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INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY



PQs Related to Navigation Aids & Flight Inspections

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Protocol Questions (PQs) Related to Navigation Aids and Flight Inspections

Based on USOAP ANS PQs – ICAO Annex 10 & Doc 8071



International Standards and Recommended Practices



PQs Directly Related to Navigation Aids (NAVAIDs)



PQ 7.391 – Surveillance of CNS systems, including Radio Navigation Aids



PQ 7.393 – Requirements & provision of periodic Flight Inspections for NAVAIDs



ICAO References: Annex 10 Vol I; Doc 8071 Vol I, C1–C7

PQ 7.391 – CNS Systems Surveillance

- State conducts surveillance over CNS/NAVAID facilities
- Programme includes audits, inspections, safety analyses
- All NAVAIDs must be identified and inspected
- AIP GEN 2.5 must list all radio navigation aids



PQ 7.393 – Flight Inspection of NAVAIDs



State must establish requirements for flight inspection



Periodic flight inspections required for:

VOR / DME

ILS

GNSS augmentation systems



Verification of flight inspection reports



Compliance with Annex 10 & Doc 8071 procedures

Indirect PQs Supporting NAVAID Certification

PQ 7.377 – Qualifications of CNS inspectors

PQ 7.381 – Training programme for CNS inspectors

PQ 7.385 – Implementation of training plans

PQ 7.390 – Designation of an entity responsible for CNS systems

PQ 7.395 – Mechanism to correct CNS deficiencies

Compliance Framework

Certification of NAVAIDs requires:

Regulatory framework aligned with Annex 10

Surveillance and oversight system

Periodic flight inspections

Qualified and trained CNS inspectors

Mechanism to correct deficiencies

VOR/DME Verification: Ground Checks vs. Flight Inspection

Based ICAO Annex
10



VOR – Parameters Measurable on the Ground



Operating frequency



RF transmission
power



Morse code
identification (clarity
& periodicity)



Frequency stability &
ICAO tolerances



30 Hz reference &
variable signal phase



Signal-to-noise ratio
& distortion



Bench radial
simulation

DME – Parameters Measurable on the Ground



Operating frequency (paired channel)



Transmission power



Morse code identification



Fixed delay within ICAO tolerance



Response stability & repeatability



Pulse Repetition Frequency (PRF)

Parameters that require Flight Inspection



Accuracy of radials throughout the service volume



Multipath/reflection effects



Radial switching zones



Operational coverage and range (VOR & DME)



DME distance accuracy with calibrated aircraft

Use of Commercial Flights ("Opportunistic Flights")

Useful for:

General signal coverage (range)

Coverage by altitude/sector

Detection of anomalies/interference

Limitations:

Not ICAO-recognized

Partial/non-systematic coverage

Depends on pilot reports



Verification Comparison



Commercial Flights:

- General coverage & anomalies
- Preliminary DME distance validation

Flight Inspection Aircraft:

- Bearing accuracy
- Morse ID certification
- Coverage validation (all sectors)
- DME delay & accuracy
- ICAO-recognized certification

Conclusions



PQs ensure safe, reliable, and ICAO-compliant NAVAID operations



Flight inspections are mandatory for certification



CNS inspector competence is crucial for system integrity



States must maintain updated oversight and corrective action systems



Thank You!