



# Terms of Reference

for a rulemaking task

## Recorders installation and maintenance thereof — certification aspects

RMT.0249 (MDM.051) — ISSUE 2 — 27.01.2016

Applicability		Process map	
Affected regulations and decisions:	Part-CAT, Part-SPA, Part-NCC of Commission Regulation (EU) No 965/2012 CS-25; CS-29; AMC & GM to Part-21 AMC & GM to Part-CAT, Part-SPA, Part-NCC	Concept Paper:	No
		Rulemaking group:	No
		RIA type:	Light
		Technical consultation during NPA drafting:	Yes
Affected stakeholders:	Type Certificate (TC)/Supplemental Type Certificate (STC) applicants	Publication date of the 1 <sup>st</sup> NPA:	2016/Q2
		Publication date of 2 <sup>nd</sup> NPA:	TBD
Driver/origin:	Safety	Duration of NPA consultation:	3 months
		Review group:	No
Reference:	Docket No FAA-2005-20245; SR UNKG-2005-074; SR UNKG-2005-075; SR UNKG-2008-074; SR UNKG-2011-045; SR UNKG-2011-027; SR UNKG-2011-029 SR CAND-1999-003; RUSF-2015-001	Focussed consultation:	No
		Publication date of the 1 <sup>st</sup> Decision:	2017/Q2
		Publication date of the 2 <sup>nd</sup> Decision:	TBD



## 1. Issue and reasoning for regulatory change

### 1.1. General

CS-23, CS-25, CS-27 and CS-29 contain certification specifications (CS XX.1457 and CS XX.1459) which are related to the installation of Cockpit Voice Recorders (CVRs) and Flight Data Recorders (FDRs), when their carriage is required by the Air Operations rules.

The present Terms of Reference address several issues regarding the certification specifications for cockpit voice recorders (CVRs) and flight data recorders (FDRs). Some of these issues were initially identified by the following Rulemaking Tasks (RMTs) (please refer to the [Agency's 4-year Rulemaking Programme](#)):

- (1) RMT.0268 (MDM.068) 'Revision of FDR and CVR certification specifications';
- (2) RMT.0249 (MDM.051) 'CVR recording quality';
- (3) RMT.0402 (OPS.091(a)) 'Requirements for combination recorders (FDR/CVR)'; and
- (4) RMT.0402 (OPS.091(b)) 'Requirement for combination recorders (FDR/CVR)'.

The above-mentioned RMTs have been merged in the course of time into one single task, namely RMT.0249 (MDM.051) (please refer to the [Agency's 4-year Rulemaking Programme](#)). The issues and reasoning associated to the subsequent RMT.0249 (MDM.051) are presented in the following sections.

### 1.2. FDR and CVR power supply

ICAO Annex 6 Part I contains a Standard which requires that large commercial air transport aeroplanes, for which the application for type certification is submitted on or after 1 January 2018, be fitted with an 'alternate power source' (refer to Standard 6.3.2.4.2).

In addition, the Federal Aviation Administration (FAA) published a rule on 7 March 2008 on 'Revisions to Cockpit Voice Recorder and Digital Flight Data Recorder Regulations' (Docket No FAA-2005-20245). This rule amended Part-23, -25, -27 and -29 with new requirements to address the fact that any single electrical failure should not disable both the CVR and FDR functions, and the need for a 10-minute backup power source for the CVR. In the meantime, the European Aviation Safety Agency (hereinafter referred to as the 'Agency') received the following safety recommendations:

SR CAND-1999-003: 'As of 01 January 2005, for all aircraft equipped with CVRs having a recording capacity of at least two hours, a dedicated independent power supply be required to be installed adjacent or integral to the CVR, to power the CVR and the cockpit area microphone for a period of 10 minutes whenever normal aircraft power sources to the CVR are interrupted.' (Accident of McDonnell Douglas MD11, registered HB-IWF, on 02 September 1998).

SR UNKG-2005-074: 'For newly manufactured aircraft, the European Aviation Safety Agency should require that no single electrical bus failure terminates the recording on both cockpit voice recorder and flight data recorder.' (Serious incident of an Airbus A320-214, registered G-BXKD, on 15 January 2005).

