Certification Issues for Flight Inspection

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ABSTRACT

(Flight Inspection Services - Relationships, standards, oversight and certification)

This paper and presentation will take a closer look at certification issues related to flight inspection. In a flight inspection organization (FIO), many areas should be taken into consideration, amongst these:

- Aircraft maintenance and operation

- Flight inspection organization and operation

- Flight inspection equipment, installation and maintenance

Certification issues and requirements may in certain areas be less clear than in others, and it is typically the decision of the local aviation authorities to decide what the certification level will be.

The paper will present a typical certification scenario, based on real-world experiences, covering many of the areas above. Certification standards such as FAR/JAR, DOC 8071, FAA 8200, CAP670, Annex 10 etc. will be discussed in this regard.

Background

The operational requirements put on flight inspection systems and its operators, is getting higher and higher for each year. Also the requirement for aircrafts is getting higher. More fuel efficient, yet representing the common denominator of aircraft.

Systems must be able to operate more or less like and FMS, but with the added requirement of independence. Flight inspectors (FI) must fully understand the operation from A-Z of flight operation, which must be reflected in a higher demand for documenting their competence level. The authority on their side must be able to certify both people and systems using accepted standards. The standards for systems are there, but for people?

Aircraft maintenance and operation

The flight inspection aircraft
A typical FI aircraft will mostly operate below 5000ft with a maneuvering pattern that is not typical for such an aircraft. There is no question that the aircraft is capable of operating under these conditions, but the aircraft was not designed for this in mind! The question would then be should flight inspection aircraft have a more thorough maintenance program? Well, one can argue that as long as a maintenance organization follows the recommended maintenance program from the aircraft manufacturer, AND the local rule and regulation for that country, it would be sufficient. But there is no question that the tear and wear of a flight inspection aircraft is higher than an ordinary commercially operated aircraft. The FI aircraft has more cycles on every aircraft system than its commercially operated "sisters", and the way it accumulates these cycles is very much different than its "sisters". This should imply that a special maintenance program should be incorporated for the aircraft, which gives special attention to systems which is more exposed to the unique operational environment that a flight inspection aircraft is flying under.

The flight inspection operation
As stated, flight inspection operation is very different than other forms of commercial flying, and this should definitely be reflected in the training and qualification of the crew in a flight inspection aircraft. Some states uses the commander (i.e. the pilot in command) as the Flight Inspector, other uses the flight crew merely as a resource for transporting the aircraft from navaid to navaid. The crew in a flight inspection aircraft, work together in a very complicated and dense environment. This should then imply that there will be special demands on training and re-qualification of the crew. The crew must have some way of communicating in an effective way, so as to ensure safe and sound operation, both technically and flight operation wise. Briefing and debriefing is a good communicating tool in this respect, but it can often be just another routine thing to do.

Night calibration is especially demanding for both the pilots and the flight inspector. Special attention is a must in these types of operation. Flying in a super dense airspace, typically in a pattern that is going the opposite way than the other traffic, really demands that a thorough brief and corporation of the ATC is a necessity.

The Flight inspection organization

The organization should have internal requirements for its flight inspectors so they can document their competence level, and maintain this level each year. In addition, the following items should also be considered:

- Medical fitness requirements
- Instrument rating
- Technical responsible for the system
- CRM training
- Annual or bi annual refresher courses for documenting competence level

In addition the organization should be ISO 9001 certified for the quality assurance of the data handling process.

As can be seen, the requirements for the flight inspector can remind of much the same "program" that a pilot in a JAR-OPS 1 company must go through each year. Sundt Air Flight Inspection Organization is following the same requirements for its flight inspectors, as its pilots are required to go through.

Flight inspection equipment, installation and maintenance

Minimum capabilities of a flight inspection equipment of today

The following should definitely be a minimum list of a flight inspection system of today:

- Capable of giving guidance for flying P-RNAV operations.
- Flight inspection of all traditional navigation aids
- Flight inspection of GLS
- Interface to aircraft FMS
- Arinc-424 database

The above list means that most authorities demands some sort of certification on the equipment.

Certification of flight inspection equipment

The above mentioned points will certainly mean that some system function of the flight inspection equipment must be defined as critical for flight safety. This will again imply that the production of the flight inspection software performs its intended function with a level of confidence in safety that complies with airworthiness requirements. But the question here is; do we have any standards that we can use for certifying flight inspection software? Yes, but its only one, namely DO-178B. The DO-178B "SOFTWARE CONSIDERATIONS IN AIRBORNE SYSTEMS AND EQUIPMENT CERTIFICATION" is the only industry standard that is widely accepted. Getting a system certified consistent with the DO-178B standard is very time consuming, and costly, not making the DO-178B a good FI equipment standard to use. But again, in today's FI

environment, where FI systems should be able to, not only guide the aircraft, but also fly the aircraft during some procedure, this may be the only way to go.

