Draft Annex X to ED Decision 201X/XXX/R

'Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Part-ATM/ANS.OR on common requirements for service providers'

Annex III to ED Decision 2017/001/R is amended as follows:

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

— deleted text is ~~struck through~~;

— new or amended text is highlighted in grey;

— an ellipsis '(…)' indicates that the rest of the text is unchanged.

1. GM1 ATM/ANS.OR.A.001 is amended as follows:

GM1 ATM/ANS.OR.A.001 Scope
DEFINITIONS AND SCOPE IN RELATION TO SERVICE PROVIDERS

(…)

(d) In this Regulation, 'services' means those specified in Annex Vb(2) to Regulation (EC) No 216/2008. This Annex includes an additional service ('airspace design' that consists of flight procedure design and airspace structure design activities)[1] that is neither directly included in the definition of ATM/ANS nor in the definition of 'Air Traffic Management' or 'Air Navigation Service'.

(…)

(g) Figure 1 indicates both a further breakdown of ATS into air traffic control services (ATC), alerting services, air traffic advisory services, and flight information services and groupings of:

(1) air traffic management (ATM): comprising ATS, ASM, and ATFM;

(2) air navigation services (ANS): comprising ATS, CNS, MET, and AIS; and

(3) ~~airspace~~ flight procedure design services (~~ASD~~FPD) and data ~~provision~~ services (DAT) and ATM network functions.

(…)

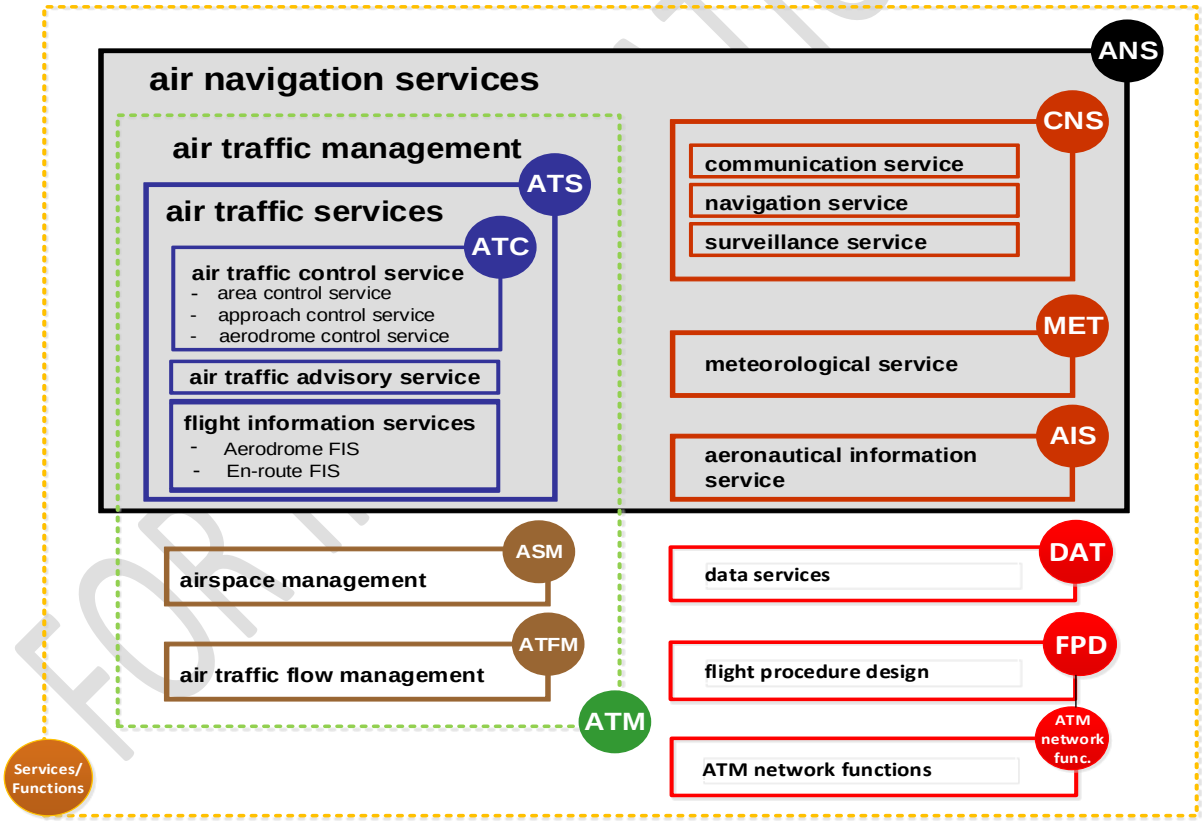

Figure 1: The scope of the services, subject to certification, as specified in Annex Vb to Regulation (EC) No 216/2008 and, additionally, the other ATM network functions.

