



International  
Civil Aviation  
Organization

Organisation  
de l'aviation civile  
internationale

Organización  
de Aviación Civil  
Internacional

Международная  
организация  
гражданской  
авиации

منظمة الطيران  
المدني الدولي

国际民用  
航空组织

Tel.: +1 (514) 954-6757

Ref.: AN 11/6.3.23-10/22

1 April 2010

**Subject:** Adoption of Amendment 29 to Annex 6, Part II

**Action required:** a) Notify any disapproval before 12 July 2010; b) Notify any differences and compliance before 18 October 2010

Sir/Madam,

1. I have the honour to inform you that Amendment 29 to the *International Standards and Recommended Practices, Operation of Aircraft — International General Aviation — Aeroplanes* (Annex 6, Part II to the Convention on International Civil Aviation) was adopted by the Council at the seventh meeting of its 189th Session on 26 February 2010. Copies of the Amendment and the Resolution of Adoption are available as attachments to the electronic version of this State letter on the ICAO-NET ([www.icao.int/icaonet](http://www.icao.int/icaonet)).

2. When adopting the amendment, the Council prescribed 12 July 2010 as the date on which it will become effective, except for any part concerning which a majority of Contracting States have registered their disapproval before that date. In addition, the Council resolved that Amendment 29, to the extent it becomes effective, will become applicable on 18 November 2010.

3. Amendment 29 arises from:

- a) the Secretariat, with the assistance of the Separation and Airspace Safety Panel (SASP), concerning long-term monitoring requirements to ensure the safety of operations in reduced vertical separation minimum (RVSM) airspace;
- b) recommendations of the ninth meeting of the Operations Panel Working Group of the Whole (OPSP/WG-WHL/9) regarding head-up displays (HUD)/enhanced vision systems (EVS) requirements;
- c) recommendations of the twelfth meeting of the Airworthiness Panel Working Group of the Whole (AIRP/WG/WHL/12) pertaining to consistency in propulsion terminology; and

- d) the Secretariat, with the assistance of the second meeting of the Flight Recorder Panel Working Group of the Whole (FLIRECP/WG/WHL/2), regarding updates to flight recorder provisions.

4. The amendment concerning RVSM long-term monitoring requirements stems from the development of the RVSM concept and related guidance and has the objective of helping to ensure the safety of operations in RVSM airspace.

5. The amendment arising from OPSP/WG-WHL/9 recommendations pertaining to HUD/EVS introduces new definitions for EVS and HUD; new Notes to 2.2.2.2 and 3.4.2.7 to indicate that a State may give operational credit for the use of HUD/EVS by allowing operations with visibilities lower than those associated with the normal aerodrome operating minima; a new Standard to require the State of Registry to approve use of such systems to gain operational benefit; training requirements; and adds the use of HUD/EVS as suggested content of a company operations manual in Attachment 3.A.

6. The existing definitions for propulsion terminology in Annexes 6 and 8 — *Airworthiness of Aircraft* are not consistent. As a result, AIRP/WG/WHL/12 recommendations proposed harmonization of terms between the two Annexes. The amendment replaces the words “power-unit” or “power-units” and “powerplant” or “powerplants” to “engine” or “engines” in all instances in Annex 6, Part II.

7. The amendment relating to flight recorder provisions addresses problems arising from the recovery of data from flight recorder systems, their obsolescence, the lack of data in accidents to small aeroplanes, and the need to prescribe recording of data link communications and include, among others: provisions for cockpit voice recorders; flight data recorders; data link recorders; combination recorders; recorders for small aircraft; and discontinuation of magnetic tape recorders.

8. The subjects are given in the amendment to the Foreword of Annex 6, Part II, a copy of which is in Attachment A.

9. In accordance with the decision of the 26th Session of the Assembly, I would like to bring to your attention the Organization’s long-standing practice of providing documentation to States upon request. In this regard, I wish to refer you to the ICAO-NET website ([www.icao.int/icao/net](http://www.icao.int/icao/net)) where you can access all relevant documentation. The practice of dispatching printed copies of such documentation has now been discontinued.

10. In conformity with the Resolution of Adoption, may I request:

- a) that before 12 July 2010 you inform me if there is any part of the adopted SARPs amendments in Amendment 29 concerning which your Government wishes to register disapproval, using the form in Attachment B for this purpose. Please note that only statements of disapproval need be registered and if you do not reply it will be assumed that you do not disapprove of the amendment;
- b) that before 18 October 2010 you inform me of the following, using the form in Attachment C for this purpose:
  - 1) any differences that will exist on 18 November 2010 between the national regulations or practices of your Government and the provisions of the whole of Annex 6, Part II, as amended by all amendments up to and including Amendment 29, and thereafter of any further differences that may arise; and

- 2) the date or dates by which your Government will have complied with the provisions of the whole of Annex 6, Part II, as amended by all amendments up to and including Amendment 29.

11. With reference to the request in paragraph 10 a) above, it should be noted that a registration of disapproval of Amendment 29 or any part of it in accordance with Article 90 of the Convention does not constitute a notification of differences under Article 38 of the Convention. To comply with the latter provision, a separate statement is necessary if any differences do exist, as requested in paragraph 10 b) 1). It is recalled in this respect that international Standards in Annexes have a conditional binding force, to the extent that the State or States concerned have not notified any difference thereto under Article 38 of the Convention.

12. Guidance on the determination and reporting of differences is given in the Note on the Notification of Differences in Attachment D.

13. Please note that a detailed repetition of previously notified differences, if they continue to apply, may be avoided by stating the current validity of such differences.

14. I would appreciate it if you would also send a copy of your notifications, referred to in paragraph 10 b) above, to the ICAO Regional Office accredited to your Government.

15. As soon as practicable after the amendment becomes effective, on 12 July 2010, replacement pages incorporating Amendment 29 will be forwarded to you.

Accept, Sir/Madam, the assurances of my highest consideration.



Raymond Benjamin  
Secretary General

**Enclosures:**

- A — Amendment to the Foreword of Annex 6, Part II
- B — Form on notification of disapproval of all or part of Amendment 29 to Annex 6, Part II
- C — Form on notification of compliance with or differences from Annex 6, Part II
- D — Note on the Notification of Differences

ATTACHMENT A to State letter AN 11/6.3.23-10/22

**AMENDMENT TO THE FOREWORD OF ANNEX 6, PART II**

*Add* the following at the end of Table A:

<i>Amendment</i>	<i>Source(s)</i>	<i>Subject</i>	<i>Adopted/Approved Effective Applicable</i>
29	Secretariat, with the assistance of the Separation and Airspace Safety Panel (SASP); ninth meeting of the Operations Panel Working Group of the Whole (OPSP/WGWHL/9); twelfth meeting of the Airworthiness Panel Working Group of the Whole (AIRP/WG/WHL/12); Secretariat, with the assistance of the second meeting of the Flight Recorder Panel Working Group of the Whole (FLIRECP/WG/WHL/2)	<ul style="list-style-type: none"> <li>a) amendment to the provisions concerning reduced vertical separation minimum (RVSM) long-term monitoring requirements;</li> <li>b) new provisions for head-up displays (HUD)/enhanced vision systems (EVS) requirements;</li> <li>c) amendment to provisions to provide consistency in propulsion terminology; and</li> <li>d) new and updated provisions regarding flight recorders.</li> </ul>	<p>26 February 2010 12 July 2010 18 November 2010</p>

-----

ATTACHMENT B to State letter AN 11/6.3.23-10/22

NOTIFICATION OF DISAPPROVAL OF ALL OR PART OF  
AMENDMENT 29 TO ANNEX 6, PART II

To: The Secretary General  
International Civil Aviation Organization  
999 University Street  
Montreal, Quebec  
Canada H3C 5H7

(State) \_\_\_\_\_ hereby wishes to disapprove the following parts of  
Amendment 29 to Annex 6, Part II:

Signature \_\_\_\_\_

Date \_\_\_\_\_

*NOTES*

- 1) If you wish to disapprove all or part of Amendment 29 to Annex 6, Part II, please dispatch this notification of disapproval to reach ICAO Headquarters by 12 July 2010. If it has not been received by that date it will be assumed that you do not disapprove of the amendment. **If you approve of all parts of Amendment 29, it is not necessary to return this notification of disapproval.**
- 2) This notification should not be considered a notification of compliance with or differences from Annex 6, Part II. Separate notifications on this are necessary. (See Attachment C.)
- 3) Please use extra sheets as required.

\_\_\_\_\_

ATTACHMENT C to State letter AN 11/6.3.23-10/22

**NOTIFICATION OF COMPLIANCE WITH OR DIFFERENCES FROM  
ANNEX 6, PART II  
(Including all amendments up to and including Amendment 29)**

To: The Secretary General  
International Civil Aviation Organization  
999 University Street  
Montreal, Quebec  
Canada H3C 5H7

1. No differences will exist on \_\_\_\_\_ between the national regulations and/or practices of **(State)** \_\_\_\_\_ and the provisions of Annex 6, Part II, including all amendments up to and including Amendment 29.

2. The following differences will exist on \_\_\_\_\_ between the regulations and/or practices of **(State)** \_\_\_\_\_ and the provisions of Annex 6, Part II, including Amendment 29 (Please see Note 3) below.)

<b>a) Annex Provision</b> (Please give exact paragraph reference)	<b>b) Difference Category</b> (Please indicate A, B, or C)	<b>c) Details of Difference</b> (Please describe the difference clearly and concisely)	<b>d) Remarks</b> (Please indicate reasons for the difference)
--	---	---	---

(Please use extra sheets as required)

3. By the dates indicated below, **(State)** \_\_\_\_\_ will have complied with the provisions of Annex 6, Part II, including all amendments up to and including Amendment 29 for which differences have been notified in 2 above.

<b>a) Annex Provision</b> (Please give exact paragraph reference)	<b>b) Date</b>	<b>c) Comments</b>
--	----------------	--------------------

(Please use extra sheets as required)

Signature \_\_\_\_\_

Date \_\_\_\_\_

*NOTES*

- 1) If paragraph 1 above is applicable to you, please complete paragraph 1 and return this form to ICAO Headquarters. If paragraph 2 is applicable to you, please complete paragraphs 2 and 3 and return the form to ICAO Headquarters.
- 2) Please dispatch the form to reach ICAO Headquarters by 18 October 2010.
- 3) A detailed repetition of previously notified differences, if they continue to apply, may be avoided by stating the current validity of such differences.
- 4) Guidance on the notification of differences from Annex 6, Part II is provided in the Note on the Notification of Differences at Attachment D.
- 5) Please send a copy of this notification to the ICAO Regional Office accredited to your Government.

