Notice of Proposed Amendment 2013-06

Approval requirements for Air-Ground Data Link and ADS-B in support of Interoperability requirements

and

Miscellaneous improvement to AMC 20

RMT.0099 (20.006(b)) and RMT.0099 (20.016) — 15/04/2013

EXECUTIVE SUMMARY

This NPA contains a draft Decision for new Certification Specifications for Airborne Communication Navigation and Surveillance (CS-ACNS) that comprises of information related to the airworthiness and interoperability standards in support of airspace applications. In particular, the intent of this NPA is to propose new sections for the Certification Specifications presented in NPA 2012-19. These sections are to provide clear standards and Guidance Material to ensure safe operations while demonstrating compliance with both Commission Regulation (EC) No 29/2009 'Data link services' and Commission Implementing Regulation (EU) No 1079/2012 'Voice channels spacing'. In addition, this NPA transposes and updates the following JAA TGL's into the EASA regulatory structure:

a. JAA TGL 6 – Reduced Vertical Separation Minima RVSM;

b. JAA TGL 12 – Terrain Awareness Warning System (TAWS).

Applicability	
Affected regulations and decisions:	CS-ACNS AMC-20
Affected stakeholders:	Design Organisations
Driver/origin:	Level Playing Field and Safety
Reference:	Commission Regulation (EC) No 29/2009 Commission Implementing Regulation (EU) No 1079/2012

Process map	
Concept Paper:	No
Terms of Reference:	9 Feb 2009 13 Dec 2010
Rulemaking group:	No
RIA type:	Light
Technical consultation during NPA drafting:	No
Duration of NPA consultation:	3 months
Review group:	No
Focussed consultation:	No
Publication date of the Opinion:	N/A
Publication date of the Decision:	2013/Q4

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A. Explanatory Note

I. General

1. The purpose of this Notice of Proposed Amendment (NPA) is to envisage amending the Certification Specification (CS-ACNS) as presented in NPA 2012-19 and AMC-20, with the airworthiness and interoperability standards with respect to Data link operations, Reduced Vertical Separation Minima (RVSM), 8.33 kHz voice channel spacing, and Terrain Awareness Warning System (TAWS). Demonstration of CS-ACNS compliance with Commission Regulation (EC) 29/2009[1] 'Data link services' and Commission Implementing Regulation (EU) No 1079/2012[2] 'Voice channels spacing' is provided in Part C of this document. The scope of this rulemaking activity is outlined in Terms of Reference (ToR) RMT.0599 (20.016) and RMT.0099 (20.006(b)) and is described in more detail below.

2. The European Aviation Safety Agency (hereafter referred to as the 'Agency') is directly involved in the rule-shaping process. It assists the Commission in its executive tasks by preparing draft regulations, and amendments thereof, for the implementation of the Basic Regulation[3] which are adopted as 'Opinions' (Article 19(1)). It also adopts Certification Specifications, Acceptable Means of Compliance and Guidance Material to be used in the certification process (Article 19(2)).

3. When developing rules, the Agency is bound to follow a structured process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as 'The Rulemaking Procedure'[4].

4. This rulemaking activity is included in the Agency's Rulemaking Programme for 2013-2016. It implements the rulemaking task RMT.0099 (20.006(b)) 'Miscellaneous improvement to AMC-20' and RMT.0559 (20.016) 'Approval requirements for Air-Ground Data Link and ADS-B in support of Interoperability requirements' .

5. The text of this NPA has been developed by the Agency. It is submitted for consultation of all interested parties in accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.

6. The proposed rule has taken into account the development of European Union and International law (ICAO), and the harmonisation with the rules of other authorities of the European Union main partners as set out in the objectives of article 2 of the Basic Regulation. The proposed rule:

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1 Commission Regulation (EC) No 29/2009 of 16 January 2009 laying down requirements on data link services for the single European sky (OJ L13, 17.1.2009, p.3)

2 Commission Implementing Regulation (EU) No 1079/2012 of 16 November 2012 laying down requirements for voice channels spacing for the single European sky (OJ L 320, 17.11.2012, p.14)

3 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC. (OJ L 79, 19.03.2008, p. 1). Regulation as last amended by Commission Regulation (EU) No 6/2013 of 8 January 2013 (OJ L 4, 9.1.2013, p. 34).

4 EASA MB Decision 01-2012 of 13 March 2012 amending and replacing MB Decision 08-2007 concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material ('Rulemaking Procedure').

a. takes into account developments of relevant European Union law in particular those developed within the framework of Single European Sky Interoperability regulation[5]; and
b. is equivalent to the ICAO provisions.

II. Consultation

7. To achieve optimal consultation, the Agency is publishing the draft decision of the Executive Director on its internet site. Comments should be provided within **3 Months** in accordance with Article 6(5) of the Rulemaking Procedure. Comments on this proposal should be submitted by one of the following methods:

8. Please submit your comments using the automated Comment-Response Tool (CRT) available at http://hub.easa.europa.eu/crt/.

9. The deadline for the submission of comments is **15 July 2013**.

III. Comment response document

10. All comments received in time will be responded to and incorporated in a comment response document (CRD). The CRD will be available on the Agency's website and in the Comment-Response Tool (CRT).

[5] Regulation (EC) No 552/2004 of the European Parliament and of the Council of 10 March 2004 on the interoperability of the European Air Traffic Management network (the interoperability Regulation) (OJ L 96, 31.3.2004, p. 26) as last amended by Regulation (EC) No 1070/2009 of the European Parliament and of the Council of 21 October 2009 (OJ L300, 14.11.2009, p 34)

IV. Content of the draft Opinion/Decision

11. Summary:

    The purpose of this Notice of Proposed Amendment (NPA) is to complement the Certification Specification (CS-ACNS) as presented in NPA 2012-19 with other Communications, Navigation and Surveillance related certification and interoperability standards. CS-ACNS was initially presented for consultation in NPA 2012-19 and contained certification standards for: Mode A/C-only surveillance, Mode S elementary Surveillance, Mode S Enhanced Surveillance and ADS-B 1090 MHz Extended Squitter. This NPA extends the scope by proposing certification and interoperability standards for RVSM, 8.33 kHz and TAWS Class A and Class B.

12. These certification standards are primarily based where applicable on:

    - JAA TGL 6 – RVSM
    - JAA TGL 7 - 8.33 kHz
    - JAA TGL 12 - Terrain Awareness Warning System (TAWS)
    - EASA Special Condition on ATN B1 Data Link installation

13. The certification standard also addresses both Commission Regulation (EC) No 29/2009, laying down requirements on data link services for the Single European Sky (SES), and Commission Implementing Regulation (EU) No 1079/2012, laying down requirements for voice channels spacing for the Single European Sky.

14. It also expands on the certification standard to address Class B equipment in line with requirements laid down in the Commission Regulation (EU) No 965/2012[6].

Compliance with SES interoperability requirements

15. The Interoperability Implementing Regulations for Voice Channel Spacing (8.33 kHz) and Data Link were developed in the framework of the SES interoperability Regulation (EC) No 552/2004 under which the conformity assessment of the European Air Traffic Management network (EATMN) systems and constituents is required. An EATMN system is derived from one of the 8 types of systems as defined in Annex I of Regulation (EC) No 552/2004. In this context, manufacturers are required to provide an EC Declaration of Conformity (DoC) or Declaration of Suitability (DSU) for use for the constituents that they place on the market. Air Navigation Service providers will need to submit an EC Declaration of Verification (DoV) of systems to their NSA for the EATMN systems that they put into service.

16. Furthermore, with regard to the airborne constituents, the aircraft equipment design and installation has to be approved by the Agency in accordance with Regulation (EC) No 748/2012.

17. To avoid any unnecessary burden for aircraft and avionics manufacturers Article 6(a) of the interoperability Regulation as amended by Regulation (EC) No 1070/2009 introduces an alternative verification of compliance on the basis of certificates issued by the Agency providing that they include a demonstration of compliance with the essential requirements of the interoperability Regulation and the relevant implementing rules for interoperability.

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[6] Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p1)

18. As a result, the Agency certificate issued in accordance with Regulation (EC) No 216/2008 (as amended by Regulation (EC) 1108/2009) on the basis of Certification Specification proposed by this NPA are to be considered as an EC declaration of conformity or suitability for use.

Voice Channel Spacing (8.33 kHz)

19. Subpart B Section 1 (CS ACNS.VCS) ensures airborne communication equipment compliance for communication equipment based on 8,33 kHz channel spacing with Commission Implementing Regulation (EU) No 1079/2012, laying down requirements for the performance and the interoperability of air-ground voice channels spacing for the SES. This regulation prescribes a phased approach to ensure that all aircraft are equipped with radio equipment with 8,33 kHz channel spacing capability before 31 December 2017.
20. The purpose of this NPA is to propose a new section in the CS-ACNS which will include the voice communication system, safety and interoperability requirements that allow airborne constituents to comply with the requirements laid down in Commission Implementing Regulation (EC) No 1079/2012.
21. Additionally TGL 7 certification requirements have been reviewed, amended as necessary and transposed into CS-ACNS.VCS.

Data link

22. Subpart B Section 2 (CS ACNS.DLS B1) ensures airborne communication equipment compliance for communication systems based on ATN B1 with Commission Regulation (EC) No 29/2009 of 16 January 2009 which lays down the requirements on data link services for the SES. This regulation prescribes a phased approach to ensure that all IFR aircraft operating above FL285 are equipped with data link capability.
23. The purpose of this NPA is to propose a new section in the CS-ACNS which will include the data link aircraft equipment safety and interoperability requirements that allow airborne constituents to comply with the requirements laid down in Regulation (EC) No 29/2009.
24. A number of aircraft operate in airspace that required the installation and operations of FANS 1/A and ATN B1 systems. The proposed CS includes the standards for dual installations.
25. The initial deployment of the data link services has shown a number of limitations on the design and implementation of data link aircraft equipment. In particular, it is found that applicants intending to install a Data Link for CPDLC communications, may propose one of the following cases:
    - Single stack with ATN B1. Aircraft intended to operate within EU Airspace.
    - Single stack without ATN B1, but with other Data Link technology. Aircraft intended to operate outside EU airspace, but manufactured or modified by EU Applicants.
    - Dual stack including ATN B1. Aircraft intended to operate within EU airspace, and outside EU airspace where other CPDLC Data Link technology are required.
    - Additionally, it is found that Regulation (EC) No 29/2009, allows other than VDL Mode 2 technology, which was not taken into account in the Special Condition.

26. The CS proposed by this NPA clarifies the applicability of requirements depending on the intended use of the CPDLC Data Link, and introduces requirements and guidance for the Dual Stack installations.

27. Additionally, the CS proposed by this NPA intends to clarify the interoperability requirements, especially those to be taken from ICAO Doc 9705, instead from ED-110B.

Terrain Awareness Warning System (TAWS)

28. The standards as defined in JAA TGL 12 have been transposed, updated and captured the Certification Specification proposed by this NPA within the CS ACNS.TAWS section.

29. Furthermore, as Commission Regulation (EU) No 965/2012 requires that:

- Turbine-powered aeroplanes having an MCTOM of more than 5 700 kg or an MPSC of more than nine shall be equipped with a TAWS that meets the requirements for Class A equipment as specified in an applicable standard.
- Reciprocating-engine-powered aeroplanes with an MCTOM of more than 5 700 kg or an MOPSC of more than nine shall be equipped with a TAWS that meets the requirement for Class B equipment as specified in an applicable standard.

the proposed Certification Specification has been extended its scope to cover Class B equipment installations.

30. ETSO-C151b and ETSO-C92c (for the GPWS functions) requirements have been taken into account for equipment approval.

31. Finally, the safety recommendations from the 'report on the accident to AIRBUS A-320-231, G-MEDA on approach to ADDIS ABEBA Airport Ethiopia – 31 March 2003' have been taken into account:

Safety recommendation 4: *It is recommended that the EASA and FAA review and revise existing TAWS certification requirements with a view to ensuring that they protect against common mode failures that could induce a CFIT accident. Furthermore, the minimum requirements for navigational accuracy of sources used for TAWS should be tightened to reflect the need of the system to perform its function. These revised standards should then be applied retrospectively to all aircraft required to be fitted with TAWS.*

Both the FMS and TAWS had sufficient information to identify that there was a problem with the ADS VOR and the derived information but there is no mechanism or requirement to communicate this effectively to the crew.

Safety Recommendation 4 is addressed by CS ACNS.TAWS.3030 Positioning information bullets (a), (b) and (c).

Safety Recommendation 5*: It is recommended that the EASA and FAA study the issues relating to the use of TAWS so that where aircraft source problems are identified by the system the flight crew can be alerted.*

Safety Recommendation 5 is address by CS ACNS.TAWS.3030 Positioning information bullet (e).

Safety Recommendation 6: *It is recommended that the EASA and FAA consider whether the crew should be alerted when a FMS has identified a recurrent problem*

with a particular navigation aid and, furthermore, consider whether the subsequent use of that navigation aid for position information is desirable.

Safety Recommendation 6 is addressed by CS ACNS.TAWS.3030 Positioning information bullet (c).

Reduced Vertical Separation Minima (RVSM)

32. JAA TGL 6 RVSM aircraft certification standard has been transposed updated and captured the Certification Specification proposed by this NPA within section CS ACNS.RVSM section.

33. Thus the scope of this NPA is to amend the Certification Specifications (CS-ACNS) as proposed in NPA 2012-19 with additional provisions in

- Subpart B, Communication, for 8.33kHz VCS and Data Link Services, and
- Subpart E, Others, for TAWS and RVSM.

V. Regulatory Impact Assessment

(a) Process and consultation

In accordance with the Rulemaking Procedure, the Agency needs to conduct a Regulatory Impact Assessment (RIA) of each proposed rule by analysing some potential and suitable options for rulemaking, and comparing them in terms of their safety, environment, economic, social, and regulatory harmonisation impacts.

Therefore, the aim of the RIA is to support the Agency and the decision makers to identify the best option to achieve the objective of this rulemaking activity as defined by the Terms of Reference for RMT.0559 (20.016) dated 10 December 2010 and RMT.0099(20.006) dated 9 February 2009.

This RIA was developed by the Agency during the preparation of the draft Decision and the resulting draft Decision takes into account the lessons learned from the current data link (Link-2000) deployment programme and with the current operations of 8.33KHz VCS, TAWS and RVSM.

(b) Issue analysis and risk assessment

(1) What is the issue and the current regulatory framework?

The issue of this RIA is based on the need to establish requirements that permits the airborne community to comply with airspace operational requirements. In particular, the issue is to permit simultaneously compliance with the two separate regulatory processes associated with Commission Regulation (EU) 748/2012[7] and Regulation (EC) 552/2004, thus alleviating the requirement for multiple approvals, certificates, and EC declarations for constituents and installations.

The issue is to address the certification standard for on-board installations and ensuring compliance with Commission Regulation (EC) No 29/2009 and Commission Implementing Regulation (EU) 1079/2012 for aircraft that are subject to that regulation. In addition, it addresses certification standard for those aircraft that are required to be required with TAWS or will operated in RVSM airspace.

(2) Who is affected?

Aircraft and avionics manufacturers, design organisations and aircraft operators developing or installing 8.33KHZ Voice communications, Data Link communications, TAWS and RVSM systems.

(3) What are the risks (probability and severity)?

If the current situation remains as it is, it will be difficult to apply the provisions of Article 6a of the interoperability Regulation without a standard that had been demonstrated to comply with the requirement of interoperability implementing rule. This has the possibility to further delay compliance with Commission Regulation (EC) No 29/2009 and the implementation of Commission Implementing Regulation (EU) No 1079/2012. Furthermore, the non-availability of the CS that include all airworthiness and interoperability requirements may result in aircraft not be fully interoperable with the subsequent safety risks that are attributed to the incorrect communication.

(c) Objectives

[7] Commission Regulation (EU) No 748/2012 of 3 August 2012 laying down implementing rules for the airworthiness and environmental certification of aircraft and related products, parts and appliances, as well as for the certification of design and production organisations

The overall objectives of the Agency are defined in Article 2 of Regulation (EC) No 216/2008 (the Basic Regulation): maintain a high and uniform aviation safety level with cost-efficient rules.

The specific objectives are:

- To establish standards that permit the airborne community to comply with airspace operational requirements related to the installation of data link and 8.33KHz voice communication installations that can be used to ensure compliance with the European regulations as specified in Commission Regulation (EC) No 29/2009 and the implementation Commission Implementing Regulation (EU) No 1079/2012.
- To transpose standards within the EASA regulatory framework for TAWS and RVSM installation previously defined within JAA material (TGL 6 and TGL12).
- To alleviate the requirement for multiple approvals, certificates and EC declarations for parts and appliances and installation.

(d) Options identified

Option 0: Do nothing.

Option 1: The provision of an appropriate Certification Specification. for data link and 8.33KHz voice communication installations that can be used to ensure compliance with the European airspace regulation as specified in Commission Regulation (EC) No 29/2009 and the implementation Commission Implementing Regulation (EU) No 1079/2012. It will also provide the appropriate certification standard, within the EASA regulatory framework for TAWS and RVSM installation previous defined within JAA material.

(e) Analysis of the impacts

(1) Safety impacts

Option 0, based on existing airworthiness certification material, will not ensure that the requirements as specified in Commission Regulation (EC) No 29/2009 and Commission Implementing Regulation (EU) No 1079/2012 are met. In particular, no suitable certification material currently exists for data link communication in support of the European applications.

Option 1. will improve safety and interoperability while ensuring that the requirements as specified in Commission Regulation (EC) No 29/2009 and the implementation Commission Implementing Regulation (EU) No 1079/2012. Furthermore, Option 1 ensures a harmonised airworthiness certification process.

(2) Environmental impacts

There is no environmental impact difference between options 0, and 1.

(3) Social impacts

There is no social impact difference between options 0, and 1.

(4) Economic impacts

The economic impact associated with the requirement to install data link communications, and 8.33KHz voice communication TAWS and RVSM systems is outside the scope of this NPA. However, with respect to demonstrating compliance,

Option 0: This will require multiple certificates to be issued with the potential to increase the administrative burden and associated costs;

Option 1: This will provide transparency with respect to the required certification standard, so the avionics manufacturers and integrators will not lose time during the certification process, thus reducing the cost with respect to options 0.

(5) Proportionality issues

The two options provide the same assurance of equity and fairness among all concerned sectors.

(6) Impact on regulatory coordination and harmonisation

Option 0 does not allow compliance with Commission Regulation (EC) No 29/2009 or Commission Implementing Regulation (EU) No 1079/2012 to be demonstrated as a result of a certificate issued by EASA. Furthermore, the continued application of the forma JAA TGL material is not transparent to all stakeholders.

Option 1 provides a simplified and unique approach that satisfies the requirements posed by all regulatory frameworks. Furthermore, it integrates lessons learned from existing TAWS and RVSM applications.

(f) Conclusion and preferred option

(1) Comparison of the positive and negative impacts for each option evaluated.

Option 0 does not allow compliance with Commission Regulation (EC) No 29/2009 and Commission Implementing Regulation (EU) No 1079/2012 to be demonstrated via the application of a single process. It does not permit transparency of the application of the JAA TGL material.

Option 1 ensures a simplified and coherent approach to the aircraft communications required by Commission Regulation (EC) No 29/2009 and Commission Implementing Regulation (EU) No 1079/2012 and globally through the application of a single process that has to be applied to the aircraft equipment design and installation in accordance with EASA regulation (EC) No 748/2012. It also enable a transparent application of the standards for TAWS and RVSM.

(2) Final assessment and recommendation of a preferred option:

The Agency concludes that Option 1 is the preferred option.

B. Draft Decision

The text of the amendment is arranged to show deleted text, new text or new paragraph as shown below:

1. deleted text is shown with a strike through: ~~deleted~~
2. new text or changed is highlighted with grey shading: new
3. … indicates that remaining text is unchanged in front of or following the reflected amendment.

I. Draft Decision on Certification Specifications, Acceptable Means of Compliance, and Guidance material for Communication Navigation and Surveillance — CS–ACNS Book 1 and Book 2

Book 1

SUBPART A — GENERAL

CS ACNS.GEN.1000 Applicability

…

(c) Commission Regulation (EC) No 29/2009 of 16 January 2009 laying down requirements on data link services for the Single European Sky; and

(d) Commission Implementing Regulation (EU) No 1079/2012 of 16 November 2012 laying down requirements for voice channels spacing for the Single European Sky.

CS ACNS.GEN.1010 Definitions

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'Altimetry System Error (ASE)' refers to the difference between the altitude indicated by the altimeter display, assuming a correct altimeter barometric setting, and the pressure altitude corresponding to the undisturbed ambient pressure.

