

The Need for Flight Inspection and the UK Regulatory Approach

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ABSTRACT

Flight inspection of radio navigational aids is a specialised activity conducted by a relatively small number of organisations worldwide. Traditionally, individual States, using their own aircraft and personnel, carried out flight inspection. Today flight inspection is a commercially driven activity, with many states contracting third party flight inspection organisations. Although flight inspection is a specialised service, the techniques employed and interpretation of guidance material can vary from State to State. The safety oversight of flight inspection organisations also varies across the world.

PURPOSE

This paper discusses the need for flight inspection of radio navigational aids, and provides an overview of the international documentation that describes flight inspections. The paper goes on to describe the United Kingdom (UK) regulatory model for the safety oversight of flight inspection and identifies several considerations of the UK regulatory approach.

THE NEED FOR FLIGHT INSPECTION

Flight inspection is a maintenance activity that ensures radio navigational aid signals in space meet the required standards. The flight inspection aircraft and its measuring system can be considered to be a large piece of test equipment.

Some important navigation signals are not properly formed until beyond the far field monitoring systems of the installed equipment. Flight inspection is a suitable method of checking those signals meet the required standards.

It is fair to say that even flight inspection does not give a guarantee that the signals in space will conform to the appropriate standards in all areas of the service volume. However, as the flight inspection procedures have developed over time, the methods used generally provide an efficient mechanism to identify problems within the areas of use of a particular navigational aid.

The ability of a radio navigational aid to continue to provide the correct indications to an aircraft receiver is dependent upon two main factors:

- The environment
- Equipment stability within the prescribed tolerances

Environment

When considering the environment effect on the signal in space the following should be kept in mind; slope and soil type of the ground in front of the radiating source, buildings, trees and mountains. This list is not exhaustive.

Each of the considerations above has a differing degree of importance at different stages in the life cycle of the navigational aid. For example, mountains are likely to be present when the equipment is first installed, and as such do not need much further consideration after commissioning. On the other hand, the reflecting ability of trees tends to increase with time and varies according to seasonal changes. This gradual change in the environment needs to be monitored and the flight inspection results provide a convenient method of achieving this monitoring.

Stability

Modern equipment operating within normal operating temperatures is usually stable and therefore does not contribute significantly to the overall cumulative errors in signal performance.

It is now more common for Air Traffic Service (ATS) providers to install navigational aids on difficult sites, which had previously been deemed unacceptable. Consequently systems can be accepted into operational service with critical performance parameters close to the edge of specification. This means that even with modern equipment, stability may still be an issue.

DIFFERENCE BETWEEN FLIGHT INSPECTION AND GROUND MAINTENANCE

Measurements performed on the ground are usually spot measurements and are easy to test with standard test equipment. The test equipment and the actual measurement methods for ground maintenance are well understood by ground engineers. The calibration process of test equipment used for ground maintenance is well established, normally in accordance with national or international standards.

During flight inspection, the measurement of signals in space is complicated by the dynamics of a moving aircraft and the fact that signals are usually measured with respect to a known position or section of airspace. Further to this, the method of making such a measurement is important to the results. e.g. level slice or fly down. However different methods can be used to get the same result.

Calibration of the flight inspection system will not generally be covered by national or international standards. As such the calibration process for flight inspection systems needs to be established on a case-by-case basis.

ICAO STANDARDS FOR FLIGHT INSPECTION

ICAO Annex 10 Volume 1 - Radio Navigational Aids¹ paragraph 2.7 - Ground and Flight testing, states:

Radio navigation aids of the types covered by the specifications in Chapter 3 and available for use by aircraft engaged in international air navigation shall be the subject of periodic ground and flight tests.

Note. - Guidance on the ground and flight testing of ICAO standard facilities is contained in Attachment C and in the Manual on Testing of Radio Navigation Aids (ICAO Doc 8071).

Although ICAO sets a standard for regular flight inspections to be conducted, there are no standards associated with the actual checks that are required.

ICAO Doc 8071² provides guidance on suitable inspection methods, but the content of Doc 8071 does not have the same status as Standards and Recommended Practices (SARP). It is therefore up to each state to interpret and apply this guidance as they wish.

THE UK REGULATORY APPROACH

In the 1990s the UK Civil Aviation Authority (CAA) introduced a system to allow non-CAA (State) owned flight inspection organisations to be approved to conduct flight inspections of radio navigational aids within the UK.

To facilitate this the ICAO standard from Annex 10 Volume 1 for periodic flight inspection, has been enabled into UK law (secondary legislation) by the Air Navigation Order (ANO) 2005³ Article 124 (5) which states:

An approval granted pursuant to paragraph (1) may include a condition requiring the person in charge of the equipment to use a person approved by the CAA pursuant to paragraph (6) for the provision of particular services in connection with the equipment and in particular but without limitation may include a condition requiring that the equipment be flight checked by such an approved person.

ANO 2005 Article 124 (1) states:

A person shall not cause or permit any air traffic service equipment to be established or used in the United Kingdom otherwise than under and in accordance with an approval granted by the CAA to the person in charge of the equipment.

ANO 2005 Article 124 (6) states:

The CAA may approve a person to provide particular services in connection with approved equipment.