-----

**NOTE ON THE NOTIFICATION OF DIFFERENCES TO ANNEX 6, PART II  
AND FORM OF NOTIFICATION**

*(Prepared and issued in accordance with instructions of the Council)*

1. *Introduction*

1.1 The Assembly and the Council, when reviewing the notification of differences by States in compliance with Article 38 of the Convention, have repeatedly noted that the state of such reporting is not entirely satisfactory.

1.2 With a view to achieving a more comprehensive coverage, this note is issued to facilitate the determination and reporting of such differences and to state the primary purpose of such reporting.

1.3 The primary purpose of reporting of differences is to promote safety and efficiency in air navigation by ensuring that governmental and other agencies, including operators and service providers, concerned with international civil aviation are made aware of all national regulations and practices in so far as they differ from those prescribed in the ICAO Standards.

1.4 Contracting States are, therefore, requested to give particular attention to the notification before 18 October 2010 of differences with respect to Standards in Annex 6, Part II. The Council has also urged Contracting States to extend the above considerations to Recommended Practices.

1.5 Contracting States are asked to note further that it is necessary to make an explicit statement of intent to comply where such intent exists, or where such is not the intent, of the difference or differences that will exist. This statement should be made not only to the latest amendment but to the whole Annex, including the amendment.

1.6 If previous notifications have been made in respect of this Annex, detailed repetition may be avoided, if appropriate, by stating the current validity of the earlier notification. States are requested to provide updates of the differences previously notified after each amendment, as appropriate, until the difference no longer exists.

2. *Notification of differences to Annex 6, Part II, including Amendment 29*

2.1 Past experience has indicated that the reporting of differences to Annex 6, Part II has in some instances been too extensive since some appear merely to be a different manner of expressing the same intent.

2.2 Guidance to Contracting States in the reporting of differences to Annex 6, Part II can only be given in very general terms. Where the national regulations of States call for compliance with procedures that are not identical but essentially similar to those contained in the Annex, no difference should be reported since the details of the procedures existing are the subject of notification through the medium of aeronautical information publications. Although differences to Recommended Practices are not notifiable under Article 38 of the Convention, Contracting States are urged to notify the Organization of the differences between their national regulations and practices and any corresponding Recommended Practices contained in an Annex. States should categorize each difference notified on the basis of whether the corresponding national regulation is:

- a) ***More exacting or exceeds the ICAO Standard or Recommended Practice (SARP) (Category A)***. This category applies when the national regulation is more demanding than the corresponding SARP, or imposes an obligation within the scope of the Annex which is not covered by a SARP. This is of particular importance where a State requires a higher standard which affects the operation of aircraft of other Contracting States in and above its territory;
- b) ***Different in character or other means of compliance (Category B)\****. This category applies when the national regulation is different in character from the corresponding ICAO SARP, or when the national regulation differs in principle, type or system from the corresponding SARP, without necessarily imposing an additional obligation; and
- c) ***Less protective or partially implemented/not implemented (Category C)***. This category applies when the national regulation is less protective than the corresponding SARP; or when no national regulation has been promulgated to address the corresponding SARP, in whole or in part.

2.3 When a Contracting State deems an ICAO Standard concerning aircraft, operations, equipment, personnel, or air navigation facilities or services to be not applicable to the existing aviation activities of the State, notification of a difference is not required. For example, a Contracting State that is not a State of Design or Manufacture and that does not have any national regulations on the subject, would not be required to notify differences to Annex 8 provisions related to the design and construction of an aircraft.

2.4 For States that have already fully reported differences from Annex 6, Part II or have reported that no differences exist, the reporting of any further differences occasioned by the amendment should be relatively straightforward; however, attention is called to paragraph 1.5 wherein it is indicated that this statement should be not only to the latest amendment but to the whole Annex, including the amendment.

### 3. *Form of notification of differences*

3.1 Differences should be notified in the following form:

- a) *Reference*: The number of the paragraph or subparagraph in Annex 6, Part II as amended which contains the Standard or Recommended Practice to which the difference relates;
- b) *Category*: Indicate the category of the difference as A, B or C in accordance with paragraph 2.2 above;
- c) *Description of the difference*: Clearly and concisely describe the difference and its effect; and

---

\* The expression “different in character or other means of compliance” in b) would be applied to a national regulation which achieves, by other means, the same objective as that of the corresponding ICAO SARPs and so cannot be classified under a) or c).

- d) *Remarks:* Under “Remarks” indicate reasons for the difference and intentions including any planned date for implementation.

3.2 The differences notified will be recorded in a Supplement to the Annex, normally in the terms used by the Contracting State when making the notification. In the interest of making the supplement as useful as possible, please make statements as clear and concise as possible and confine remarks to essential points. Comments on implementation, in accordance with paragraph 4 b) 2) of the Resolution of Adoption, should not be combined with those concerning differences. The provision of extracts from national regulations cannot be considered as sufficient to satisfy the obligation to notify differences. General comments that do not relate to specific differences will not be published in Supplements.

— END —

**AMENDMENT No. 29**

**TO THE**

**INTERNATIONAL STANDARDS  
AND RECOMMENDED PRACTICES**

# **OPERATION OF AIRCRAFT**

**ANNEX 6**

**TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION**

**PART II**

**INTERNATIONAL GENERAL AVIATION — AEROPLANES**

The amendment to Annex 6, Part II, contained in this document was adopted by the Council of ICAO on **26 February 2010**. Such parts of this amendment as have not been disapproved by more than half of the total number of Contracting States on or before **12 July 2010** will become effective on that date and will become applicable on **18 November 2010** as specified in the Resolution of Adoption. (State letter AN 11/6.3.23–10/22 refers.)

**FEBRUARY 2010**

**INTERNATIONAL CIVIL AVIATION ORGANIZATION**



**AMENDMENT 29 TO THE INTERNATIONAL STANDARDS AND  
RECOMMENDED PRACTICES**

**OPERATION OF AIRCRAFT — INTERNATIONAL GENERAL  
AVIATION — AEROPLANES**

**RESOLUTION OF ADOPTION**

*The Council*

Acting in accordance with the Convention on International Civil Aviation, and particularly with the provisions of Articles 37, 54 and 90 thereof,

1. *Hereby adopts* on 26 February 2010 Amendment 29 to the International Standards and Recommended Practices contained in the document entitled *International Standards and Recommended Practices, Operation of Aircraft, International General Aviation — Aeroplanes* which for convenience is designated Annex 6, Part II to the Convention;

2. *Prescribes* 12 July 2010 as the date upon which the said amendment shall become effective, except for any part thereof in respect of which a majority of the Contracting States have registered their disapproval with the Council before that date;

3. *Resolves* that the said amendment or such parts thereof as have become effective shall become applicable on 18 November 2010;

4. *Requests the Secretary General:*

a) to notify each Contracting State immediately of the above action and immediately after 12 July 2010 of those parts of the amendment which have become effective;

b) to request each Contracting State:

1) to notify the Organization (in accordance with the obligation imposed by Article 38 of the Convention) of the differences that will exist on 18 November 2010 between its national regulations or practices and the provisions of the Standards in the Annex as hereby amended, such notification to be made before 18 October 2010, and thereafter to notify the Organization of any further differences that arise;

2) to notify the Organization before 18 October 2010 of the date or dates by which it will have complied with the provisions of the Standards in the Annex as hereby amended;

c) to invite each Contracting State to notify additionally any differences between its own practices and those established by the Recommended Practices, when the notification of such differences is important for the safety of air navigation, following the procedure specified in subparagraph b) above with respect to differences from Standards.

-----

**NOTES ON THE PRESENTATION OF THE  
AMENDMENT TO ANNEX 6, PART II**

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1. ~~Text to be deleted is shown with a line through it.~~ text to be deleted
2. New text to be inserted is highlighted with grey shading. new text to be inserted
3. ~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading. new text to replace existing text

**TEXT OF AMENDMENT 29 TO THE**  
**INTERNATIONAL STANDARDS**  
**AND RECOMMENDED PRACTICES**  
**OPERATION OF AIRCRAFT**  
**ANNEX 6**  
**TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION**  
**PART II**  
**INTERNATIONAL GENERAL AVIATION — AEROPLANES**

...

---

*Editorial Note.*— Replace the words “power-unit” or “power-units” and “powerplant” or “powerplants” to “engine” or “engines” in all instances in Annex 6, Part II.

---

...

**SECTION 1**  
**GENERAL**

**CHAPTER 1.1 DEFINITIONS**

---

*Insert new definitions as follows:*

---

...

***Airworthy.*** The status of an aircraft, engine, propeller or part when it conforms to its approved design and is in a condition for safe operation.

...

***Continuing airworthiness.*** The set of processes by which all aircraft comply with the applicable airworthiness requirements and remain in a condition for safe operation throughout their operating life.

...

***Engine.*** A unit used or intended to be used for aircraft propulsion. It consists of at least those components and equipment necessary for functioning and control, but excludes the propeller/rotors (if applicable).

...

***Enhanced vision system (EVS).*** A system to display electronic real-time images of the external scene achieved through the use of image sensors.

...

**Head-up display (HUD).** A display system that presents flight information into the pilot's forward external field of view.

...

## SECTION 2 GENERAL AVIATION OPERATIONS

...

### CHAPTER 2.2 FLIGHT OPERATIONS

...

#### 2.2.2 Operational management

...

##### 2.2.2.2 Aerodrome operating minima

The pilot-in-command shall not operate to or from an aerodrome using operating minima lower than those which may be established for that aerodrome by the State in which it is located, except with the specific approval of that State.

*Note 1.— It is the practice in some States to declare, for flight planning purposes, higher minima for an aerodrome when nominated as an alternate, than for the same aerodrome when planned as that of intended landing.*

*Note 2.— The use of head-up displays (HUD) or enhanced vision systems (EVS) may allow operations with lower visibilities than normally associated with the aerodrome operating minima.*

...

### CHAPTER 2.4 AEROPLANE INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS

...

#### 2.4.15 Aeroplanes equipped with head-up displays (HUD) and/or enhanced vision systems (EVS)

...

Where aeroplanes are equipped with HUD and/or EVS, the use of such systems to gain operational benefits shall be approved by the State of Registry.

*Note.— Guidance on HUD and EVS is contained in Attachment J to Annex 6, Part I.*

...