'Automatic Altitude Control System' means any system that is designed to automatically control the aircraft to a referenced pressure altitude.

'Advisory Alerts' means the level or category of alert for conditions that require flight crew awareness and may require subsequent flight crew response.

'Alert' means a generic term used to describe a flight deck indication meant to attract the attention of and identify to the flight crew a non-normal operational or aeroplane system condition. Alerts are classified at levels or categories corresponding to Warning, Caution, and Advisory. Alert indications also include non-normal range markings (for example, exceedances on instruments and gauges).

'Aural Alert' means a discrete sound, tone, or verbal statement used to annunciate a condition, situation, or event.

'ATS communications management service' means a service that provides automated assistance to flight crews and air traffic controllers for conducting the transfer of ATC communications (voice and data).

'ATS Clearance and Information service' means a service that provides flight crews and controllers with the ability to conduct operational exchanges.

'ATS microphone check service' means a service that provides air traffic controllers with the capability to send an instruction to several data link equipped aircraft, at the same time, in order to instruct flight crews to verify that their voice communication equipment is not blocking a given voice channel.

'Caution' means the level or category of alert for conditions that require immediate flight crew awareness and a less urgent subsequent flight crew response than a warning alert.

'Controlled Flight Into Terrain (CFIT)' means an accident or incident in which an aircraft, under the full control of the pilot, is flown into terrain, obstacles, or water.

'CPDLC' is the ICAO standardised procedure for controller-pilot communications. CPDLC takes the form of an application, present on both aircraft and ground-based ATC centres that provides support for the Data Link Communications Initiation Capability (DLIC), ATS communications management service (ACM), ATS Clearance and Information service (ACL) and ATS microphone check service (AMC).

'Data Link' is a communication technology where 'Data Link' equipped aircraft communicate with 'Data Link' capable ground units to exchange digital information (bi-directional exchange).

'Data Link Communications Initiation Capability' means a service that enables the exchange of the necessary information for the establishment of data link communications between the ground and aircraft data link systems.

'Downlink' is a transfer of information, generated by an aircraft (not necessarily airborne) and sent to the ground for further processing by an ATC Centre.

'Failure' An occurrence that affects the operation of a component, part, or element such that it can no longer function as intended. This includes both loss of function and malfunction.

'False Alert' means an incorrect or spurious alert caused by a failure of the alerting system including the sensor.

'Forward Looking Terrain Avoidance (FLTA)' Looks ahead of the aeroplane along and below the aeroplane's lateral and vertical flight path and provides suitable alerts if a potential CFIT exists.

'Group Aircraft' is a group of aircraft with similar altitude keeping equipment configurations and performance characteristics that are combined together for the purposes of statistical generic performance evaluation. Typically group aircraft refers to aircraft constructed to the same Type Certificate, Service Bulletin or Supplementary Type Certificate.

'Hazard' means a state or set of conditions that together with other conditions in the environment can lead to an accident.

'Non-group aircraft' refers to an aircraft that is not a group aircraft but which is submitted for airworthiness approval on the characteristics of the unique airframe

'Nuisance Alert' means an alert generated by a system that is functioning as designed but which is inappropriate or unnecessary for the particular condition.

'RVSM Flight Envelope' may be considered to be in two parts; the basic RVSM flight envelope and the full RVSM flight envelope. The basic envelope includes those ranges of Mach numbers and gross weights at which the aircraft can most frequently be expected to operate at RVSM levels (i.e. FL 290 to FL 410 (or maximum attainable altitude)). The full envelope refers

to the entire range of Mach numbers, gross weights and altitude values that the aircraft can be operated in RVSM airspace.

'RVSM operational flight envelope' is the Mach number, W/δ, and altitude ranges over which an aircraft can be operated in cruising flight within the RVSM airspace.

'Required Obstacle Clearance (ROC)' means required vertical clearance expressed in ft between an aircraft and an obstruction.

'Required Terrain Clearance (RTC)' A TAWS FLTA mode that alerts when the aeroplane is above the terrain in the aeroplane's projected flight path, but the projected amount of terrain clearance is considered unsafe for the particular phase of flight.**'Static Source Error (SSE)'** is the difference between the pressure sensed by the static system at the static port and the undisturbed ambient pressure.

'Static Source Error Correction (SSEC)' is the correction for the residual static error to ensure compliance with performance requirements.

'Search Volume' means a volume of airspace around the aeroplane's current and projected path that is used to define a TAWS alert condition.

'Terrain Cell' means a grid of terrain provided by the TAWS database which identifies the highest terrain elevation within a defined geographical area. Terrain cell dimensions and resolution can vary depending on the needs of the TAWS system and availability of data. If a supplier desires, obstacle height can be included in the terrain elevation.

'Uplink' is a transfer of information, issued from any ground-based entity (typically: the ATC Centre under which the aircraft is under responsibility) to an aircraft (not necessarily airborne).

'Worst case avionics' means a combination of tolerance values, specified by the aircraft constructor for the altimetry fit into the aircraft which gives the largest combined absolute value for residual SSE plus avionics errors.

'Warning' means the level or category of alert for conditions that require immediate flight crew awareness and immediate flight crew response.

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SUBPART B — COMMUNICATIONS

SECTION 1 – VOICE CHANNEL SPACING (VCS)

General

CS ACNS.VCS.1000 Applicability

The section provides standards for aircraft voice communication systems operating in the band 117,975-137 MHz.

System functional requirements

CS ACNS.VCS.2000 Voice Communication System

(see AMC1 ACNS.VCS.2000)

(a) The voice communication systems are to be capable of 8.33 kHz and 25 kHz channel spacing

(b) Voice communication systems are to be capable of operating with off-set carrier frequencies on 25 kHz channel spacing.

System performance requirements

CS ACNS.VCS.3000 Performance Requirements

The voice communication systems conforms to the performance requirements of the following sections of ICAO Annex 10, Volume III, Part 2 (Second Edition — July 2007 incorporating Amendment No 85) Chapter 2 'Aeronautical Mobile Service':

(a) Section 2.1 'Air-ground VHF communication system characteristics'.

(b) Section 2.2 'System characteristics of the ground installations' of ICAO.

(c) Section 2.3.1 'Transmitting function'.

(d) Section 2.3.2 'Receiving function' excluding sub-section 2.3.2.8 'VDL — Interference Immunity Performance'.

CS ACNS.VCS.3010 Integrity

The voice communication systems are designed commensurate with a major failure condition.

CS ACNS.AC.3020 Continuity

The probability of the loss of voice communication is better than or equal to remote.

Installation requirements

CS ACNS.VCS.4000 Flight Deck Interface

(see AMC1 ACNS.VCS.4000)

A means is provided to:

(a) select the voice communications channel;

(b) display the selected voice communications channel to the flight crew;

(c) indicate the non-operational status or failure of the system without undue delay;

SECTION 2 –DATA LINK SERVICES (DLS)

General

CS ACNS.DLS.B1.1000 Applicability
(See GM1 ACNS.DLS.B1.1000)

This section provides the airworthiness standard for ATN B1 with VDL Mode 2 data link aircraft systems to be installed on aircraft intended to be used for CPDLC Communications.

CS ACNS.DLS.B1.1001 Installation Requirements
(See AMC1 ACNS.DLS.B1.1001)

The data link system includes a means to enable data communication and flight deck annunciations and controls.

Flight deck control and indication capabilities

CS ACNS.DLS.B1.1010 Flight Deck Interface
(See AMC1 ACNS.DLS.B1.1010)

(a) A means is provided:

(1) to inform clearly and unambiguously when uplinked messages are received;

(2) for the flight crew to activate or deactivate the data link services;

(3) for the flight crew to know in real time the identity of the ATS provider(s) connecting with the aircraft;

(4) to display all messages, with minimal flight crew action, in a format that is easy to comprehend and distinguishable from each other;

(5) for the flight crew to respond to ATS messages;

(6) to inform the flight crew that pending or open messages are waiting for a response;

(7) for the flight crew to determine the status of the data link system;

(b) A means is provided to prohibit the deletion, confirmation, or clearance of a message until the entire message is displayed.

CS ACNS.DLS.B1.1011 Dual Data Link Capabilities (Dual stack)
(See AMC1 ACNS.DLS.B1.1011)

For aircraft integrating both FANS 1/A and ATN B1 CPDLC applications:

(a) Control and display: Messages with the same intent that are transmitted or received through these technologies are displayed in the same way.

(b) Alerting: Where a common alerting is not demonstrable, a mean is provided to distinguish between the alerting scheme in a format that is easy to comprehend .

ATN B1 data link

CS ACNS.DLS.B1.2000 Data Link Services
(See AMC1 ACNS.DLS.B1.2000)

The data link system provides the following services:

(a) Data Link Initiation Capability (DLIC);

(b) ATC Communications Management (ACM);

(c) ATC Clearances and Information (ACL); and

(d) ATC Microphone Check (AMC).

CS ACNS.DLS.B1.2001 Protection mechanism
(See AMC1 ACNS.DLS.B1.2001 AMC2 ACNS.DLS.B1.2001 AMC3 ACNS.DLS.B1.2001, GM1 ACNS.DLS.B1.2001, GM2 ACNS.DLS.B1.2001, and GM3 ACNS.DLS.B1.2001)

A means is provided to protect the integrity of the message.

System performance requirements

CS ACNS.DLS.B1.3000 Integrity

The data link system is designed commensurate with a minor failure condition.

CS ACNS.DLS.B1.3010 Continuity

The data link system is designed to an allowable qualitative probability of probable

Time

CS ACNS.DLS.B1.3101 Universal Time Coordinated (UTC)
(See AMC1 ACNS.DLS.B1.3101)

For time synchronisation a valid UTC time source is to be used.

Data link initiation capability (DLIC) service messages

CS ACNS.DLS.B1.3201 DLIC Uplink Messages
(see AMC1 ACNS.DLS.B1.3201)

The data link system is capable of receiving and processing the following messages for the DLIC logon and contact functions:

Function	Message
Logon	CMLogonResponse
Contact	CMContactRequest

CS ACNS.DLS.B1.3202 DLIC Downlink Messages
(see AMC1 ACNS.DLS.B1.3202)

The data link system is capable of sending the following messages for the DLIC logon and contact functions:

Function	Message
Logon	CMLogonRequest
Contact	CMContactResponse

CS ACNS.DLS.B1.3203 DLIC Initiation when in CPDLC Inhibited State (Uplink)

When the data link system is in the 'CPDLC inhibited' state, DLIC Contact Request is processed but the system is remaining in the 'CPDLC inhibited' state.

CPDLC Messages

CS ACNS.DLS.B1.3301 CPDLC Uplink Messages
(See AMC1 ACNS.DLS.B1.3301, AMC2 ACNS.DLS.B1.3301, GM1 ACNS.DLS.B1.3301 and GM2 ACNS.DLS.B1.3301)

The data link system is capable of receiving, processing and displaying the following message elements:

ID	Message
UM0	UNABLE
UM1	STANDBY
UM3	ROGER
UM4	AFFIRM
UM5	NEGATIVE
UM19	MAINTAIN [level]
UM20	CLIMB TO [level]
UM23	DESCEND TO [level]
UM26	CLIMB TO REACH [level] BY [time]
UM27	CLIMB TO REACH [level] BY [position]
UM28	DESCEND TO REACH [level] BY [time]
UM29	DESCEND TO REACH [level] BY [position]
UM46	CROSS [position] AT [level]
UM47	CROSS [position] AT OR ABOVE [level]
UM48	CROSS [position] AT OR BELOW [level]

ID	Message
UM51	CROSS [position] AT [time]
UM52	CROSS [position] AT OR BEFORE [time]
UM53	CROSS [position] AT OR AFTER [time]
UM54	CROSS [position] BETWEEN [time] AND [time]
UM55	CROSS [position] AT [speed]
UM61	CROSS [position] AT AND MAINTAIN
UM64	OFFSET [specifiedDistance] [direction] OF ROUTE
UM72	RESUME OWN NAVIGATION
UM74	PROCEED DIRECT TO [position]
UM79	CLEARED TO [position] VIA [routeClearance]
UM80	CLEARED [routeClearance]
UM82	CLEARED TO DEVIATE UP TO [specifiedDistance] [direction] OF ROUTE
UM92	HOLD AT [position] AS PUBLISHED MAINTAIN [level]
UM94	TURN [direction] HEADING [degrees]
UM96	CONTINUE PRESENT HEADING
UM106	MAINTAIN [speed]
UM107	MAINTAIN PRESENT SPEED
UM108	MAINTAIN [speed] OR GREATER
UM109	MAINTAIN [speed] OR LESS
UM116	RESUME NORMAL SPEED
UM117	CONTACT [unitname] [frequency]
UM120	MONITOR [unitname] [frequency]
UM123	SQUAWK [code]
UM133	REPORT PRESENT LEVEL
UM148	WHEN CAN YOU ACCEPT [level]
UM157	CHECK STUCK MICROPHONE [frequency]
UM159	ERROR [errorInformation]
UM160	NEXT DATA AUTHORITY [facility]
UM162	SERVICE UNAVAILABLE
UM165	THEN
UM171	CLIMB AT [verticalRate] MINIMUM
UM172	CLIMB AT [verticalRate] MAXIMUM
UM173	DESCEND AT [verticalRate] MINIMUM
UM174	DESCEND AT [verticalRate] MAXIMUM
UM179	SQUAWK IDENT

ID	Message
UM183	[freetext]
UM190	FLY HEADING [degrees]
UM196	[freetext]
UM203	[freetext]
UM205	[freetext]
UM211	REQUEST FORWARDED
UM213	[facilitydesignation] ALTIMETER [altimeter]
UM215	TURN [direction] [degrees]
UM222	NO SPEED RESTRICTION
UM227	LOGICAL ACKNOWLEDGEMENT
UM231	STATE PREFERRED LEVEL
UM232	STATE TOP OF DESCENT
UM237	REQUEST AGAIN WITH NEXT UNIT

CS ACNS.DLS.B1.3302 CPDLC Downlink Messages

(See AMC1 ACNS.DLS.B1.3302, GM1 ACNS.DLS.B1.3302, GM2 ACNS.DLS.B1.3302 and GM3 ACNS.DLS.B1.3302)

The data link system is capable of preparing and send the following downlink message elements:

ID	Message
DM0	WILCO
DM1	UNABLE
DM2	STANDBY
DM3	ROGER
DM4	AFFIRM
DM5	NEGATIVE
DM6	REQUEST [level]
DM22	REQUEST DIRECT TO [position]
DM32	PRESENT LEVEL [level]
DM62	ERROR [errorInformation]
DM63	NOT CURRENT DATA AUTHORITY
DM66	DUE TO AIRCRAFT PERFORMANCE
DM81	WE CAN ACCEPT [level] AT [time]
DM82	WE CANNOT ACCEPT [level]
DM89	MONITORING [unitname] [frequency]

ID	Message
DM98	[freetext]
DM99	CURRENT DATA AUTHORITY
DM100	LOGICAL ACKNOWLEDGEMENT
DM106	PREFERRED LEVEL [level]
DM107	NOT AUTHORIZED NEXT DATA AUTHORITY
DM109	TOP OF DESCENT [time]

Data link services requirements

CS ACNS.DLS.B1.4101 Data Link Initiation Capability (DLIC) Service
(See AMC 1 ACNS.DLS.B1.4101 and GM1 ACNS.DLS.B1.4101)

The data link system for DLIC should conform with section 4.1, 4.2.2 and 4.3.2 of EUROCAE Document ED-120, including change 1 and change 2 and section 2.2.1 and 4.1 of EUROCAE Document ED-110B.

CS ACNS.DLS.B1.4201 ATC Communications Management (ACM) Service
(See AMC1 ACNS.DLS.B1.4201 and GM1 ACNS.DLS.B1.4201)

The data link system for ACM should conform with section 5.1.1, 5.1.2.3 (excluding requirements relating to downstream clearance) and 5.1.3.2 of EUROCAE Document ED-120, including change 1 and change 2.

CS ACNS.DLS.B1.4301 ACL Service Safety Requirements
(See AMC1 ACNS.DLS.B1.4301 and GM1 ACNS.DLS.B1.4301)

The data link system for ACL should conform with section 5.2.1, 5.2.2.3 and 5.2.3.2 of EUROCAE Document ED-120, including change 1 and change 2.

CS ACNS.DLS.B1.4401 ATC Microphone Check (AMC) Service

The data link system for AMC should conform with section 5.3.1, 5.3.2.3 and 5.3.3.2 of EUROCAE Document ED-120, including change 1 and change 2.

Interoperability Requirements

CS ACNS.DLS.B1.4531 Network Layer Requirements
(See AMC1 ACNS.DLS.B1.4531 and GM1 ACNS.DLS.B1.4531)

The ATN Router conforms to Class 6 with the capability to support Inter-domain routing protocol (IDRP) .

CS ACNS.DLS.B1.4541 Transport Layer Protocol Requirements
(See AMC1 ACNS.DLS.B1.4541 and GM1 ACNS.DLS.B1.4541)

The ATN Connection Oriented Transport Protocol (COTP), conforms to Transport Protocol Class 4.

CS ACNS.DLS.B1.4551 Session Layer Requirement
(See AMC1 ACNS.DLS.B1.4551)

ATN Session protocol is capable of supporting the following session protocol data units (SPDUs):

Abbreviation	Full SPDU Name
SCN	Short Connect
DRPSAC	Short Accept
SACC	Short Accept Continue
SRF	Short Refuse
SRFC	Short Refuse Continue

CS ACNS.DLS.B1.4561 Presentation Layer Requirements
(See AMC ACNS.DLS.B1.4561)

ATN Presentation protocol is capable of supporting the presentation protocol data units (PPDUs) listed in the following table:

Abbreviation	Full PPDU Name
SHORT-CP	Short Presentation Connect, unaligned PER
SHORT-CPA	Short Presentation Connect Accept, unaligned PER
SHORT-CPR	Short Presentation Connect Reject

CS ACNS.DLS.B1.4571 Application Layer Requirements
(See AMC1 ACNS.DLS.B1.4571 and GM1 ACNS.DLS.B1.4571)

The Application Layer is to be application-independent (also known as 'Layer 7a'), and composed of a Convergence Function supporting operations of an Application Control Service Element (ACSE).

SUBPART E – OTHERS

SECTION 1 – TERRAIN AWARENESS WARNING SYSTEM (TAWS)

General

CS ACNS.TAWS.1000 Applicability
(See GM1 ACNS.TAWS.1000)

This section provides the airworthiness standards applicable to Terrain Awareness Warning System Class A and Class B for aeroplanes.

CS ACNS.TAWS.1010 TAWS Equipment Approval
(See AMC1 ACNS.TAWS.1010)

The TAWS is Class A or Class B approved equipment.

System functional requirements

CS ACNS.TAWS.2010 Required Functions and Interfaces
(See AMC1 ACNS.TAWS.2010, AMC2 ACNS.TAWS.2010)

TAWS Class A or Class B provides suitable alerting and warning capabilities and other system interfaces to support the following functions:

TAWS System Function		Class A TAWS	Class B TAWS
Alerting	Imminent contact with ground indications (GPWS functions) including: (1) excessive Rates of Descent; (2) negative Climb Rate or Altitude Loss After Take-Off or Go-around. A Voice callout when descending through a predefined altitude above the runway threshold elevation for landing.	x	x With a 500 ft call out
	A forward Looking Terrain Avoidance (FLTA) function, including: • a Reduced Required Terrain Clearance (RTC) function; • an Imminent Terrain Impact function; • a FLTA Turning Flight function.	x	x
	A Premature Descent Alert (PDA) function, including detection and alerting for Premature Descents Along the Final Approach Segment	x	x
	Excessive Closure Rate to Terrain	x	
	Flight Into Terrain When not in Landing Configuration	x	

TAWS System Function		Class A TAWS	Class B TAWS
	Excessive Downward Deviation from a glide slope or glide path	x	
	TAWS and sensor failure monitoring and annunciation function	x	x
	Capability to initiate the TAWS self-test function on the ground and where feasible in the air	x	x
Interfaces	A terrain display capability	x	
	Capability to drive a terrain display		x
	The use of position source input	x	x
	The use of landing guidance deviation input	x	
	The use of radio altimeter sensor input	x	
	The use of Terrain and Airport information	x	x
	Interface with the flight recording system to record TAWS alerts and inhibition of the FLTA or PDA functions	x	x
	The use of landing gear and flaps position	x	x
	The use of roll attitude input	x	x
	The interface with flight deck audio systems	x	x

CS ACNS.TAWS.2020 FLTA function requirements
(See AMC1 ACNS.TAWS.2020)

Provide an FLTA function that:

(a) looks ahead of the aeroplane, within the search volume, which consists of a computed look ahead distance, a lateral distance on both sides of the aeroplane's flight path, and a specified look down distance based upon the aeroplane's vertical flight path. The lateral search volume expands as necessary to accommodate turning flight. The FLTA search volume is compatible with the accuracy of the TAWS navigation source;

(b) that gives timely alerts in the event terrain is predicted to penetrate the search volume;

(c) is available during all airborne phases of flight including turning flight;

(d) gives Required Terrain Clearance (RTC) alerts when the aeroplane is currently above the terrain in the aeroplane's projected flight path but the projected amount of terrain clearance is considered unsafe for the particular phase of flight.