(…)

[1] To be included before the adoption of the new EASA Basic Regulation.

	Annex III (Part-ATM/ANS.OR)				Annex IV (Part-ATS)	Annex V (Part-MET)	Annex VI (Part-AIS)	Annex VII (Part-DAT)	Annex VIII (Part-CNS)	Annex IX (Part-ATFM)	Annex X (Part-FPD~~ASM~~)	Annex XI (Part-ASD)	Annex XII (Part-NM)	Annex XIII (Part-PERS)
	Subpart A	Subpart B	Subpart C	Subpart D										
Air traffic services providers (see Note 1)	**X**	**X**		**X**	**X**									
Meteorological services providers	**X**	**X**	**X**	**X**		**X**								
Aeronautical information services providers	**X**	**X**	**X**	**X**			**X**							
Data services providers	**X**	**X**	**X**					**X**						
Communication, navigation and surveillance service providers	**X**	**X**	**X**	**X**					**X**					
Air traffic flow management service providers	**X**	**X**	**X**	**X**						**X**				
Airspace management service providers	**X**	**X**	**X**								**X**			
~~Airspace design~~ Flight procedure design services providers	**X**	**X**	**X**									~~**tbd***~~ **X**		
Network Manager	**X**	**X**	**X**	**X**									**X**	

service providers (see Note 2)														**X**

Table 1: Applicability of annexes to service providers

X = Applicable annexes for each service provider.

Note 1: Section 3 of Annex IV (Part-ATS) only applies to providers of air traffic control services and not to providers of alerting, air traffic advisory, and flight information services.

Note 2: The applicability of Annex XIII is dependent upon the scope as specified within each of the subparts of Annex XIII.

~~* to be introduced under RMT.0445, as necessary.~~

2. GM1 ATM/ANS.OR.A.005 is inserted as follows:

GM1 ATM/ANS.OR.A.005 Application for a service provider certificate

AIS CERTIFICATE — SCOPE OF SERVICE

The template for the AIS certificate details the scope of the services that can be included in the certificate. The information below details specific provisions that apply to service providers when certified for such type of service.

With regard to Annex VI, the following sections apply to all certified service providers providing aeronautical information services:

— Section 1 - General requirements

— Section 2 - Data quality requirements

— Section 6 - Personnel requirements

In addition, the following sections apply to certified service providers providing aeronautical information products and/or for pre-flight information services, as applicable to their scope:

— Section 3 - Aeronautical information products

— Section 4 - Distribution and pre-flight information services

— Section 5 - Aeronautical information products updates

3. GM2 ATM/ANS.OR.A.005 is inserted as follows:

GM2 ATM/ANS.OR.A.005 Application for a service provider certificate

AIS CERTIFICATE — DELEGATION FROM A MEMBER STATE

Certification of an AIS provider confirms the compliance with the requirements of this Regulation and does not constitute a delegation from the Member State for the provision of the service as described in GM1 to Article 3.

4. GM2 ATM/ANS.OR.A.005 is inserted as follows:

GM3 ATM/ANS.OR.A.005 Application for a service provider certificate

AIS CERTIFICATE — TERRAIN DATA SETS

Regulation (EU) No 2017/373 does not require the provision of terrain data to be AIS certified. Terrain data sets are typically originated and maintained by non-aviation entities for general purposes. The provision of terrain data sets for the purpose of air navigation is consequently limited to the mere distribution of a finished product or even only the provision of information on how the product can be obtained. As such, the provision of terrain data, is not subject to an AIS certificate.