### CHAPTER 2.5 AEROPLANE COMMUNICATION AND NAVIGATION EQUIPMENT

...

#### 2.5.2 Navigation equipment

...

2.5.2.4 For flights in defined portions of airspace where, based on regional air navigation agreement,

a reduced vertical separation minimum (RVSM) of 300 m (1 000 ft) is applied between FL 290 and FL 410 inclusive, an aeroplane:

- a) shall be provided with equipment which is capable of:
  - 1) indicating to the flight crew the flight level being flown;
  - 2) automatically maintaining a selected flight level;
  - 3) providing an alert to the flight crew when a deviation occurs from the selected flight level. The threshold for the alert shall not exceed  $\pm 90$  m (300 ft); and
  - 4) automatically reporting pressure-altitude; ~~and~~
- b) shall be authorized by the State of Registry for operation in the airspace concerned; and
- c) shall demonstrate a vertical navigation performance in accordance with Appendix 2.

...

2.5.2.7 The State of the Operator that has issued an RVSM approval to an operator shall establish a requirement which ensures that a minimum of two aeroplanes of each aircraft type grouping of the operator have their height-keeping performance monitored, at least once every two years or within intervals of 1 000 flight hours per aeroplane, whichever period is longer. If an operator aircraft type grouping consists of a single aeroplane, monitoring of that aeroplane shall be accomplished within the specified period.

*Note.— Monitoring data from any regional monitoring programme established in accordance with Annex 11, 3.3.5.2, may be used to satisfy the requirement.*

2.5.2.78 All States that are responsible for airspace where RVSM has been implemented, or that have issued RVSM approvals to operators within their State, shall establish provisions and procedures which ensure that appropriate action will be taken in respect of aircraft and operators found to be operating in RVSM airspace without a valid RVSM approval.

*Note 1.— These provisions and procedures need to address both the situation where the aircraft in question was operating without approval in the airspace of the State, and the situation where an operator for which the State has regulatory oversight responsibility is found to be operating without the required approval in the airspace of another State.*

*Note 2.— Guidance material relating to the approval for operation in RVSM airspace is contained in the Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574).*

2.5.2.89 The aeroplane shall be sufficiently provided with navigation equipment to ensure that, in the event of the failure of one item of equipment at any stage of the flight, the remaining equipment will enable the aeroplane to navigate in accordance with 2.5.2.1 and where applicable 2.5.2.2, 2.5.2.3 and 2.5.2.4.

*Note 1.— This requirement may be met by means other than the duplication of equipment.*

*Note 2.— Guidance material relating to aircraft equipment necessary for flight in airspace where a 300 m (1 000 ft) VSM is applied above FL 290 is contained in the Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574).*

2.5.2.910 On flights in which it is intended to land in instrument meteorological conditions, an aeroplane shall be provided with radio equipment capable of receiving signals providing guidance to a point from which a visual landing can be effected. This equipment shall be capable of providing such guidance for each aerodrome at which it is intended to land in instrument meteorological conditions and for any designated alternate aerodromes.

...

### SECTION 3 LARGE AND TURBOJET AEROPLANES

...

#### CHAPTER 3.4 FLIGHT OPERATIONS

...

##### 3.4.2 Operational management

...

##### 3.4.2.7 Aerodrome operating minima

An operator shall ensure that no pilot-in-command operates to or from an aerodrome using operating minima lower than those which may be established for that aerodrome by the State in which it is located, except with the specific approval of that State.

*Note 1.— It is the practice in some States to declare, for flight planning purposes, higher minima for an aerodrome when nominated as an alternate, than for the same aerodrome when planned as that of intended landing.*

*Note 2.— The use of head-up displays (HUD) or enhanced vision systems (EVS) may allow operations with lower visibilities than normally associated with the aerodrome operating minima.*

...

### CHAPTER 3.6 AEROPLANE INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS

...

#### 3.6.3 Flight recorders

*Note 1.— ~~Crash protected flight recorders comprise two four systems: a flight data recorder and (FDR), a cockpit voice recorder (CVR), an airborne image recorder (AIR) and a data link recorder (DLR). Image and data link information may be recorded on either the CVR or the FDR.~~*

*Note 2.— ~~Combination recorders (FDR/CVR) can only be used to meet the flight recorder equipage requirements as specifically indicated in this Annex. Lightweight flight recorders comprise four systems: an aircraft data recording system (ADRS), a cockpit audio recording system (CARS), an airborne image recording system (AIRS) and a data link recording system (DLRS). Image and data link information may be recorded on either the CARS or the ADRS.~~*

*Note 3.— Detailed guidance on flight recorders is contained in Attachment 3-C Appendix 3.1.*

### 3.6.3.1 Flight data recorders—types and aircraft data recording systems

*Note 1.— FDR and AIR performance requirements are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

*Note 2.— ADRS performance requirements are as contained in the EUROCAE ED-155, Minimum Operational Performance Specification (MOPS) for Lightweight Flight Recorder Systems, or equivalent documents.*

*Note 3.— Parameters to be recorded are listed in Tables A3.1-1 and A3.1-3 of Appendix 3.1.*

#### 3.6.3.1.1 Types

3.6.3.1.1.1 ~~A Type I flight data recorder~~ Types I and IA FDRs shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power, configuration and operation.

3.6.3.1.1.2 ~~A Type II flight data recorder~~ Type II FDRs shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power and configuration of lift and drag devices.

---

*Editorial Note.— Paragraphs 3.6.3.1.3 and 3.6.3.1.4 have been relocated to paragraphs 3.6.3.1.3.1 and 3.6.3.1.3.2.*

---

~~3.6.3.1.3 The use of engraving metal foil flight data recorders shall be discontinued by 1 January 1995.~~

~~3.6.3.1.4 **Recommendation.**— The use of analogue flight data recorders using frequency modulation (FM) should be discontinued by 5 November 1998.~~

---

*Editorial Note.— Paragraph 3.6.3.1.4.1 has been relocated to paragraph 3.6.3.1.3.4.*

---

~~3.6.3.1.4.1 The use of photographic film flight data recorders shall be discontinued from 1 January 2003.~~

---

*Editorial Note.— Paragraph 3.6.3.1.5 has been relocated to paragraph 3.6.3.3.1.1.*

---

~~3.6.3.1.5 All aeroplanes for which the individual certificate of airworthiness is first issued after 1 January 2005, which utilize data link communications and are required to carry a cockpit voice recorder (CVR), shall record on a flight recorder, all data link communications to and from the aeroplane. The minimum recording duration shall be equal to the duration of the CVR, and shall be correlated to the recorded cockpit audio.~~

~~3.6.3.1.5.1 From 1 January 2007, all aeroplanes which utilize data link communications and are required to carry a CVR, shall record on a flight recorder, all data link communications to and from the aeroplane. The minimum recording duration shall be equal to the duration of the CVR, and shall be correlated to the recorded cockpit audio.~~

~~— 3.6.3.1.5.2 Sufficient information to derive the content of the data link communications message, and, whenever practical, the time the message was displayed to or generated by the crew shall be recorded.~~

~~— Note.— Data link communications include, but are not limited to, automatic dependent surveillance contract (ADS-C), controller-pilot data link communications (CPDLC), data link flight information services (D-FIS) and aeronautical operational control (AOC) messages.~~

~~— 3.6.3.1.6 **Recommendation.**— All aeroplanes of a maximum certificated take-off mass over 5 700 kg, required to be equipped with a flight data recorder and a cockpit voice recorder, may alternatively be equipped with two combination recorders (FDR/CVR).~~

~~— 3.6.3.1.7 **Recommendation.**— All aeroplanes of a maximum certificated take-off mass of 5 700 kg or less, required to be equipped with a flight data recorder and/or a cockpit voice recorder, may alternatively be equipped with one combination recorder (FDR/CVR).~~

---

*Editorial Note.*— Paragraph 3.6.3.1.8 has been *relocated* to 2.2.2 of Appendix 3.1.

---

~~— 3.6.3.1.8 A Type IA flight data recorder shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power, configuration and operation. The parameters that satisfy the requirements for a Type IA flight data recorder are listed in the paragraphs below. The parameters without an asterisk (\*) are mandatory parameters which shall be recorded. In addition, the parameters designated by an asterisk (\*) shall be recorded if an information data source for the parameter is used by aeroplane systems or the flight crew to operate the aeroplane.~~

~~— 3.6.3.1.8.1 The following parameters satisfy the requirements for flight path and speed:~~

- ~~— Pressure altitude~~
- ~~— Indicated airspeed or calibrated airspeed~~
- ~~— Air-ground status and each landing gear air-ground sensor when practicable~~
- ~~— Total or outside air temperature~~
- ~~— Heading (primary flight crew reference)~~
- ~~— Normal acceleration~~
- ~~— Lateral acceleration~~
- ~~— Longitudinal acceleration (body axis)~~
- ~~— Time or relative time count~~
- ~~— Navigation data\*: drift angle, wind speed, wind direction, latitude/longitude~~
- ~~— Groundspeed\*~~
- ~~— Radio altitude\*~~

~~— 3.6.3.1.8.2 The following parameters satisfy the requirements for attitude:~~

- ~~— Pitch attitude~~
- ~~— Roll attitude~~
- ~~— Yaw or sideslip angle\*~~
- ~~— Angle of attack\*~~

~~3.6.3.1.8.3 The following parameters satisfy the requirements for engine power:~~

- ~~— Engine thrust/power: propulsive thrust/power on each engine, cockpit thrust/power lever position~~
- ~~— Thrust reverse status\*~~

- Engine thrust command\*
- Engine thrust target\*
- Engine bleed valve position\*
- Additional engine parameters\*: EPR,  $N_1$ , indicated vibration level,  $N_2$ , EGT, TLA, fuel flow, fuel cut off lever position,  $N_3$

— 3.6.3.1.8.4 The following parameters satisfy the requirements for configuration:

- Pitch trim surface position
- Flaps\*: trailing edge flap position, cockpit control selection
- Slats\*: leading edge flap (slat) position, cockpit control selection
- Landing gear\*: landing gear, gear selector position
- Yaw trim surface position\*
- Roll trim surface position\*
- Cockpit trim control input position pitch\*
- Cockpit trim control input position roll\*
- Cockpit trim control input position yaw\*
- Ground spoiler and speed brake\*: ground spoiler position, ground spoiler selection, speed brake position, speed brake selection
- De-icing and/or anti-icing systems selection\*
- Hydraulic pressure (each system)\*
- Fuel quantity\*
- AC electrical bus status\*
- DC electrical bus status\*
- APU bleed valve position\*
- Computed centre of gravity\*