TAWS REQUIRED TERRAIN CLEARANCE (RTC) BY PHASE OF FLIGHT	TAWS (RTC) Level Flight	TAWS (RTC) Descending /climbing
En route	700 ft	500 ft
Terminal (Intermediate Segment)	350 ft	300 ft
Approach	150 ft	100 ft
Departure (above 400 ft)	100 ft	100 ft

TABLE 1

(e) gives Imminent Terrain Impact alerts when the aeroplane is currently below the elevation of a terrain cell along the aeroplane's lateral projected flight path and, based upon the vertical projected flight path, the equipment predicts that the terrain clearance will be less than the value given in the RTC column of Table 1.

(f) gives alerts for the Imminent Terrain Impact and Required Terrain Clearance functions when the aeroplane is in turning flight.

CS ACNS.TAWS.2030 PDA function requirements
(See GM1 ACNS.TAWS.2030)

Provide a Premature Descent Alert function:

(a) to determine if the aeroplane is significantly below the normal approach flight path to a runway and in such a case issue an alert, based on the current position and flight path information of the aeroplane, as determined from a suitable navigation source and airport database;

(b) that is available on all types of instrument approaches including straight-in approaches, circling approaches and approaches that are not aligned within 30 degrees of the runway heading.

CS ACNS.TAWS.2040 Class A TAWS inhibition
(See AMC1 ACNS.TAWS.2040)

A means is provided to:

(a) manual inhibit capability for FLTA aural alerts, PDA aural and visual alerts and terrain display;

(b) manual inhibit capability for GPWS Flight into terrain when not in the landing configuration and excessive downward deviation from the glide slope;

(c) indicate to the flight crew of the 'Inhibit status'.

CS ACNS.TAWS.2050 Terrain information display
(See AMC1 ACNS.TAWS.2050)

(a) When terrain information is provided it is clearly visible to the flight crew.

(b) Terrain information should be displayed as follows:

(1) The terrain is depicted relative to the aeroplane's position such that the pilot may estimate the relative bearing and distance to the terrain of interest.

(2) The terrain depicted is oriented in accordance with the orientation of the navigation information used on the flight deck.

(3) Variations in terrain elevation depicted relative to the aeroplane's elevation (above and below) are visually distinguishable.

(4) Terrain that generates alerts is displayed in a manner to distinguish it from non-hazardous terrain, consistent with the caution and warning alert level.

(5) If the terrain is presented on a multi-function display, the terrain mode and terrain information is distinguishable from weather and other features.

(6) Terrain information is readily available and displayed with sufficient accuracy and in a manner to allow the flight crew to determine if it is a terrain threat to the aeroplane.

(c) Terrain information can be selected or deselected.

(d) The display of terrain data complements and is compatible with the terrain alerting function of the TAWS.

(e) The terrain information is clear and unambiguous, available without potential confusion during day and night operations under all ambient conditions expected in service.

(f) Where additional terrain views are provided, they must present information consistent and compatible with (a) to (e) above.

CS ACNS.TAWS.2060 Aural and visual alerts
(See AMC1 ACNS.TAWS.2060)

(a) The TAWS provides suitable aural and visual alerts for each of its functions.

(b) Aural and visual alerts are initiated simultaneously, except when suppression of aural alerts is necessary to protect pilots from nuisance aural alerting.

(c) Each aural alert should identify the reason for the alert

(d) The system is capable of accepting and processing aeroplane performance related data or aeroplane dynamic data and providing the capability to update aural and visual alerts at least once per second.

(e) The aural and visual outputs should be compatible with the standard cockpit displays and auditory systems.

(f) The visual display of alerting information should be continuously displayed until the situation is no longer valid.

(g) The alerting logic for 'Excessive Closure Rate to Terrain' and 'Flight Into Terrain When Not in Landing Configuration' provides sufficient time for the flight crew to react and take corrective action.

Safety objectives

CS ACNS.TAWS.3000 Integrity

(a) Detected loss of the TAWS is designed commensurate with a minor failure condition

(b) Undetected failures of the TAWS (including unannunciated loss of the terrain alerting function) is designed commensurate with a major failure condition.

(c) False and nuisance terrain alerting is designed commensurate with a major failure condition.

(d) Failure of the installed TAWS does not degrade the integrity of any system interfacing with the TAWS.

System performance requirements

CS ACNS.TAWS.3010 GPWS

The predictive terrain hazard warning functions, does not adversely affect the functionality, reliability or integrity of the basic GPWS functions.

CS ACNS.TAWS.3020 Terrain and airport database
(See AMC1 ACNS.TAWS.3020)

(a) Terrain and airport information are developed in accordance with an acceptable standard.

(b) TAWS is capable of accepting updated terrain and airport information.

CS ACNS.TAWS.3030 Positioning information
(See AMC1 ACNS.TAWS.3030)

(a) The positioning information (i.e. horizontal and vertical position, velocity, or rate of information) is provided from an approved positioning source.

(b) For Class B TAWS, GNSS is the only approved horizontal positioning source.

(c) When the TAWS positioning source is the same as the one used by the primary navigation system and provided that, applicable performance requirements are satisfied for navigation, a failure of the TAWS (including loss of electrical power to the TAWS) cannot degrade the primary navigation capability.

(d) When a positioning source generates a fault indication or any flag indicating the position is invalid or does not meet performance requirements, the TAWS is to stop utilising that positioning source.

(e) The positioning source for the predictive terrain hazard warning system accuracy is suitable for each phase of flight and/or region of operations.

(f) The TAWS provides indications, as appropriate, regarding degradation or loss of function associated with the loss of the positioning source.

Installation requirements

CS ACNS.TAWS.4000 Failure mode

(a) A failure of the TAWS does not disable other protection functions (e.g. windshear or weather radar).

(b) The failure of the GPWS functions, except for power supply failure, input sensor failure, or failure of other common portions of the equipment, does not affect the FLTA function, PDA function, or Terrain Display and vice versa.

(c) Where the terrain information is displayed on a multi-function display, failure of the TAWS does not prevent the normal functioning of other systems using that display.

CS ACNS.TAWS.4010 Prioritisation scheme
(See AMC1 ACNS.TAWS.4010)

The prioritisation scheme for Class A TAWS alerts is compatible and consistent with other alerts including voice call outs from all alerting systems.

CS ACNS.TAWS.4020 Pop-up mode
(See AMC1 ACNS.TAWS.4020)

(a) If implemented, the design of an automatic pop-up function ensures that:

(1) the terrain information is automatically displayed when a TAWS caution alert occurs;

(2) the TAWS pop-up function is consistent with pop-up weather and traffic alerts;

(3) it is evident that an automatic pop-up has occurred;

(4) the terrain display mode is annunciated on the display;

(5) manual switching back to the original display mode is simple.

(b) If a terrain alert is issued then terrain information is displayed automatically on all crew member terrain displays.

SECTION 2 – REDUCED VERTICAL SEPARATION MINIMUM (RVSM)

General

CS ACNS.RVSM.1000 Applicability
This section provides airworthiness standard for aircraft to operate a 1000 ft vertical separation within RVSM airspace.

CS ACNS.RVSM.1010 RVSM system
(See AMC1 ACNS.RVSM.1010)

The RVSM system includes:

(a) two independent altitude measurement systems. Each system is to be composed of the following elements:

(1) Cross-coupled static source/system, with ice protection if located in areas subject to ice accretion;

(2) Equipment for measuring static pressure sensed by the static source, converting it to pressure altitude;

(3) Equipment for providing a digitally encoded signal corresponding to the displayed pressure altitude, for automatic altitude reporting purposes;

(4) Static source error correction (SSEC), as required to meet the performance criteria as specified in CS-ACNS.RVSM 3010; and

(5) Signals referenced to a pilot selected altitude for automatic control and alerting derived from one altitude measurement system.

(b) an altitude alerting system;

(c) an automatic altitude control system; and

(d) a secondary surveillance radar (SSR) transponder with altitude reporting system that can be connected to the altitude measurement system in use for altitude keeping.

System functional requirements

CS ACNS.RVSM.2000 Required functions
(See AMC1 ACNS.RVSM.2000)

The system:

(a) provides indication to the flight crew of the pressure altitude being flown;

(b) based on the signal produced by the altimetry system, automatically maintains a selected flight level with its altitude control system;

(c) provides an alert to the flight crew when the altitude displayed to the flight crew deviates from the selected altitude by a value of ±60 m (±200 ft) or greater;

(d) automatically reports pressure altitude;

(e) provides an output to the aircraft transponder.

Safety objectives

CS ACNS.RVSM.3000 Intergrity

The RVSM system is designed commensurate with a major failure condition.

CS ACNS.RVSM.3010 Continuity

The probability of the loss of the RVSM system is better than or equal to remote

System performance requirements

CS ACNS.RVSM.3020 RVSM system performance

(See AMC1 ACNS.RVSM.3020)

(a) The automatic altitude control system controls the altitude within ±20 m (65 ft) about the selected altitude, when the aircraft is operated in straight and level flight under non-turbulent non-gust conditions.

(b) The tolerance of the alert issued when the altitude displayed to the flight crew deviates from the selected altitude by a value of ±60 m (±200 ft) or greater is no greater than ±15 m (±50 ft).

(c) Where an altitude select/acquire function is provided, the altitude select/acquire control panel is configured such that an error of no more than ±8 m (±25 ft) exists between the value selected by, and displayed to, the flight crew, and the corresponding output to the control system.

CS ACNS.RVSM.3030 Altimetry system accuracy

(See AMC1 ACNS.RVSM.3030, GM1 ACNS.RVSM.3030)

(a) The ASE of each individual aircraft of a group is within ±60m (±200 ft).

(b) For Group aircraft, the altimetry system accuracy is to meet the following criteria in the full flight envelope:

(1) At the point of the flight envelope where the mean ASE (ASEmean) reaches its largest absolute value that value does not exceed 25 m (80 ft);

(2) At the point of the flight envelope where the absolute mean ASE plus three standard deviations of ASE (ASE3SD) reaches its largest absolute value, the absolute value does not exceed 75 m (245 ft).

(c) For RVSM installations on a non-group aircraft, the altimetry system accuracy is to meet the following criteria:

(1) For all conditions in the basic envelope:

| residual static source error +worst case avionics | does not exceed 50 m (160 ft).

(2) For all conditions in the full envelope:

| residual static source error +worst case avionics | does not exceed 60 m (200 ft).

BOOK 2

SUBPART B - COMMUNICATIONS

SECTION 1 - VOICE CHANNEL SPACING (VCS) (8.33 KHZ)

AMC1 ACNS.VCS.2000 Voice Communication Systems

The VCS equipment composing of the system should be approved in accordance with ETSO-2C37e, ETSO-2C38e or ETSO-2C169a.

For the 25 kHz channel spacing off-set carrier frequency operations the equipment composing the system should conform with the requirements of EUROCAE document ED-23C

In airspace where 8.33 kHz channel spacing communication equipment is mandatory and the carriage of two radios is required, both radios should be 8.33 kHz capable (as opposed to one 8.33 kHz system and one 25 kHz system).

AMC1 ACNS.VCS.4000 Flight Deck Interface

Flight Crew control and display of communication frequencies information should be consistent with the overall crew flight deck design philosophy.

SECTION 2 –ATN B1 DATA LINK SERVICES

General

GM1.ACNS.DLS.B1.1000 Applicability

Controller pilot communications through data link is used in different airspaces worldwide. Different technologies are used, and this CS is intended to provide the airworthiness standard for such installations. Additionally, controller pilot communications over ATN B1 data link technology has been mandated in Europe, through the Regulation (EC) No 29/2009. Installations intended to operate within EU Airspace defined in mentioned regulation, should fully comply with all requirements of 'DATA LINK SERVICES' section, in its entirety.

Installations not intended to operate within EU Airspace, are not required to comply with mentioned section.

Installations intended to operate worldwide, should follow the guidance of AMC1 ACNS.DLS.B1.1011.

GM1 ACNS.DLS.B1.1001 Data Link System Installation

An example of installation may be a system comprising the following components or inputs:

(a) A VHF Data Radio (VDR) with Mode 2 capability and its associated antenna.

(b) A Unit for Communication Management with Mode 2 and ATN capabilities

(c) A display unit with means for crew to be notified of ATS Requests and Clearances, and issue downlink crew requests to controllers or responses to outstanding messages (from controllers).

(d) An adequate source for UTC time e.g. a Global Navigation Satellite System (GNSS).

(e) An adequate source for conducted flight plan information (Departure Airport, Destination Airport, Estimated Time of Arrival) e.g. Flight Management System (FMS)

(f) An adequate source of aeroplane position e.g. Flight Management System (FMS), or a Global Navigation Satellite System (GNSS) or both

(g) An adequate source for Air/Ground Status information e.g. an interface with the landing gear or Flight Management System (FMS) or both

(h) An adequate aural attention getter for announcements.

(i) Adequate indication means of system and service availability.

(j) Adequate control means for the crew.

(k) A means for the flight crew to inhibit the DLS Services together with appropriate annunciation of the inhibited condition.

Flight Deck Control and Indication Capabilities

AMC1 ACNS.DLS.B1.1010 Flight Deck Interface

Flight crew control and display of data link related information (connectivity status, outstanding messages, etc.) should be consistent with the overall crew flight deck design philosophy.

Flight crew control and display of data link messages should satisfy integrity and interface design criteria appropriate for the intended purpose. Reference to the applicable paragraph xx.1309 requirements should be observed.

If a direct interface exists between the data link application and other on board systems, (e.g. flight planning and navigation), a means should be provided for the flight crew to initiate the use of the data contained in the message by the other on board system. The means provided should be separate from that used to respond to a message.

Flight deck annunciations should be compatible with the overall alerting scheme of the aircraft.

Audible and visual indications should be given by the data link system for each uplinked ATS message, including those messages not displayed immediately because of lack of crew response to an earlier ATS message. Visual alerts alone may be used for non-ATS messages.

Annunciation of the receipt of a message during critical flight phases should be inhibited until after the critical flight phase. The criteria that define critical flight phases should be consistent with the particular flight deck philosophy and the particular data link services supported.

Means should be provided for the flight crew to list, select, and retrieve the most recent ATS messages received and sent by the flight crew during the flight segment. The status of each message, the time it was received or sent, should be accessible.

Means should be provided for the flight crew to clear uplinked messages from the display. However, this capability should be protected against inadvertent deletion.

Means should be provided for the flight crew to create, store, retrieve, edit, delete, and send data link messages.

The data link system should indicate when message storage and/or printing is not available.

A flight deck printer could be used as a means of storing data communications messages received or sent during flight.

If a message intended for visual display is greater than the available display area and only part of the message is displayed, a visual indication shall be provided to the pilot to indicate the presence of remaining message.

Data link messages from the ATS should be displayed and remain displayed until responded, cleared or the flight crew selects another message.

Where data link messages are displayed on a shared display or on a shared display area, selection of another display format or function should not result in the loss of uplinked messages which are waiting for a response. In case the pilot is working on another task and a message is uplinked, the uplinked message should not interrupt the current work, nor result in the loss of any uplinked message and/or data entered while accomplishing the other task.

When the data link system is sharing a display and/or input devices with other aircraft functions, appropriate prioritisation of tasks and information display should be assured.

The status of each message (i.e. source, time sent, open/closed) should be displayed together with the message.

AMC1.ACNS.DLS.B1.1011 Dual Data Link Capabilities (Dual stack)

(a) The data link system should comply with ED-154A, interoperability requirements IR-207, IR-209, IR-210, IR-211, IR-212, IR-214, and IR-215 to ensure seamless transition between two adjacent ATSUs, one using FANS 1/A+ and the other using ATN B1

(b) The data link system should demonstrate common accessibility to the FANS 1/A and ATN B1 CPDLC applications. Accessibility demonstration should include common controls (i.e. line select keys) or, where different, the potential to introduce confusion or unacceptable flight crew workload should be evaluated.

(c) The data link system should demonstrate common control and input procedures for retrieving and responding to FANS 1/A and ATN B1 uplink messages.

(d) The data link system should demonstrate common control and input procedures for composing and sending FANS 1/A and ATN B1 downlink messages.

(e) The data link system should demonstrate common flight deck indications for incoming FANS 1/A and ATN B1 messages. Where common alerting is not demonstrable, the alerting scheme evaluate to ensure that neither confusion nor unnecessary flight crew workload is introduced.

(f) Annunciations and indications should be clear, unambiguous, timely, and consistent with the flight deck philosophy

(g) Flight Deck Display of Messages from either FANS 1/A or ATN B1 CPDLC Applications.

A common flight deck display should be capable of displaying messages with the same operational intent resulting from same message elements that may be implemented differently between FANS 1/A and ATN B1 CPDLC applications. The common format to display FANS 1/A messages should be in accordance with the preferred format denoted in Annex A of ED 122, which is consistent with Doc 4444, 15th Ed, and ATN B1 message formats.

(h) Dual Stack ATS Data Link System Status Indication.

The system should provide the flight crew with a means to clearly identify the status of different modes of the data link system that affect significant operational capability. Examples of different modes of data link may include situations when downlink messages are available in one airspace, but not the other; or messages that may or may not be loadable depending on system status, i.e., ATN B1 or FANS 1/A.

(i) ATSU Connections and Handoffs:

The system should be capable of the following functions:

(1) Proper connection and termination for FANS 1/A ATSU.

(2) Proper connection and termination for ATN B1 ATSU.

(3) Transfer to next data authority (e.g., FANS 1/A ATSU to ATN B1 ATSU), in both directions. This should include proper connection, maintenance of connection and connection termination protocol to ensure that aircraft does not hold two simultaneous active CPDLC connections.

(4) Ability for flight crew to manually terminate existing connection and establish new connection, in both directions (i.e., FANS 1/A-to-ATN B1 and ATN B1-to-FANS 1/A).

(5) Ability for flight crew to verify current and next facility designation or name.

(j) FAA AC 20-140A provides adequate guidance related to the application interoperability, sub-networks and performance designators. (refer to Tables 5.1 and 5.2).

ATN B1 Data link

AMC1 ACNS.DLS.B1.2000 Data Link Services

When the aircraft has no CPDLC Current Data Authority, the data link aircraft equipment should provide crew members entering an airspace of a data link equipped ATS unit with the capability to initiate a DLIC 'Logon' function (e.g. send a CMLogonRequest message) with the applicable ATS unit, in order to identify the aircraft and initiate the use of data link services.

GM1 ACNS.DLS.B1.2000 Data Link Services

(a) **Data Link Initiation Capability (DLIC) Service**

The DLIC service enables the exchange of information between aircraft and ground data link equipment necessary for the establishment of data link communications. It ensures:

(1) the unambiguous association of flight data from the aircraft with flight plan data used by an ATS unit,

(2) the exchange of the supported air–ground application type and version information,

(3) the delivery of the addressing information of the entity hosting the application.

(b) **ATC Communications Management (ACM) Service**

The ACM service provides automated assistance to flight crews for conducting the transfer of ATC communications (voice and data). It includes:

(1) the initial establishment of CPDLC with an ATS unit;

(2) the CPDLC ATC transfer instruction from one ATS unit to the next ATS unit;

(3) the CPDLC ATC instructions for a change in voice channel;

(4) the normal termination of CPDLC with an ATS unit.

(c) **ATC Clearances and Information (ACL) Service**

The ACL service provides flight crews with the ability to:

(1) send requests and reports to air traffic controllers;

(2) receive clearances, instructions and notifications issued by air traffic controllers to flight crews.

(d) **ATC Microphone Check (AMC) Service**

The AMC service provides CPDLC ATC instructions to flight crews requesting them to verify the status of their voice communication equipment

AMC1 ACNS.DLS.B1.2001 Protection mechanism

The data link system should comply with the following applicable ATN Baseline 1 standards:

(a) ICAO Document 9705 (Edition 2) for ICS (Sub-Volume V), ULCS (Sub-Volume IV), CM CPDLC (Sub-Volume II) ASE requirements;

(b) EUROCAE Document ED-110B;

(c) ICAO Document 9776 and ARINC 631-6 for VDL Mode 2 multi-frequency operations.

