ICAO Annex 15 / PANS-AIM Data Quality Requirements

Interregional EUR/MID PANS AIM Workshop
Paris, France, 10-12 July 2018

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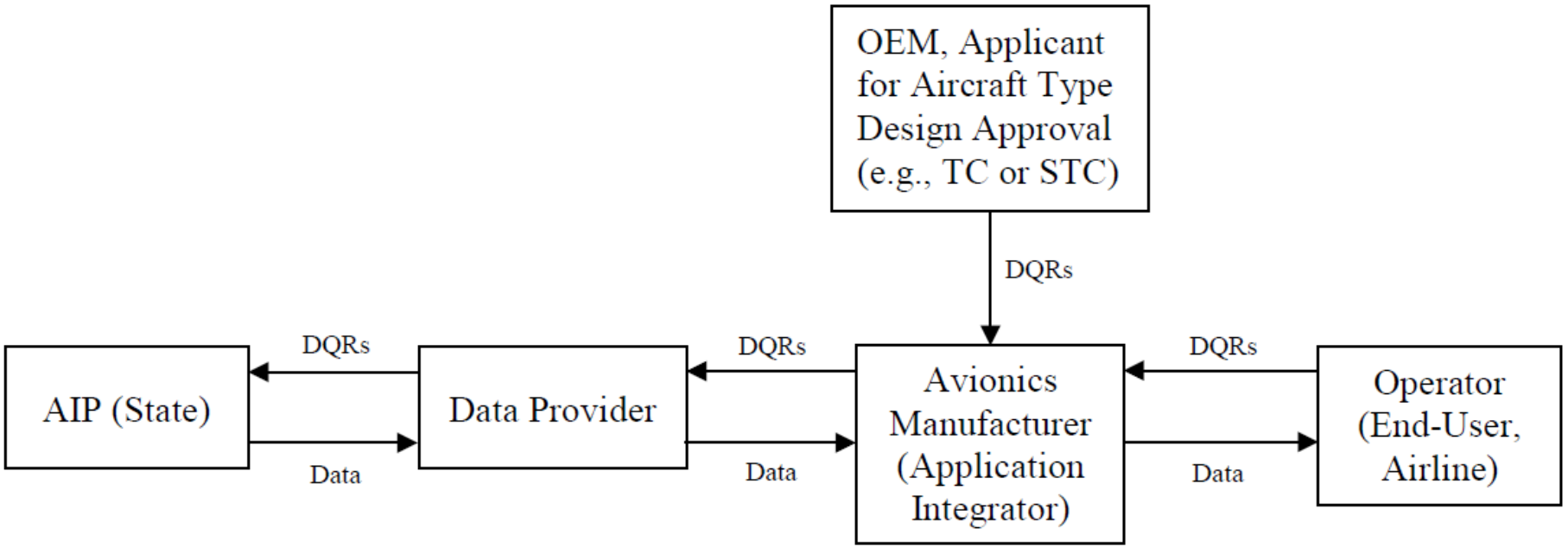
Data Quality Requirements in New Annex 15