3.6.3.1.8.5 The following parameters satisfy the requirements for operation:

- Warnings
- Primary flight control surface and primary flight control pilot input: pitch axis, roll axis, yaw axis
- Marker beacon passage
- Each navigation receiver frequency selection
- Manual radio transmission keying and CVR/FDR synchronization reference
- Autopilot/autothrottle/AFCS mode and engagement status\*
- Selected barometric setting\*: pilot, first officer
- Selected altitude (all pilot selectable modes of operation)\*
- Selected speed (all pilot selectable modes of operation)\*
- Selected mach (all pilot selectable modes of operation)\*
- Selected vertical speed (all pilot selectable modes of operation)\*
- Selected heading (all pilot selectable modes of operation)\*
- Selected flight path (all pilot selectable modes of operation)\*: course/DSTRK, path angle
- Selected decision height\*
- EFIS display format\*: pilot, first officer
- Multi-function/engine/alerts display format\*
- GPWS/TAWS/GCAS status\*: selection of terrain display mode including pop up display status, terrain alerts, both cautions and warnings, and advisories, on/off switch position
- Low pressure warning\*: hydraulic pressure, pneumatic pressure
- Computer failure\*
- Loss of cabin pressure\*

- TCAS/ACAS (traffic alert and collision avoidance system/airborne collision avoidance system)\*
- Ice detection\*
- Engine warning each engine vibration\*
- Engine warning each engine over temperature\*
- Engine warning each engine oil pressure low\*
- Engine warning each engine over speed\*
- Wind shear warning\*
- Operational stall protection, stick shaker and pusher activation\*
- All cockpit flight control input forces\*: control wheel, control column, rudder pedal cockpit input forces
- Vertical deviation\*: ILS glide path, MLS elevation, GNSS approach path
- Horizontal deviation\*: ILS localizer, MLS azimuth, GNSS approach path
- DME 1 and 2 distances\*
- Primary navigation system reference\*: GNSS, INS, VOR/DME, MLS, Loran C, ILS
- Brakes\*: left and right brake pressure, left and right brake pedal position
- Date\*
- Event marker\*
- Head up display in use\*
- Para visual display on\*

— *Note 1.* *Parameter requirements, including range, sampling, accuracy and resolution, are as contained in the Minimum Operational Performance Specification (MOPS) document for Flight Recorder Systems of the European Organization for Civil Aviation Equipment (EUROCAE) or equivalent documents.*

— *Note 2.* *The number of parameters to be recorded will depend on aeroplane complexity. Parameters without an (\*) are to be recorded regardless of aeroplane complexity. Those parameters designated by an (\*) are to be recorded if an information source for the parameter is used by aeroplane systems and/or flight crew to operate the aeroplane.*

### 3.6.3.1.2 Operation

*Note.*— Airborne image recorders classification is defined in 4.1 of Appendix 3.1.

3.6.3.1.2.1 **Recommendation.**— All turbine-engined aeroplanes of a maximum certificated take-off mass of 5 700 kg or less for which the individual certificate of airworthiness is first issued on or after 1 January 2016 should be equipped with:

- a) a Type II FDR; or
- b) a Class C AIR capable of recording flight path and speed parameters displayed to the pilot(s); or
- c) an ADRS capable of recording the essential parameters defined in Table A3.1-3 of Appendix 3.1.

---

*Editorial Note.*— Paragraph 3.6.3.2 has been relocated to paragraph 3.6.3.1.4.

---

### 3.6.3.2 Flight data recorders—duration

Types I and II flight data recorders shall be capable of retaining the information recorded during at least the last 25 hours of their operation.

~~3.6.3.3 Flight data recorders — aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1989~~

---

*Editorial Note.*— Paragraphs 3.6.3.3.1 and 3.6.3.3.2 have been *relocated* to paragraphs 3.6.3.1.2.3 and 3.6.3.1.2.4 respectively.

---

~~3.6.3.3.1 All aeroplanes of a maximum certificated take-off mass of over 27 000 kg shall be equipped with a Type I flight data recorder.~~

~~3.6.3.3.2 **Recommendation.**— All aeroplanes of a maximum certificated take-off mass of over 5 700 kg up to and including 27 000 kg should be equipped with a Type II flight data recorder.~~

3.6.3.4 Flight data recorders — aeroplanes for which the individual certificate of airworthiness is first issued after 1 January 2005

3.6.3.1.2.2 All aeroplanes of a maximum certificated take-off mass of over 5 700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2005 shall be equipped with a Type IA flight data recorder FDR.

---

*Editorial Note.*— Paragraphs 3.6.3.1.2.3 and 3.6.3.1.2.4 were previously paragraphs 3.6.3.3.1 and 3.6.3.3.2 respectively.

---

~~3.6.3.3.1-3.6.3.1.2.3 All aeroplanes of a maximum certificated take-off mass of over 27 000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1989 shall be equipped with a Type I flight data recorder FDR.~~

~~3.6.3.3.2-3.6.3.1.2.4 **Recommendation.**— All aeroplanes of a maximum certificated take-off mass of over 5 700 kg, up to and including 27 000 kg, for which the individual certificate of airworthiness is first issued on or after 1 January 1989, should be equipped with a Type II flight data recorder FDR.~~

3.6.3.1.2.5 All aeroplanes for which a type certificate is first issued on or after 1 January 2016 and which are required to be fitted with an FDR, shall record the following parameters at a maximum recording interval of 0.125 seconds:

- Pilot input and/or control surface position – primary controls (pitch, roll, yaw).

*Note 1.*— For aeroplanes with control systems in which movement of a control surface will back drive the pilot's control, "or" applies. For aeroplanes with control systems in which movement of a control surface will not back drive the pilot's control, "and" applies. In aeroplanes with independent moveable surfaces, each surface needs to be recorded separately. In aeroplanes with independent pilot input on primary controls, each pilot input on primary controls needs to be recorded separately.

*Note 2.*— Type certificate first issued refers to the date of issuance of the original "Type Certificate" for the aeroplane type, not the date of certification of particular aeroplane variation or derivative models.

### 3.6.3.1.3 Discontinuation

---

*Editorial Note.*— Paragraphs 3.6.3.1.3.1 and 3.6.3.1.3.2 were previously paragraphs 3.6.3.1.3 and 3.6.3.1.4 respectively.

---

~~3.6.3.1.3~~ ~~3.6.3.1.3.1~~ The use of engraving ~~Engraving~~ metal foil flight data recorders ~~FDRs~~ shall be discontinued by 1 January 1995.

~~3.6.3.1.4~~ ~~3.6.3.1.3.2~~ **Recommendation.**— ~~The use of analogue flight data recorders~~ ~~Analogue FDRs~~ using frequency modulation (FM) should be discontinued by ~~5 November 1998~~.

~~3.6.3.1.3.3~~ The use of analogue FDRs using frequency modulation (FM) shall be discontinued by 1 January 2012.

---

*Editorial Note.*— Paragraph 3.6.3.1.3.4 was previously paragraph 3.6.3.1.4.1.

---

~~3.6.3.1.4.1~~ ~~3.6.3.1.3.4~~ The use of photographic film flight data recorders ~~FDRs~~ shall be discontinued from 1 January 2003.

~~3.6.3.1.3.5~~ **Recommendation.**— ~~The use of magnetic tape FDRs should be discontinued by 1 January 2011.~~

~~3.6.3.1.3.6~~ The use of magnetic tape FDRs shall be discontinued by 1 January 2016.

---

*Editorial Note.*— Paragraph 3.6.3.1.4 was previously paragraph 3.6.3.2.

---

~~3.6.3.2~~ ~~3.6.3.1.4~~ Flight data recorders — ~~duration~~ ~~Duration~~

~~Types I and II flight data recorders~~ All FDRs shall be capable of retaining the information recorded during at least the last 25 hours of their operation.

~~3.6.3.5~~ Cockpit voice recorders — aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1987

### 3.6.3.2 Cockpit voice recorders and cockpit audio recording systems

*Note 1.*— ~~Cockpit voice recorder~~ CVR performance requirements are as contained in the ~~EUROCAE ED-112 Minimum Operational Performance Specification (MOPS) document for Flight Recorder Systems of the European Organization for Civil Aviation Equipment (EUROCAE) for Crash Protected Airborne Recorder Systems~~, or equivalent documents.

*Note 2.*— CARS performance requirements are as contained in the EUROCAE ED-155, Minimum Operational Performance Specification (MOPS) for Lightweight Flight Recorder Systems, or equivalent documents.

#### 3.6.3.2.1 Operation

3.6.3.2.1.1 All turbine-engined aeroplanes for which a type certificate is first issued on or after 1 January 2016 and required to be operated by more than one pilot shall be equipped with either a CVR or a CARS.

**3.6.3.2.1.2 Recommendation.**— *All turbine-engined aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 2016 and required to be operated by more than one pilot should be equipped with either a CVR or a CARS.*

~~3.6.3.5.1~~ **3.6.3.2.1.3** All aeroplanes of a maximum certificated take-off mass of over 27 000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1987 shall be equipped with a cockpit voice recorder, the objective of which is the recording of the aural environment on the flight deck during flight time CVR.

~~3.6.3.5.2~~ **3.6.3.2.1.4 Recommendation.**— *All aeroplanes of a maximum certificated take-off mass of over 5 700 kg, up to and including 27 000 kg, for which the individual certificate of airworthiness is first issued on or after 1 January 1987, should be equipped with a cockpit voice recorder, the objective of which is the recording of the aural environment on the flight deck during flight time CVR.*

### 3.6.3.2.2 Discontinuation

**3.6.3.2.2.1** The use of magnetic tape and wire CVRs shall be discontinued by 1 January 2016.

**3.6.3.2.2.2 Recommendation.**— *The use of magnetic tape and wire CVRs should be discontinued by 1 January 2011.*

### ~~3.6.3.6~~ **3.6.3.2.3** Cockpit voice recorders — duration ~~Duration~~

~~3.6.3.6.1~~ **3.6.3.2.3.1** ~~A cockpit voice recorder~~ All CVRs shall be capable of retaining the information recorded during at least the last 30 minutes of its ~~its~~ their operation.

