United Kingdom **Overseas Territories Aviation Circular**

OTAC 39-13

Operational Serviceability and Readout of Flight Data Recorder Systems and Cockpit Voice Recorders

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GENERAL

Overseas Territories Aviation Circulars are issued to provide advice, guidance and information on standards, practices and procedures necessary to support Overseas Territory Aviation Requirements. They are not in themselves law but may amplify a provision of the Air Navigation (Overseas Territories) Order or provide practical guidance on meeting a requirement contained in the Overseas Territories Aviation Requirements.

PURPOSE

This Overseas Territories Aviation Circular provides information and guidance on the serviceability and readouts of Flight Recorder Systems (FDR and CVR) when required for an aircraft registered in a Territory and granted a Certificate of Airworthiness.

RELATED REQUIREMENTS

This Circular relates to OTAR Part 39 Subpart C.

CHANGE INFORMATION

First issue.

ENQUIRIES

Enquiries regarding the content of this Circular should be addressed to Air Safety Support International at the address on the ASSI website www.airsafety.aero or to the appropriate Overseas Territory Aviation Authority.

CONTENTS

Glossary of Terms

CARS: Cockpit Audio Recording System

C of A: Certificate of Airworthiness

CVR: Cockpit Voice Recorder

DFL: Data Frame Layout

DLR: Data Link Recorder

FDAU: Flight Data Acquisition Unit

FDR: Flight Data Recorder

MCM: Maintenance Control Manual

MOE: Maintenance Organisation Approval

STC: Supplemental Type Certificate

TC: Type Certificate

1. Introduction

Aviation legislation in the Overseas Territories (OTs) reflects the ICAO Standards and requires that certain categories of aircraft are equipped with crash-protected Flight Data Recorder (FDR) systems and Cockpit Voice Recorder (CVR) systems. These systems are installed primarily to assist investigations into incidents and accidents. Additionally, a number of operators monitor certain operational aspects of their aircraft, either by using the FDR itself or via a secondary quick access recorder.

To satisfy legal requirements, the installations have to comply with the appropriate minimum requirements dependent upon the class of aircraft. Continued serviceability requires compliance with the installer's maintenance instructions as well as validation of data recorded in-flight.

This OTAC provides general advice and guidance to OTAAs and operators of aircraft equipped with Flight Recorder Systems, for their serviceability in accordance with OTAR Part 39, 39.61(h) (10). It is a means but not the only means to ensure the serviceability of FDRs and CVRs. Operators should consult with their OTAA in the interpretation of the requirements for FDR and CVR serviceability.

This guidance is based on the standards of ICAO Annex 6 for FDR and CVR serviceability.

2. Flight Recorder (FDR and CVR) Serviceability - General

The following sections detail the OTAA's expectations relating to the replay and validation of Flight Recorders during the processes related to initial aircraft TC/STC and leading to a C of A issue. The order of the paragraphs is expected to reflect the process time line.

2.1 Type Certification and Supplemental Type Certification (TC/STC Holder responsibilities)

At the time of the type certification, the TC/STC holder will have the following available:

a) Evidence which demonstrates that the installed recorder system meets the appropriate operational requirements including accuracy, resolution, range, duration and sampling rates.

b) Evidence that the recorder system consists of appropriately-approved equipment as required by the applicable operating requirements.

c) Information necessary to enable operators of aircraft to conduct a readout of the FDR. As a minimum this shall include a dataframe layout document together with any necessary conversion data to enable translation into engineering units.

d) Information necessary to enable operators to perform scheduled maintenance tasks that demonstrate continued compliance with the certification requirements. This information is expected to address all parts of the recorder systems, for example the associated sensors.

e) For the initial entry into service requirements, the TC/STC applicant is expected to conduct an initial representative flight together with a recorder readout and validation of the results.

f) An analysis of the maintenance activities for the recorder systems. This must be translated into a list of maintenance actions that must be provided to the operator.

Note: In accordance with ICAO Annex 6 and OTAR Parts 121, 125 and 135, the use of tape FDRs shall have been discontinued by 1 Jan 2016, so the recorders should be of solid-state technology.

2.2 Initial Certificate of Airworthiness Issue – (Operator Responsibilities)

At the time of the C of A issue, an operator/applicant will be expected to provide evidence that, for the individual aircraft to be issued with a C of A, the TC/STC holder has met the TC/STC requirements as specified in 2.1 above.