5. GM1 ATM/ANS.OR.A.035 is added as follows:

GM1 ATM/ANS.OR.A.035 Demonstration of compliance

RELEVANT EVIDENCE

ATM/ANS.OR.B.005(e) requires 'The management system shall be proportionate to the size of the service provider and the complexity of its activities, taking into account the hazards and associated risks inherent in those activities.' Consequently, the relevant evidence to demonstrate compliance with the applicable

requirements of this Regulation should be also proportionate to the size of the service provider and the complexity of its activities.

6. AMC1 ATM/ANS.OR.A.040(b) is amended as follows:

AMC1 ATM/ANS.OR.A.040(b) Changes — general

PROCEDURE FOR ~~DEALING WITH~~ CHANGES REQUIRING PRIOR APPROVAL

(…)

7. AMC2 ATM/ANS.OR.A.040(b) is amended as follows:

AMC2 ATM/ANS.OR.A.040(b) Changes — general

PROCEDURE FOR ~~DEALING WITH~~ CHANGES NOT REQUIRING PRIOR APPROVAL

(…)

8. GM1 ATM/ANS.OR.A.040(b) is amended as follows:

GM1 ATM/ANS.OR.A.040(b) Changes — general

PROCEDURE FOR ~~DEALING WITH~~ CHANGES NOT REQUIRING PRIOR APPROVAL

(…)

9. In ATM/ANS.OR.085, the following provisions are added as follows:

(…)

GM1 ATM/ANS.OR.085 Aeronautical data quality management

DISTRIBUTION OF AERONAUTICAL INFORMATION

The obligation to comply with the relevant provisions of ATM/ANS.OR.085 (Data quality management) shall not inhibit the urgent distribution of aeronautical information necessary to ensure the safety of flight. It is recognised that, in this case it is not always possible to comply with all the relevant provisions. However, it is also not possible to determine a priori in all cases where this exception may apply, hence this shall be dependent on a case by case individual assessment made by competent staff.

GM1 ATM/ANS.OR.A.085(a) Aeronautical data quality management

PURPOSE

The aeronautical data catalogue presents the scope of data that can be collected and maintained by the aeronautical information services providers and provides a common terminology that can be used by data originators and service providers.

GM1 ATM/ANS.OR.A.085(b) Aeronautical data quality management

GENERAL

Minimum requirements for the processing of aeronautical data may be found in the EUROCAE Document

ED-76A, 'Standards for processing aeronautical data', June 2015, which aims to assist aeronautical data chain actors.

GM1 ATM/ANS.OR.A.085(b)(4) Aeronautical data quality management

RESOLUTION

(a) Stating that resolution needs to be commensurate with the actual accuracy means that digital data needs to have sufficient resolution to maintain accuracy. Typically, if an accuracy of .1 units is needed, then a resolution of 0.01 or .001 units would enable a data chain to preserve the accuracy without issue. A finer resolution could be misleading as one could assume that it supports a finer accuracy. This factor range of 10 to 100 between accuracy and resolution is applicable regardless of the units of measurements used.

(b) The resolution should be enough to capture the accuracy of the data.

GM1 ATM/ANS.OR.A.085(b)(5) Aeronautical data quality management

TRACEABILITY

Traceability is supported by maintaining the metadata.

AMC1 ATM/ANS.OR.A.085(b)(8) Aeronautical data quality management

FORMAT

The specified requirements should be included in the formal arrangements.

GM1 ATM/ANS.OR.A.085(c) Aeronautical data quality management

ELECTRONIC MEANS

The transmission of aeronautical data and aeronautical information may be done by different electronic means avoiding the need of manual interaction with the data itself.

AMC1 ATM/ANS.OR.A.085(d) Aeronautical data quality management

FORMAL ARRANGEMENTS — CONTENT

Formal arrangements should include the following minimum content:

(a) the aeronautical data to be provided;

(b) the data quality requirements for each data item supplied according to the aeronautical data catalogue;

(c) the method(s) for demonstrating that the data provided conforms with the specified requirements;

(d) the action to be taken in the event of discovery of a data error or inconsistency in any data provided;

(e) the following minimum criteria for notification of data changes:

(1) criteria for determining the timeliness of data provision based on the operational or safety significance of the change;

(2) any prior notice of expected changes; and

(3) the means to be adopted for notification;

(f) the party responsible for documenting data changes;

(g) data exchange details such as format or format change processes;

(h) any limitations on the use of data;

(i) requirements for the production of data origination quality reports;

(j) metadata to be provided; and

(k) contingency requirements concerning the continuity of data provision.