The data link aircraft equipment should provide support for the CPDLC application message integrity check mechanism , with support for 'default checksum algorithm' only.

AMC2 ACNS.DLS.B1.2001 Protection mechanism

Testing demonstrations could be based in two main steps:

(a) Equipment testing (done by equipment manufacturer) using adequate simulation testing tools.

(b) System testing, at system test bench and/or at aircraft test level (either on ground or in flight).

Equipment qualification testing data may be reused from the avionics manufacturer, provided that full and unrestricted access to the compliance data is established and maintained. However, the applicant remains responsible for all test data used in the course of compliance demonstration.

AMC3 ACNS.DLS.B1.2001 Protection mechanism

Where ARINC 631-6 identifies a specific deviation from ICAO Doc 9776 (Manual on VDL Mode 2), the provisions of the former should take precedence.

ARINC 631-6 also references ARINC 750 for definition of Signal Quality Parameter (SQP) levels. Measurements of SQP levels may be passed over the air-ground link as parameters in the XID exchanges.

GM1 ACNS.DLS.B1.2001 Protection mechanism

EUROCAE Document ED-110B sections 3.3.5.1 and 3.3.6 mentions an 'ATN Message Checksum Algorithm' (or 'Application Message Integrity Check (AMIC)') that does not exist in ICAO Document 9705 Edition 2. These terms are correctly referenced in ICAO Doc 9705 PDR M60050001.

GM2 ACNS.DLS.B1.2001 Protection mechanism

Both ICAO Document 9705 and EUROCAE Document ED-110B include requirements for the support of FIS and ADS-C applications. These two applications are not mandated for operations in European airspace. Data link aircraft implementations are free to support these applications and should notify their application availability in the DLIC logon function.

GM3 ACNS.DLS.B1.2001 Protection mechanism

Further guidance material from EUROCONTROL is available at Link 2000+ Programme Websites:

- http://www.eurocontrol.int/link2000/public/subsite_homepage/homepage.html.
- http://www.eurocontrol.int/link2000/public/site_preferences/display_library_list_public.html.
- LINK2000+/ATC DATA LINK OPERATIONAL GUIDANCE, Version 5.1, Date: 01 March 2010.
- LINK 2000+ Guidance to Airborne Implementers, Version 1.1, Date: 09 December 2009.
- LINK2000+/FLIGHT CREW DATA LINK OPERATIONAL GUIDANCE Version 4.0, Date: 30 June 2009.
- LINK2000+ Programme, Generic Interop Test Plan for Avionics - Part 1, Upper Layers and CM/CPDLC applications, Version 2.3, Date: 15th June 2010.

Time

AMC1 ACNS.DLS.B1.3101 Universal Time Coordinated (UTC)

A Global Navigation Satellite System (GNSS) sensor provides an acceptable source of synchronised UTC time.

Time synchronisation is required by ICAO Annex II, chapter 3, section 3.5 as referred by EUROCAE Document ED-110B, section 3.3.2. It is also identified as a safety requirement in EUROCAE Document ED-120 (e.g. SR-ACL-15).

Data link initiation capability (DLIC) service messages

AMC1 ACNS.DLS.B1.3201 DLIC Uplink Messages

Data link aircraft equipment should comply with ICAO Doc 9705 (Edition 2), section 2.1.4 and EUROCAE Document ED-110B, section 2.2.1.

AMC1 ACNS.DLS.B1.3202 DLIC Downlink Messages

Data link aircraft equipment should comply with ICAO Doc 9705 (Edition 2), section 2.1.4 and EUROCAE Document ED-110B, section 2.2.1.

CPDLC messages

AMC1 ACNS.DLS.B1.3301 CPDLC Uplink Messages

The data link system should comply with EUROCAE Document ED-110B section 2.2.3 and comply with the CPDLC message syntax ICAO Doc 9705 (Edition 2), section 2.1.4.

For the sole exception of UM117, the data link system should prepare the appropriate response downlink message to a received uplink message in compliance with EUROCAE Document ED-110B, section 2.2.3.3 Table 2-4. Received uplink messages with response type 'A/N'or 'Y' as indicated in the 'Response' column should be responded with either DM4 (AFFIRM) or DM5 (NEGATIVE). Received uplink messages with response type 'R' as indicated in the 'Response' column should be responded with DM3 (ROGER). When UM117 CONTACT is received, no DM89 MONITORING message should be sent.

The data link aircraft system should also handle unsupported messages (i.e. uplink message not referenced in CS ACNS.DLS.B1.3201) as specified in EUROCAE Document ED-110B, section 3.3.7.6.

AMC2 ACNS.DLS.B1.3301 CPDLC Uplink Messages

EUROCAE Document ED-110B requires (in Table 4-3, item 6a) aircraft to send the DM89 (MONITORING [unitname] [frequency]) CPDLC message upon receipt of a UM117 (CONTACT) or UM120 (MONITOR) CPDLC message. The sending of DM89 should be executed in response to UM120 but not for UM117.

GM1 ACNS.DLS.B1.3301 Uplink Messages

The following table associates uplink CPDLC messages to the data link services.

ID	Message	ACM	ACL	AMC
UM0	UNABLE		x	
UM1	STANDBY		x	
UM3	ROGER		x	
UM4	AFFIRM		x	
UM5	NEGATIVE		x	
UM19	MAINTAIN [level]		x	
UM20	CLIMB TO [level]		x	
UM23	DESCEND TO [level]		x	
UM26	CLIMB TO REACH [level] BY [time]		x	
UM27	CLIMB TO REACH [level] BY [position]		x	
UM28	DESCEND TO REACH [level] BY [time]		x	
UM29	DESCEND TO REACH [level] BY [position]		x	
UM46	CROSS [position] AT [level]		x	
UM47	CROSS [position] AT OR ABOVE [level]		x	
UM48	CROSS [position] AT OR BELOW [level]		x	
UM51	CROSS [position] AT [time]		x	
UM52	CROSS [position] AT OR BEFORE [time]		x	
UM53	CROSS [position] AT OR AFTER [time]		x	
UM54	CROSS [position] BETWEEN [time] AND [time]		x	
UM55	CROSS [position] AT [speed]		x	
UM61	CROSS [position] AT AND MAINTAIN		x	
UM64	OFFSET [specifiedDistance] [direction] OF ROUTE		x	
UM72	RESUME OWN NAVIGATION		x	
UM74	PROCEED DIRECT TO [position]		x	
UM79	CLEARED TO [position] VIA [routeClearance]		x	
UM80	CLEARED [routeClearance]		x	
UM82	CLEARED TO DEVIATE UP TO [specifiedDistance] [direction] OF ROUTE		x	
UM92	HOLD AT [position] AS PUBLISHED MAINTAIN [level]		x	
UM94	TURN [direction] HEADING [degrees]		x	
UM96	CONTINUE PRESENT HEADING		x	

ID	Message	ACM	ACL	AMC
UM106	MAINTAIN [speed]		x	
UM107	MAINTAIN PRESENT SPEED		x	
UM108	MAINTAIN [speed] OR GREATER		x	
UM109	MAINTAIN [speed] OR LESS		x	
UM116	RESUME NORMAL SPEED		x	
UM117	CONTACT [unitname] [frequency]	x		
UM120	MONITOR [unitname] [frequency]	x		
UM123	SQUAWK [code]		x	
UM133	REPORT PRESENT LEVEL		x	
UM148	WHEN CAN YOU ACCEPT [level]		x	
UM157	CHECK STUCK MICROPHONE [frequency]			x
UM159	ERROR [errorInformation]	x	x	
UM160	NEXT DATA AUTHORITY [facility]	x		
UM162	SERVICE UNAVAILABLE		x	
UM165	THEN		x	
UM171	CLIMB AT [verticalRate] MINIMUM		x	
UM172	CLIMB AT [verticalRate] MAXIMUM		x	
UM173	DESCEND AT [verticalRate] MINIMUM		x	
UM174	DESCEND AT [verticalRate] MAXIMUM		x	
UM179	SQUAWK IDENT		x	
UM183	[freetext]	x	x	x
UM190	FLY HEADING [degrees]		x	
UM196	[freetext]		x	
UM203	[freetext]		x	
UM205	[freetext]		x	
UM211	REQUEST FORWARDED		x	
UM213	[facilitydesignation] ALTIMETER [altimeter]		x	
UM215	TURN [direction] [degrees]		x	
UM222	NO SPEED RESTRICTION		x	
UM227	LOGICAL ACKNOWLEDGEMENT	x	x	
UM231	STATE PREFERRED LEVEL		x	
UM232	STATE TOP OF DESCENT		x	
UM237	REQUEST AGAIN WITH NEXT UNIT		x	x

GM2 ACNS.DLS.B1.3301 Uplink Messages

The above ACL messages correspond to the common subset of ACL messages defined in EUROCAE Document ED-120 section 5.2.1.1.5 as required by Regulation (EC) No 29/2009.

AMC1 ACNS.DLS.B1.3302 Downlink Messages

The data link system should comply with EUROCAE Document ED-110B section 2.2.3 and comply with the CPDLC message syntax ICAO Doc 9705 (Edition 2), section 2.1.4.

For the sole exception of UM117, data link aircraft equipment should prepare the appropriate response downlink message to a received uplink message in compliance with EUROCAE Document ED-110B, section 2.2.3.3 Table 2-4. When UM117 CONTACT is received, no DM89 MONITORING message should be sent.

GM1 ACNS.DLS.B1.3302 Downlink Messages

The following table associates uplink messages to the data link services.

ID	Message	ACM	ACL	AMC
DM0	WILCO	x	x	
DM1	UNABLE	x	x	
DM2	STANDBY	x	x	
DM3	ROGER		x	
DM4	AFFIRM		x	
DM5	NEGATIVE		x	
DM6	REQUEST [level]		x	
DM9	REQUEST CLIMB TO [level]		o[8]	
DM10	REQUEST DESCENT TO [level]		O[8]	
DM22	REQUEST DIRECT TO [position]		x	
DM27	REQUEST WEATHER DEVIATION UP TO [specifiedDistance] [direction] OF ROUTE		O[8]	
DM32	PRESENT LEVEL [level]		x	
DM62	ERROR [errorInformation]	x	x	
DM63	NOT CURRENT DATA AUTHORITY	x		
DM66	DUE TO AIRCRAFT PERFORMANCE		x	
DM81	WE CAN ACCEPT [level] AT [time]		x	
DM82	WE CANNOT ACCEPT [level]		x	
DM89	MONITORING [unitname] [frequency]	x		
DM98	[freetext]	x	x	
DM99	CURRENT DATA AUTHORITY	x		

[8] See GM3 ACNS.DLS_B1.3202

ID	Message	ACM	ACL	AMC
DM100	LOGICAL ACKNOWLEDGEMENT	x	x	
DM106	PREFERRED LEVEL [level]		x	
DM107	NOT AUTHORIZED NEXT DATA AUTHORITY	x	x	
DM109	TOP OF DESCENT [time]		x	

GM2 ACNS.DLS.B1.3302 Downlink Messages

The above ACL messages correspond to the common subset of ACL messages defined in EUROCAE Document ED-120 section 5.2.1.1.5 as required by Regulation (EC) No 29/2009.

GM3 ACNS.DLS.B1.3302 Optional ACL Downlink Messages

The data link system may also allow the sending the following ACL messages defined in EUROCAE Document ED-120 section 5.2.1.1.5. The message syntax should also comply with ICAO Doc 9705 (Edition 2), section 2.3.4.

ID	Message
DM9	REQUEST CLIMB TO [level]
DM10	REQUEST DESCENT TO [level]
DM27	REQUEST WEATHER DEVIATION UP TO [specifiedDistance] [direction] OF ROUTE

Data link services requirements

AMC1 ACNS.DLS.B1.4101 Data Link Initiation Capability (DLIC) Service

(a) The data link aircraft equipment DLIC logon function should comply with the aircraft system PR-DLIC-Init-ET_{RCTP} and PR-DLIC-Init-TT performance values, respectively 6 seconds and 4 seconds, as specified in EUROCAE Document ED-120 Table A-3.

(b) The data link aircraft equipment DLIC contact function should comply with the aircraft system PR-DLIC-Cont-ET_{RCTP} and PR-DLIC-Cont-TT performance values, respectively 6 seconds and 4 seconds, as specified in EUROCAE Document ED-120 Table A-3.

(c) The data link system should:

(1) not permit data link services when there are incompatible DLIC version numbers;

(2) reinitiate the service with the applicable ATSUs when any of the application or flight information changes;

(3) insert the relevant initiation data in the initiation messages;

(4) not affect the intent of the DLIC message during processing (data entry/encoding/ transmitting/decoding/displaying).

GM1 ACNS.DLS.B1.4101 Data Link Initiation Capability (DLIC) Service

The Performance Tables in the main body of EUROCAE Document ED-120 for DLIC (Table 4-9), ACM (Table 5-21) and ACL (Table 5-31) provide the required round-trip time (TRN) and the allocated values for the two-way transactions.

A detailed allocation for Aircraft delays is provided in EUROCAE Document ED-120 Annex A/Table A-3.

AMC1 ACNS.DLS.B1.4201 ATC Communications Management (ACM) Service

The data link system for ACM service should comply with the aircraft system PR-ACM-ET_{RCTP} and PR-ACM-TT performance values, respectively 6 seconds and 4 seconds, as specified in EUROCAE Document ED-120 Table A-3.

GM1 ACNS.DLS.B1. 4201 ATC Communications Management (ACM) Service

The Performance Tables in the main body of EUROCAE Document ED-120 for DLIC (Table 4-9), ACM (Table 5-21) and ACL (Table 5-31) provide the required round-trip time (TRN) and the allocated values for the two-way transactions.

A detailed allocation for Aircraft delays is provided in EUROCAE Document ED-120 Annex A/Table A-3.

AMC1 ACNS.DLS.B1.4301 ATC Clearances and Information (ACL) Service

The data link system for ACL service should comply with the aircraft system PR-ACL-ET_{RCTP} and PR-ACL-TT performance values, respectively 6 seconds and 4 seconds, as specified in EUROCAE Document ED-120 Table A-3.

GM1 ACNS.DLS.B1.4301 ATC Clearances and Information (ACL) Service

The Performance Tables in the main body of EUROCAE Document ED-120 for DLIC (Table 4-9), ACM (Table 5-21) and ACL (Table 5-31) provide the required round-trip time (TRN) and the allocated values for the two-way transactions.

A detailed allocation for Aircraft delays is provided in EUROCAE Document ED-120 Annex A/Table A-3.

Interoperability requirements

AMC1 ACNS.DLS.B1.4531 Network Layer Requirements

The ATN Router should comply with ICAO Document 9705 (Edition 2), sections 5.2.4.1, 5.2.4.3 with an IDRP Hold Time value of 900 seconds.

GM1 ACNS.DLS.B1.4531 Network Layer Requirements

Compression Schemes

Airborne ATN Router may implement several distinct, yet complementary, compression schemes.

Airborne ATN Routers should support the CLNP Header Compression (also known as 'LREF Compression'). Other compression schemes in ICS are optional.

In addition to the CLNP Header Compression, data link ATN Routers that claims support for optional DEFLATE compression should also support ICAO PDU M0070002 ('Interoperability impact when deflate compression is used. Non-compliance with Zlib').

AMC1 ACNS.DLS.B1.4541 Transport Layer Requirements

The ATN End System of the data link aircraft equipment should comply with the Transport Protocol Class 4 specified in ICAO Document 9705 (Edition 2), Sub-volume V, section 5.5.2.

The data link aircraft equipment should implement Transport Protocol Class 4 parameter settings in accordance with the following table:

Scope	Parameter	Definition	Value
Inactivity	Inactivity time (I)	A bound for the time after which a transport entity will, if it does not receive a Transport Protocol Data Unit (TPDU), initiate the release procedure to terminate the transport connection.	360 sec
Re-transmission	Retransmission time (T1)	A bound for the maximum time the transport entity will wait for acknowledgement before re-transmitting a TPDU. The retransmission time is adaptive.	Initial value 30 sec
	Maximum Retransmission (N)	Maximum number of TPDU retransmissions.	7
Window	Window time (W)	A bound for the maximum time a transport entity will wait before retransmitting up-to-date window information.	120 sec
Flow Control	Local Acknowledgement delay (Al)	A bound for the maximum time which can elapse between the receipt of a TPDU by the local transport entity from the network layer and the transmission of the corresponding acknowledgement.	1 sec

GM1 ACNS.DLS.B1.4541 Transport Layer Requirements

Transport Protocol Classes

ICAO Doc 9705 (Edition 2), Sub-volume V, section 5.5 identifies both Connection Oriented and Connection-Less Transport Protocols (as specified in, respectively, ISO/IEC 8073 for COTP and ISO/IEC 8602 for CLTP). The only mandated support is for COTP (i.e. CLTP support is not required).

In addition, ISO/IEC 8073 identifies 5 distinct possible implementations for COTP support, ranging from Class 0 (the less constraining to implement, but also the less reliable) to Class 4 (most reliable). The fifth Class, i.e. COTP Class 4 (also known as 'TP4'), is the only mandated implementation (all other implementations classes are useless for the ATN COTP support).

Transport Protocol Classes

In the ATN Baseline 1 SARPS (i.e. Doc 9705, Edition 2), the Transport Class 4 - as known as TP4 - is as specified in ISO 8073, that mandates support for a 16-bits checksum. Such checksum is considered to be insufficient to detect, and thus compensate, all potential miss deliveries of CLNP Packets by the underlying network routers. The analysis that concluded of TP4 inability to detect and compensate all CLNP miss deliveries is available in ICAO PDR M00040002. The use of a 32-bits long checksum is identified as a solution to address this potential issue.

AMC1 ACNS.DLS.B1.4551 Session Layer Requirement

(a) The ATN End System of the data link aircraft equipment should support a Session Protocol as specified in ICAO Doc 9705 (Edition 2), Sub-Volume IV, section 4.4 including the ISO/IEC 8327 Technical Corrigendum 1 (2002), listed in the following table.

Value (Hex)	Abbreviation	Full SPDU Name
E8	SCN	Short Connect
F0	SAC	Short Accept
D8	SACC	Short Accept Continue
E0-E3	SRF	Short Refuse E0: TC retained, transient refusal E1: TC retained, persistent refusal E2: TC released, transient refusal E3: TC released, persistent refusal
A0	SRFC	Short Refuse Continue

(b) The ATN End System Session Protocol of the data link system should make use of the value 'E3' to encode the Short Refuse (SRF) SPDU.

AMC1 ACNS.DLS.B1.4561 Presentation Layer Requirement

(a) The ATN End System of the data link aircraft equipment should support a Presentation Protocol as specified in ICAO Doc 9705 (Edition 2), Sub-Volume IV, section 4.5, and listed in the following table:

Value (Hex)	Abbreviation	Full PPDU Name
02	SHORT-CP	Short Presentation Connect, unaligned PER
02	SHORT-CPA	Short Presentation Connect Accept, unaligned PER
x2	SHORT-CPR	Short Presentation Connect Reject Where x = reason code: 02: presentation-user 12: reason not specified (transient) 22: temporary congestion (transient) 32: local limit exceeded (transient) 42: called presentation address unknown (permanent) 52: protocol version not supported (permanent) 62: default context not supported (permanent) 72: user data not readable (permanent)

(b) The ATN End System Presentation Protocol of the data link aircraft equipment should make use of the value '02' to encode the SHORT-CPR PPDU.

AMC1 ACNS.DLS.B1.4571 Application Layer Requirements

(a) The ATN End System of the data link system should support an ATN Convergence Function compliant with ICAO Doc 9705 (Edition 2), Sub-volume IV, section 4.3.

(b) The ATN End System of the data link system should support an ATN Association Control Service Element (ACSE) compliant with ICAO Doc 9705 (Edition 2), Sub-volume IV, section 4.6.

GM1 ACNS.DLS.B1.4571 Application Layer Requirements

From an OSI perspective, the ATN Application layer is composed of three distinct parts:

- Layer 7a, that includes all application-independent services (Convergence Function + ACSE).
- Layer 7b, that includes all application-dependent service elements (such as the CPDLC-ASE).
- Layer 7c, that includes applications (such as the CPDLC application, that uses CPDLC-ASE for its communications with ground-based systems).

SUBPART E — OTHERS

SECTION 1 – TERRAIN AWARENESS WARNING SYSTEM (TAWS)

GM1 ACNS.TAWS.1000 Applicability

CS-ACNS.TAWS airworthiness requirements are not suitable to allow the use of TAWS for navigation or for mitigation of navigation system failures.