~~3.6.3.6.2~~ **Recommendation.**— *A cockpit voice recorder, installed in aeroplanes of a maximum certificated take off mass of over 5 700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1990, should be capable of retaining the information recorded during at least the last two hours of its operation.*

~~3.6.3.6.3~~ A cockpit voice recorder, installed in aeroplanes of a maximum certificated take off mass of over 5 700 kg for which the individual certificate of airworthiness is first issued after 1 January 2003, shall be capable of retaining the information recorded during at least the last two hours of its operation.

**3.6.3.2.3.2** From 1 January 2016, all CVRs shall be capable of retaining the information recorded during at least the last two hours of their operation.

**3.6.3.2.3.3 Recommendation.**— *All aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1990, and that are required to be equipped with a CVR, should have a CVR capable of retaining the information recorded during at least the last two hours of their operation.*

### 3.6.3.3 Data link recorders

*Note.*— *Data link recorders performance requirements are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

### 3.6.3.3.1 Applicability

---

*Editorial Note.*— Paragraph 3.6.3.3.1.1 was previously paragraph 3.6.3.1.5.

---

~~3.6.3.1.5~~ 3.6.3.3.1.1 All aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 2005 2016, which utilize any of the data link communications applications listed in 5.1.2 of Appendix 3.1 and are required to carry a cockpit voice recorder (CVR), shall record on a flight recorder; all data link communications messages to and from the aeroplane. The minimum recording duration shall be equal to the duration of the CVR, and shall be correlated to the recorded cockpit audio.

3.6.3.3.1.2 All aeroplanes which are modified on or after 1 January 2016 to install and utilize any of the data link communications applications listed in 5.1.2 of Appendix 3.1 and are required to carry a CVR, shall record on a flight recorder the data link communications messages.

*Note 1.*— Data link communications are currently conducted by either ATN-based or FANS 1/A-equipped aircraft.

*Note 2.*— A Class B AIR could be a means for recording data link communications applications messages to and from the aeroplanes where it is not practical or is prohibitively expensive to record those data link communications applications messages on FDR or CVR.

### 3.6.3.3.2 Duration

The minimum recording duration shall be equal to the duration of the CVR.

### 3.6.3.3.3 Correlation

Data link recording shall be able to be correlated to the recorded cockpit audio.

## ~~3.6.3.7~~ 3.6.3.4 Flight recorders — construction and installation general

### 3.6.3.4.1 Construction and installation

Flight recorders shall be constructed, located and installed so as to provide maximum practical protection for the recordings in order that the recorded information may be preserved, recovered and transcribed. Flight recorders shall meet the prescribed crashworthiness and fire protection specifications.

*Note 1.*— Industry crashworthiness and fire protection specifications can be found in documents such as the European Organization for Civil Aviation Equipment (EUROCAE) documents ED55 and ED56A for FDR, CVR, AIR and DLR are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.

*Note 2.*— Industry crashworthiness and fire protection specifications for ADRS and CARS are as contained in the EUROCAE ED-155, Minimum Operational Performance Specifications (MOPS) for Lightweight Flight Recorder Systems, or equivalent documents.

### ~~3.6.3.8~~ 3.6.3.4.2 Flight recorders—~~operation~~Operation

~~3.6.3.8.1~~ 3.6.3.4.2.1 Flight recorders shall not be switched off during flight time.

~~3.6.3.8.2~~ 3.6.3.4.2.2 To preserve flight recorder records, flight recorders shall be deactivated upon completion of flight time following an accident or incident. The flight recorders shall not be reactivated before their disposition as determined in accordance with Annex 13.

*Note 1.— The need for removal of the flight recorder records from the aircraft will be determined by the investigation authority in the State conducting the investigation with due regard to the seriousness of an occurrence and the circumstances, including the impact on the operation.*

*Note 2.— The pilot-in-command's responsibilities regarding the retention of flight recorder records are contained in ~~3.6.3.9~~ 3.6.3.4.3.*

### ~~3.6.3.9~~ 3.6.3.4.3 Flight recorder records

The pilot-in-command, and/or the owner/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.

### ~~3.6.3.10~~ 3.6.3.4.4 Flight recorders—~~continued~~Continued serviceability

Operational checks and evaluations of recordings from the flight ~~data and cockpit voice~~ recorder systems shall be conducted to ensure the continued serviceability of the recorders.

*Note.— Procedures for the inspections of the flight ~~data and cockpit voice~~ recorder systems are given in Attachment 3.C Appendix 3.1.*

### 3.6.3.4.5 Flight recorder electronic documentation

**Recommendation.**— *The documentation requirement concerning FDR and ADRS parameters provided by operators to accident investigation authorities should be in electronic format and take account of industry specifications.*

*Note.— Industry specification for documentation concerning flight recorder parameters may be found in the ARINC 647A, Flight Recorder Electronic Documentation, or equivalent document.*

### 3.6.3.4.6 Combination recorders

**Recommendation.**— *All aeroplanes of a maximum certificated take-off mass over 5 700 kg, required to be equipped with an FDR and a CVR, may alternatively be equipped with two combination recorders (FDR/CVR).*

---

*Editorial Note.— Renumber subsequent paragraphs accordingly.*

---

...

## ATTACHMENT 3.A COMPANY OPERATIONS MANUAL

...

- r) use/protection of FDR/CVR records (where applicable); and
- s) handling of dangerous goods; and
- t) use of head-up displays (HUD)/enhanced vision systems (EVS).

...

## ATTACHMENT 3.C APPENDIX 3.1 FLIGHT RECORDERS

*Supplementary to 3.6.3 (Note.— See Chapter 3, 3.6.3)*

### Introduction

The material in this Attachment Appendix concerns flight recorders intended for installation in aeroplanes engaged in international air navigation. Crash protected flight recorders comprise two-four systems—: a flight data recorder and (FDR), a cockpit voice recorder (CVR), an airborne image recorder (AIR) and a data link recorder (DLR). Flight data recorders are classified as Type I, Type II and Type II-A depending upon the number of parameters to be recorded and the duration required for retention of the recorded information. Lightweight flight recorders comprise four systems: an aircraft data recording system (ADRS), a cockpit audio recording system (CARS), an airborne image recording system (AIRS) and a data link recording system (DLRS).

### 1. Flight data recorder (FDR) General requirements

#### 1.1 General requirements

---

*Editorial Note.— Paragraph 1.1.1 has been relocated to paragraph 2.1.*

---

—1.1.1 The FDR is to record continuously during flight time.

—1.1.2 1.1 The FDR container is to flight recorder systems containers shall:

- a) be painted a distinctive orange or yellow colour;
- b) carry reflective material to facilitate its their location; and
- c) have securely attached an automatically activated underwater locating device.

—1.1.3 1.2 The FDR is to flight recorder systems shall be installed so that:

- a) the probability of damage to the recording is recordings is minimized. To meet this requirement it should be located as far aft as practicable. In the case of pressurized aeroplanes it should be located in the vicinity of the rear pressure bulkhead;

- b) ~~it receives its~~ they receive electrical power from a bus that provides the maximum reliability for operation of the ~~FDR—flight recorder systems~~ without jeopardizing service to essential or emergency loads; ~~and~~
- c) there is an aural or visual means for pre-flight checking that the ~~FDR is—flight recorder systems~~ are operating properly; ~~and~~

---

*Editorial Note.*— Sub-paragraph d) was previously sub-paragraph d) of 2.1.4.

---

- d) if the ~~CVR has~~ flight recorder systems have a bulk erasure device, the installation ~~should~~ shall be designed to prevent operation of the device during flight time or crash impact.

---

*Editorial Note.*— Paragraphs 1.3 and 1.4 were previously paragraphs 2.2.3 and 2.2.4 respectively.

---

~~2.2.3-1.3~~ 1.3 The ~~CVR~~ flight recorder systems, when tested by methods approved by the appropriate certificating authority, ~~will~~ shall be demonstrated to be suitable for the environmental extremes over which ~~it is~~ they are designed to operate.

~~2.2.4-1.4~~ 1.4 Means ~~will~~ shall be provided for an accurate time correlation between the ~~FDR and CVR~~ recorder systems recordings.

---

*Editorial Note.*— Paragraph 1.5 was previously paragraph 1.3.3.

---

~~1.3.3-1.5~~ 1.5 The manufacturer ~~usually provides~~ shall provide the ~~national~~ appropriate certificating authority with the following information in respect of the ~~FDR~~ flight recorder systems:

- a) manufacturer's operating instructions, equipment limitations and installation procedures; ~~and~~
- b) ~~parameter origin or source and equations which relate counts to units of measurement; and~~
- ~~e) manufacturer's test reports.~~

## **2. Flight data recorder (FDR)**

---

*Editorial Note.*— Paragraph 2.1 was previously paragraph 1.1.1.

---

~~1.1.1-2.1~~ 2.1 The ~~FDR is to~~ flight data recorder shall start to record prior to the aeroplane moving under its own power and record continuously until the termination of the flight when the aeroplane is no longer capable of moving under its own power ~~record continuously during flight time.~~

~~1.2-2.2~~ 2.2 Parameters to be recorded

2.2.1 Flight data recorders shall be classified as Type I, Type IA and Type II depending upon the number of parameters to be recorded.

---

*Editorial Note.*— Paragraph 2.2.2 was previously paragraph 3.6.3.1.8.

---

~~3.6.3.1.8.2.2.2~~ A Type IA flight data recorder shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power, configuration and operation. The parameters that satisfy the requirements for a Type IA flight data recorder FDRs are listed in the paragraphs below. The number of parameters to be recorded shall depend on aeroplane complexity. The parameters without an asterisk (\*) are mandatory parameters which shall be recorded regardless of aeroplane complexity. In addition, the parameters designated by an asterisk (\*) shall be recorded if an information data source for the parameter is used by aeroplane systems or the flight crew to operate the aeroplane. However, other parameters may be substituted with due regard to the aeroplane type and the characteristics of the recording equipment.

~~3.6.3.1.8.1.2.2.2.1~~ The following parameters shall satisfy the requirements for flight path and speed:

...

~~3.6.3.1.8.2.2.2.2~~ The following parameters shall satisfy the requirements for attitude:

...

~~3.6.3.1.8.3.2.2.2.3~~ The following parameters shall satisfy the requirements for engine power:

...

~~3.6.3.1.8.4.2.2.2.4~~ The following parameters shall satisfy the requirements for configuration:

...

- Ground spoiler and speed brake\*: ~~ground~~ Ground spoiler position, ground spoiler selection, speed brake position, speed brake selection
- De-icing and/or anti-icing systems selection\*
- Hydraulic pressure (each system)\*
- Fuel quantity in CG trim tank\*

...