GM1 ATM/ANS.OR.A.085(d) Aeronautical data quality management

FORMAL ARRANGEMENTS — TEMPLATE

AIS providers may use the pre-determined template 'Data Provision Agreement' developed by EUROCONTROL (ADQ Formal Arrangement Template, version 1.1. issued on 22 February 2016.)

AMC1 ATM/ANS.OR.A.085(g) Aeronautical data quality management

TOOLS AND SOFTWARE — EVIDENCE

(a) In order to prove that software tools do not adversely impact on the quality of data, the potential software contribution to failure conditions should be analysed and a global analysis process of error cases should be chosen e.g. 'Failure Modes and Effects Analysis' (FMEA).

(b) During the software development phase, system-level requirements dealing with error cases should be further developed, or detailed, as requirements.

GM1 ATM/ANS.OR.A.085(g) Aeronautical data quality management

SOFTWARE

(a) A means by which ATM/ANS.OR.A.085(g) can be met, is through the validation and verification of software applied to a known executable version of the software in its target operating environment.

(b) The validation of software is a process of ensuring that software meets the requirements for the specified application or intended use of the aeronautical data and aeronautical information.

(c) The verification of software is an evaluation of the output of an aeronautical data and/or aeronautical information software development process to ensure correctness and consistency with respect to the inputs and applicable software standards, rules and conventions used in that process.

GM2 ATM/ANS.OR.A.085(g) Aeronautical data quality management

TOOLS AND SOFTWARE — TOOL QUALIFICATION

Tools (e.g. software) can be used to eliminate, reduce or automate the activities associated with aeronautical data processes. Tool qualification is the process by which assurance is achieved that tools employed will neither introduce errors into the data nor fail to detect an error. When required, tool qualification shall be performed within the context of the tool's intended use, using EUROCAE ED-215/RTCA DO-330 with adaptations provided in EUROCAE ED-76A/RTCA DO-200B, Appendix D.

The objectives of tool qualification are to:

— demonstrate that the tool complies with its requirements; and

— ensure that the tool provides equivalence to any activities that it automates and tool qualification is commensurate with the tool's intended use or the data production process.

(a) Determining requirement for tool qualification

Tools shall be qualified when data processes are eliminated, reduced or automated by the use of the tool without the output being verified. Only tools that have the ability to insert or fail to detect an error in the aeronautical data process require qualification. The following requirements apply equally to tools obtained 'off the shelf' or developed by the data chain participants.

— Each proposal for a new tool or for a modification of an existing tool, shall be reviewed to determine whether the tool is required to undergo qualification; and

— Where a decision is made that qualification is not required, justification for that decision shall be documented.

The tool qualification process may be applied to a single tool, a collection of tools, or one or more functions within a tool. For a tool with multiple functions, if protection between tool functions can be demonstrated, only those functions that are used to eliminate, reduce or automate data processes, and whose outputs are not verified, need to be qualified. Protection is the use of a mechanism to ensure that a tool function cannot adversely impact on another tool function. A tool is qualified where the intention to use the tool is stated in the data processing procedures. A tool is qualified to support data quality, as defined in the DQRs. If a tool is used to provide data compliance with additional or modified DQRs, the need for re-qualification shall be assessed.