AMC1 ACNS.TAWS.1010 TAWS equipment approval

The Class A or Class B TAWS equipment should be approved in accordance with ETSO-C151b and ETSO-C92c (for the GPWS functions).

AMC1 ACNS.TAWS.2010 Required functions

Note: An example of an acceptable TAWS installation is provided at Appendix 2.

(a) For the voice call out a predetermined altitude of 500 ft. has been found acceptable. However, another altitude may be allowed when a call-out at 500 ft. would interfere with other call outs

(b) For Class B equipment the predetermined altitude voice callout is based upon barometric height above runway elevation.

Note: The nearest runway elevation may be used for this purpose.

(c) TAWS equipment may compute Barometric Altitude Rate using an Instantaneous Vertical Speed Indicator (IVSI) or an inertial smoothed vertical speed indicator. An alternative means, with demonstrated equal or better accuracy, may be used in lieu of barometric altitude rate (accuracy specified in ETSO-C10b, Altimeter, Pressure Actuated, Sensitive Type, or later revisions) and/or altimeter altitude (accuracy specified in ETSO-2C87 (Low range radio altimeters) - or later revisions) to meet the warning requirements described in RTCA Document No. DO-161A. In addition, ETSO-C106 for Air Data Computers may be used as an alternative means of compliance with this provision.

AMC 2 ACNS.TAWS.2010 Required functions

In case of an intentional descent an awareness check at a predefined altitude (typically 500 ft) should be provided by the TAWS or by an operational procedure.

In case of an unintentional descent the TAWS should provide an automatic call out when descending through a predefined altitude (typically 500ft).

For a Class B TAWS in order to compensate for the lack of ‘excessive closure rate to terrain ‘ function the predefined altitude should be 500ft.

AMC1 ACNS.TAWS.2020 FLTA function requirements

(a) The TAWS lateral search area should be less than the protected area defined by ICAO PANS OPS 8168, volume 2 to prevent nuisance alerts.

Note: The required obstacle (terrain) clearance (ROC) have been used to define the minimum requirements for obstacle/terrain clearance (RTC) appropriate to the FLTA function

(b) As an alternate to the stepped down reduction from the terminal to approach phase in CS ACNS.TAWS 2020 Table 1 , a linear reduction of the RTC as the aeroplane comes closer

to the nearest runway is allowed, providing the requirements of CSACNS.TAWS 2020 Table 1 are met.

(c) During the visual segment of a normal instrument approach (typically about 1 NM from the runway threshold), the RTC should be defined/reduced to minimise nuisance alerts.

(d) The RTC values can be reduced slightly for descending flight conditions to accommodate the dynamic conditions and pilot response times.

(e) The FLTA search volume should vary as a function of phase of flight, distance from runway, and the required terrain clearance.

GM1 ACNS.TAWS.2030 PDA function requirements

The purpose of the PDA alert is to increase pilot's awareness. Therefore 'significantly below' means the point below the profile where the pilot would normally initiate a Go Around (e.g. for ILS this would correspond to 1 dot deviation).

AMC1 ACNS.TAWS.2040 Class A TAWS inhibition

(a) An automatic inhibit capability is acceptable if it uses the information of the TAWS as a failure monitoring function.

Note: The alternate manual inhibit functionality will allow pilots to disable the TAWS FLTA and PDA alerts without removing the terrain display when landing at a site not included in the database or landing at a site that generates known nuisance alerts.

(b) If an automatic inhibition is provided and it automatically inhibits the FLTA alerts, PDA alerts and terrain display then the manual inhibit may be designed to only inhibit aural and visual alerts.

(c) A separate guarded control may be provided to inhibit GPWS alerts based on flaps being other than the landing configuration.

AMC1 ACNS.TAWS.2050 Terrain information display

(a) Terrain data should be displayed in the normal field of view. Terrain that is more than 2000 ft below the aeroplane's elevation need not be depicted.

(b) Terrain, obstacle and alerting information could be displayed on a weather radar, an Electronic Flight Instrument System display, or other compatible display system available on the flight deck. In this case, the TAWS information should be displayed in a manner consistent with other information (e.g. range, colour coding, symbology).

(c) When Auto-range switching is provided, an auto-ranging display should be designed so that it is evident to the flight crew that the range has been automatically selected. The range selected for auto-ranging should clearly depict the threat on the display. Manual reversion to a selected range should be simple.

AMC1 ACNS.TAWS.2060 Aural and visual alerts

(a) Table 1 below contains a set of acceptable TAWS alerts. In addition to this minimum set, other voice alerts may be provided.

Alert Condition	Caution	Warning
Ground proximity Altitude Loss after Take-off	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural	**Visual Alert** None required **Aural Alert** None Required

Alert Condition	Caution	Warning
Class A & Class B equipment	message **Aural Alert** 'Don't Sink' and 'Too Low Terrain'	
Ground Proximity Envelope 1 (Not in Landing Configuration) Class A equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Too Low Terrain' and 'Too Low Gear'	**Visual Alert** None required **Aural Alert** None Required
Ground Proximity Envelope 2 Insufficient Terrain Clearance (Landing and Go around configuration) Class A equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Too Low Terrain' and 'Too Low Flaps'	**Visual Alert** None required **Aural Alert** None Required
Ground Proximity Envelope 4C Insufficient Terrain Clearance (Take-off configuration) Class A equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Too Low Terrain'	**Visual Alert** None required **Aural Alert** None Required
Ground Proximity Excessive Glide Slope Deviation Class A equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Glide Slope'	**Visual Alert** None required **Aural Alert** None Required
Ground Proximity Advisory Voice Call Out Class A & Class B equipment	**Visual Alert** None Required **Aural Alert** 'Five Hundred'	**Visual Alert** None required **Aural Alert** None Required
Reduced Required Terrain Clearance Class A & Class B equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** Minimum selectable Voice Alerts:	**Visual Alert** Red text message that is obvious, concise and must be consistent with the Aural message **Aural Alert** Minimum selectable Voice Alerts:

Alert Condition	Caution	Warning
	'Caution, Terrain; Caution, Terrain' and 'Terrain Ahead; Terrain Ahead'	'Caution, Terrain; Terrain; Pull-Up, Pull-Up' and 'Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up'
Imminent Impact with Terrain Class A & Class B equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** Minimum selectable Voice Alerts: 'Caution, Terrain; Caution, Terrain' and 'Terrain Ahead; Terrain Ahead'	**Visual Alert** Red text message that is obvious, concise and must be consistent with the Aural message **Aural Alert** Minimum selectable Voice Alerts: 'Caution, Terrain; Terrain; Pull-Up, Pull-Up' and 'Terrain Ahead, Pull-Up; Terrain Ahead, Pull-Up'
Premature Descent Alert (PDA) Class A & Class B equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Too Low Terrain'	**Visual Alert** None required **Aural Alert** None Required
Ground Proximity Envelope 1, 2 or 3 Excessive Descent Rate Class A & Class B equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Sink Rate'	**Visual Alert** Red text message that is obvious, concise and must be consistent with the Aural message **Aural Alert** ' Pull-Up'
Ground Proximity Excessive Closure Rate (Flaps not in Landing Configuration) Class A equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Terrain- Terrain'	**Visual Alert** Red text message that is obvious, concise and must be consistent with the Aural message **Aural Alert** ' Pull-Up'
Ground Proximity Excessive Closure Rate (Landing Configuration) Class A equipment	**Visual Alert** Amber text message that is obvious, concise, and must be consistent with the Aural message **Aural Alert** 'Terrain- Terrain'	**Visual Alert** None required **Aural Alert** ' Pull-Up' - for gear up None required - for gear down

TABLE 1: Visual and aural alerts

(b) If a two tone sweep ('Whoop Whoop') is used then the complete cycle of the two tone sweeps plus annunciation may be extended from '1.4' to '2' seconds.

Note: GPWS alerting thresholds may be adjusted or modified to be more compatible with the FLTA alerting functions and to minimize GPWS nuisance alerts.

(c) Parameters such as airspeed, groundspeed barometric altitude rate should be included in the logic that determines basic GPWS alerting time.

(d) GPWS alerting thresholds may be adjusted or modified to be more compatible with the FLTA alerting functions and to minimize GPWS nuisance alerts.

(e) Consideration should be given to presenting voice announcements at a pre-set level via headsets when they are in use.

AMC1 ACNS.TAWS.3020 Terrain and airport information

An airport and terrain database used by the TAWS should be compliant with EUROCAE ED-98 () – User Requirements for Terrain and Obstacle Data.

Note: Other technologies could be considered to provide the required terrain and airport information.

The manufacturer of the TAWS system should present the development and methodology used to validate and verify the terrain, obstacle and airport information in compliance with EUROCAE ED76/RTCA DO200A.

AMC1 ACNS.TAWS.3030 Positioning information

(a) The TAWS positioning information can be generated internally to the TAWS (e.g. GPS receiver) or acquired by interfacing to other installed avionics on the aeroplane (e.g. FMS).

(1) For Class A TAWS an RNAV system may be used as an aeroplane horizontal position sensor provided that:

- it has been approved for navigation in accordance with ETSO-C115() or ETSO-C129c or ETSO-C145() or ETSO-C146() or ETCO-C196a; or
- it satisfies FAA AC 20-138.

(2) For Class A and B TAWS a GNSS sensor may be used as an aeroplane horizontal position sensor provided that it is compliant with ETSO-C196 or ETSO-C145.

Note: For TAWS relying on GNSS sensor, the TAWS design should consider the use of other horizontal position sensors to ensure TAWS availability in case of GNSS failures

(3) Equipment that uses a GNSS internal to the TAWS for horizontal position information, and that are capable of detecting a positional error that exceeds the appropriate alarm limit for the particular phase of flight in accordance with ED-72A is considered acceptable.

(4) Vertical position for TAWS may come from a barometric source such as an altimeter or an air data computer, or from a geometric source, such as GNSS provided that:

- the barometric altitude equipment is approved in accordance with ETSO-C106 Air data computer or ETSO-C10b Altimeter, Pressure Actuated, Sensitive Type;
- the radio altimeter equipment is approved in accordance with ETSO-2C87 Low-Range Radio Altimeter;
- the vertical velocity equipment is compliant with ETSO-C8 Vertical Velocity Instruments or ETSO-C105 Air Data Computer;
- the GNSS equipment is approved in accordance with:
    - ETSO-C145, Airborne Navigation Sensors Using the Global Positioning System Augmented by the Satellite Based Augmentation System; or

- ETSO-C146, Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented by the Satellite Based Augmentation System.

Note: Designs that cross check barometric and geometric altitude are recommended.

(b) When the GPS alert limit is activated, the GPS computed position is considered unsuitable for TAWS, and a TAWS unsuitability indication should be given.

(c) Geometric altitude should be enabled if the system has the facility.

AMC1 ACNS.TAWS.4010 Prioritisation schemes

TAWS prioritisation schemes should be compliant with the content of Table 2:

Priority	Description	Alert Level	Comments
1	Reactive Windshear Warning	W	
2	Sink Rate Pull-Up Warning	W	Continuous
3	Excessive Closure Pull-Up Warning	W	Continuous
4	RTC Terrain Warning	W	
5	V1 Callout	A	
6	Engine Fail Callout	W	
7	FLTA Pull-Up Warning	W	Continuous
8	PWS Warning	W	
9	RTC Terrain Caution	C	Continuous
10	Minimums	A	
11	FLTA Caution	C	7 s period
12	Too Low Terrain	C	
13	PDA 'Too Low Terrain' Caution	C	
14	Altitude Callouts	A	
15	Too Low Gear	C	
16	Too Low Flaps	C	
17	Sink Rate	C	
18	Don't Sink	C	
19	Glideslope	C	3 s period
20	PWS Caution	C	
21	Approaching Minimums	A	
22	Bank Angle	C	
23	Reactive Windshear Caution	C	
Mode 6	TCAS RA ('Climb', 'Descent', etc)	W	continuous
Mode 6	TCAS TA ('Traffic, Traffic')	C	Continuous

Table 2: Alert Prioritization Scheme

Note 1: These alerts can occur simultaneously with TAWS voice callout alerts.

Note 2: W= Warning, C= Caution, A= Advisory.

TAWS internal priority alerting scheme should be compliant with the content of Table 3 below

Priority	Description
1	Sink Rate Pull-Up Warning
2	Terrain Awareness Pull-Up warning
3	Terrain Awareness Caution
4	PDA 'Too Low Terrain' Caution
5	Altitude Callouts '500'
6	Sink Rate
7	Don't Sink (Mode 3)

TABLE3: TAWS Internal Alert Prioritization Scheme

AMC1 ACNS.TAWS.4020 Pop-up mode

For dual displays, the pop-up function can be inhibited if terrain is already presented on at least one display.

If TAWS and the Predictive Windshear System share the same display and an automatic pop-up function is employed, the display priorities indicated in Table 4 are recommended:

Priority	Description
Highest	Terrain Awareness Warning
↕	Predictive Windshear Warning
	Terrain Awareness Caution
	Predictive Windshear Caution
	Normal Terrain Display
Lowest	Weather Radar Display

TABLE 4: Alert display priorities

If the TAWS system provides alerting for obstacle threats, the priority for warning and cautions should be the same as those for terrain.

APPENDIX 1: TAWS INSTALLATIONS TESTING GUIDANCE MATERIAL

General Testing:

(a) Most of the testing of a TAWS installation can be achieved by ground testing that verifies system operation, interfaces between affected aeroplane systems, correct warning prioritisation, and freedom from unwanted interaction or interference.

(b) The use of the TAWS as an integrated part of the aeroplane flight deck should be demonstrated. The TAWS should be shown to be compatible with the operation of the installed navigation systems including paper charts, the airborne collision and avoidance system (ACAS), the windshear warning system, and the weather radar.

(c) The tests should evaluate the effects of sensor failure on TAWS operation.

(d) Flight testing should be carried out to evaluate overall operation, compatibility between TAWS, warning systems, navigation systems, and displays, freedom from unwanted interference, and to assess, during adverse flight conditions, instrument visibility, display lighting, sound levels and intelligibility of voice announcements, and the effects of electrical transients.

(e) Adequate flight testing to evaluate the terrain display can be conducted while verifying all the other required TAWS functions. Emphasis could be placed on showing compliance with CS ACNS.TAWS requirements during normal aeroplane manoeuvres for all phases of flight. Pop-up and auto-ranging features could be evaluated if applicable. Sustained turns could be performed, to evaluate for example symbol stability, flicker, jitter, display update rate, readability, the use of colour to depict relative elevation data, caution and warning alerts, and overall suitability of the display.

GPWS Testing:

(a) Flight testing to verify the proper operation of Basic GPWS functions can be conducted in any area where the terrain elevation is known to the flight crew. The following information provides an example of guidance for conducting flight tests to verify the proper operation of each GPWS function.

(1) Excessive *Rate of Descent.* Descents toward near level terrain are recommended if they provide the best results and ease of correlation with DO161A envelopes. This test verifies the operation of barometric altitude (and the corresponding computation of barometric altitude rate) and radio altitude.

(2) Excessive *Closure Rate To Terrain*. It is recommended that one level test run at an altitude between 500 and 1000 ft above the terrain elevation be conducted. This test will verify the proper installation of the radio altimeter.

(3) *Negative Climb Rate or Altitude Loss After take-off.* If it is adequate this test can be conducted immediately after take-off before climbing above 700 AGL or above runway elevation. This test verifies the proper operation of barometric altitude, barometric altitude rate and radio altitude.

(4) *Flight Into Terrain When Not In Landing Configuration.* If it is adequate this test can be conducted while *on* a visual approach to a suitable runway. This test verifies the proper installation of barometric altitude, barometric altitude rate and radio altitude as well as the gear and flap sensor inputs to TAWS.

(5) *Excessive Downward Deviation from an ILS Glideslope.* This test should be conducted during an ILS approach. This test will verify the proper operation of the ILS Glideslope input to TAWS.

(6) *Voice Callout 'Five Hundred ft.* This test can be conducted during an approach to a suitable runway. This test will verify the proper operation of barometric altitude, radio altitude, and height above terrain as determined by either radio altitude.

(7) Go-*around*. This test can be performed to confirm that nuisance alerts do not occur during normal go-around manoeuvres.

FLTA Testing:

(a) Flight testing to verify the proper operation of the FLTA function can be conducted in an area where the terrain or obstacle elevation for the test runs is known within approximately 300 ft. Two test runs can be performed:

(1) In level flight at approximately 500 ft above the terrain/obstacle of interest.

(2) While descending toward the terrain/obstacle of interest.

(b) In each test case, the terrain display, the aural and visual alerts, the navigation source input, and the terrain data base can each be evaluated if necessary. Confirmation that the specific terrain cells do generate the required alert can also be evaluated if necessary.

NOTE: To conduct the test as described, the chosen terrain could be for example at least 15 NM from the nearest airport. If this is not practical, the fly-over altitude will have to be lowered, for example to 300 ft or less above the terrain/obstacle in order to generate a TAWS alert.

PDA Testing:

(a) Flight testing to verify the proper operation of the PDA function can be conducted in any airport area within an adequate distance of the nearest runway for example, 10 NM. The aeroplane should be configured for landing at an adequate height for example, 1500 ft AGL, along the final approach segment of the runway at an adequate distance from the runway, for example, 10 NM.

(b) At a suitable point, a normal flight path angle descent, for example, three degrees can be initiated and maintained until the PDA alert occurs. This test may exercise also, if necessary the 500 ft voice callout.

The adequacy of the PDA aural alert should be verified during this test. If necessary, this test could verify the adequacy of the airport data base, the navigation source input and the barometric and/or radio altitude inputs to TAWS.

NOTE: The area in the vicinity of the runway selected for this test should be relatively free from terrain and obstacles to preclude activation of the FLTA function. Approximately level terrain along the final approach segment will exercise the PDA function.

(c) Flight tests should be conducted to verify that conditions at 1000 ft AGL within 10 -15 NM of the nearest airport the TAWS system does not generate alerts.

APPENDIX 2: EXAMPLE OF AN ACCEPTABLE TAWS INSTALLATION

An example of an acceptable installation is a single approved TAWS comprising the following components or inputs:

(a) A single terrain awareness and warning computer.

(b) A single radio altimeter sensor.

(c) A single air data system.

(d) An ILS/GBAS/SBAS/MLS/MMR receiver for Class A TAWS only.

(e) An interface with the landing gear and flaps.

(f) A roll attitude sensor.

(g) An accurate source of aeroplane position e.g. Flight Management System (FMS), or a Global Positioning System (GPS) or both.

(h) Where operations are reliant on the use of QFE, an adequate means of determining the altitude should be provided.

(i) A terrain data base covering the expected region of normal operations, together with a means of updating the stored data and to check its validity (by effective date and geographical region).

(j) A terrain awareness display.

(k) A loudspeaker for voice announcements.

(l) Consideration should be given to presenting voice announcements via headsets at a preset level particularly where active noise-reducing or noise cancelling headsets are used.

(m) Indication of TAWS and sensor failures.

(n) Indication that the TAWS is operating in Basic GPWS mode only.

(o) A means to initiate the TAWS self-test function on the ground and where feasible in the air.

(p) An interface with the flight recording system to record TAWS alerts and inhibition of FLTA or PDA functions.

(q) Indication to the flight crew where geographical regions of operation or other factors which adversely affect system performance to the extent that the TAWS may be potentially misleading and should not be relied up. If this indication is not practicable, a flight crew procedure may be used to determine whether the navigation system accuracy is acceptable for continued use of the TAWS.

(r) A means for the flight crew to inhibit the FLTA and PDA functions together with appropriate annunciation of the inhibited condition.

(s) A display with a means for the flight crew to select or deselect the terrain information. An automatic pop-up mode may be used with a simple means to deselect the terrain information after an automatic pop-up.

SECTION 2 – REDUCED VERTICAL SEPARATION MINIMUM (RVSM)

AMC1 ACNS.RVSM.1010 RVSM system

(a) When Static Source Error Corrections (SSEC) are required they should be embedded within the altimetry system.

Note: The design aim for SSEC is to correct for the residual static source error, compatible with the RVSM performance requirements.

(b) For RVSM systems with SSEC, an equivalent SSEC may be applied to the altitude control signal.

AMC1 ACNS.RVSM.2000 Required functions

The signal representing the altitude alerting system may be used either directly, or combined with other sensor signals. The signal may be an altitude deviation signal, relative to the selected altitude, or a suitable absolute altitude signal.