SR UNKG-2005-075: 'For newly manufactured aircraft, the European Aviation Safety Agency should require that the cockpit voice recorder and cockpit area microphone are provided with an independent 10 minute back-up power source, to which the cockpit voice recorder and cockpit area microphone are switched automatically, in the event that normal power is interrupted.' (Serious incident of an Airbus A320-214, registered G-BXKD, on 15 January 2005).

SR IRLD-2012-003: 'European Aviation Safety Agency (EASA) should introduce a requirement that the CVR should continue to record in the event of power failure.' (Serious incident of a Boeing 737-8AS, registered EI-ENB, on 21 December 2010, investigated by AAIU Ireland).



RUSF-2015-001: ‘To prevent the loss of recording flight data in case of power supply interruptions from the main bus with the power plant failure or shutdown or other in-flight failure, to consider the usage of uninterruptible power supply systems or units on board that could provide the continuous availability of flight data recorders, flight information acquisition and communication systems with a defined time interval after the failure of power supply from the main bus.’

Certification Specifications for European Technical Standard Orders (CS-ETSO) already contains requirements for recorder independent power supply (refer to ETSO-C155a). However, there is no corresponding specification for the installation of this power supply function. Dedicated provisions need to be introduced in the certification specifications for large aeroplanes (CS-25) and large rotorcraft (CS-29). Hence, this ToR considers updating CS XX.1457 and CS XX.1459 with regard to the power supply of the FDR and the CVR.

Note: the case of already type-certified aircraft was previously envisioned in RMT.0308 ‘Amendment of requirements for data recorders II’. The Agency decided that, for efficiency, it should rather be included in the present RMT.0249.

### 1.3. Specifications for data link recording

The air operations rules, annexed to Commission Regulation (EU) No 965/2012<sup>1</sup>, contain requirements on the recording of data link messages on a flight recorder for newly manufactured aircraft and under certain conditions (refer to Part-CAT, CAT.IDE.A.190 and CAT.IDE.H.195). In addition, specifications for data link recorders are defined in ETSO-C177.

However, there is no corresponding specification for the installation of a data recording function. Dedicated provisions need to be introduced in CS-25 and CS-29.

### 1.4. Means to automatically stop the recording after an accident

Additionally, several safety investigation authorities have reported reliability issues with the recorders’ negative acceleration sensors, the so-called ‘G switches’. Such negative acceleration sensors comply with the certification specifications that recommend to have an automatic means to stop the recorder within 10 minutes after crash impact and prevent each erasure feature from functioning.

In several events involving high airframe vibrations, some G switches were triggered early in the event and, therefore, the recording of voices or data stopped before the end of the flight.

The Agency also received two safety recommendations on this issue:

SR UNKG-2008-074: ‘It is recommended that the Federal Aviation Administration and the European Aviation Safety Agency review the certification requirements for automatically stopping flight recorders within 10 minutes after a crash impact, with a view to including a specific reference prohibiting the use of ‘g’ switches as a means of compliance as recommended in ED112 issued by EUROCAE Working Group 50.’ (Accident to Bombardier BD700, registered VP-CRC, on 29 January 2008).

SR UNKG-2011-045: ‘It is recommended that the European Aviation Safety Agency require the ‘crash sensor’ in helicopters, fitted to stop a Cockpit Voice Recorder in the event of an accident, to comply with EUROCAE ED62A.’ (Accident to AS332-L2 Super Puma, registered G-REDL, on 1 April 2009).

Therefore, these ToR include updating CS XX.1457 and CS XX.1459 with regard to the means for stopping the recording and preventing erasure after a crash impact.

<sup>1</sup> Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p. 1).

Note: the case of already type-certified aircraft was previously envisioned in RMT.0308 'Amendment of requirements for data recorders II'. The Agency decided that, for efficiency, it should rather be included in the present RMT.0249.

