify the flight inspector and make the necessary adjustment.

B. An ANS provider shall notify the Authority and also other relevant agencies that the air navigation aid in question is undergoing a flight inspection.

10. TYPES OF FLIGHT INSPECTIONS

A. Flight inspections are classified and shall be carried out as follows:

i. **Site approval:** Inspection to be carried out to confirm that the location selected for installation of a new air navigation aid is appropriate, it may include checks normally made during a commissioning inspection and any additional tests which may be required.

ii. **Commissioning**: is a comprehensive inspection to be carried out to obtain complete information regarding all aspects of performance of navigational aids. The facility shall not be declared operational before this check.

iii. **Periodic**: Inspection to be conducted on a regular basis to confirm the validity of air navigation aids.

iv. **Surveillance:** surveillance inspection shall be carried out to ensure that Navigational aids facility is being maintained within tolerance limits in spite of the inherent drift in the equipment. Surveillance inspections do not normally involve major adjustments unless the performance is observed to have drifted either close to, or beyond the applicable tolerance limits**.**

v. **Special Inspections:** Special flight inspection shall be made on special request to confirm satisfactory

performance. It may follow a major maintenance on the equipment especially the antenna system. Special Flight Inspection may also be carried out for investigation purpose after any incident or accident.

11. FLIGHT INSPECTION UNIT

A. The Flight testing of Radio navigation aids used by ANSPs shall be conducted by organizations or units that are approved by the Authority.

B. The ANSP shall make available all relevant Records regarding the Flight Inspection Unit to enable the Authority to make a determination and approve of such an entity. The Records shall include but not limited to

i. Certification Files of the Inspection Unit

ii. Training Records of Flight Inspection Crew

iii. Calibration Records of Flight Equipment and Aircraft

iv. Licenses and Authorization of Flight Inspection Crew, etc.

12. FLIGHT INSPECTION AIRCRAFT

A. This section describes the concept for the special requirements of the aircraft, flight inspection crew members and ground support equipment used for flight Inspection.

B. Appropriately equipped aircraft shall be used when required to undertake flight inspection. The general characteristics of a flight inspection aircraft shall be as follows:

i. Aircraft equipped with special instrument for flight check
ii. Sufficient capacity for a flight inspection crew, ground maintenance and/or installation personnel, and required electronic equipment.
iii. Sufficient range and endurance for a normal mission.
iv. Aerodynamically stable throughout the speed range.

v. Low noise and vibration level

vi. Adequate and stable electrical system capable of operating required electronic and recording equipment and other aircraft equipment.

vii. Wide speed and altitude range to allow the conduct of flight inspections under normal conditions as encountered by the users.

viii. Appropriate for modifications for flight inspection of new and improved navigation services.

13. FLIGHT INSPECTION CREW MEMBERS

The members of the flight inspection crew shall be experts in their individual fields, have sound knowledge and experience in flight inspection procedures and be capable of working as a team.

14. AIRBORNE AND GROUND SUPPORT EQUIPMENT

The selection and utilization of flight inspection equipment used to determine the validity of navigation information shall minimize the uncertainty of the measurement being performed. Aircraft and ground support flight inspection equipment shall be calibrated to appropriate standards.

15. PREPARATION OF FLIGHT INSPECTION PLAN

A. The ANS provider shall prepare the following year's flight inspection plan for air navigation aids that require flight inspections and notify the Authority.

B. When it is necessary to change the flight inspection date, ANS provider shall notify the Authority, of the changed flight inspection date.

16. PRIORITY OF FLIGHT INSPECTIONS

ANS providers shall conduct flight inspections according to the following priorities:

A. Inspection requested from a concerned agency in relation to an aircraft accident

B. Inspection to correct a malfunction of an air navigation aid, inspection of a reported malfunction, or malfunction inspection after repairs according to a plan

C. Periodic, Commissioning, inspection of instrument flight procedures, and site approval.

17. INSPECTION AFTER UPGRADING OR MODIFICATION OF FACILITY

Inspection shall be carried out when the conditions below prevail:

A. Upgrade/modification of feeders, antennas, and other major components;
B. Change in location of antenna or upgrade/modification of VOR counter poise;
C. Modification or replacement of main components of the transmitter;
D. Change in operation frequency and/or ID code;
E. Change in transmission output following increase or decrease of an air navigation aid's service area;
F. Where there is concern for signal interruption from construction of a building, a power line, or other obstacles in the vicinity of an operating air navigation aid;
G. Partial upgrade/modification or extension of any operating light system (approach light, approach angle indicator light, runway indicator light); and
H. Other special flight inspections deemed necessary.

18. BASIC SCHEDULE FOR PERIODIC FLIGHT INSPECTION

This section prescribes the minimum frequency of periodic flight inspections. More frequent inspections may be made when deemed necessary. Facilities subject to flight inspections and frequency of their inspections are as shown in the Table below:

NAVAIDS FACILITY	Maintenance Standards	Maximum Periodicity, (Ground Test)	Maximum Periodicity, (Flight Test)
VOR (DVOR/CVOR)	• 8071 V ol. 1 (Par 2.3.1 – to- 2.3.31) • GCAR Part 23, Subparts 23.1.3.3.1 –to– 23.13.3.7.1	12 Months	12 Months
ILS .	• GCAR Part 23, Subparts 23.1.3.1.7.4 –to– 23.1.3.1.7.7.1	3 Months	6 Months
DME	• GCAR Part 23, Subparts 23.1.3.5.3.1.2 –to– 23.1.3.54.7.2 • 8071 V ol. 1 (Par 3.2.4 – to- 3.3.17)	12 Months	12 Months
NDB	• GCAR Part 23, Subparts 23.1.3.4.5.1 –to– 23.1.3.4.8.1	6 Months	12 Months

19. USE OF REMOTELY PILOTED AIRCRAFT SYSTEMS

A. A basic principle of flight inspection to assess compliance with ICAO Standards is to use representative avionics at normal aircraft speeds. While flight inspection aircraft and their avionics are not representative of all aircraft and avionics, they nonetheless facilitate making judgements on the operational relevance of signal anomalies. This principle does not prevent the use of more advanced measurement capabilities both in ground and flight testing; however, it requires that good correlation (impact of filtering, etc.) needs to be established.

B. Remotely piloted aircraft systems (RPAS) or unmanned aerial vehicles (UAV) should be assessed to determine that they provide the payload capability, speed and range necessary to conduct a flight inspection for navigation aids as recommended herein in a cost-effective manner.

C. The Authority recognizes that RPAS can and have been used for special and advanced measurement applications which are difficult to achieve with traditional ground and flight measurement capabilities.

D. The Authority welcomes the development of such capabilities to help in making more regular measurement checks with the aim to reduce the periodicity of a full flight inspection with a typical flight inspection aircraft but ensuring the results obtained are consistent and comply with the Standards published.

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