The OTAA will expect the operator to provide a compliance statement that demonstrates the following:

a) A data frame layout document (DFL) is available for the FDR system.

b) Sufficient conversion data (to enable translation of the raw FDR data into engineering units) is available for the FDR system.

c) Procedures are in place to provide the DFL and conversion data to an appropriate readout facility.

d) The approved Aircraft maintenance programme includes a list of tasks specified by the TC/STC holder to ensure the continued serviceability of the recorder systems.

e) A FDR readout from a representative flight (see Section 4), conducted immediately prior to C of A issue has been evaluated to ensure that the FDR is functioning correctly.

f) For a second-hand aircraft imported from outside the OTAA, an examination of the recorded signal on a CVR should be carried out by replay of the CVR recording as required by 4.2.1. This should be carried out immediately prior to the issue of the C of A.

If this cannot be achieved refer to Note 1 below.

Notes:

1. Where an operator experiences a delay such that the results of the readout are not available for validation at the time of C of A issue, the responsible OTAA should be contacted to agree a specified time scale for its completion. This should normally be within 30 days of the date of C of A issue.

2. Irrespective of the originating source of the aircraft, the FDR system is required to meet the OTAA operational rules.

3. If the aircraft is second-hand or has been transferred and the information can’t be obtained via the route specified in paragraph 2.1, the applicant should engage the services of a suitably qualified design organisation to facilitate the function that would have otherwise been provided by the TC/STC holder.

3. FDR Readout and Serviceability

3.1 Introduction

The FDR readout may be performed either by an appropriate OTAR, FAR, EASA or Transport Canada approved Part 145 organisation with procedures to perform an FDR readout, or by an operator that can demonstrate that they have the required equipment and competence to perform this task. This task may be subcontracted by the owner/operator; details of which will need to be included in their MCM. The approved organisation is also required to have procedures detailing how the FDR readout will be performed and controlled.

The aircraft owner/operator is responsible for the continued serviceability of the FDR system and retaining the relevant records required by the operational requirements. The validation of recorded data from a representative flight may be used to provide evidence of the FDR system performance in a flight dynamic situation that cannot be achieved using ground testing alone.

Notes:

1. An operator who conducts their own readout does not need to hold an acceptable Part 145 approval however they will need to confirm that they have appropriate procedures and competence in place. These should be detailed in their MCM. Operators who wish to provide FDR readouts as a service to other operators will be required to hold an appropriate Maintenance Approval and have procedures in their MOE.

2. If a flight recorder needs to be removed and sent to a readout facility to download the required data, the serviceability of the flight recorder should be verified and the equipment released to service using an appropriate Part 145 approved maintenance organisation (eg FAA, EASA, Transport Canada or OTAA) prior to re-installation in the aircraft.

3.2 Inspections of Flight Data Recorder (FDR) Systems

In accordance with ICAO Annex 6, Part 1 Appendix 8; ICAO Annex 6 Part 2, Appendix 3.1 and ICAO Annex 6 Part 3, Appendix 4 (as applicable) the operator shall comply with the following:

3.2.1 Prior to the first flight of the day, the built-in test features for the FDR and Flight Data Acquisition Unit (FDAU), when installed, shall be monitored by manual and/or automatic checks.

3.2.2 FDR systems shall have recording system inspection intervals of not exceeding one year; subject to the approval from the OTAA. This period may be extended to two years provided these systems have demonstrated a high integrity of serviceability and self-monitoring. DLR systems or DLRs shall have recording system inspection intervals not exceeding two years. Subject to the approval from the appropriate regulatory authority; this period may be extended to four years provided these systems have demonstrated high integrity of serviceability and self-monitoring.

3.2.3 Recording system inspections shall be carried out as follows:

a) an analysis of the recorded data from the flight recorders shall ensure that the recorder operates correctly for the nominal duration of the recording;

b) the analysis of the FDR shall evaluate the quality of the recorded data to determine if the bit error rate (including those errors introduced by recorder, the acquisition unit, the source of the data on the aeroplane and by the tools used to extract the data from the recorder) is within acceptable limits and to determine the nature and distribution of the errors;

c) a complete flight recording from the FDR shall be examined in engineering units of measurement (eg degrees, knots) to evaluate and confirm the validity of all recorded parameters. Particular attention shall be given to parameters from sensors dedicated to the FDR or ADRS. Parameters taken from the aircraft's electrical bus system need not be checked if their serviceability can be detected by other aircraft systems;

d) the readout facility shall have the necessary software to accurately convert the recorded values to engineering units and to determine the status of discrete signals.