### 1.5. Provisions for ensuring serviceability of flight recorders

- (1) CS XX.1457 and CS XX.1459, or their AMC, should be amended to highlight that applicants for (supplemental) type certificates ((S)TC) that include a flight recorder system installation (FDR, CVR or DLR system) should define exhaustive maintenance instructions based on an analysis of the failures and losses of data quality that would not be readily apparent to the flight crew or to maintenance personnel, as reminded in the EASA SIB 2009-28R1. This should be performed considering the air operation provisions of the Annex to ED Decision 2014/015/R, AMC1 CAT.GEN.MPA.195(b) and GM1 CAT.GEN.MPA.195(b), and the Certification Specifications and Guidance Material for the Master Minimum Equipment List (CS-MMEL) of the Annex to ED Decision 2014/004/R. The provisions of ICAO Annex 6 regarding FDR/CVR maintenance requirements and EUROCAE document ED-112A should also be considered.
- (2) In addition, this ToR envisages to amend the certification specifications, or their acceptable means of compliance (AMC), to better indicate that the TC (or STC) applicant has to provide to the operator or owner of the aircraft, the necessary documentation to perform an inspection of the recording of the flight recorder, in order to allow the operator or owner to comply with the operational requirements (refer to Annex IV to Commission Regulation (EU) No 965/2012, Part-CAT, CAT.GEN.MPA.195 and AMC1 CAT.GEN.MPA.195(d)). This documentation should include, in the case of the FDR, necessary information to convert FDR raw data into flight parameters expressed in engineering units. Guidance detailing the content and format of the FDR decoding documentation should also be added. The following safety recommendations were received by the Agency:

SR UNKG-2011-027: 'It is recommended that the European Aviation Safety Agency review their certification requirements, guidance and procedures to ensure that controlled documentation, sufficient to satisfy operator flight data recorder documentation requirements, are explicitly part of the type certification and supplemental type certification processes where flight data recorder installations are involved.' (Serious incident of a Cessna 680 Citation Sovereign, registered G-CJCC, on 30 September 2010).

SR UNKG-2011-029: 'It is recommended that the European Aviation Safety Agency provides guidance detailing the standards for the flight data recorder documentation required for the certification of systems or system changes associated with flight data recorders.' (Serious incident of a Cessna 680 Citation Sovereign, registered G-CJCC, on 30 September 2010).

In addition, safety investigation authorities found out and reported eight other cases of missing, incomplete or inaccurate FDR decoding documentation at (S)TC holder level. Because of this, the analysis of the FDR data was delayed from some weeks to several months.

Therefore, this ToR envisages to update CS-25, CS-29 and AMC/GM to Part-21 with regard to defining maintenance instructions and providing documentation to the aircraft operator in order to perform an inspection of the recording.

### 1.6. Quality of recording of Cockpit Voice Recorders

EASA specifications for function, installation and continuing airworthiness of CVRs are provided in paragraph XX.1457 of CS-23, CS-25, CS-27 and CS-29<sup>2</sup>. In addition, ETSO C123b provides minimum performance and design standards for CVR systems.

<sup>2</sup> In particular CS XX.1301 (Function and installation), 1309 (Equipment, system and installations), 1457 (CVR) and 1529 (Instructions for Continued Airworthiness).

Safety investigation authorities found that some CVR system installations do not provide the quality expected for the cockpit area microphone (CAM) and other audio channels. The problems identified include<sup>3</sup>:

- (1) poor quality of the recording on the CAM channel;
- (2) saturation of recording on the CAM channel by very low frequency vibrations;
- (3) excessive electrical background noise on a channel;
- (4) signals from the channels of flight crew members cancelling each other;
- (5) clipping of the signals on the channels of flight crew members when coming from the oxygen mask microphones;
- (6) superimposition of microphone signals by radio reception signals;
- (7) inversion of the sign of the signal coming from the CAM channel, resulting in significant attenuation;
- (8) wrong allocation of recording capacity to a channel.

Those problems are due to the installation of the CVR, and therefore not covered by ETSO-C123b.

The EASA Certification Memorandum CM-AS-001, issued in June 2012, provides guidance on how compliance with CVR recording quality requirements can be demonstrated.