~~3.6.3.1.8.5.2.2.2.5~~ The following parameters shall satisfy the requirements for operation:

...

- Selected ~~mach~~ Mach (all pilot selectable modes of operation)\*

...

*Note 1.— Parameter requirements, including guidance for range, sampling, accuracy and resolution, are as contained in the EUROCAE ED-112 Minimum Operational Performance Specification (MOPS) document for Flight Recorder Systems of the European Organization for Civil Aviation Equipment (EUROCAE) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

*Note 2.— The number of parameters to be recorded will depend on aeroplane complexity. Parameters without an (\*) are to be recorded regardless of aeroplane complexity. Those parameters designated by an (\*) are to be recorded if an information source for the parameter is used by aeroplane*

~~systems and/or flight crew to operate the aeroplane. It is not intended that aeroplanes issued with an individual certificate of airworthiness before 1 January 2016 be modified to meet the range, sampling, accuracy or resolution guidance detailed in this Appendix.~~

2.2.2.6 *Type IA FDR.* This FDR shall be capable of recording, as appropriate to the aeroplane, at least the 78 parameters in Table A3.1-1.

~~1.2.1~~ 2.2.2.7 *Type I FDR.* This FDR ~~will~~ shall be capable of recording, as appropriate to the aeroplane, at least the first 32 parameters in ~~Table 3.C-1~~ Table A3.1-1. However, other parameters may be substituted with due regard to the aeroplane type and the characteristics of the recording equipment.

~~1.2.2~~ 2.2.2.8 *Types II and IIA FDRs* ~~Type II FDR.~~ These FDRs ~~will~~ This FDR shall be capable of recording, as appropriate to the aeroplane, at least the first 15 parameters in ~~Table 3.C-1~~ Table A3.1-1. However, other parameters may be substituted with due regard to the aeroplane type and the characteristics of the recording equipment.

2.2.2.9 The parameters that satisfy the recommendations for flight path and speed as displayed to the pilot(s) are listed below. The parameters without an (\*) are mandatory parameters which shall be recorded. In addition, the parameters designated by an (\*) are to be recorded if an information source for the parameter is displayed to the pilot and is practicable to record:

- Pressure altitude
- Indicated airspeed or calibrated airspeed
- Heading (primary flight crew reference)
- Pitch attitude
- Roll attitude
- Engine thrust/power
- Landing gear status\*
- Total or outside air temperature\*
- Time\*
- Navigation data\*: Drift angle, wind speed, wind direction, latitude/longitude
- Radio altitude\*

### 1.3-2.3 Additional information

~~1.3.1~~ 2.3.1 A Type IIA FDR, in addition to a 30-minute recording duration, ~~is to~~ shall retain sufficient information from the preceding take-off for calibration purposes.

~~1.3.2~~ 2.3.2 The measurement range, recording interval and accuracy of parameters on installed equipment ~~are usually~~ shall be verified by methods approved by the appropriate certifying authority.

---

*Editorial Note.*— Paragraph 1.3.3 has been *relocated* to paragraph 1.5.

---

~~1.3.3~~ The manufacturer usually provides the national certifying authority with the following information in respect of the FDR:

- ~~a) manufacturer's operating instructions, equipment limitations and installation procedures;~~
- ~~b) parameter origin or source and equations which relate counts to units of measurement; and~~

— ~~e) manufacturer's test reports.~~

~~1.3.4.2.3.3~~ Documentation concerning parameter allocation, conversion equations, periodic calibration and other serviceability/ maintenance information ~~should~~ **shall** be maintained by the operator/owner. The documentation ~~must~~ **shall** be sufficient to ensure that accident investigation authorities have the necessary information to read out the data in engineering units.

## **2.3. Cockpit voice recorder (CVR) and cockpit audio recording system (CARS)**

### 2.1—General requirements

---

*Editorial Note.*— Paragraph 2.1.1 has been *relocated* to paragraph 3.1.1.

---

— ~~2.1.1 The CVR is to be designed so that it will record at least the following:~~

— ~~a) voice communication transmitted from or received in the aeroplane by radio;~~

— ~~b) aural environment on the flight deck;~~

— ~~c) voice communication of flight crew members on the flight deck using the aeroplane's interphone system;~~

— ~~d) voice or audio signals identifying navigation or approach aids introduced in the headset or speaker;~~

— ~~e) voice communication of flight crew members using the passenger address system, if installed; and~~

— ~~f) digital communications with ATS, unless recorded by the FDR.~~

— ~~2.1.2 The CVR container is to:~~

— ~~a) be painted a distinctive orange or yellow colour;~~

— ~~b) carry reflective material to facilitate its location; and~~

— ~~c) have securely attached an automatically activated underwater locating device.~~

— ~~2.1.3 To aid in voice and sound discrimination, microphones in the cockpit are to be located in the best position for recording voice communications originating at the pilot and co-pilot stations and voice communications of other crew members on the flight deck when directed to those stations. This can best be achieved by wiring suitable boom microphones to record continuously on separate channels.~~

— ~~2.1.4 The CVR is to be installed so that:~~

— ~~a) the probability of damage to the recording is minimized. To meet this requirement it should be located as far aft as practicable. In the case of pressurized aeroplanes it should be located in the vicinity of the rear pressure bulkhead;~~

- ~~— b) it receives its electrical power from a bus that provides the maximum reliability for operation of the CVR without jeopardizing service to essential or emergency loads;~~
- ~~— c) there is an aural or visual means for pre-flight checking of the CVR for proper operation; and~~

---

*Editorial Note.*— Sub-paragraph d) has been *relocated* to paragraph 1.2 d).

---

- ~~— d) if the CVR has a bulk erasure device, the installation should be designed to prevent operation of the device during flight time or crash impact.~~

### 3.1 Signals to be recorded

The CVR and CARS shall start to record prior to the aeroplane moving under its own power and record continuously until the termination of the flight when the aeroplane is no longer capable of moving under its own power. In addition, depending on the availability of electrical power, the CVR and CARS shall start to record as early as possible during the cockpit checks prior to engine start at the beginning of the flight until the cockpit checks immediately following engine shutdown at the end of the flight.

---

*Editorial Note.*— Paragraph 3.1.1 was previously paragraph 2.1.1.

---

~~2.1.1~~ 3.1.1 The CVR ~~is to be designed so that it will record~~ shall record on four separate channels, or more, at least the following:

- a) voice communication transmitted from or received in the aeroplane by radio;
- b) aural environment on the flight deck;
- c) voice communication of flight crew members on the flight deck using the aeroplane's interphone system, if installed;
- d) voice or audio signals identifying navigation or approach aids introduced in the headset or speaker; and
- e) ~~voice communication of flight crew members using the passenger address system, if installed;~~  
and
- ~~— f) digital communications with ATS, unless recorded by the FDR.~~

3.1.2 The CARS shall record on two separate channels, or more, at least the following:

- a) voice communication transmitted from or received in the aeroplane by radio;
- b) aural environment on the flight deck; and
- c) voice communication of flight crew members on the flight deck using the aeroplane's interphone system, if installed.

## 2.2—Performance requirements

~~2.2.1~~ ~~3.1.3~~ The CVR will recorder shall be capable of recording on at least four tracks channels simultaneously except for the CVR in ~~3.6.3.5.2~~ recorder in 3.6.3.2.1.4. To On a tape-based CVR, to ensure accurate time correlation between tracks channels, the CVR is to recorder shall record in an ~~inline~~ in-line format. If a bi-directional configuration is used, the in-line format and track channel allocation should shall be retained in both directions.

~~2.2.2~~ ~~3.1.4~~ The preferred track channel allocation is shall be as follows:

Track Channel 1 — co-pilot headphones and live boom microphone

Track Channel 2 — pilot headphones and live boom microphone

Track Channel 3 — area microphone

Track Channel 4 — time reference plus the third and fourth crew members' headphone and live microphone, if applicable.

*Note 1.— Track Channel 1 is located closest to the base of the recording head.*

*Note 2.— The preferred track channel allocation presumes use of current conventional magnetic tape transport mechanisms, and is specified because the outer edges of the tape have a higher risk of damage than the middle. It is not intended to preclude use of alternative recording media where such constraints may not apply.*

---

*Editorial Note.—* Paragraphs 2.2.3 and 2.2.4 have been *relocated* to paragraphs 1.3 and 1.4 respectively.

---

~~2.2.3~~ The CVR, when tested by methods approved by the appropriate certifying authority, will be demonstrated to be suitable for the environmental extremes over which it is designed to operate.

~~2.2.4~~ Means will be provided for an accurate time correlation between the FDR and CVR.

~~Note.— One method of achieving this is by superimposing the FDR time signal on the CVR.~~

## 2.3—Additional information

The manufacturer usually provides the national certifying authority with the following information in respect of the CVR:

- ~~a) manufacturer's operating instructions, equipment limitations and installation procedures; and~~
- ~~b) manufacturer's test reports.~~

## 4. Airborne image recorder (AIR)

### 4.1 Classes

4.1.1 A Class A AIR captures general cockpit area in order to provide data supplemental to conventional flight recorders.

*Note 1.—To respect crew privacy, the cockpit area view may be designed as far as practical to exclude the head and shoulders of crew members whilst seated in their normal operating position.*

*Note 2.— There are no provisions for Class A AIRs in this document.*

4.1.2 A Class B AIR captures data link message displays.

4.1.3 A Class C AIR captures instruments and control panels.

*Note.— A Class C AIR may be considered as a means for recording flight data where it is not practical or is prohibitively expensive to record on an FDR, or where an FDR is not required.*

4.1.4 The AIR must start to record prior to the aeroplane moving under its own power and record continuously until the termination of the flight when the aeroplane is no longer capable of moving under its own power. In addition, depending on the availability of electrical power, the AIR must start to record as early as possible during the cockpit checks prior to engine start at the beginning of the flight until the cockpit checks immediately following engine shutdown at the end of the flight.

## 5. Data link recorder (DLR)

### 5.1 Applications to be recorded

5.1.1 Where the aircraft flight path is authorized or controlled through the use of data link messages, all data link messages, both uplinks (to the aircraft) and downlinks (from the aircraft), shall be recorded on the aircraft. As far as practicable, the time the messages were displayed to the flight crew and the time of the responses shall to be recorded.

*Note.— Sufficient information to derive the content of the data link communications message and the time the messages were displayed to the flight crew is needed to determine an accurate sequence of events on board the aircraft.*

5.1.2 Messages applying to the applications listed below shall be recorded. Applications without the asterisk (\*) are mandatory applications which shall be recorded regardless of the system complexity. Applications with an (\*) shall be recorded only as far as is practicable given the architecture of the system.