3.2.4 A flight recorder system shall be considered unserviceable if there is evidence of poor quality data, unintelligible signals, or if one or more of the mandatory parameters is not recorded correctly.

3.2.5 A report of the recording system inspection shall be made available on request to regulatory authorities for monitoring purposes.

3.2.6 The data from the representative flights and the readouts shall be retained at least until the next readout is accomplished

3.2.7 Calibration of the FDR system:

a) for those parameters which have sensors dedicated only to the FDR and are not checked by other means, recalibration shall be carried out at least every five years or in accordance with the recommendations of the sensor manufacturer to determine any discrepancies in the engineering conversion routines for the mandatory parameters and to ensure that parameters are being recorded within the calibration tolerances; and

b) when the parameters of altitude and airspeed are provided by sensors that are dedicated to the FDR system, there shall be a recalibration performed as recommended by the sensor manufacturer, or at least every two years.

Note: The term "Calibration" has caused some confusion among industry. It is a term that was originally used for analogue FDR's. Some of the sensors providing data to the recorders could drift out of tolerance and would require re-calibration. Modern aircraft use digital systems to provide data to the FDR, which normally do not require calibration. The Type Certificate holder should be consulted in the event of any doubt.

4. Cockpit Voice Recorders (CVR) Maintenance and Continued Airworthiness

4.1 Inspections of Cockpit Voice Recorder (CVR) Systems

In accordance with ICAO Annex 6, Part 1 Appendix 8; ICAO Annex 6 Part 2, Appendix 3.1 and ICAO Annex 6 Part 3, Appendix 4 (as applicable) the operator shall comply with the following:

4.1.1 Prior to the first flight of the day, the built-in test features for the CVR, when installed, shall be monitored by manual and/or automatic checks.

4.1.2 CVR systems, shall have recording system inspection intervals not exceeding one year; subject to the approval from the OTAA.

This period may be extended to two years provided these systems have demonstrated a high integrity of serviceability and self-monitoring.

4.1.3 CVR inspections shall be carried out as follows:

a) an analysis of the recorded data from the flight recorders shall ensure that the recorder operates correctly for the nominal duration of the recording;

b) an examination of the recorded signal on the CVR shall be carried out by replay of the CVR recording. While installed in the aircraft, the CVR or CARS shall record test signals from each aircraft source and from relevant external sources to ensure that all required signals meet intelligibility standards;

c) where practicable, during the examination, a sample of in-flight recordings of the CVR shall be examined for evidence that the intelligibility of the signal is acceptable; and

4.1.4 A CVR system shall be considered unserviceable if there is poor-quality data, unintelligible signals.

4.1.5 A report of the CVR system inspection shall be made available on request to regulatory authorities for monitoring purposes.

Note: In accordance with ICAO Annex 6 and the OTAR 121, 125 and 135 the use of tape and wire CVRs shall have been discontinued by 1 Jan 2016.

4.1.6 The CVR readouts shall be retained at least until the next readout is accomplished.

4.2 OTAA CVR Recommendations

4.2.1 The following are recommended for continued airworthiness of Cockpit Voice Recorders:

a) At intervals not exceeding 12 months

i) In the first instance the TC or STC Holder’s Recommendations should be followed. If these recommendations are not as comprehensive as detailed in paragraph ii) that paragraph should be carried out as a minimum.

ii) In the absence of specific instructions from the TC/STC holder inspect the installation.

Whenever the following functions are available, confirm by means of the cockpit located CVR controller monitor jack, proper recording of:

- each audio channel from area microphone(s),
- receiver audio from the audio control panels,
- sidetone,
- interphone,
- public address (if recorded) and
- boom microphone (including 'hot mike' function, i.e. interphone OFF).

Confirm proper function of the inhibit logic for the bulk erase.

b) At C of A issue for Solid State CVRs

An examination of the recorded signal on the CVR should be carried out by replay of the CVR recording. While installed in the aircraft, the CVR should record test signals from each aircraft source and from relevant external sources to ensure that all required signals meet intelligibility standards.