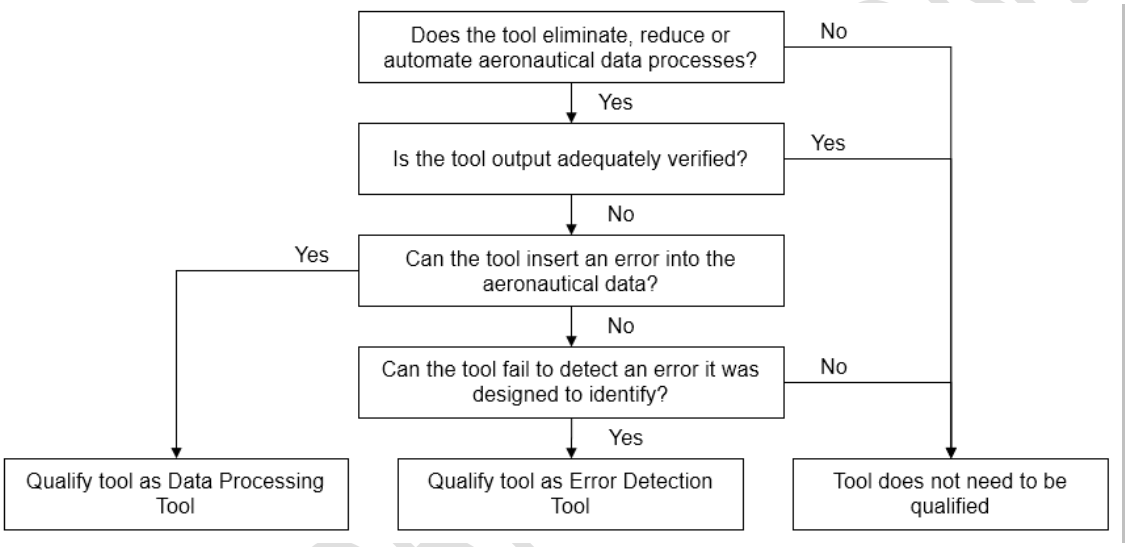

Figure: Criteria for tool qualification

The first question posed is whether or not the tool eliminates, reduces, or automates an activity associated with the aeronautical data chain, which includes any action that is performed to complete an aeronautical data chain functional link. If the answer is yes, the next question is posed, and if no, the tool does not need to be qualified.

The second question is whether or not the activity or resultant output of the tool will be adequately verified by a different qualified tool or a manual process. If the answer is no, the next question is posed, and if yes, the tool does not need to be qualified.

The third question is whether or not the tool has the ability to insert an error into the aeronautical data contained in the database being processed. If the answer is yes, the tool shall be qualified as a data processing tool. If the answer is no, the next question is posed.

The final question posed, for tools that have not yet been identified as needing qualification, is whether or not the tool could theoretically fail to detect an error it was designed to identify. If the answer is yes, the tool shall be qualified as an error detection tool, and if no (which essentially means that the tool was not designed to directly perform modification or verification of any aeronautical data elements), the tool does not need to be qualified. It should be noted that the error detection tool does not need qualification to find any error that may exist in the data, but only errors in the data it is designed to find.

(b) Determining tool qualification level

When tool qualification is needed, the impact of the tool use in the aeronautical data chain should be assessed in order to determine its tool qualification level (TQL).

The appropriate DPAL and TQL are indicated in the table below. Three levels of tool qualification, TQL-3 to TQL-5, are identified based on the tool use and its potential impact on the aeronautical data chain. TQL-3 is the most rigorous level and TQL-5 is the least rigorous level.

The objectives, activities, and guidance required for each TQL are described in EUROCAE ED-215/RTCA DO-330 with adaptations provided in Appendix D of this standard (TQL-1 and TQL-2 are not invoked).

DPAL	**Data processing tool**	**Error detection tool**
1	TQL-3	TQL-5
2	TQL-4	TQL-5
3	Not required	Not required

(c) Tools previously qualified under EUROCAE ED-76/RTCA DO-200A

If an organisation has tools that were previously qualified under EUROCAE ED-76/RTCA DO-200A and it desires to meet EUROCAE ED-76A/RTCA DO-200B process standards, those tools can continue to be used without additional qualification activities taking place as long as the following conditions are met:

— The tool has not changed since its previous qualification;

— The tool environment has not changed since its previous qualification; and

— The use of the tool to eliminate, reduce or automate activities associated with aeronautical data processes remains the same.

Tools previously qualified under EUROCAE ED-76/RTCA DO-200A that have changed and require requalification after a data supplier has transitioned to meet EUROCAE ED-76A/RTCA DO-200B process standards, shall perform that new qualification based on the following guidelines.