- Data link initiation capability
- Controller – pilot data link communications
- Data link – flight information services
- Automatic dependent surveillance – contract
- Automatic dependent surveillance – broadcast\*
- Aeronautical operational control\*

*Note.— Descriptions of the applications are contained in Table A3.1-2.*

## 6. Aircraft data recording systems (ADRS)

### 6.1 Parameters to be recorded

ADRS shall be capable of recording, as appropriate to the aeroplane, at least the essential (E) parameters in Table A3.1-3.

### 6.2 Additional information

6.2.1 The measurement range, recording interval and accuracy of parameters on installed equipment is usually verified by methods approved by the appropriate certificating authority.

6.2.2 Documentation concerning parameter allocation, conversion equations, periodic calibration and other serviceability/maintenance information shall be maintained by the operator/owner. The documentation shall be sufficient to ensure that accident investigation authorities have the necessary information to read out the data in engineering units.

## 3-7. Inspections of FDR and CVR flight recorder systems

3-1-7.1 Prior to the first flight of the day, the built-in test features on for the flight deck for the CVR, FDR recorders and flight data acquisition unit (FDAU), when installed, should shall be monitored by manual and/or automatic checks.

3-2-7.2 Annual inspections should shall be carried out as follows:

- a) the readout an analysis of the recorded data from the FDR and CVR should flight recorders shall ensure that the recorder operates correctly for the nominal duration of the recording;
- b) the analysis of the FDR should shall evaluate the quality of the recorded data to determine if the bit error rate (including those 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 from the FDR should shall be examined in engineering units to evaluate the validity of all recorded parameters. Particular attention should shall be given to parameters from sensors dedicated to the FDR. 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 should shall have the necessary software to accurately convert the recorded values to engineering units and to determine the status of discrete signals;
- e) an annual examination of the recorded signal on the CVR should shall be carried out by replay of the CVR recording. While installed in the aircraft, the CVR should shall record test signals from each aircraft source and from relevant external sources to ensure that all required signals meet intelligibility standards; and
- f) where practicable, during the annual examination, a sample of in-flight recordings of the CVR should shall be examined for evidence that the intelligibility of the signal is acceptable; and

g) an annual examination of the recorded images on the AIR shall be carried out by replay of the AIR recording. While installed in the aircraft, the AIR shall record test images from each aircraft source and from relevant external sources to ensure that all required images meet recording quality standards.

3.3-7.3 Flight recorder systems ~~should~~ shall be considered unserviceable if there is a significant period of poor quality data, unintelligible signals, or if one or more of the mandatory parameters is not recorded correctly.

3.4-7.4 A report of the annual inspection ~~should~~ shall be made available on request to ~~the State's~~ regulatory authority/authorities for monitoring purposes.

3.5-7.5 Calibration of the FDR system:

- a) for those parameters which have sensors dedicated only to the FDR system ~~should~~ and are not checked by other means, recalibration shall be re-calibrated at least 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 ~~should~~ shall be a recalibration performed as recommended by the sensor manufacturer, or at least every two years.

**Table 3.C-1 A3.1-1 Parameters for flight data recorders Parameter Guidance for Flight Data Recorders**

Serial number	Parameter	Measurement range	Recording Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
1	Time (UTC when available, otherwise elapsed time relative time count or GPS time sync)	24 hours	4	±0.125% per hour	1 second
2	Pressure altitude	-300 m (-1 000 ft) to maximum certificated altitude of aircraft +1 500 m (+5 000 ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)	1.5 m (5 ft)
3	Indicated airspeed or calibrated airspeed	95 km/h (50 kt) to max $V_{S_0}$ (Note 1) $V_{S_0}$ to 1.2 $V_D$ (Note 2)	1	±5% ±3%	1 kt (0.5 kt recommended)
4	Heading (primary flight crew reference)	360°	1	±2°	0.5°
5	Normal acceleration (Note 3)	-3 g to +6 g	0.125	±1% of maximum range excluding datum error of ±5%	0.004 g
6	Pitch attitude	±75° or usable range whichever is greater	+ 0.25	±2°	0.5°

Serial number	Parameter	Measurement range	Recording Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
7	Roll attitude	±180°	± 0.25	±2°	0.5°
8	Radio transmission keying	On-off (one discrete)	1		
9	Power on each engine (Note 3 4)	Full range	1 (per engine)	±2%	0.2% of full range or the resolution required to operate the aircraft
10*	Trailing edge flap or and cockpit control selection	Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
11*	Leading edge flap or and cockpit control selection	Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
12*	Thrust reverser position	Stowed, in transit, and reverse	1 (per engine)		
13*	Ground spoiler/speed brake selection (selection and position)	Full range or each discrete position	1	±2% unless higher accuracy uniquely required	0.2% of full range
14	Outside air temperature	Sensor range	2	±2°C	0.3°C
15*	Autopilot/auto throttle/AFCS mode and engagement status	A suitable combination of discrettes	1		

Note.— The preceding 15 parameters satisfy the requirements for a Type II FDR.

16	Longitudinal acceleration (Note 3)	±1 g	0.25	±1.5% max range ±0.015 g excluding a datum error of ±5% ±0.05 g	0.004 g
17	Lateral acceleration (Note 3)	±1 g	0.25	±1.5% max range ±0.015 g excluding a datum error of ±5% ±0.05 g	0.004 g
18	Pilot input and/or control surface position—primary controls (pitch, roll, yaw) (Note 4 5) (Note 3)	Full range	± 0.25	±2° unless higher accuracy uniquely required	0.2% of full range or as installed
19	Pitch trim position	Full range	1	±3% unless higher accuracy uniquely required	0.3% of full range or as installed
20*	Radio altitude	−6 m to 750 m (−20 ft to 2 500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150 m (500 ft) and ±5% above 150 m (500 ft)	0.3 m (1 ft) below 150 m (500 ft) 0.3 m (1 ft) + 0.5% of full range above 150 m (500 ft)
21*	Glide path deviation Vertical beam deviation (ILS/GPS/GLS glide path MLS elevation, IRNAV/IAN vertical deviation)	Signal range	1	±3%	0.3% of full range
22*	Localizer deviation Horizontal	Signal range	1	±3%	0.3% of full range

Serial number	Parameter	Measurement range	Recording Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
	beam deviation (ILS/GPS/GLS localizer, MLS azimuth, IRNAV/IAN lateral deviation)				
23	Marker beacon passage	Discrete	1		
24	Master warning	Discrete	1		
25	Each NAV 1 and 2 receiver frequency selection (Note 5 6)	Full range	4	As installed	
26*	DME 1 and 2 distance (includes distance to runway threshold (FLS) and distance to missed approach point (IRNAV/IAN) (Notes 5 and 6 6 and 7)	0–370 km (0 – 200 NM)	4	As installed	1 852 m (1 NM)
27	Landing gear squat switch Air/ground status	Discrete	1		
28*	GPWS (ground proximity warning system) GPWS/TAWS/GCAS status (selection of terrain display mode including pop-up display status) and (terrain alerts, both cautions and warnings, and advisories) and (on/off switch position)	Discrete	1		
29*	Angle of attack	Full range	0.5	As installed	0.3% of full range
30*	Hydraulics, each system (low pressure)	Discrete	2		0.5% of full range
31*	Navigation data (latitude/longitude, ground speed and drift angle) (Note 7 8)	As installed	1	As installed	
32*	Landing gear <del>or</del> and gear selector position	Discrete	4	As installed	
<i>Note.— The preceding 32 parameters satisfy the requirements for a Type I FDR.</i>					
33*	Groundspeed	As installed	1	Data should be obtained from the most accurate system	1 kt
34	Brakes (left and right brake pressure, left and right brake pedal position)	(Maximum metered brake range, discretized or full range)	1	± 5%	2% of full range
35*	Additional engine parameters (EPR, N <sub>1</sub> , indicated vibration level, N <sub>2</sub> , EGT, fuel flow, fuel cut-off lever position, N <sub>3</sub> )	As installed	Each engine each second	As installed	2% of full range

<i>Serial number</i>	<i>Parameter</i>	<i>Measurement range</i>	<i>Recording Maximum sampling and recording interval (seconds)</i>	<i>Accuracy limits (sensor input compared to FDR readout)</i>	<i>Recording resolution</i>
36*	TCAS/ACAS (traffic alert and collision avoidance system)	Discretes	1	As installed	
37*	Windshear warning	Discrete	1	As installed	
38*	Selected barometric setting (pilot, co-pilot)	As installed	64	As installed	0.1 mb (0.01 in-Hg)
39*	Selected altitude (all pilot selectable modes of operation)	As installed	1	As installed	Sufficient to determine crew selection
40*	Selected speed (all pilot selectable modes of operation)	As installed	1	As installed	Sufficient to determine crew selection
41*	Selected Mach (all pilot selectable modes of operation)	As installed	1	As installed	Sufficient to determine crew selection
42*	Selected vertical speed (all pilot selectable modes of operation)	As installed	1	As installed	Sufficient to determine crew selection
43*	Selected heading (all pilot selectable modes of operation)	As installed	1	As installed	Sufficient to determine crew selection
44*	Selected flight path (all pilot selectable modes of operation) (course/DSTRK, path angle, final approach path (IRNAV/IAN))	As installed	1	As installed	As installed
45*	Selected decision height	As installed	64	As installed	Sufficient to determine crew selection
46*	EFIS display format (pilot, co-pilot)	Discrete(s)	4	As installed	
47*	Multi-function/engine/alerts display format	Discrete(s)	4	As installed	
48*	AC electrical bus status	Discrete(s)	4	As installed	
49*	DC electrical bus status	Discrete(s)	4	As installed	
50*	Engine bleed valve position	Discrete(s)	4	As installed	
51*	APU bleed valve position	Discrete(s)	4	As installed	
52*	Computer failure	Discrete(s)	4	As installed	
53*	Engine thrust command	As installed	2	As installed	2% of full range
54*	Engine thrust target	As installed	4	As installed	2% of full range
55*	Computed centre of gravity	As installed	64	As installed	1% of full range
56*	Fuel quantity in CG trim tank	As installed	64	As installed	1% of full range
57*	Head-up display in use	As installed	4	As installed	