DQRs come from the end-user

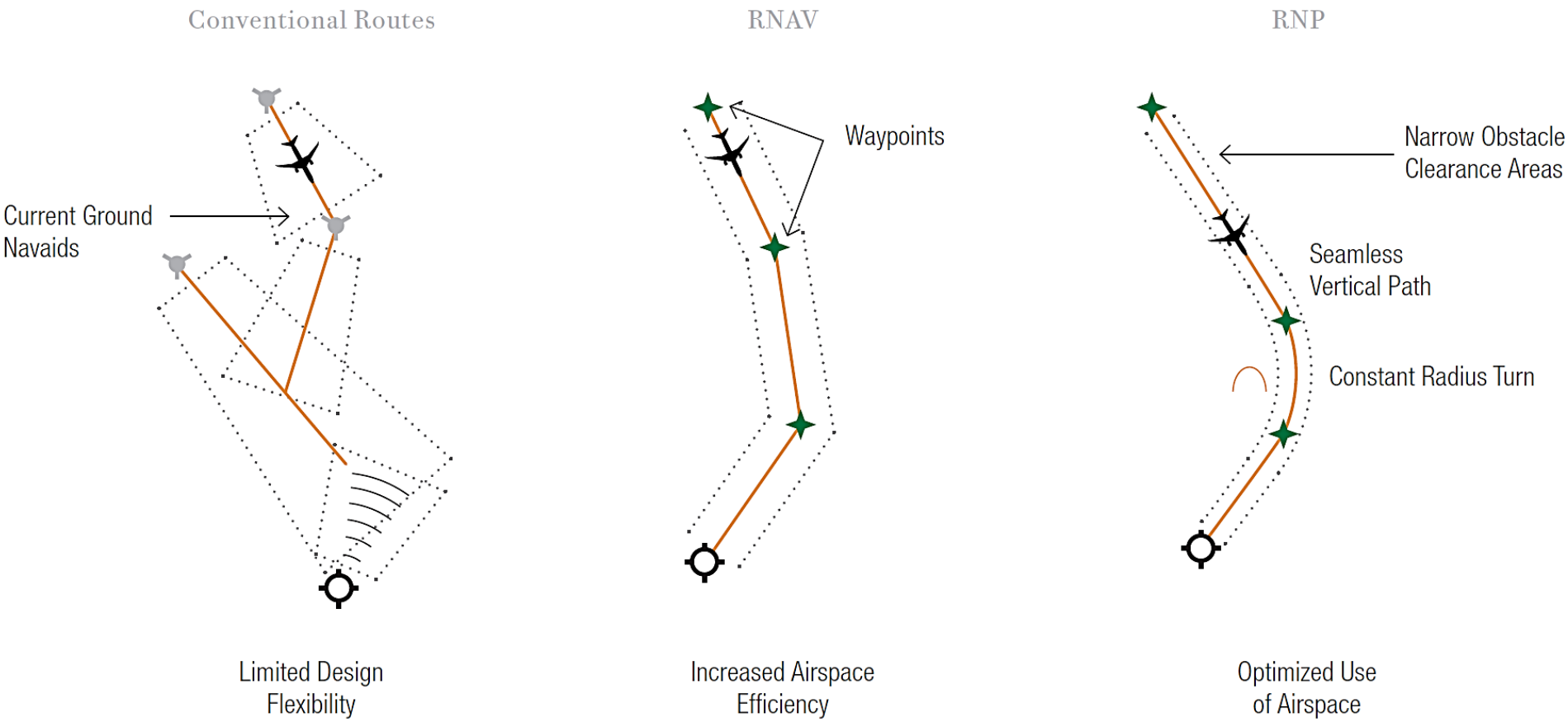
Figure 1. Typical Aeronautical Data Chain



Required Navigation Performance

Required navigation performance (RNP):

"A statement of the navigation performance necessary for operation within a defined airspace." – ICAO Doc 4444 PANS-ATM



RNP Approach requires highest quality data

Why is accuracy and resolution so critical in PBN, especially RNP ?