CAP670 FLI 02, is not a standard, and is definitely not widely accepted as a certifying standard, BUT it's a very convenient norm to use for approving FI systems and its organization! The FLI02 "The Approval of Flight Calibration Organisation", is a guideline used by the CAA (of UK), written by SRG, for approving an organization, or a person, for flight checking of navigation aids. In this guideline, there are requirements to the people in the organization, the equipment used, the manufacturer of the FI equipment used, the FI aircraft, the maintenance of the FI equipment, and so on.

For the equipment itself, and especially the software, the CAP 670 FLI02 does not prescribe how the assurance evidence is to be produced or its adequacy argued, giving both the authority and the manufacturer of the FI system the opportunity to use or recommend a suitable standard. Here the DO-178B, ARP 4761 or IEC 61508Part 3, ESAR 4, 5 and 6 are suitable candidates when designing and approving the equipment. The problem for the manufacturer is that the safety integrity level is very hard to define for traditional flight inspection function. Is it likely that a system error in the flight inspection system can go unnoticed, so that the output from the FI system, the results, may lead to an accident? Probably not, and the probability here is very low since its not just the FI system alone deciding the status of the navigation aid, but many other factors and people involved with a level of competence which make the scenario very much unlikely. But quite another thing is the guidance and/or maneuvering of an FI aircraft by the FI software. Here the classification is clear; this type of functions may lead to serious accidents. When designing such functions, DO-178B will be the only internationally accepted standard to follow.

The installation and maintenance of a flight inspection system

Flight inspection systems of today are extremely complicated and so are the demands and requirements on maintaining them and installing them as well. Typically a flight inspection system is part of the aircraft airworthiness certificate. The authorities should approve a technical responsible person in the organization that has special competence both in maintaining such a system, and for the installation process. If the aircraft operates under a JAR-145 maintenance organization, the maintenance and follow up items can easily be incorporated into the already existing system. The authorities can then audit the JAR-145 organization and the technical side of the flight inspection organization at the same time.

Certification of Flight Inspectors

The service provider should document that all personnel that are involved in the operation of carrying out operation and maintenance, comply with the competence requirement that are established.

According to ICAO Doc 8071 Chapter 1 §1.11.3 the state authority or flight inspection organization, as authorized by the State authority, should formally certify flight inspection personnel.

It is further stated that the objectives are to:
- Grant authority to the flight crew member who ensures the satisfactory operation of air navigation facilities;
- Provide a uniform method for examining employee competence; and
- Issue credentials that authenticate inspection authority.

What are the competence levels for flight inspectors today? They should have a very thorough understanding, not just on the technical side of FI matters, but also of the operational side of aviation. This does not mean that they have to be pilots with thousands of hours, but they need to know more than the basics of flying. Should it be mandatory for flight inspectors to have a pilot license with an instrument rating? More and more of the flight inspection of today is to verify different procedures, meaning that a thorough understanding of every item involved in designing the procedure, implementing it, and using it must be understood.

An FIO organized under a JAR-OPS 1 company, may inherit many of the training requirements put on crew members in such an organization. Under JAR-OPS1, a flight inspector will be defined as a special crewmember, and with that he/she must fulfill medical, CRM, safety and any other special requirements put on the JAR OPS1 operator.

The manufacturer of the flight inspection system should have an authority approved technical and operating course, giving the customer an extensive knowledge and understanding of the system. The FIO should have a requirement for a re-qualifying program its operators incorporated.

Conclusions

Flight inspection systems of today are getting so complicated that a common certifying standard for flight inspection aircraft and its systems should be agreed upon. Also the requirements put on the flight inspectors are such that the inspector and/or the operator should follow the same sort of requirements that is put on a pilot. The documentation of competence for a flight inspector is just as high as a pilot, if not higher. In addition to the traditional flight inspection items, the understanding of procedures, how they are designed, how they are implemented, why they are implemented, rules and regulation around the procedures, makes the competence level of a flight inspector of today pretty impressing.

References

CAP670 FLI02 Issue 1 Amendment 6
ICAO Doc 8071
DO-178B: "SOFTWARE CONSIDERATIONS IN AIRBORNE SYSTEMS AND EQUIPMENT CERTIFICATION"