<i>Serial number</i>	<i>Parameter</i>	<i>Measurement range</i>	<i>Recording Maximum sampling and recording interval (seconds)</i>	<i>Accuracy limits (sensor input compared to FDR readout)</i>	<i>Recording resolution</i>
58*	Para-visual display on/off	As installed	1	As installed	
59*	Operational stall protection, stick shaker and pusher activation	As installed	1	As installed	
60*	Primary navigation system reference (GNSS, INS, VOR/DME, MLS, Loran C, localizer glideslope)	As installed	4	As installed	
61*	Ice detection	As installed	4	As installed	
62*	Engine warning each engine vibration	As installed	1	As installed	
63*	Engine warning each engine over temperature	As installed	1	As installed	
64*	Engine warning each engine oil pressure low	As installed	1	As installed	
65*	Engine warning each engine over speed	As installed	1	As installed	
66*	Yaw trim surface position	Full range	2	±3% unless higher accuracy uniquely required	0.3% of full range
67*	Roll trim surface position	Full range	2	±3% unless higher accuracy uniquely required	0.3% of full range
68*	Yaw or sideslip angle	Full Range	1	±5%	0.5°
69*	De-icing and/or anti-icing systems selection	Discretes	4		
70*	Hydraulic pressure (each system)	Full range	2	±5%	100 psi
71*	Loss of cabin pressure	Discrete	1		
72*	Cockpit trim control input position pitch	Full range	1	±5%	0.2% of full range or as installed
73*	Cockpit trim control input position roll	Full range	1	±5%	0.2% of full range or as installed
74*	Cockpit trim control input position yaw	Full range	1	±5%	0.2% of full range or as installed
75	All cockpit flight control input forces (control wheel, control column, rudder pedal)	Full range (±311 N (±70 lbf), □378 N (± 85 lbf), ±734 N (±165 lbf))	1	±5%	0.2% of full range or as installed
76*	Event marker	Discrete	1		
77*	Date	365 days	64		

Serial number	Parameter	Measurement range	Recording Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
78*	ANP or EPE or EPU	As installed	4	As installed	

Note.— The preceding 78 parameters satisfy the requirements for a Type IA FDR.

Notes.—

1.  $V_{S_0}$  stalling speed or minimum steady flight speed in the landing configuration is in Section “Abbreviations and Symbols”.
2.  $V_D$  design diving speed.
3. Refer to 3.6.3.1.2.5 for increased recording requirements.
- 3-4. Record sufficient inputs to determine power.
- 4-5. For aeroplanes with ~~conventional~~ control systems in which movement of a control surface will back drive the pilot’s control, “or” applies. For aeroplanes with ~~non-mechanical~~ control systems in which movement of a control surface will not back drive the pilot’s control, “and” applies. In aeroplanes with split surfaces, a suitable combination of inputs is acceptable in lieu of recording each surface separately.
- 5-6. If signal available in digital form.
- 6-7. Recording of latitude and longitude from INS or other navigation system is a preferred alternative.
- 7-8. If signals readily available.

If further recording capacity is available, recording of the following additional information should be considered:

- a) operational information from electronic display systems, such as electronic flight instrument systems (EFIS), electronic centralized aircraft monitor (ECAM) and engine indication and crew alerting system (EICAS). Use the following order of priority:
  - 1) parameters selected by the flight crew relating to the desired flight path, e.g. barometric pressure setting, selected altitude, selected airspeed, decision height, and autoflight system engagement and mode indications if not recorded from another source;
  - 2) display system selection/status, e.g. SECTOR, PLAN, ROSE, NAV, WXR, COMPOSITE, COPY, ~~ETC.~~ etc.;
  - 3) warnings and alerts;
  - 4) the identity of displayed pages for emergency procedures and checklists;

b) retardation information including brake application for use in the investigation of landing overruns and rejected take-offs; ~~and~~.

~~c) additional engine parameters (EPR, N<sub>1</sub>, EGT, fuel flow, etc.).~~

---

*Editorial Note.— Insert new Table A3.1-2 and A3.1-3 as follows:*

---

**Table A3.1-2  
Description of Applications for Data Link Recorders**

Item No.	Application Type	Application Description	Recording Content
1	Data link Initiation	This includes any applications used to logon to or initiate data link service. In FANS-1/A and ATN, these are ATS Facilities Notification (AFN) and Context Management (CM) respectively.	C
2	Controller/Pilot Communication	This includes any application used to exchange requests, clearances, instructions and reports between the flight crew and controllers on the ground. In FANS-1/A and ATN, this includes the CPDLC application. It also includes applications used for the exchange of oceanic (OCL) and departure clearances (DCL) as well as data link delivery of taxi clearances.	C
3	Addressed Surveillance	This includes any surveillance application in which the ground sets up contracts for delivery of surveillance data. In FANS-1/A and ATN, this includes the Automatic Dependent Surveillance (ADS-C) application. Where parametric data are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	C
4	Flight Information	This includes any service used for delivery of flight information to specific aircraft. This includes, for example, D-METAR, D-ATIS, D-NOTAM and other textual data link services.	C
5	Aircraft Broadcast Surveillance	This includes Elementary and Enhanced Surveillance Systems, as well as ADS-B output data. Where parametric data sent by the aeroplane are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	M *
6	Aeronautical Operational Control	This includes any application transmitting or receiving data used for AOC purposes (per the ICAO	M *

Item No.	Application Type	Application Description	Recording Content
	Data	definition of AOC).	

Key:

C: Complete contents recorded.

M: Information that enables correlation to any associated records stored separately from the aeroplane.

\*: Applications that are to be recorded only as far as is practicable given the architecture of the system.

**Table A3.1-3**  
**Parameter guidance for aircraft data recording systems**

N°	Parameter name	Parameter Category	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
1	Heading (Magnetic or True)	R*	±180 degrees	1	±2 degrees	0.5 degree	* If not available, record rates
2	Pitch attitude	E*	±90 degrees	0.25	±2 degrees	0.5 degree	* If not available, record rates
3	Roll attitude	E*	±180 degrees	0.25	±2 degrees	0.5 degree	* If not available, record rates
4	Yaw rate	E*	±300 degrees/s	0.25	±1% + drift of 360°/hr	2 degree/s	* Essential if no heading available
5	Pitch rate	E*	±300 degrees/s	0.25	±1% + drift of 360°/hr	2 degree/s	* Essential if no pitch attitude available
6	Roll rate	E*	±300 degrees/s	0.25	±1% + drift of 360°/hr	2 degree/s	* Essential if no roll attitude available
7	Positioning system : latitude/longitude	E	Latitude: ±90 degrees Longitude: ±180 degrees	2 (1 if available)	As installed (0.00015 degree recommended)	0.00005 degree	
8	Positioning system estimated error	E*	Available range	2 (1 if available)	As installed	As installed	* If available
9	Positioning system : altitude	E	-300 m (-1 000 ft) to maximum certificated altitude of aircraft + 1 500m (5 000 ft)	2 (1 if available)	As installed (±15 m (±50 ft) recommended)	1.5 m (5 ft)	
10	Positioning system : time*	E	24 hours	1	±0.5 second	0.1 second	* UTC time preferred where available.
11	Positioning system : ground speed	E	0 - 1000 kt	2 (1 if available)	As installed (±5 kt recommended)	1 kt	
12	Positioning system : channel	E	0 - 360 degrees	2 (1 if available)	As installed (± 2 degrees recommended)	0.5 degrees	
13	Normal acceleration	E	- 3 g to + 6 g (*)	0.25 (0.125 if available)	As installed (± 0.09 g excluding a datum error of ± 0.45 g recommended)	0.004 g	
14	Longitudinal	E	±1 g (*)	0.25 (0.125	As installed	0.004 g	

N°	Parameter name	Parameter Category	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
	acceleration			if available)	(± 0.015 g excluding a datum error of ± 0.05 g recommended)		
15	Lateral acceleration	E	±1 g (*)	0.25 (0.125 if available)	As installed (± 0.015 g excluding a datum error of ± 0.05 g recommended)	0.004 g	
16	External static pressure (or pressure altitude)	R	34.4 mb (3.44 in-Hg) to 310.2 mb (31.02 in-Hg) or available sensor range	1	As installed (±1 mb (0.1 in-Hg) or ±30 m (±100 ft) to ±210 m (±700 ft) recommended - refer to table A3-2)	0.1 mb (0.01 in-Hg) or 1.5 m (5 ft)	
17	Outside air temperature (or total air temperature)	R	-50° to +90°C or available sensor range	2	As installed (±2°C recommended)	1°C	
18	Indicated air speed	R	As the installed pilot display measuring system or available sensor range	1	As installed (±3 % recommended)	1 kt (0.5 kt recommended)	
19	Engine RPM	R	Full range including overspeed condition	Each engine each second	As installed	0.2% of full range	
20	Engine oil pressure	R	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
21	Engine oil temperature	R	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
22	Fuel flow or pressure	R	Full range	Each engine each second	As installed	2% of full range	
23	Manifold pressure	R	Full range	Each engine each second	As installed	0.2% of full range	
24	Engine thrust/power/torque Parameters required to determine propulsive thrust/power*	R	Full range	Each engine each second	As installed	0.1% of full range	* Sufficient parameters e.g. EPR/N1 or torque/Np as appropriate to the particular engine shall be recorded to determine power in both normal and reverse thrust. A margin for possible overspeed should be provided.
25	Engine gas generator speed (Ng)	R	0-150%	Each engine each second	As installed	0.2% of full range	
26	Free power turbine speed (Nf)	R	0-150%	Each engine each second	As installed	0.2% of full range	
27	Coolant temperature	R	Full range	1	As installed (±5°C recommended)	1°C	

N°	Parameter name	Parameter Category	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
28	Main voltage	R	Full range	Each engine each second	As installed	1 Volt	
29	Cylinder head temperature	R	Full range	Each cylinder each second	As installed	2% of full range	
30	Flaps position	R	Full range or each discrete position	2	As installed	0.5 degree	
31	Primary flight control surface position	R	Full range	0.25	As installed	0.2 % of full range	
32	Fuel quantity	R	Full range	4	As installed	1% of full range	
33	Exhaust gas temperature	R	Full range	Each engine each second	As installed	2% of full range	
34	Emergency voltage	R	Full range	Each engine each second	As installed	1 Volt	
35	Trim surface position	R	Full range or each discrete position	1	As installed	0.3 % of full range	
36	Landing gear position	R	Each discrete position *	Each gear every two seconds	As installed		* Where available, record up-and-locked and down-and-locked position
37	Novel/unique aircraft features	R	As required	As required	As required	As required	

Key:

E: Essential parameters

R: Recommended parameters

---

End of new text

---

...

— END —