In summary, ANO 2005 article 124 allows the CAA to approve an ATS providers radio navigational aids for an intended purpose. The CAA may then direct an ATS provider to carry out a flight inspection of their radio navigational aids by a CAA approved organisation. Flight inspection organisations are approved under article 124 (6).

To obtain ANO approval an applicant must satisfy the CAA that their equipment and or operation is suitably safe. To facilitate this the CAA promulgates to the industry acceptable means of compliance in the form of safety requirements published in CAP 670⁴ - Air Traffic Services Safety Requirements. CAP 670 contains requirements, recommendations and guidance for both ATS providers and flight inspection organisations.

Safety requirements for flight inspection organisations are contained in FLI 02 -The Approval of Flight Inspection Organisations. The requirements for ATS providers are contained in equipment specific requirements, i.e. ILS 02 - Flight Inspection Limits to be Applied and ILS 07 - ILS and ILS/DME Flight Inspection Types and Requirements. The latter set of requirements also needs to be considered by the flight inspection organisation to ensure that the correct sets of measurements are made for each inspection type.

Industry Consultation

Before safety requirements are introduced or amended in CAP 670, the CAA is required to consult with the industry and also conduct a regulatory impact assessment. The regulatory impact assessment considers the costs, benefits and risks to the industry of any particular change.

Cost recovery

The CAA recovers its costs by charging the industry for the time taken for initial approval and for the ongoing regulatory oversight. The charges are published in the CAA Scheme of Charges. For flight inspection this is covered in the CAA Scheme of Charges No.210 - Aerodrome Licensing and Aerodrome Air Traffic Services Regulation⁵.

Contents of CAP 670 FLI 02

CAP 670 FLI 02 consists mainly of objective based requirements. This format gives the flight inspection organisation the freedom of design solution and also encourages innovative approaches to a solution. FLI 02 requires that an organisation provide an exposition of their organisation and operation. In addition the exposition is used to present arguments for the demonstration of compliance with the requirements using supporting documentation as necessary.

Amongst other items the exposition covers:

- Organisation
 - Accountable Manager
 - Flight Inspectors
 - Quality Management Systems
 - Internal Audit
- Training, competency and recency
- Aircraft
 - Crosswind limits
 - Propeller Modulation
- Equipment
 - Software
 - Antenna
 - Antenna phase centre
 - Stability
- Report format
- Measurement uncertainty

Type approval

The ANO 2005 approval to operate as a flight inspection organisation considers all the aspects of FLI 02. This approach means that it is not possible to 'type approve' a particular piece of flight inspection equipment.

Responsibilities

Flight Inspection Organisation:

- Conduct flight inspection

- Maintain compliance with FLI 02
- Generation of the flight inspection report
- Ensure the report is accurate

ATS provider:

- Contracting an approved flight inspection organisation
 - Checking the report against the requirements
 - Safety management of the navigational aid. i.e. NOTAMs
 - Ensuring the flight inspection is conducted at the appropriate time
- Regulator (CAA):
- Approval of flight inspection organisation
 - Approval of the ATS provider's equipment
 - Ongoing regulatory oversight of flight inspection organisations
 - Ongoing regulatory oversight of ATS providers
 - Creating and maintaining regulatory requirements

Regulatory Oversight

The CAA has three ongoing regulatory paths for the safety oversight of flight inspection organisations:

1. Annual audit of the flight inspection organisation. These audits are designed to ensure continued compliance with the requirements of CAP 670 FLI 02,
 2. Approval of changes to the exposition,
 3. Periodically monitoring the flight inspection reports.
- In addition the ATS provider is also subject to regular audits.

Considerations of the UK approach to regulation of flight inspection

1. Results. It does not specifically check how efficient the flight inspection organisation is at obtaining sufficient information to produce the results.
2. Approval is for the organisation and not just the flight inspection equipment.
3. Regulator needs to maintain knowledge in the principles and practices of flight inspection, without the advantage of hands on experience.
4. Regulator must be capable of evaluating innovative ideas.
5. Example a small organisation may have less onerous internal audit procedures compared with a large organisation.
6. ATS providers can choose which organisation flight inspects their equipment. As long as they are approved by the CAA. This encourages competition in the market place.
7. Inspection has the appropriate independence from the ground maintenance staff.

CONCLUSION

Flight inspection is a constantly evolving business. Although the inspection process is specialised and produces the same end product, the methods used vary from State to State. The UK has a regulatory approach for the safety oversight of flight inspection, which encourages innovation whilst giving the ATS providers the choice of which flight inspection organisation inspects their navigational aids.

REFERENCES

1. ICAO Annex 10 Volume 1- Radio Navigational Aids, Fifth Edition Amendment 80
2. ICAO Doc 8071 - Manual on Testing of Radio Navigation Aids, Volume 1 - Testing of Ground Based Radio Navigation Systems
3. Air Navigation Order (ANO) 2005
4. CAP 670 - Air Traffic Services Safety Requirements, Issue 2 Amendment 2/05
5. CAA Scheme of Charges No.210 -Aerodrome Licensing and Aerodrome Air Traffic Services Regulation