Therefore, this ToR envisages to update AMC or GM to CS XX.1457 with regard to the quality of the CVR recording.

### 1.7. Performance specifications for flight recorders

In the certification specifications for aeroplanes and rotorcraft the current reference to the EUROCAE performance specifications for flight recorders do not reflect the most recent standards. Therefore, this ToR envisages to update AMC or GM to CS XX.1457 and CS XX.1459 to refer to the latest EUROCAE performance specifications for flight recorders.

### 1.8. Specifications for combination recorders

Recorders designated by the term 'combination recorders' combine two functions: the FDR function and the CVR function. They may in addition have other recording functions (such as data link or images), which are not considered in this rulemaking task.

Regarding large aeroplanes, CS 25.1457(e) and CS 25.1459(b) recommend that the FDR and the CVR be located as far aft as practicable in order to maximise the probability that the crash-protected memory

<sup>3</sup>

For more details, refer to the EASA Certification Memorandum CM-AS-001 'Quality of recording of cockpit voice recorders'.



survives the impact forces and a potential fire. However, there are no specific provisions for combination recorders in CS-25.

The Air Operations requirements applicable to the carriage of combination recorders on large commercial air transport aeroplanes are contained in CAT.IDE.A.200.

In addition, AMC1 CAT.IDE.A.200 highlights that ‘when two flight data and cockpit voice combination recorders are installed, one should be located near the flight crew compartment (...). The other should be located at the rear section of the aeroplane (...).’

Therefore, CS-25 should also cover the case where one or two combination recorders are required to be installed. This ToR envisages to update AMC or GM to CS 25.1457 and CS 25.1459 accordingly.

### 1.9. Specifications for deployable recorders

CS-ETSO already contains specifications applicable to deployable flight recorders (refer to ETSO-C123b, ETSO-C124b and ETSO-C177). In addition, tEASA Opinion No 01/2014 proposed amendments to flight recorder carriage requirements in the OPS rules in order to allow the carriage of deployable flight recorders. However, in CS-25, the current provisions for flight recorders are not adequate for deployable flight recorders. In particular, the specifications related to colour and to underwater locating devices (ULDs) are not appropriate for a deployable flight recorder. ICAO Annex 6 Part I contains provisions that are specific to the installation of deployable flight recorders (such as the colour, or the fitment of the flight recorder with an emergency locator transmitter (ELT)).

Therefore, this ToR envisages to update CS 25.1457 and CS 25.1459 to cover the case where the flight recorder is deployable.

## 2. Objectives

The general objective of this rulemaking task is to improve the availability and quality of data recorded by flight recorders in order to better support safety investigation authorities in the investigation of accidents and incidents. The specific objectives linked to the identified issues are to:

- increase the robustness of flight recorders to a loss of power supply;
- prevent premature termination of recording due to the triggering of a negative acceleration sensor;
- optimise data recovery and analysis process by adding provisions to clearly establish the ((S)TC) applicant’s obligation to provide the necessary information to convert FDR raw data into engineering units as well as maintenance procedures;
- establish the ((S)TC) applicant’s obligation with regard to maintenance instructions for flight recorders;
- define the conditions for approving the installation of a combination recorder;
- establish certification specifications for the installation of a deployable flight recorder;
- establish certification specifications for installation of the data link recording function;
- achieve a better quality of the recording for rapid and effective accident investigations by providing better regulatory guidance on the installation and testing of installed CVR systems;
- improve the probability of recovering both the CVR and the FDR recordings following large aeroplane accidents fitted with combination recorders.

## 3. Activities

- a) The Agency will develop a first Notice of Proposed Amendment (NPA) addressing the items of improvement listed in subparagraphs:



- 1.2 - FDR and CVR power supply;
- 1.4 – Means to automatically stop the recording after an accident;
- 1.8 – Specifications for combination recorders.