Operators should review all their Approved Aircraft Maintenance Programmes for compliance with the above recommendations. If changes are needed these should be submitted to the OTAA for review and approval.

4.2.2 **Example Replay and Analysis**

The replay centre should establish that recordings of adequate quality have been made on all channels for the test conditions stated below. In addition to subjective listening tests, proper signal recording level should be confirmed.

The recording should be played back in an area where the privacy and confidentiality of the recorded voices may be assured. This may require a separate room depending on the size of the organisation performing the task.

To assess the serviceability of the CVR system the Type Certificate holder's data should be used, however, the following checks and functional tests are given as an example:

i) All voice communications transmitted from or received by the aircraft communications equipment;

ii) All conversation on the flight deck;

iii) Voice communications of flight crew-members on the flight deck, using the aircraft's interphone system;

iv) Voice or audio signals identifying navigation aids introduced into the aircraft audio system;

v) Audio signals from alerting or warning devices on the flight deck, both fully integrated with the aircraft audio system and non-integrated;

vi) General flight deck sounds monitor the Cockpit Area Microphone to ensure that it satisfactorily picks up all cockpit sounds.

4.2.3 **Operators Responsibilities**

Where an operator undertakes to carry out validation of their own CVR replays, this should be detailed in the company MCM. This replay will be undertaken by competent staff and will be documented.

A procedure should be established, acceptable to the OTAA, which enables the operator to demonstrate that a replay has been carried out and highlights any deficiencies and together with the associated remedial actions.

The operator may sub-contract this task to an organisation not holding a Maintenance approval and detail this in the MCM. However, this task will still form part of the operator's OTAR Part 39 Subpart E approval under its Quality system

The OTAA recognises that in certain cases, an aircraft operator may lack sufficient resources to undertake the replay of CVR's. In these cases, the replay, as detailed in the subject procedure, may be contracted to a third party by the operator. In these circumstances, the operator will need to provide evidence of the following:

(i) The OTAR Part 145 organisation has the capability to replay CVRs in their approved procedures.

(ii) The OTAR Part 145 CVR replay report should include an assessment in accordance with these procedures.

The report should identify the aircraft and flight concerned and should confirm that all input channels were identified for the various test conditions. Details of any other observations made from the recording should be included. For helicopters, correlation between rotor speed announcements by the crew and recorded rotor speed data should be established and recorded. In all cases, the position of the area microphone in the particular aircraft should be stated in the report.

4.2.4 **Preservation of Recording**

Under certain conditions, the CVR may continue to run and record while electrical power is provided to the recorder. Historical evidence confirms that even if the Flight Crew has isolated electrical power to the CVR, subsequent maintenance or other activity may have re-instated the power supply resulting in the loss of the recording.

Regulations at the date of publication, requiring the preservation of recordings are as follows:

ICAO Annex 6 Part I, 11.6 requires that:

"The operator shall ensure, to the extent possible, in the event the aeroplane becomes involved in an accident or incident, the preservation of all related flight recorder records and, if necessary, the associated flight recorders, and their retention in safe custody pending their disposition as determined in accordance with Annex 13."

OTAR 91.140 (b) requires that:

To preserve flight recorder records, flight recorders shall be de-activated upon completion of flight time following an accident or incident. The flight recorders shall not be re-activated before their disposition as determined in accordance with OTAR Part 13.

OTAR 91.140 (c) requires that:

In the event of an incident or accident, flight recorder records, and where possible the associated flight recorders, shall be retained in safe custody.

Operators and continuing airworthiness management organisations should ensure that robust procedures are in place and prescribed in the relevant Operations Manual and Expositions to ensure that CVR/FDR recordings that may assist in the investigation of an accident or incident are appropriately preserved. This should include raising awareness of Flight Crew and Maintenance staff to minimise the possibility of loss of any recorded data on both the CVR and FDR.

When appropriate, the relevant circuit breakers should be pulled and collared/tagged and an entry made in the aircraft technical log to make clear to any airline personnel that an investigation is progressing. Furthermore, confirmation from the investigating authority/operator is required to be obtained before systems are reactivated and power is restored.

Operators who contract their maintenance activities or ground handling to a third party should ensure that the contracted organisation is made aware of all the relevant procedures.