AMC1 ACNS.RVSM.3020 RVSM system performance requirement

If the design and characteristics of the aircraft and its altimetry system are such that the performance requirements are not satisfied by the location and geometry of the static sources alone, then suitable Static Source Error Corrections should be applied automatically within the altimetry system.

AMC1 ACNS.RVSM.3030 Altimetry system accuracy

To demonstrate the compliance with ASE performances the following steps should be performed:

(a) Group and Non Group determination:

(1) Aircraft should have been constructed to a nominally identical design and be approved on the same Type Certificate (TC). Aircraft constructed or modified to a TC amendment, Supplemental TC may be considered as part of the same group providing that all height keeping performance characteristics as described in the following paragraphs remain the same.

(2) The static system of each aircraft should be nominally identical. The Static Source Error and any applied SSE Corrections should be the same for all aircraft of the group.

(3) The operational flight envelope should be the same.

(4) The avionics units installed on each aircraft to meet the minimum RVSM performance requirements should demonstrate equivalent height keeping system performance in relation to; altitude control, altitude reporting and the interface to the altimetry system sensors. Altimetry system integrity should be the same with equivalent reliability, degradation and failure rates.

If an airframe does not meet the conditions above to qualify as a member of a Group, or is presented as an individual airframe for approval, then it will be considered as a non-group aircraft for the purposes of RVSM approval.

(b) RVSM Flight envelopes boundaries (Full and Basic)

The RVSM full flight envelope boundaries should be defined based on the RVSM airspace and aircraft or group aircraft characteristics as summarised in Table 1.

The RVSM basic envelope boundaries are similar to the ones of the full flight envelope, however, the upper Mach boundary may be lower than the one of the full flight envelope but not be less than the Long Range Cruise Mach Number plus 0.04 Mach, unless limited

by available cruise thrust, buffet or other flight limitations. This reduction in upper Mach value would typically apply to cases where airspeeds could be limited to the range of airspeeds over which the aircraft can reasonably be expected to operate most frequently.

Condition	Lower Boundary is defined by	Upper Boundary is defined by
Flight Level	FL 290	The lower of : • FL 410 • Aircraft maximum certified altitude • Altitude limited by: cruise thrust; buffet; other aircraft flight limitations
Mach or Speed	The lower of: • Maximum endurance (holding speed) • Manoeuvre speed	The lower of : • MMO/VMO • Speed limited by cruise thrust; buffet; other aircraft flight limitations
Gross Weight	• The lowest gross weight compatible with operations in RVSM airspace	• The highest gross weight compatible with operations in RVSM airspace

TABLE 1 - Full RVSM envelope boundaries

(c) Test performance results presentation:

The test performance results may be presented on a single chart if the RVSM flight envelope is plotted using W/δ (weight divided by atmospheric pressure ratio) versus Mach number.

Note: This is due to the relationship between W/δ and the fundamental aerodynamic variables M and lift coefficient as shown below.

$W/\delta = 1481.4 C_L M^2 S_{Ref}$, where:

δ = ambient pressure at flight altitude divided by sea level standard pressure of 1013.25 hPa

W/δ = Weight over Atmospheric Pressure Ratio

C_L = Lift Coefficient

M = Mach number

S_{Ref} = Reference Wing Area

Since δ is a fixed value for a given altitude, weight can be obtained for a given condition by simply multiplying the W/δ value by δ. Furthermore, over the RVSM altitude range, it is a good approximation to assume that position error is uniquely related to Mach number and W/δ for a given aircraft.

(d) Error budget

The demonstration of compliance with the RVSM performance criteria should include a justification of the contribution of all significant errors to the ASE (Error Budget). Appendix 1 provides guidance supporting the development of such justification.

Note: A trade-off may be made between the various error sources which contribute to ASE (e.g.: in the case of an aircraft group approval, the smaller the mean of the group and the more stringent the avionics standard, the larger the available allowance for the SSE variations). The ASE performance demonstration should consider this ASE trade off.

(e) ASE Flight Calibration Methods

Where flight calibrations are used to quantify or verify altimetry system performance they should be accomplished by any of the following methods. Flight calibrations should be performed only when appropriate ground checks have been completed. Uncertainties in application of the method will need to be assessed and taken into account in the data package.

(1) Precision tracking radar in conjunction with pressure calibration of atmosphere at test altitude.

(2) Trailing cone.

(3) Pacer aircraft.

Note: When using pacer aircraft, the pacer aircraft will need to be calibrated directly to a known standard. It is not acceptable to calibrate a pacer aircraft by another pacer aircraft.

(f) Compliance Demonstration for Groups of Aircraft.

Because of the statistical nature of the performance requirements, the demonstration of the compliance may vary considerably from group to group and therefore for a group aircraft the following process should be applied:

(1) The mean and airframe-to-airframe variability of ASE should be established, based on flight test calibration of the accuracy for a number of aircraft. Where analytical methods are available, it may be possible to enhance the flight test data base and to track subsequent changes in the mean and variability based on geometric inspections and bench test, or any other method acceptable to the responsible authority. In the case of derivative aircraft it may be possible to use data from the parent as part of the data base, providing adequate provision is made for the changes that may contribute to difference in ASE characteristics.

Note: This is particularly important when a derivative involves changes to the airframe structure that may alter the SSE characteristics.

(2) An assessment of the aircraft-to-aircraft variability of each error source should be made. The error assessment may take various forms as appropriate to the nature and magnitude of the source and the type of data available. It may be acceptable to use specification values to represent three standard deviations for smaller error sources; however a more comprehensive assessment may be required for those sources that contribute a greater proportion of the overall error.

Note: This assessment is particularly important for airframe error sources where specification values of ASE contribution may not have been previously established.

(3) In many cases, one or more of the major ASE error sources will be aerodynamic in nature, such as variations in the airframe surface contour in the vicinity of the static pressure source. If evaluation of these errors is based on geometric measurements, substantiation should be provided that the methodology used is adequate to ensure compliance.

(4) An error budget should be established to ensure that the RVSM performance criteria are met.

Note: the worst condition experienced in flight may differ for each criterion and therefore the component error values may also differ.

(5) In showing compliance with the overall criteria, the component error sources should be combined appropriately. In most cases this will involve the algebraic summation of the mean components of the errors, root-sum-square (rss) combination of the variable components of the errors, and summation of the rss value with the absolute value of the overall mean. Care should be taken that only variable component error sources that are independent of each other are combined by rss.

(6) A statistical study based on a representative sample of measured data should provide sufficient confidence that each individual aircraft in the group would have an ASE contained within ±60m (±200 ft).

Note :It is accepted that if any aircraft is identified as having an error exceeding ±60m (±200 ft) then it should receive corrective action.

(g) Compliance Demonstration for a Non Groups Aircraft.

For non-group aircraft, the following data should be established:

(1) Flight test calibration of the aircraft to establish its ASE or SSE over the RVSM envelope should be conducted. The flight test calibration should be performed at points in the flight envelope(s) as agreed by the responsible authority using one of the methods identified in (e) above.

(2) Calibration of the avionics used in the flight test as required may be conducted for establishing residual SSE. The number of test points should be agreed by the responsible authority. Since the purpose of the flight test is to determine the residual SSE, specially calibrated altimetry equipment may be used.

(3) The installed altimetry avionics equipment specification should identify the largest allowable errors.

GM1 ACNS.RVSM.3030 Altimetry System Accuracy

To evaluate a system against the ASE performance it is necessary to quantify the mean and three standard deviation values for ASE expressed as ASE_{mean} and ASE_{3SD}. To do this it is necessary to take into account the different ways in which variations in ASE can arise. The factors that affect ASE are:

(a) Unit to unit variability of avionics equipment.

(b) Effect of environmental operating conditions on avionics equipment.

(c) Airframe to airframe variability of static source error.

(d) Effect of flight operating conditions on static source error.

Note : Assessment of ASE, whether based on measured or predicted data will need to consider item a to b above. The effect of item d as a variable can be eliminated by evaluating ASE at the most adverse flight condition in an RVSM flight envelope.

Appendix 2 provides two examples of methods to establish and monitor static source errors.

APPENDIX 1 - ALTIMETRY SYSTEM ERROR COMPONENTS

1 Introduction

The purpose of this appendix is to provide guidance to help ensure that all the potential error sources are identified and included in the Altimetry System Error budget.

2 Objective of ASE Budget

The purpose of the ASE budget is to demonstrate that the allocation of tolerances amongst the various parts of the altimetry system is consistent with the overall statistical ASE performance requirements. These individual tolerances within the ASE budget also form the basis of the procedures, defined in the airworthiness approval data package, which will be used to demonstrate that aircraft satisfy the RVSM criteria.

It is necessary to ensure that the budget takes account of all contributory components of ASE.

For group approval it is necessary to ensure either that the budget assesses the combined effect of the component errors in a way that is statistically realistic, or that the worst case specification values are used.

3 Altimetry System Error

3.1 Breakdown

Figure 1 shows the breakdown of total ASE into its main components, with each error block representing the error associated with one of the functions needed to generate a display of pressure altitude. This breakdown encompasses all altimetry system errors that can occur, although different system architectures may combine the components in slightly different ways.

(a) The 'Actual Altitude' is the pressure altitude corresponding to the undisturbed ambient pressure.

(b) The 'Static Source Error' is the difference between the undisturbed ambient pressure and the pressure within the static port, at the input end of the static pressure line.

(c) The 'Static Line Error' is the difference in pressure along the length of the line.

(d) The 'Pressure Measurement and Conversion Error' is the error associated with the processes of sensing the pneumatic input seen by the avionics, and converting the resulting pressure signal into altitude. As drawn, Figure 2-1 represents a self-sensing altimeter system in which the pressure measurement and altitude conversion functions would not normally be separable. In an air data computer system the two functions would be separate, and SSEC would probably then be applied before pressure altitude (Hp) was calculated.

(e) The 'Perfect SSEC' would be that correction that compensated exactly for the SSE actually present at any time. If such a correction could be applied, then the resulting value of Hp calculated by the system would differ from the actual altitude only by the static line error plus the pressure measurement and conversion error. In general this cannot be achieved, so although the 'Actual SSEC' can be expected to reduce the effect of SSE, it will do so imperfectly.

(f) The 'Residual Static Source Error' is applicable only in systems applying an avionic SSEC. It is the difference between the SSE and the correction actually applied. The

corrected value of Hp will therefore differ from actual pressure altitude by the sum of static line error, pressure measurement and conversion error, and residual SSE.

(g) The error between Hp and displayed altitude is the sum of the baro-correction error and the display error. Figure 2-1 represents their sequence for a self-sensing altimeter system. Air data computer systems can implement baro-correction in a number of ways that would modify slightly this part of the block diagram, but the errors would still be associated with either the baro-correction function or the display function. The only exception is that those systems that can be switched to operate the display directly from the Hp signal can eliminate baro-correction error where standard ground pressure setting is used, as in RVSM operations.

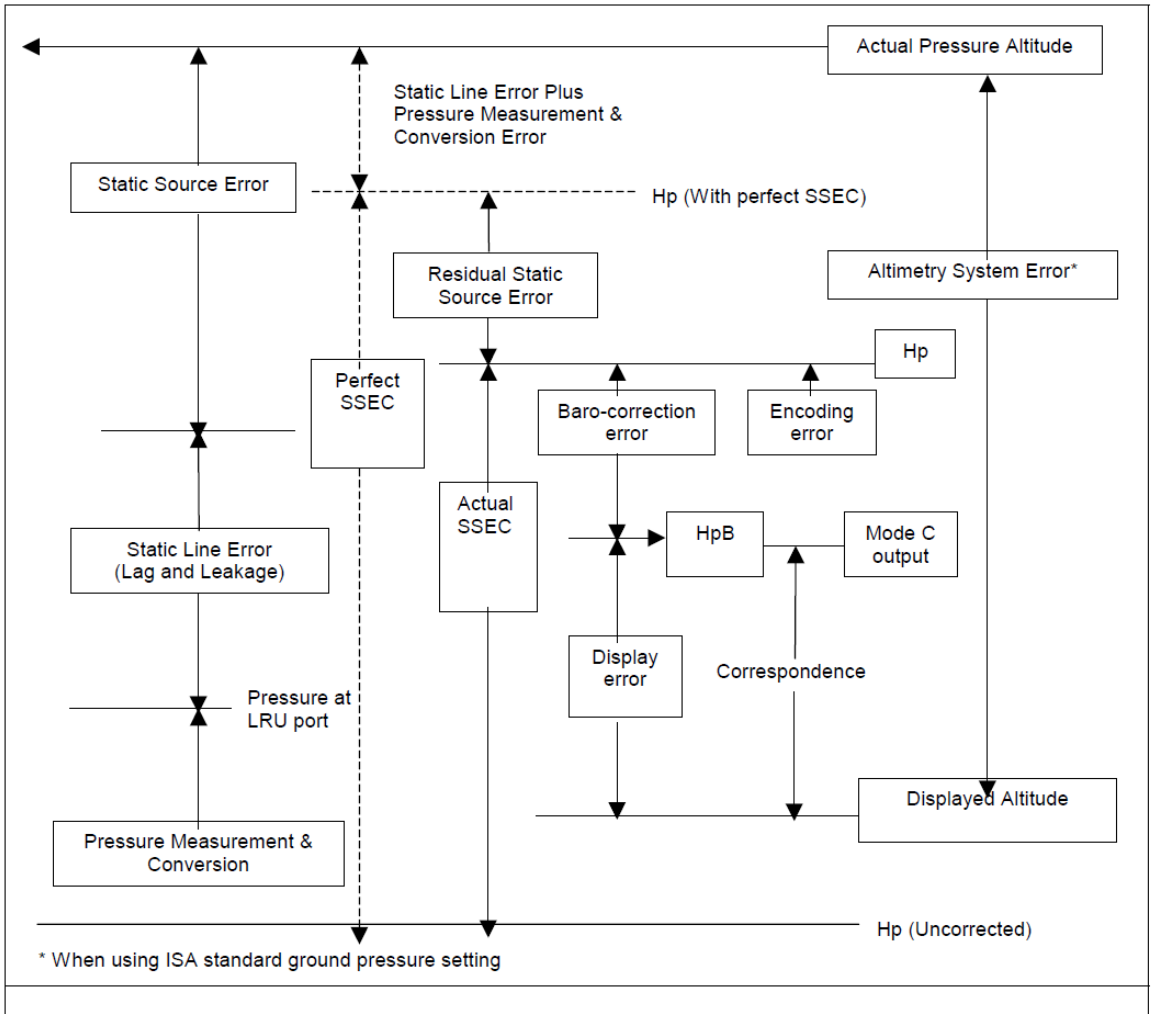


FIGURE 1 - Altimetry system errors

3.2 Components

Each of the system errors presented in Figure 1 and described in (c)(1) is discussed below in greater detail.

3.2.1 Static Source Error

The component parts of SSE are presented in Table 1, with the factors that control their magnitude.

(a) The reference SSE is the best estimate of actual SSE, for a single aircraft or an aircraft group, obtained from flight calibration measurements. It is variable with operating condition characteristically reducing to a family of W/δ curves that are functions of Mach.

(b) It includes the effect of any aerodynamic compensation that may have been incorporated in the design. Once determined, the reference SSE is fixed for the single aircraft or group, although it may be revised when considering subsequent data.

(c) The test techniques used to derive the reference SSE will have some measurement of uncertainty associated with them, even though known instrumentation errors will normally be eliminated from the data. For trailing-cone measurements the uncertainty arises from limitations on pressure measurement accuracy, calibration of the trailing-cone installation, and variability in installations where more than one are used. Once the reference SSE has been determined, the actual measurement error is fixed, but as it is unknown it can only be handled within the ASE budget as an estimated uncertainty.

(d) The airframe variability and probe/port variability components arise from differences between the individual airframe and probe/port, and the example(s) of airframe and probe port used to derive the reference SSE.

3.2.2 Residual Static Source Error

(a) The components and factors are presented in Table 1. Residual SSE is made up of those error components which make actual SSE different from the reference value, components 2, 3, and 4 from Table 1, plus the amount by which the actual SSEC differs from the value that would correct the reference value exactly, components 2(a), (b) and(c) from Table 2.

(b) There will generally be a difference between the SSEC that would exactly compensate the reference SSE, and the SSEC that the avionics is designed to apply. This arises from practical avionics design limitations. The resulting error component 2(a) will therefore be fixed, for a particular flight condition, for the single aircraft or group. Additional variable errors 2(b) and 2(c) arise from those factors that cause a particular set of avionics to apply an actual SSEC that differs from its design value.

(c) The relationship between perfect SSEC, reference SSEC, design SSEC and actual SSEC is illustrated in Figure 2, for the case where static line errors and pressure measurements and conversion errors are taken as zero.

(d) Factors that create variability of SSE relative to the reference characteristic should be accounted for twice. First, as noted for the SSE itself in Table 2, and secondly for its effect on the corruption of SSEC as in factor 2(a)(i) of Table 2. Similarly the static pressure measurement error should be accounted for in two separate ways. The main effect will be by way of the 'pressure measurement and conversion' component, but a secondary effect will be by way of factor 2(a)(ii) of Table 2.

Factors	Error Components
Airframe Effects Operating Condition (Speed, altitude, angle of attack, sideslip) Geometry: Size and shape of airframe; Location of static sources; Variations of surface contour near the sources; Variations in fit of nearby doors, skin panels or other items.	1) Reference SSE values from flight calibration measurements. 2) Uncertainty of flight calibration measurements. 3) Airframe to airframe variability.
Probe/Port Effects Operating Condition (Speed, altitude, angle of attack, sideslip) Geometry: Shape of probe/port; Manufacturing variations; Installation variations.	4) Probe/port to probe/port variability.

TABLE 1 - Static source error

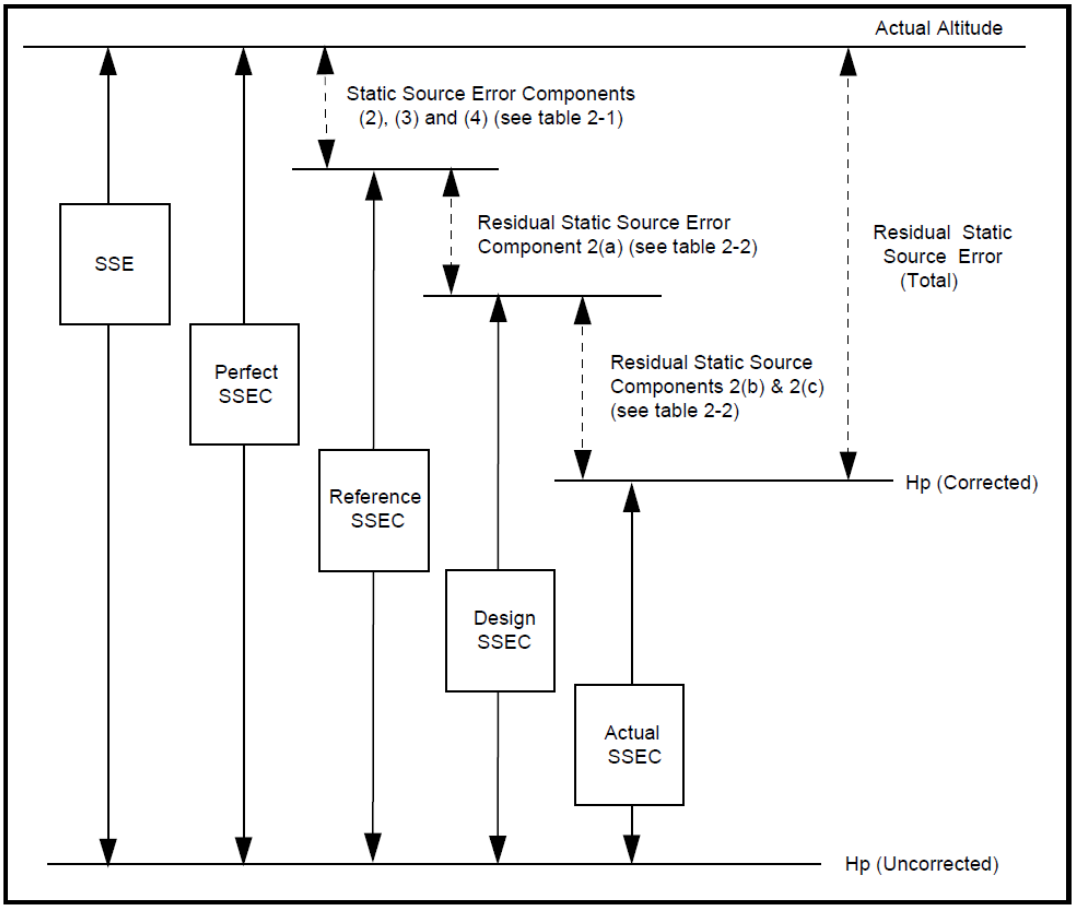
(Cause: Aerodynamic Disturbance to Free-Stream Conditions)

Factors	Error Components
(1) As for Static Source Error PLUS	1) Error Components (*2*), (*3*), and (*4*) from table 2-1 PLUS
(2) Source of input data for SSEC function	2(a) Approximation in fitting design SSEC to flight calibration reference SSE.
(a) Where SSEC is a function of Mach:	
(i) P_S sensing: difference in SSEC from reference SSE.	2(b) Effect of production variability (sensors and avionics) on achieving design SSEC.
(ii) P_S measurement: pressure transduction error.	
(iii) P_T errors: mainly pressure transduction error.	2(c) Effect of operating environment (sensors and avionics) on achieving design SSEC.
(b) Where SSEC is a function of angle of attack:	
(i) geometric effects on alpha: - sensor tolerances; - installation tolerances; - local surface variations.	
(ii) measurement error: - angle transducer accuracy.	
(3) Implementation of SSEC function	
(a) Calculation of SSEC from input data;	
(b) Combination of SSEC with uncorrected height.	