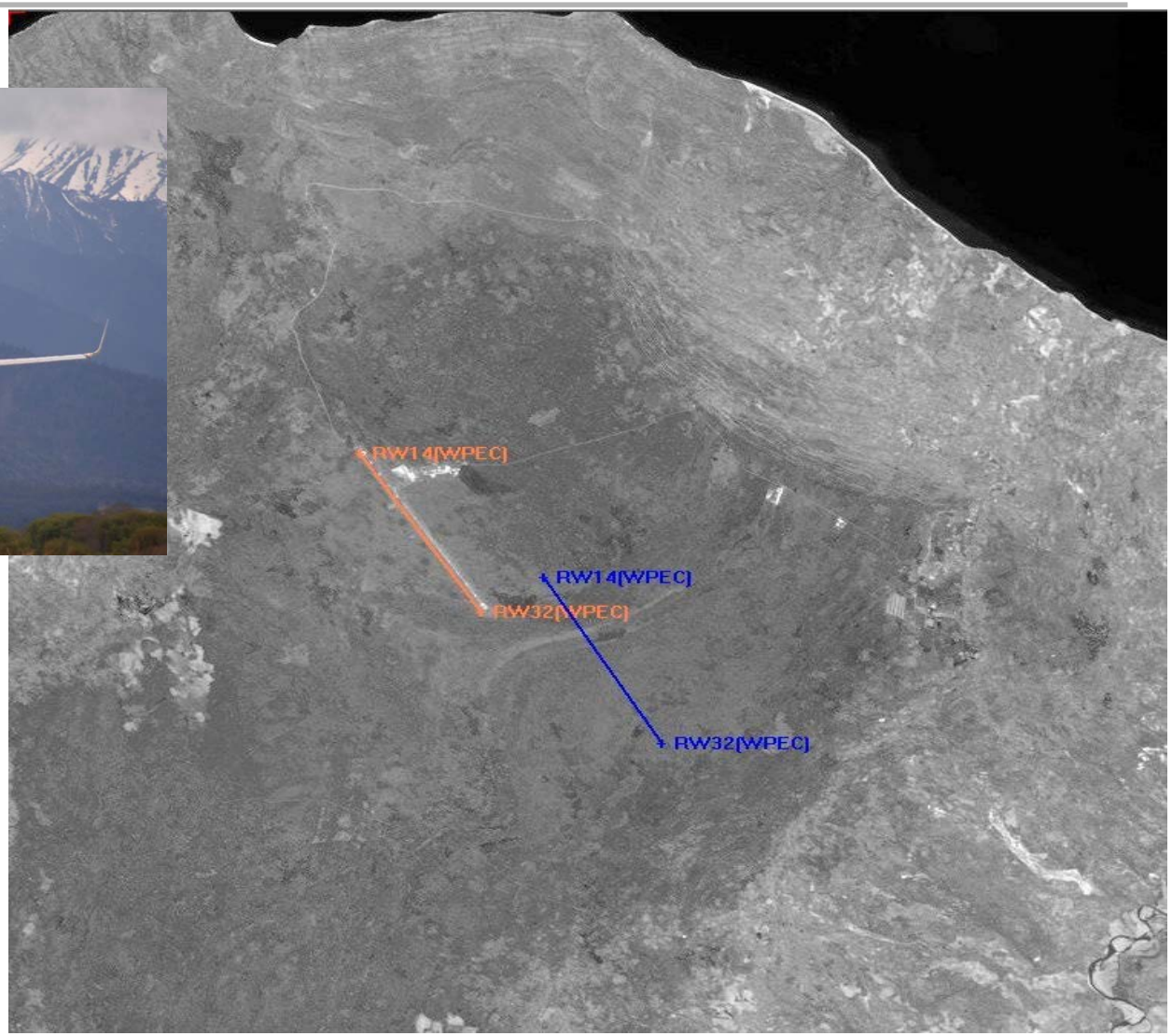
Conventional Procedure

- **Truth used to be an ILS beam**
- **The airplane flies a ground based signal that is always in the same position relative to the runway**

RNP Procedure

- **Truth is the database**
- **The airplane flies to the waypoint in the database, right or wrong**

… The airplane flies to the waypoint, right or wrong



Actual Runway Location (orange)

Official AIP Location (blue)

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3.6 Quality management system

3.6.1 Quality management systems shall be implemented and maintained encompassing all functions of an AIS, as outlined in 2.2. The execution of such quality management systems shall be made demonstrable for each function stage.

Note.— Guidance material is contained in the Manual on the Quality Management System for Aeronautical Information Services (Doc 9839).

3.6.2 **Recommendation.—** *Quality management should be applicable to the whole aeronautical information data chain from data origination to distribution to the next intended user, taking into consideration the intended use of data.*

3.6.3 **Recommendation.—** *The quality management system established in accordance with 3.6.1 should follow the ISO 9000 series of quality assurance standards, and be certified by an accredited certification body.*

Data Quality Requirements in New Annex 15

Whilst the industry standards (EUROCAE ED76A / RTCA DO200B) require seven characteristics of data quality (accuracy, resolution, integrity, timeliness, completeness, traceability and format), Annex 15 currently only includes three characteristics (accuracy, resolution and integrity).