First, the tool is classified as a data processing or error detection tool. Then, the EUROCAE ED-76A/RTCA DO-200B TQL that the tool corresponds to is determined using Section 2.4.5.2. Based on this determination, one of the three following requirements applies:

— For tools categorised as TQL-3, the new tool qualification process shall follow EUROCAE ED-76A/ RTCA DO-200B tool qualification standards.

— For tools categorised as TQL-4, the tool qualification process approved under EUROCAE ED-76/ RTCA DO-200A may continue to be used so long as concurrence from the authority granting recognition of compliance with this standard has been obtained/maintained. This concurrence may be granted based on an analysis of the tool addressing one or more of the following concepts:

- configuration management of the tool;
- effectiveness of problem reporting activity for the tool;
- stability and maturity of the tool;
- relevance of tool service history environment;
- actual error rates and tool service history; and

- impact of tool modifications.

If concurrence cannot be achieved or is not desired, EUROCAE ED-76A/RTCA DO-200B tool qualification standards shall be met.

— For tools categorised as TQL-5, the tool qualification process shall follow either EUROCAE ED-76 / RTCA DO-200B tool qualification standards, or the supplier's previous tool qualification process approved under EUROCAE ED-76/RTCA DO-200A.

NOTE: The previous tool qualification data collected using EUROCAE ED-76/RTCA DO-200A tool qualification standards, or a tool's service history, can be used as an alternate method of compliance with some EUROCAE ED-215/RTCA DO-330 objectives if qualification is being performed against EUROCAE ED-76A/RTCA DO-200B standards. EUROCAE ED-215/RTCA DO-330 provides additional information regarding alternative methods for tool qualification.

GM3 ATM/ANS.OR.A.085(g) Aeronautical data quality management

TOOLS AND SOFTWARE

This GM provides guidance on the application of EUROCAE ED-215/RTCA DO-330 to qualified tools in the aeronautical data processing domain.

In the aeronautical data processing domain, EUROCAE ED-215/RTCA DO-330 certification liaison objectives are not applicable.

The following terms from EUROCAE ED-215/RTCA DO-330 are changed to the aeronautical data processing domain. They are applicable to the intent of EUROCAE ED-76A/RTCA DO-200B, Appendix D:

— Certification credit — replaced by the general statement 'satisfaction of the applicable RTCA DO-200B/EUROCAE ED-76A objectives';

— Certification authority — should be understood as approval authority (See EUROCAE ED-76A/RTCA DO-200B, Section 2.5.1);

— Applicant — identifies the entity seeking compliance with EUROCAE ED-76A/RTCA DO-200B requirements; and

— Terms such as 'software life cycle', 'software processes', 'software plans', and 'software' are used. They refer to the product life cycle, processes, plans, and domain where the tool will be used in the software domain. In the context of this standard, the term 'software" should be understood as 'aeronautical databases', and 'software life cycle processes' should be understood as 'aeronautical data processes'.

TQL-1 and TQL-2 are not invoked as they have been assessed as not applicable to the aeronautical data processing domain.

Tool development standards (e.g. tool requirements standards, tool design standards, and tool coding standards), as defined in EUROCAE ED-215/RTCA DO-330, are not required under the aeronautical data processing domain.

GM4 ATM/ANS.OR.A.085(g) Aeronautical data quality management

TOOLS AND SOFTWARE — PROCESSING ADAPTATIONS

Tables:

— summarising the objectives adapted from EUROCAE ED-215/RTCA DO-330 by showing the applicability of each objective by TQL;

— whether the objective is to be implemented with independence;

— the output which results from satisfying the objective;

— and the control category for each tool life cycle data item,

may be found in Appendix D.2 to ED-76A (EUROCAE ED-215/RTCA DO-330 OBJECTIVES AERONAUTICAL DATA PROCESSING ADAPTATIONS)

AMC1 ATM/ANS.OR.A.085(i) Aeronautical data quality management

VALIDATION AND VERIFICATION — GENERAL

(a) The processes should define the means used to:

(1) confirm that the data has been received without corruption;

(2) ensure that stored data is protected from corruption; and

(3) confirm that originated data has not been corrupted prior to being stored.