TABLE 2 - Residual static source error: (aircraft with avionic SSEC)

(Cause: Difference between the SSEC actually applied and the actual SSE)

FIGURE 2-2 SSE/SSEC RELATIONSHIPS FOR ASE WHERE STATIC LINE, PRESSURE MEASUREMENT AND CONVERSION ERRORS ARE ZERO



3.2.3 Static Line Error

Static line errors arise from leaks and pneumatic lags. In level cruise these can be made negligible for a system that is correctly designed and correctly installed.

3.2.4 Pressure Measurement and Conversion Error

(a) The functional elements are static pressure sensing, which may be mechanical, electromechanical or solid-state, and the conversion of pressure signal to pressure altitude.

(b) The error components are:

(i) calibration uncertainty;

(ii) nominal design performance;

(iii) unit to unit manufacturing variations; and

(iv) effect of operating environment.

(c) The equipment specification is normally taken to cover the combined effect of the error components. If the value of pressure measurements and conversion error used in the error budget is the worst case specification value, then it is not necessary to assess the above components separately. However, calibration uncertainty, nominal design performance and effect of operating environment can all contribute to bias errors within the equipment tolerance. Therefore, if it is

desired to take statistical account of the likely spread of errors within the tolerance band, then it will be necessary to assess their likely interaction for the particular hardware design under consideration.

(d) It is particularly important to ensure that the specified environmental performance is adequate for the intended application.

3.2.5 Baro-Setting Error

This is the difference between the value displayed and the value applied within the system. For RVSM operation the value displayed should always be the International Standard Atmosphere ground pressure, but setting mistakes, although part of TVE, are not components of ASE.

(a) The components of Baro-Setting Error are:

(i) resolution of setting knob/display;

(ii) sensing of displayed value; and

(iii) application of sensed value.

(b) The applicability of these factors and the way that they combine depend on the particular system architecture.

(c) For systems in which the display is remote from the pressure measurement function there may be elements of the sensing and/or application or sensed value error components which arise from the need to transmit and receive the setting between the two locations.

3.2.6 Display Error

The cause is imperfect conversion from altitude signal to display.

The components are:

(a) conversion of display input signal;

(b) graticule/format accuracy, and

(c) readability.

Note: In self-sensing altimeters the first of these would normally be separate from the pressure measurement and conversion error

APPENDIX 2 — EXAMPLES OF METHODS TO ESTABLISH AND MONITOR STATIC SOURCE ERRORS

1 Introduction

Two examples showing the method establish and monitor static source errors are presented below.

2 Example 1

One process for showing compliance with RVSM criteria is shown in Figure 1. Figure 1 illustrates how those flight test calibrations and geometric inspections will be performed on a given number of aircraft. The flight calibrations and inspections will continue until a correlation between the two is established. Geometric tolerances and SSEC will be established to satisfy RVSM criteria. For aircraft being manufactured, every Nth aircraft will be inspected in detail and every Mth aircraft will be flight test calibrated, where 'N' and 'M' are determined by the aircraft constructor and agreed to by the competent authority.

The data generated by 'N' inspections and 'M' flight calibrations can be used to track the mean and three standard deviation values to ensure continued compliance of the model with the criteria of CS ACNS.RVSM 3030

As additional data are acquired, they should be reviewed to determine if it is appropriate to change the values of N and M as indicated by the quality of the results obtained.

There are various ways in which the flight test and inspection data might be used to establish the correlation. The example shown in Figure 2 is a process in which each of the error sources for several aeroplanes is evaluated based on bench tests, inspections and analysis. Correlation between these evaluations and the actual flight test results would be used to substantiate the method.

The method illustrated in Figures 1 and 2 is appropriate for new models since it does not rely on any pre-existing data base for the group.

3 Example 2

Figure 3 illustrates that flight test calibrations should be performed on a given number of aircraft and consistency rules for air data information between all concerned systems verified. Geometric tolerances and SSEC should be established to satisfy the criteria. A correlation should be established between the design tolerances and the consistency rules. For aircraft being manufactured, air data information for all aircraft should be checked for consistency in cruise conditions and every Mth aircraft should be calibrated, where M is determined by the manufacturer and agreed to by the responsible authority. The data generated by the M flight calibrations should be used to track the mean and three standard deviation values to ensure continued compliance of the group with the criteria of CS ACNS.RVSM 3030.

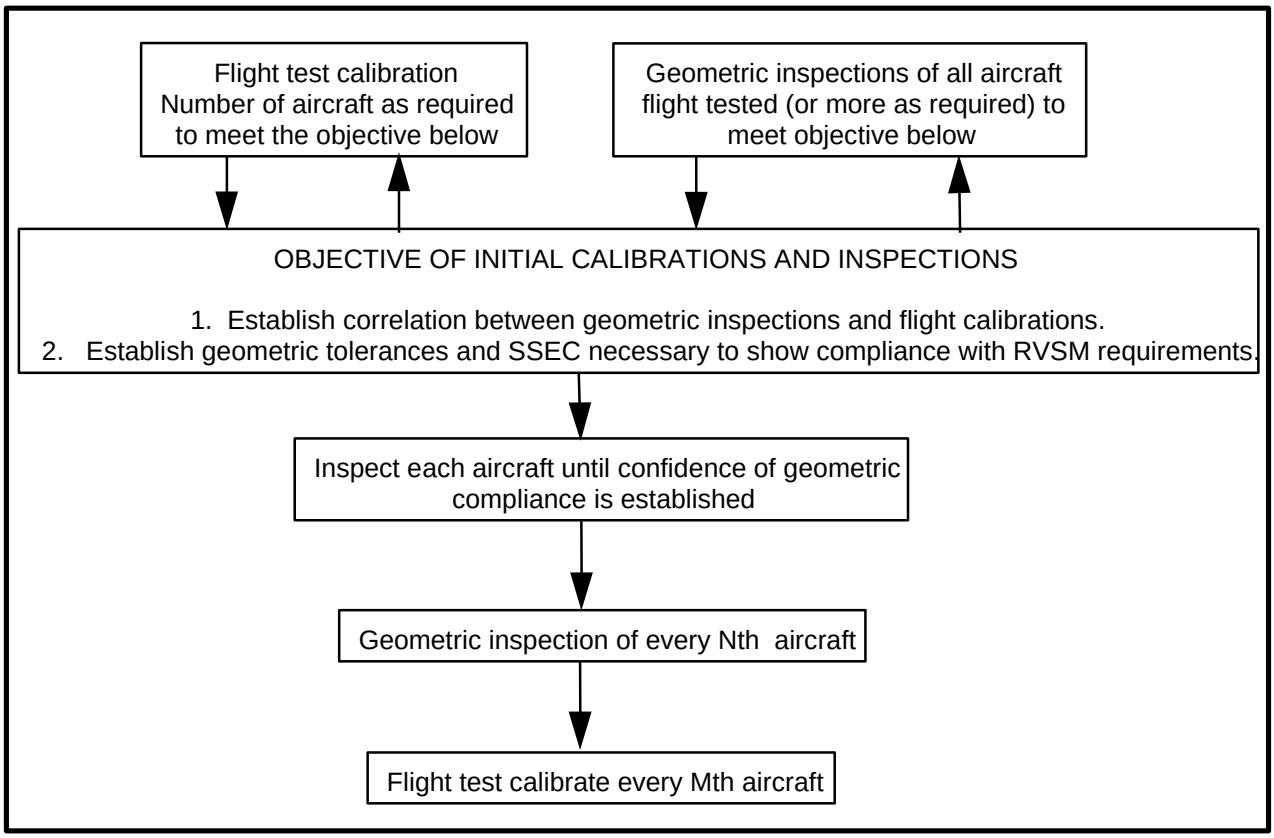


FIGURE 1 - Process for showing initial and continued compliance of airframe static pressure systems

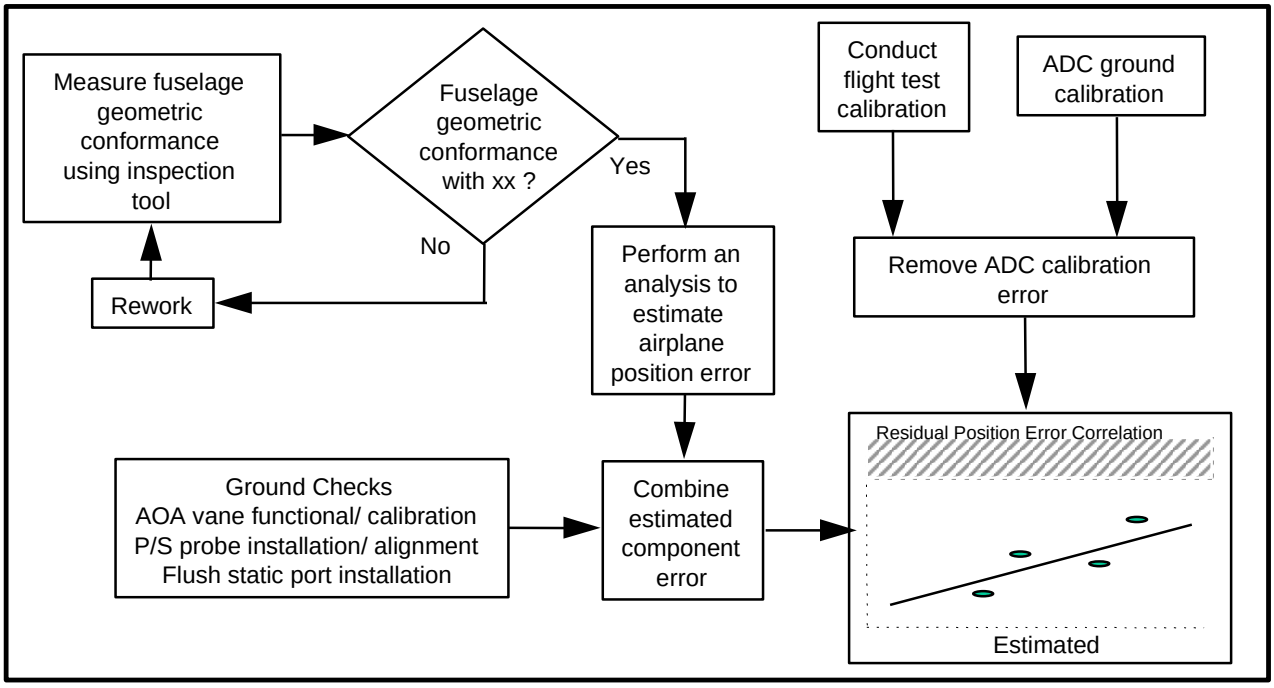


FIGURE 2 - Compliance demonstration ground - to flight test correlation process example

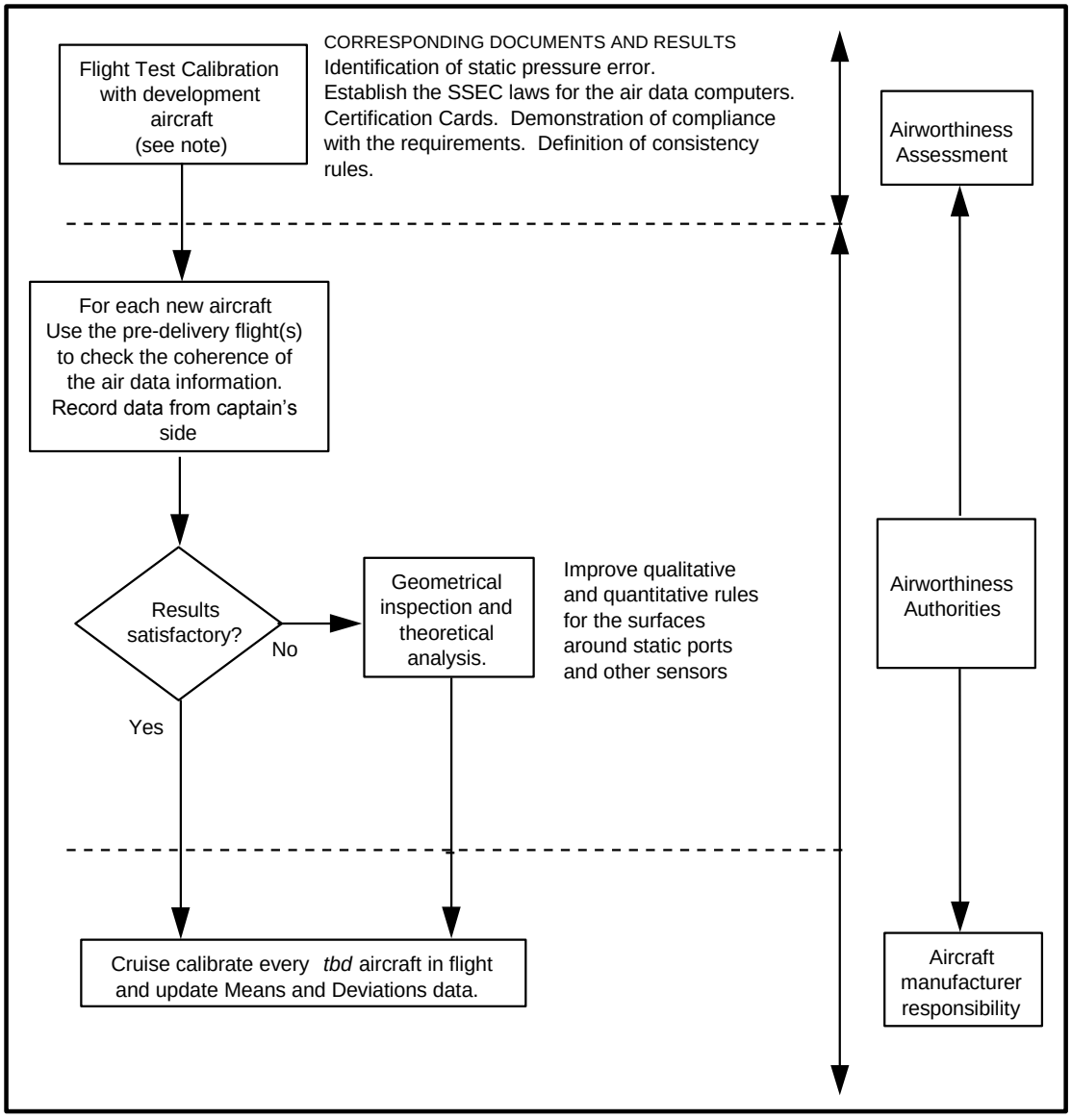


FIGURE 3 - Process for showing initial and continued compliance of airframe static pressure systems for new model aircraft.

Note : The flight test installation chosen to get the calibration data will need to have an accuracy compatible with the level of performance to be demonstrated and an analysis of this accuracy will need to be provided. Any possible degradation of this accuracy will need to be monitored and corrected during the flight test period.

II Draft Decision amending Decision No 2003/12/RM of the Executive Director of the European Aviation Safety Agency of 5 November 2003 on Acceptable Means of Compliance for airworthiness of products, parts and appliances ('AMC-20')

The following AMC-20 standards are deleted from the table of contents.

CONTENTS

AMC-20

GENERAL ACCEPTABLE MEANS OF COMPLIANCE FOR AIRWORTHINESS OF PRODUCTS, PARTS AND APPLIANCES

….

AMC 20-11 ~~Acceptable Means of Compliance for the Approval of use of Initial Services for Air-Ground Data Link in Continental Airspace~~

Cancelled

….

C. Cross reference with Interoperability regulations

As implementing rules for interoperability refine the essential requirements of the interoperability Regulation, the below material traces Articles and Annexes of Commission Regulation (EC) No 29/2009 and Commission Implementing Regulation (EU) NO 1079/2012 to the Subpart B Sections 1 and 2 of Book 1 of CS-ACNS requirements.

Each numbered article of the regulation is reproduced in the first column of the table below, followed by a second column cross-referencing to the corresponding Subpart B Sections 1 or 1 Book 1 requirement(s). A third column provides explanatory notes.

I Compliance Matrix with Commission Regulation (EC) No 29/2009 (DLS IR)

Article 1. Subject matter and scope

IR Ref.	IR Text	CS ACNS allocation	Notes
1.	This Regulation lays down requirements for the coordinated introduction of data link services based on air–ground point-to-point data communications as defined in Article 2 (5).	CS ACNS.DLS.B1.1000	The CS-ACNS.DLS standard will ensure interoperability of the aircraft system with the ground system of the DLS implementing rule.
2.	This Regulation shall apply to:		
(a)	Flight data processing systems, their constituents and associated procedures, and human-machine interface systems, their constituents and associated procedures serving air traffic control units providing services to general air traffic;	N/A	
(b)	airborne human-machine interface constituents and associated procedures	CS ACNS.DLS.B1.1000 CS ACNS.DLS.B1.1010	
(c)	air-ground communication systems, their constituents and associated procedures.	CS ACNS.DLS.B1.1000	
3.	This Regulation shall apply to all flights operating as general air traffic in accordance with instrument flight rules within the airspace above FL285 defined in Annex I, Part A. In addition, it shall apply from 5 February 2015 to all flights	N/A	

IR Ref.	IR Text	CS ACNS allocation	Notes
	operating as general air traffic in accordance with instrument flight rules within the airspace above FL285 defined in Annex I, Part B.		Airspace and deployment timescales are outside the scope of the CS
4.	This Regulation shall apply to air traffic service providers (hereinafter ATS providers) providing services to general air traffic within the airspace referred to in paragraph 3 and in accordance with the relevant dates of application.	N/A	

Article 2. Definitions

Definitions that are relevant for CS ACNS.DLS.B1 have been integrated Subpart A, for DLIC, ACM, ACL and AMC.

Article 3. Data link services

This article is not relevant for an airworthiness standard

Article 4. Associated procedures

This article is not relevant for an airworthiness standard.

Article 5. Obligations of ATS providers for data link communications

This article is not relevant for an airworthiness standard.

Article 6. Obligations of operators for data link communications

This article is not applicable for an airworthiness standard. Compliance with CS ensures compliance with Regulation (EC) No 29/2009.

Article 7. General obligations of Member States for data link communications

This article is not relevant for an airworthiness standard.

Article 8. Data link communication for transport type State aircraft

This article is not relevant to for an airworthiness standard.

Article 9. Obligations of air navigation services providers and other entities for data link communications

This article is not relevant to for an airworthiness standard.

Article 10. Safety requirements

This article is applicable to Member States and is not relevant for an airworthiness standard.

Article 11. Conformity or suitability for use of constituents

IR	IR Text	CS-ACNS allocation	Notes
1.	Before issuing an EC declaration of conformity or suitability for use referred to in Article 5 of Regulation (EC) No 552/2004, manufacturers of constituents of the systems referred to in Article 1(2) of this Regulation, or their authorised representatives established in the Community, shall assess the conformity or suitability for use of those constituents in accordance with the requirements set out in Annex V.	N/A	
2.	However, certification airworthiness processes complying with Regulation (EC) No 216/2008, when applied to airborne constituents referred to in Article 1(2)(b) and (c) of this Regulation, shall be considered acceptable procedures for the conformity assessment of those constituents if they include the demonstration of compliance with the interoperability, performance and safety requirements of this Regulation.	N/A	This traceability material demonstrates the compliance of the CS-ACNS DLS section to the DLS IR.

Article 12. Verification of systems

This article is applicable to ANS providers and is not relevant for an airworthiness standard.

Article 13. Additional requirements

This article is applicable to Member States, ANS and ATS providers, and operators. It is not relevant for an airworthiness standard.