During the development of the draft rule and the Regulatory Impact Assessment (RIA), the following activities will be considered:

- Development of a RIA, as necessary, and proportionate in relation to the options available;
  - Amendment of the provisions related to CVR and FDR in CS-25, CS-29 and AMC/GM to Part-21.
  - Amendment of the provisions related to CVR and FRD in Part-CAT of Commission Regulation (EU) No 965/2012 and related AMC/GM (Part-CAT, Part-SPA, Part-NCC).
- b) The items of improvement listed below will be subject to a second NPA :
- 1.3 – Specifications for data link recording
  - 1.5 – Provisions for ensuring serviceability of flight recorders
  - 1.6 – Quality of recording of Cockpit Voice Recorders
  - 1.7 – Performance specifications for flight recorders
  - 1.9 – Specifications for deployable recorders

#### 4. Deliverables

- Notice of Proposed Amendment (NPA) proposing as necessary, changes to Part-CAT of Commission Regulation (EU) No 965/2012, CS-25, CS-29, AMC/GM to Part-CAT, Part-SPA Part-NCC or AMC/GM to Part-21;
- Comment-Response Document (CRD),
- Opinion proposing an amendment to Part-CAT of Commission Regulation (EU) No 965/2012
- Decision(s) amending CS-25, CS-29, AMC/GM to Part-CAT, Part-SPA Part-NCC or AMC/GM to Part-21.

#### 5. Interface issues

- ToR RMT.0498 on the 'Reorganisation of Part 23 and CS-23' was published on 31 October 2013. One of the objectives of the task is to reorganise CS-23 in order to establish a single set of certification specifications for aeroplanes in the range from CS-LSA up to CS-23, that:
  - contain requirements based on proportionate performance, complexity, and type of operation;
  - make certification specifications for light aeroplanes less susceptible to changes as a result of technological developments or new compliance-showing methods by defining design-independent safety objectives;
  - are complemented by acceptable consensus standards that contain the detailed technical requirements to meet the safety objectives set by the certification specifications.

A reorganised CS-23 may have an impact on the certification specifications for flight recorders for light aeroplanes. Therefore, the requirements specific to CS-23 aeroplanes will be considered at a later stage. Requirements for CS-27 rotorcraft will be equally considered at a later stage.



## 6. Annex I: Reference documents

### 6.1. Affected regulations

Part-CAT of Commission Regulation (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

### 6.2. Affected decisions

- ED Decision 2012/020/R of the Executive Director of the Agency of 30 October 2012 on acceptable means of compliance and guidance material for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations' (AMC & GM to Part-21 — Issue 2)
- ED Decision 2003/002/RM of the Executive Director of the Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large aeroplanes (CS-25)
- ED Decision 2003/016/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications for large rotorcraft (CS-29)
- ED Decision 2014/015/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-CAT of Regulation (EU) No 965/2012 (AMC and GM to Part-CAT — Issue 2)
- ED Decision 2012/019/R of the Executive Director of the Agency of 24 October 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council 'acceptable means of compliance and guidance material to Part-SPA
- ED Decision 2013/021/R of the Executive Director of the Agency of 22 August 2013 adopting adopting Acceptable Means of Compliance and Guidance Material for Non-commercial operations with complex motor-powered aircraft (Part-NCC)

### 6.3. Reference documents

- Docket No FAA-2005-20245: Revisions to Cockpit Voice Recorder and Digital Flight Data Recorder Regulations
- ICAO Annex 6: Parts I, II and III
- EASA CM-AS-001: Quality of Recording of Cockpit Voice Recorders
- EASA Opinion No 01/2014 'Amendment of requirements for flight recorders and underwater locating devices'
- EASA SIB No 2009-28R1: Flight Data Recorder and Cockpit Voice Recorder Systems Serviceability
- EASA ToR RMT.0498 'Reorganisation of Part 23 and CS-23'
- ED-112A (September 2013): Minimum Operational Performance Specification For Crash Protected Airborne Recorder Systems
- EUROCAE ED-62A (February 2009): Minimum Operational performance specification for aircraft emergency locator transmitters 406 MHz and 121.5 MHz (optional 243 MHz)
- FAA AC 20-141B: Airworthiness and Operational Approval of Digital Flight Data Recorder Systems





- BEA Study on Detection of Audio Anomalies on CVR recording, published September 2015