The proposed amendment aims to solve this inconsistency by updating the data quality definition, adding four additional definitions of the data quality characteristics and updating the quality provisions.

Data Quality Requirements in New Annex 15

3.2 Data quality specifications

3.2.1 Data Accuracy

The order of accuracy for aeronautical data shall be in accordance with its intended use.

Note.— Specifications concerning the order of accuracy (including confidence level) for aeronautical data are contained in the PANS-AIM (Doc 10066), Appendix 1.

3.2.2 Data Resolution

The order of resolution of aeronautical data shall be commensurate with the actual data accuracy.

Note 1.— Specifications concerning the resolution of aeronautical data are contained in the PANS-AIM (Doc 10066), Appendix 1.

Note 2.— The resolution of the data contained in the database may be the same or finer than the publication resolution.

Data Quality Requirements in New Annex 15

3.2.3 Data Integrity

3.2.3.1 The integrity of aeronautical data shall be maintained throughout the data process from origination to distribution to the next intended user.

Note.— Specifications concerning the integrity classification related to aeronautical data are contained in the PANS-AIM (Doc 10066), Appendix 1.

3.2.3.2 Based on the applicable integrity classification, procedures shall be put in place in order to:

a) for routine data: avoid corruption throughout the processing of the data;

b) for essential data: assure corruption does not occur at any stage of the entire process and include additional processes as needed to address potential risks in the overall system architecture to further assure data integrity at this level; and

c) for critical data: assure corruption does not occur at any stage of the entire process and include additional integrity assurance processes to fully mitigate the effects of faults identified by thorough analysis of the overall system architecture as potential data integrity risks.

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3.2.4 Data Traceability

3.2.4.1 Traceability of aeronautical data shall be ensured and retained as long as the data is in use.

3.2.5 Data Timeliness

3.2.5.1 Timeliness shall be ensured by including limits on the effective period of the data elements.

Note 1.— These limits may be associated with individual data elements or data sets.

Note 2.— If the effective period is defined for a data set, it will account for the effective dates of all of the individual data elements.

3.2.6 Data Completeness

3.2.6.1 Completeness of the aeronautical data shall be ensured in order to support the intended use.

3.2.7 Data Format

3.2.7.1 The format of delivered data shall be adequate to ensure that the data is interpreted in a manner that is consistent with its intended use.

Data Quality Requirements in PANS-AIM

APPENDIX 1. AERONAUTICAL DATA CATALOGUE

Note 3.— The Data Catalogue provides a means for States to facilitate the identification of the organizations and authorities responsible for the origination of the aeronautical data and information. It is also providing a common language and facilitating the formal arrangements between data originators and the aeronautical information service. ***It includes data quality requirements applicable from origination through to publication.***

Data Quality Requirements in PANS-AIM

CHAPTER 2. AERONAUTICAL INFORMATION MANAGEMENT

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2.1.2 Processing

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Note 3. —Supporting data quality material in respect of data accuracy, publication resolution, and integrity of aeronautical data, together with guidance material in respect to the rounding convention for aeronautical data, is contained in Radio Technical Commission for Aeronautics ***(RTCA) Document DO-201A*** *and European Organization for Civil Aviation Equipment* ***(EUROCAE) Document ED-77 — Standards for Aeronautical Information*** *(or equivalent).*

Data Quality Requirements in PANS-AIM

CHAPTER 2. AERONAUTICAL INFORMATION MANAGEMENT

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2.2 Data integrity monitoring and assurance

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Note.— Guidance material in respect to the processing of aeronautical data and aeronautical information is contained in ***RTCA Document DO-200B*** *and European Organization for Civil Aviation Equipment* ***(EUROCAE) Document ED-76A — Standards for Processing Aeronautical Data****.*

Data Quality Requirements in RTCA DO-200B

Accuracy

The required accuracy of a particular data element should be based upon its intended use. **Accuracy is usually specified for data elements that are derived from measured values** and are not specified for data elements which have a defined value. For example, the location of a VHF (Very High Frequency) Omni-Directional Radio Range (VOR) and the height of an obstacle are measured and should have an associated accuracy requirement. The identifier associated with that VOR is defined and does not have an accuracy requirement.