(b) The processes should define the:

(1) actions to be taken when data fails a verification or validation check;

(2) tools required for the verification and validation process;

(3) methods used to verify received data;

(4) methods by which data quality is preserved;

GM1 ATM/ANS.OR.A.085(i) Aeronautical data quality management

VALIDATION AND VERIFICATION

(a) Validation

(1) Validation is the activity where a data element is checked as having a value that is fully applicable to the identity ascribed to the data element, or where a set of data elements are checked as being acceptable for their intended use.

(2) The application of validation techniques considers the entire aeronautical data chain. This includes the validation performed by prior data chain participants and any requirements levied on the data supplier.

(3) Examples of validation technique include:

(i) Validation by application

One method of validation is to apply data under test conditions. In certain cases, this may not be practical. Validation by application is considered to be the most effective form of validation. For example, flight inspection of final approach segment data prior to publication can be used to ensure that the published data is acceptable.

(ii) Logical consistency

Logical consistency validates by comparing two different data sets or elements and identifying inconsistencies between values based on operative rules (e.g. business rules).

(iii) Semantic consistency

Semantic consistency validates by comparing data to an expected value or range of values for the data characteristics.

(iv) Validation by sampling

Validation by sampling evaluates a representative sample of data and applies statistical analysis to determine the confidence in the data quality.

(b) Verification

(1) Verification is a process for checking the integrity of a data element whereby the data element is compared to another source, either from a different process or from a different point in the same process. While verification cannot ensure that the data is correct, it can be effective to ensure that the data has not been corrupted by the data process.

(2) The application of verification techniques considers only the portion of the aeronautical data chain controlled by the organisation. Yet, verification techniques may be applied at multiple phases of the data processing chain.

(3) Examples of verification techniques include:

(i) Feedback

Feedback testing is the comparison between the output and input state of a data set.

(ii) Independent redundancy

Independent redundancy testing involves processing the same data through two or more independent processes and comparing the data output of each process.

(iii) Update comparison

Updated data can be compared to its previous version. This comparison can identify all data elements that have changed. The list of changed elements can then be compared to a similar list generated by the supplier. A problem can be detected if an element is identified as changed on one list and not on the other.

GM2 ATM/ANS.OR.A.085(i) Aeronautical data quality management

VALIDATION AND VERIFICATION TECHNIQUES

Validation and verification techniques are employed throughout the data processing chain to ensure that the data meets the associated data quality requirements. More explanatory material may be found in ED-76A 'Standards for processing aeronautical data'.

GM1 ATM/ANS.OR.A.085(j) Aeronautical data quality management

DATA ERROR DETECTION TECHNIQUES

(a) Digital error detection techniques can be used to detect errors during the transmission or storage of data. An example of a digital error detection technique is the use of cyclic redundancy checks (CRCs). Coding techniques can be effective regardless of the transmission media (e.g. computer disks, modem communication, or internet).

(b) Transmission of data via electronic/digital means (e.g. file transfer protocol (FTP) sites, web downloads, or email) may be subject to malicious attack that can corrupt the integrity of data for its intended use. Provision of means to mitigate the intentional corruption of digitally transmitted data may already exist within the organisational construct and operating procedures of participating entities.

(c) The objective of data security is to ensure that data is received from a known source and that there is no intentional corruption during processing and exchange of data.

(d) Records shall be maintained to show what data security provisions have been implemented.

(e) Provisions supporting this objective may include:

(1) implementation of technical data security measures to provide authentication and prevent intentional corruption during exchange of data (e.g. secure hashes, secure transmissions, digital signatures); and

(2) Implementation of organisational data security measures to protect processing resources and prevent intentional corruption during processing of data.

GM2 ATM/ANS.OR.A.085(j) Aeronautical data quality management

DATA ERROR PROCESSING

More explanation and guidance may be found in Appendix C (Guidance on compliance with data processing requirements) of EUROCAE ED-76A.

GM1 ATM/ANS.OR.A.085(l) Aeronautical data quality management

ERROR HANDLING

(a) The term 'error' is understood as being defective, degraded, lost, misplaced or corrupted data elements, or data elements not meeting stated quality requirements.

(b) Guidance on how to detect, identify, report and address/resolve aeronautical data errors may be found in EUROCAE ED-76A, 'Standards for processing aeronautical data'.