Article 14. Exemptions

This article is not applicable for an airworthiness standard. Aircraft that are exempted from the DLS implementing rule are not required to comply.

Article 15. Entry into force and application

This article is not applicable for an airworthiness standard deployment timescales are outside the scope of the CS.

ANNEX I. Airspace referred to in Article 1(3)

This ANNEX is not applicable for an airworthiness standard as the definition of airspace areas is outside the scope of the CS.

ANNEX II. Definition of data link services referred to in Articles 3, 4, 5 and 7 and Annex IV

IR	IR Text	CS ACNS allocation	Notes
1.	Definition of Data Link Communications Initiation Capability (DLIC)		
	The DLIC service shall enable the exchange of the necessary information for the establishment of data link communications between ground and data link aircraft equipment.	CS ACNS.DLS.B1.2000 CS ACNS.DLS.B1.2001 CS ACNS.DLS.B1.3201 CS ACNS.DLS.B1.3202 CS ACNS.DLS.B1.3203	This is core DLIC functionality supported by the ATN CM application. The CS ACNS only applies to the aircraft equipment
	The DLIC service shall be available to support:		
-	the unambiguous association of flight data from the aircraft with flight plan data used by an ATS unit;	CS ACNS.DLS.B1.4101	DLIC logon data includes the following information used for flight plan association: airframe identification, callsign, ADEP, ADES and optionally the EOBT.
-	the exchange of the supported air–ground application type and version information;	CS ACNS.DLS.B1.4101	DLIC logon data includes this information
-	and the delivery of the addressing information of the entity hosting the application	CS ACNS.DLS.B1.4101	DLIC logon data includes this information
	The exchanges between airborne and ground data link systems for the execution of DLIC service shall comply with:		
-	operating methods, time sequence diagrams and messages for the DLIC initiation and DLIC contact functions specified in Section 4.1 of the Eurocae document identified in point 11 of Annex III,	CS ACNS.DLS.B1.4101	.
-	safety requirements specified in Section 4.2.2 of the Eurocae document identified in point 11 of Annex III,	CS ACNS.DLS.B1.4101	.

IR	IR Text	CS ACNS allocation	Notes
-	performance requirements specified in Section 4.3.2 of the Eurocae document identified in point 11 of Annex III.	CS ACNS.DLS.B1.4101	..
2.	Definition of ATC Communications Management service (ACM)		
	The ACM service shall provide automated assistance to flight crews and air traffic controllers for conducting the transfer of ATC communications (voice and data) comprising:	CS ACNS.DLS.B1.2000	
-	the initial establishment of CPDLC with an ATS unit;	CS ACNS.DLS.B1.2000 CS ACNS.DLS.B1.4201	
-	the transfer of CPDLC and voice for a flight from one ATS unit to the next ATS unit, or to instruct a change of voice channel within an ATS unit or sector;	CS ACNS.DLS.B1.2000 CS ACNS.DLS.B1.4201	
-	the normal termination of CPDLC with an ATS unit.	CS ACNS.DLS.B1.2000 CS ACNS.DLS.B1.4201	
	The exchanges between airborne and ground data link systems for the execution of ACM service shall comply with:		
-	operating methods and time sequence diagrams specified in Sections 5.1.1.1.1 to 5.1.1.1.7 and 5.1.1.2 of the Eurocae document identified in point 11 of Annex III,	CS ACNS.DLS.B1.4201	..
-	safety requirements specified in Section 5.1.2.3 of the Eurocae document identified in point 11 of Annex III, excluding requirements relating to downstream clearance,	CS ACNS.DLS.B1.4201	
-	performance requirements for the en route phase specified in Section 5.1.3.2 of the Eurocae document identified in point 11 of Annex III.	CS ACNS.DLS.B1.4201	

IR	IR Text	CS ACNS allocation	Notes
3.	Definition of ATC Clearances and Information service (ACL)		
	The ACL service shall provide flight crews and controllers with the ability to conduct operational exchanges comprising:	CS ACNS.DLS.B1.2000 CSACNS.DLS.B1.4301	These requirements are relevant for the flight crew and the aircraft data link system
-	requests and reports from flight crews to air traffic controllers;	CS ACNS.DLS.B1.4301	
-	clearances, instructions and notifications issued by air traffic controllers to flight crews.	CS ACNS.DLS.B1.4301	
	The exchanges between airborne and ground data link systems for the execution of ACL service shall comply with:		
-	operating methods and time sequence diagrams specified in Sections 5.2.1.1.1 to 5.2.1.1.4 and 5.2.1.2 of the Eurocae document identified in point 11 of Annex III,	CS ACNS.DLS.B1.4301	
-	a common subset of the message elements specified in Section 5.2.1.1.5 of the Eurocae document identified in point 11 of Annex III as appropriate to the en route operational environment,	CS ACNS.DLS.B1.4301	
-	safety requirements specified in Section 5.2.2.3 of the Eurocae document identified in point 11 of Annex III,	CS ACNS.DLS.B1.4301	.
-	performance requirements for the en route phase specified in Section 5.2.3.2 of the Eurocae document identified in point 11 of Annex III.	CS ACNS.DLS.B1.4301	

IR	IR Text	CS ACNS allocation	Notes
4.	Definition of ATC Microphone Check service (AMC)		
	The AMC service shall provide air traffic controllers with the capability to send an instruction to several data link equipped aircraft, at the same time, in order to instruct flight crews to verify that their voice communication equipment is not blocking a given voice channel.	CS ACNS.DLS.B1.2000 CS ACNS.DLS.B1.4401	This requirement is relevant for the flight crew and the aircraft data link system
	This instruction shall only be issued to those aircraft tuned to the frequency that is blocked.	N/A	Procedure applicable to air traffic controllers.
	The exchanges between airborne and ground data link systems for the execution of AMC service shall comply with:		
-	operating methods and time sequence diagrams specified in Sections 5.3.1.1.1, 5.3.1.1.2 and 5.3.1.2 of the Eurocae document identified in point 11 of Annex III,	CS ACNS.DLS.B1.4401	The DLS IR reference is to ED-120. Book 2 contains the reference to ED-120 as acceptable means of compliance to CS ACNS.DLS.B1.4401.
-	safety requirements specified in Section 5.3.2.3 of the Eurocae document identified in point 11 of Annex III,	CS ACNS.DLS.B1.4401	The DLS IR reference is to ED-120. Book 2 contains the reference to ED-120 as acceptable means of compliance to CS ACNS.DLS.B1.4402.
-	performance requirements specified in Section 5.3.3.2 of the Eurocae document identified in point 11 of Annex III.	CS ACNS.DLS.B1.4401	The DLS IR reference is to ED-120. Book 2 contains the reference to ED-120 as acceptable means of compliance to CS ACNS.DLS.B1.4403.

ANNEX III. ICAO provisions referred to in Articles 3, 5, 6, 7, 8, 9 and 13 and Annex IV / EUROCAE documents referred to in Articles 3 and 13 and Annex II

The following references are relevant for Subpart B Section 1 and are integrated into Book 2:

IR	IR Text	CS ACNS allocation	Notes
2.	Chapter 3 – Aeronautical Telecommunication Network, section 3.5.1.1 "Context Management" (CM) application items a) and b) of ICAO Annex 10 – Aeronautical Telecommunications – Volume III, Part I (Digital Data Communication Systems) (First edition July 1995 incorporating Amendment 81 (23.11.2006)).	N/A	Annex 10 specifies high level requirements for CM.
3.	Chapter 3 – Aeronautical Telecommunication Network, section 3.5.2.2 "Controller-Pilot Data Link Communications" (CPDLC) application items a) and b) of ICAO Annex 10 – Aeronautical Telecommunications – Volume III, Part I (Digital Data Communication Systems) (First edition July 1995 incorporating Amendment 81 (23.11.2006)).	N/A	Annex 10 specifies high level requirements for CPDLC.
4.	Chapter 3 – Aeronautical Telecommunication Network, sections 3.3, 3.4 and 3.6 of ICAO Annex 10 – Aeronautical Telecommunications – Volume III, Part I (Digital Data Communication Systems) (First edition July 1995 incorporating Amendment 81 (23.11.2006)).	N/A	Annex 10 specifies high level requirements for the ATN.
5.	Chapter 6 – VHF air–ground digital link (VDL) of ICAO Annex 10 – Aeronautical Telecommunications – Volume III, Part I (Digital Data Communication Systems) (First edition July 1995 incorporating Amendment 81 (23.11.2006)).	N/A	

IR	IR Text	CS ACNS allocation	Notes
11.	Eurocae ED -120 Safety and Performance Requirements Standard for Air Traffic Data Link Services in Continental Airspace, published in May 2004, including Change 1, published in April 2007, and Change 2, published in October 2007.	N/A	

ANNEX IV. Requirements referred to in Article 5, 6, 7, 8 and 9

Part A: Requirements for end-to-end communications

IR	IR Text	CS ACNS allocation	Notes
1.	End-to-end data communications shall ensure seamless provision and use of communication services in the airspace referred to in Article 1(3).	CS ACNS.DLS.B1.2000 CS ACNS.DLS.B1.2001	
2.	End-to-end data communications shall support the exchange of messages in support of the data link services defined in Annex II, in accordance with a common standardised messages set.	CS ACNS.DLS.B1.3201 CS ACNS.DLS.B1.3202 CS ACNS.DLS.B1.3203 CS ACNS.DLS.B1.3301 CS ACNS.DLS.B1.3302	
3.	End-to-end data communications shall support a common standardised end-to-end protection mechanism to ensure the integrity of messages received consistent with safety requirements of the data link services defined in Annex II.	CS ACNS.DLS.B1.2000	The referenced protection mechanism is the CPDLC Application Message Integrity Check, which was developed to satisfy the ED-120 safety requirements.

Part B: Requirements for air–ground communications based on ATN and VDL Mode 2

IR	IR Text	CS ACNS allocation	Notes
1.	Air-ground communications shall be designed to support end-to-end communications and to ensure seamless provision and use of communications services to air-ground applications defined in the ICAO standards specified in points 2 and 3 of Annex III in the airspace referred to in Article 1(3).	CS ACNS.DLS.B1.2000 CS ACNS.DLS.B1.2001	The CS ACNS DLS Book 2 covers interoperability of the referenced CM and CPDLC air-ground applications, mainly by reference to EUROCAE ED-110B and ICAO Doc 9705 Edition 2.

IR	IR Text	CS ACNS allocation	Notes
2.	Air-ground communications shall comply with safety and performance requirements of the data link services defined in Annex II.	CS ACNS.DLS.B1.4101 CS ACNS.DLS.B1.4201 CS ACNS.DLS.B1.4301 CS ACNS.DLS.B1.4401	
3.	Air-ground communications shall be based on a common addressing scheme.	CS ACNS.DLS.B1.4531 CS ACNS.DLS.B1.4541 CS ACNS.DLS.B1.4551 CS ACNS.DLS.B1.4561 CS ACNS.DLS.B1.4571	Book 2 refers to the data communication protocols (data, network, transport, session, presentation and application layers) that comply to their respective addressing schemes
4.	The transmission and reception of data units between ground and aircraft systems hosting the air-ground applications defined in the ICAO standards specified in points 2 and 3 of Annex III shall be based on communication protocols which comply with the ICAO standards defining the Aeronautical Telecommunication Network referenced in point 4 of Annex III.	CS ACNS.DLS.B1.1001 CS ACNS.DLS.B1.4531 CS ACNS.DLS.B1.4541 CS ACNS.DLS.B1.4551 CS ACNS.DLS.B1.4561 CS ACNS.DLS.B1.4571	
5.	The ground and aircraft communication system characteristics and the transmission and reception of bit frames between ground and aircraft communication systems shall comply with the ICAO standards defining the very high frequency digital link, VDL Mode 2, referenced in point 5 of Annex III.	CS ACNS.DLS.B1.1001 CS ACNS.DLS.B1.4531 CS ACNS.DLS.B1.4541 CS ACNS.DLS.B1.4551 CS ACNS.DLS.B1.4561 CS ACNS.DLS.B1.4571	The initial deployment of the data link services has shown a number of limitations on the design and implementation of data link aircraft equipment. In particular, performance monitoring of VDL Mode 2 data link communications has revealed cases of invalid data transmission. The data link services implementing rule requires the introduction of protected-mode which will mitigate any impact at operational level. However, even with protected-mode communications, VDL Mode 2 data may be invalid as ARINC 631-6 allows such transmissions (Table A 2.2.2 Note). The Certification

IR	IR Text	CS ACNS allocation	Notes
			Specification introduces new requirements for the data link layer of the data link service.

Part C: Requirements for air–ground communications based on other communication protocols

Part C of the Annex IV of the DLS IR applies to data link systems that do not make use of ATN and VDL Mode 2 communications. Therefore it is not applicable to Subpart B Section 2.

Part D: Conditions referred to in Part C

Part D of the Annex IV of the DLS IR applies to data link systems that do not make use of ATN and VDLm2 communications. Therefore it is not applicable to Subpart B Section 2.

ANNEX V

Requirements for the assessment referred to in Article 11 of the conformity or suitability for use of constituents

This Annex is not applicable for an airworthiness standard. Applying the CS, manufacturers of data link aircraft equipment (EATMN constituents) will receive a certificate that can be considered as an EC declaration of conformity or suitability for use. This is a direct application of the Article 6a of the interoperability Regulation as amended by Regulation (EC) No 1070/2009.

ANNEX VI. Conditions referred to in Article 12

This Annex is not applicable for an airworthiness standard.

ANNEX VII

Part A & B: Requirements for the verification of systems referred to in Article 12(1) & 12(2)

This Annex does not apply for an airworthiness standard.

II Compliance MATRIX with Commission Implementing Regulation (EU) No 1079/2012 (VCS IR)

Article 1. Subject matter

VCS IR Requirement	CS ACNS allocation	Comment
This Regulation lays down requirements for the coordinated introduction of air-ground voice communications based on 8,33 kHz channel spacing.	N/A	

Article 2. Scope

VCS IR Requirement	CS ACNS allocation	Comment
This Regulation shall apply to all radios operating in the 117,975-137 MHz band ('the VHF band') allocated to the aeronautical mobile route service, including systems, their constituents and associated procedures.	CS ACNS.VCS 1000	CS-ACNS scope is limited to aircraft radio equipment.
This Regulation shall apply to flight data processing systems serving air traffic control units providing services to general air traffic, their constituents and associated procedures	N/A	
This Regulation shall apply to all flights operating as general air traffic, within the airspace of the International Civil Aviation Organisation ('ICAO') EUR region where Member States are responsible for the provision of air traffic services in accordance with Regulation (EC) No 550/2004 of the European Parliament and of the Council	NA	
The conversion requirements shall not apply to frequency assignments: (a) that will remain in 25 kHz channel spacing on the following frequencies: (i) the emergency frequency (121,5 MHz); (ii) the auxiliary frequency for search and rescue operations (123,1 MHz); (iii) the VHF digital link (VDL) frequencies (136,725 MHz, 136,775 MHz, 136,825 MHz, 136,875 MHz, 136,925 MHz and 136,975	N/A	CS-ACNS.VCS scope is limited to aircraft radio equipment

MHz); (iv) the aircraft communications addressing and reporting system (ACARS) frequencies (131,525 MHz, 131,725 MHz and 131,825 MHz); (b) where offset carrier operation within a 25 kHz channel spacing is utilised.		
Radios intended to operate exclusively in one or more frequency assignments that will remain in 25 kHz channel spacing shall not be required to have the 8,33 kHz channel spacing capability..	N/A	CS ACNS provides airworthiness and interoperability standards for 8.33 kHz channel spacing aircraft radios.

Article 3: Definitions

Definitions that are relevant for CS ACNS.VCS have been integrated Subpart A.

Article 4: Interoperability and performance requirements of radio equipment

VCS IR Requirement	CS ACNS allocation	Comment
Manufacturers of radios intended to operate in the VHF band, or their authorised representatives established in the Union, shall ensure that from 17 November 2013 all radios placed on the market, are 8,33 kHz channel spacing capable.	CS ACNS.VCS 2000	
Air navigation service providers, operators and other users or owners of radios shall ensure that all radio equipment put into service from 17 November 2013, includes the 8,33 kHz channel spacing capability..	N/A	ANS requirements are outside the scope of CS ACNS.VCS
Member States shall ensure that aircraft for which the individual certificates of airworthiness or individual flight permits are first issued in the Union from 17 November 2013 and have a radio equipage requirement, are fitted with radios having the 8,33 kHz channel spacing capability.	N/A	Member States requirements are outside the scope of CS ACNS.VCS
Air navigation service providers, operators and other users or owners of radios shall ensure that from 17 November 2013 their radios include the 8,33 kHz channel spacing capability whenever they are subject to radio upgrades..	N/A	ANS requirements are outside the scope of CS ACNS.VCS

Member States shall ensure that by 31 December 2017 at the latest all radios have the 8,33 kHz channel spacing capability with the exception of ground radios operated by air navigation service providers.	N/A	Member States requirements are outside the scope of CS-ACNS.VCS
In addition to 8,33 kHz channel spacing capability, the equipment referred to in paragraphs 1-5 shall be able to tune to 25 kHz spaced channels.	CS ACNS.VCS 2000	
Users or owners of ground radios having the 8,33 kHz channel spacing capability shall ensure that the performance of these radios and the transmitter/receiver ground constituent complies with the ICAO standards specified in point 1 of Annex II.	N/A	Transmitter/receiver ground constituents are outside the scope of CS-ACNS.VCS.
Users or owners of aircraft radio equipment having the 8,33 kHz channel spacing capability shall ensure that the performance of these radios comply with the ICAO standards specified in point 2 of Annex II.	CS-ACNS.VCS 3000	

Article 5 : Specific obligations of operators

This article is applicable to operators and is not relevant for an airworthiness standards.

Article 6 : Requirements on 8,33 kHz channel spacing conversions

This article is applicable to Member States and is not relevant to aircraft radio equipment.

Article 7: Specific obligations of air navigation service providers

This article is applicable to air navigation service providers and is not relevant for an airworthiness standards.

Article 8: Associated procedures

ANSP and operators procedures are outside the scope of CS-ACNS

Article 9: Arrangements for State aircraft

This article is applicable to Member States and is not relevant for an airworthiness standards.

Article 10: Safety requirements

This article is applicable to Member States and is not relevant for an airworthiness standards.

Article 11: Conformity or suitability for use of constituents

VCS IR Requirement	CS ACNS allocation	Comment
Before issuing an EC declaration of conformity or suitability for use pursuant to Article 5 of Regulation (EC) No 552/2004, manufacturers of constituents of the systems referred to in Article 2(1) of this Regulation shall assess the conformity or suitability for use of these constituents in compliance with the requirements set out in Annex IV, Part A, to this Regulation.	N/A	
Where a certificate issued in accordance with Regulation (EC) No 216/2008 of the European Parliament and of the Council (1) applies to constituents, it shall be considered as an EC declaration of conformity or suitability for use if it includes a demonstration of compliance with the applicable interoperability, performance and safety requirements of this Regulation.	N/A	This traceability material demonstrates the compliance of the CS ACNS VCS section to the VCS IR.

Article 12: Verification of systems

This article is applicable to ANS providers and is not relevant for an airworthiness standard.

Article 13: Additional requirements

This article is applicable to Member States , Air Navigation Service Providers, Operators and the Network Manager and is not relevant for an airworthiness standard.

Article 14: Exemptions

This article is not applicable for an airworthiness standard. Aircraft that are exempted from the VCS implementing rule are not required to comply.

Article 15: Repeals

This article is not applicable to for an airworthiness standard.

Article 16: Entry into force and application

This article is not applicable for an airworthiness standard deployment timescales are outside the scope of the CS.

Annex I: Member States referred to in Articles 5 and 6

This annex is not applicable for an airworthiness standard.

Annex II: ICAO provisions referred to in Articles 4 and 8

Annex II requirements are captured under CS ACNS.VCS 3000.

Annex III: Requirements referred to in Article 10, to be taken into consideration during the safety assessment

Article 10 and this associated Annex is not relevant for an airworthiness standard

Annex IV: Part A: Requirements for the assessment of the conformity or suitability for use of constituents referred to in Article 11

This annex is not applicable for an airworthiness standard.

Annex IV: Part B: Internal production control module

This annex is not applicable beyond the scope of CS-ACNS.

Annex IV: Part C: Requirements for the verification of systems referred to in Article 12(1)

This annex is not applicable for an airworthiness standard.

Annex IV: Part D: Requirements for the verification of systems referred to in Article 12(2)

This annex is not applicable for an airworthiness standard.

Annex V: Conditions referred to in Article 12

Article 12 and this associated Annex are not relevant for an airworthiness standard.