Accuracy requirements should be developed in accordance with a system allocation of a higher-level accuracy requirement. For typical navigation operations, levels of accuracy for individual data elements are defined in RTCA DO-201A/EUROCAE ED-77, RTCA DO-272C/E1JR0CAE ED-99C, and RTCA DO-276B/EUR0CAE ED-98B.

Data Quality Requirements in RTCA DO-200B

Resolution

The required resolution of a particular data element should be based on its intended use. Resolution only applies to data elements that are derived from measured values and does not apply to data elements that are defined. **Since the resolution may also affect the accuracy of the data, it should be considered in relation to the accuracy requirement.** Once the resolution is defined, it should be incorporated into the specified data format. For typical navigation operations, the resolution of individual data elements is defined in RTCA DO-201A/EUROCAE ED-77, RTCA DO-272C/EUROCAE ED-99C, and RTCA DO-276B/EUROCAE ED-98B.

Data Quality Requirements in RTCA DO-200B

Integrity (of data) **A degree of assurance that aeronautical data and its value has not been lost or altered since the data origination or authorized amendment.**

In order to quantify data integrity requirements, the following assurance levels are defined: critical, essential, routine.

Data integrity covers the entire data chain.

Transmission of data via electronic digital means (e. g., FTP sites, web downloads, or email) may be subject to malicious attack that can corrupt the integrity of data for its intended use.

Checks are carried out to ensure the integrity of the original data is maintained after translation.

Data Quality Requirements in RTCA DO-200B

Timeliness

Many data elements have an identified period for which the data is valid. The period of validity may be based upon a revision period from the supplier or the underlying characteristics of the data itself. An example of a revision period is when States publish aeronautical data on a 28 day AIRAC cycle. An example of the period being based on its characteristics is terrain data supporting a terrain application: the period of time for which terrain data remains acceptable should be determined during evaluation of the system.

The requirement is to use valid and current data. This responsibility rests with the end-user. This responsibility can be partially discharged by receiving data from an accredited supplier whose accreditation against this standard shall be periodically confirmed.

Data Quality Requirements in RTCA DO-200B

Completeness

Completeness includes defining any requirements that define the minimum acceptable set of data to perform the intended function. One minimum set may be defined at the time of equipment approval while a larger set may be identified by the end-user.

The requirement defined at time of equipment approval is typically just that there is a database that is consistent with planned operations. The requirement defined for the operation is for the database to contain a particular set of data for the area(s) where operations are intended. **For many systems, database size limitations restrict the total amount of data that can be stored.** In this case, selection criteria can be used to reduce the total content. This selection criterion should be consistent with the operational requirements of the end-user. For example:

1. A navigation database may contain all approaches within the U.S., excluding all approaches to runways less than 5000 feet long; or,
2. A terrain database may contain terrain for a complete area with higher resolution for all airports with runways longer than 3500 feet.

Data Quality Requirements in RTCA DO-200B

Traceability

Traceability requirements are typically stated in terms of the duration of time that specific data elements and physical media, as required, are traceable. It is recommended that data be retained as long as the data is in use, as a minimum, with additional retention period determined as per regulatory requirements.

Data Quality Requirements in RTCA DO-200B

Format

The format characteristic refers to the data structure. **The format of delivered data should be adequate to ensure the data is interpreted in a manner consistent with the intent of the data.**

For transmission or upload, two potential formats are available for aeronautical data: human readable or digital. With the advent of cross-industry standardization, highly structured mark-up languages, such as the Extensible Markup Language (XML) tend to replace the simpler human-readable formats based on position in the row/column (e.g., ARINC 424) or field separators (e.g., NOTAM format).

There is also a trend for the definition of conceptual/logical data models from which the data coding specification is derived. This facilitates the use of different coding formats, adapted to local needs, while ensuring interoperability through a common semantic model.


THANK YOU!