10. In ATM/ANS.OR.090, the following provisions are added as follows:

(…)

GM1 ATM/ANS.OR.A.090(a) Common reference systems for air navigation

HORIZONTAL REFERENCE SYSTEM — WGS-84

(a) A reference system provides a definition of a co-ordinate system in terms of the position of an origin in space, the orientation of an orthogonal set of Cartesian axes, and a scale. A terrestrial reference system defines a spatial reference system in which positions of points anchored on the Earth's solid surface have coordinates. Examples are WGS-84, ITRS/European Terrestrial Reference System (ETRS) and national reference systems.

(b) WGS-84 defines, inter alia, a conventional terrestrial reference system, a reference frame and a reference ellipsoid. WGS-84 is currently the reference system ICAO requires for geo-referencing aeronautical information.

(c) Further explanation and guidance may be found in Annex B (Horizontal reference systems) to EUROCONTROL Specifications for the Origination of Aeronautical Data, Volume 2: Guidance material (EUROCONTROL-SPEC-154, Edition 1.0 of 04/02/2013).

GM2 ATM/ANS.OR.A.090(a) Common reference systems for air navigation

TEMPORARY NON-COMPLIANCE OF GEOGRAPHICAL COORDINATES

In those particular cases where geographical coordinates have been transformed into WGS-84 coordinates by mathematical means and whose accuracy of original field work does not meet the applicable requirements

contained in the aeronautical data catalogue, they should be identified until the time when they can be compliant.

AMC1 ATM/ANS.OR.A.090(b) Common reference systems for air navigation

VERTICAL REFERENCE SYSTEM

(a) A service provider should use the Earth Gravitational Model — 1996 (EGM-96), as the global gravity model.

(b) When a geoid model other than the EGM-96 model is used, a description of the model used, including the parameters required for height transformation between the model and EGM-96, should be provided in the AIP.

GM1 ATM/ANS.OR.A.090(b) Common reference systems for air navigation

MEAN SEA LEVEL

(a) The geoid globally most closely approximates MSL. It is defined as the equipotential surface in the gravity field of the Earth which coincides with the undisturbed MSL extended continuously through the continents.

(b) Gravity-related heights (elevations) are also referred to as 'orthometric heights', while distances of points above the ellipsoid are referred to as 'ellipsoidal heights'.

(c) Global and local geoids differ in their origin: global geoids consider only the long- and middle-wave part of the Earth's gravity field, whilst local geoids also consider the short-wave part of the gravity field. Global geoids are used when consistent orthometric heights, over long distances (continent or earth surveying), are required. Currently, the world's best global geoid model is EGM 200846. It was determined using satellite tracking, gravity anomalies and satellite altimetry. Its accuracy is in the range of ± 0.05 m (oceans) and ± 0.5 m (on land). This accuracy is higher in flat regions than in topographically mountainous terrain, such as the Alps.

(d) For local engineering applications and cadastre-surveying, global geoids are not as accurate as needed. For such applications, local geoid models are calculated. These can only be developed using local field measurements. They offer centimetre accuracy over several hundred kilometres, with a high resolution. Local geoids are not suitable for height comparison over large distances since they are based on different origins and reference heights (different equipotential levels).

(e) Further explanation and guidance may be found in Annex C (Vertical reference systems) to EUROCONTROL Specifications for the Origination of Aeronautical Data, Volume 2: Guidance material (EUROCONTROL-SPEC-154, Edition 1.0 of 04/02/2013).

GM1 ATM/ANS.OR.A.090(b) Common reference systems for air navigation

VERTICAL REFERENCE SYSTEM

Further explanation and guidance may be found in Annex C (Vertical reference systems) to EUROCONTROL Specifications for the Origination of Aeronautical Data, Volume 2 (EUROCONTROL-SPEC-154, Edition 1.0 of 04/02/2013).

GM1 ATM/ANS.OR.A.090(c) Common reference systems for air navigation

TEMPORAL REFERENCE SYSTEM

(a) A value in the time domain is a temporal position measured relative to a temporal reference system.

(b) ISO Standard 8601 specifies the use of the Gregorian calendar and 24-hour local or UTC for information interchange, while ISO Standard 19108 prescribes the Gregorian calendar and UTC as the primary temporal reference system for use with geographic information.