INTERNATIONAL CIVIL AVIATION ORGANIZATION

A United Nations Specialized Agency

P-17 - QUALITY

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AIM Transition Roadmap

Four inter-related transition Steps

AIM Transition Roadmap

- Four Inter-related transition Steps

- <u>P-17 — Quality</u>
- Roadmap Phase 1

- *Quality management measures will be re-enforced to ensure the required level of quality of the aeronautical information. In order to assist States in the implementation of an efficient quality management system, guidance material for the development of a quality manual will be developed.*

AIM Transition Roadmap

- Four Inter-related transition Steps

- <u>P-01 – Data Quality Monitoring</u>
- Roadmap Phase 2

- *An ongoing challenge for organizations producing information is to ensure that the quality of the information suits its intended uses and that data users are provided with the appropriate information about data quality.*

AIM Transition Roadmap

- Four Inter-related transition Steps

- <u>P-02 — Data Integrity Monitoring</u>
- Roadmap Phase 2

- *Data integrity requirements introduced by safety objectives must be measurable and adequate.*

AIM Transition Roadmap

- Four Inter-related transition Steps

- <u>P-18 — Agreements with Data Originators</u>
- Roadmap Phase 3

- *Data of high quality can only be maintained if the source material is of good quality. States will be required to better control relationships along the whole data chain from the producer to the distributor. This may take the form of template service level agreements with data originators, neighbouring States, information service providers or others*

AIM Transition Roadmap

AIS to AIM Roadmap
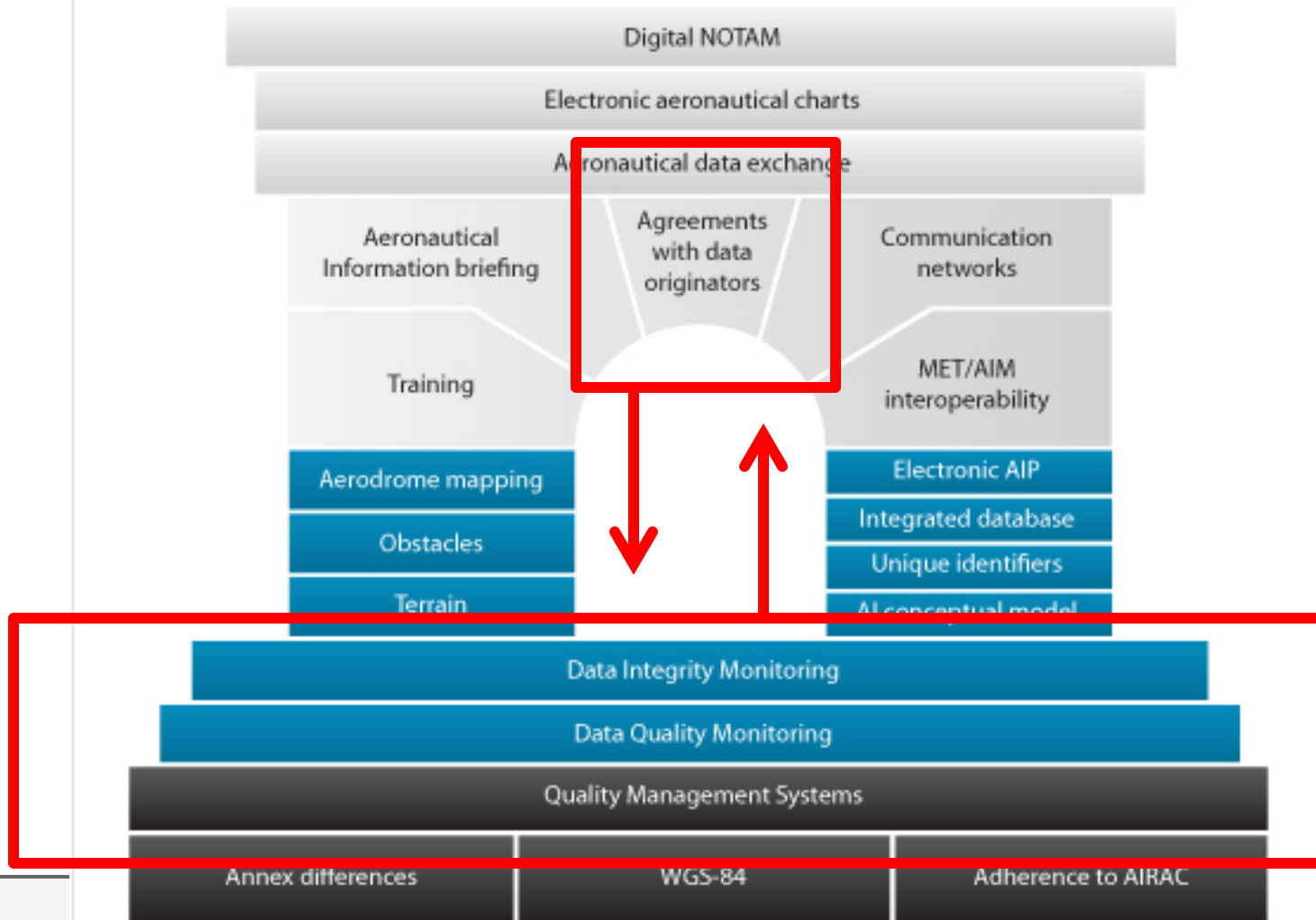
P-17 – Quality

- Aeronautical Information Management - AIM

- Definition:

*The dynamic, integrated management of aeronautical information services through the provision and exchange of **quality-assured** digital aeronautical data in collaboration with all parties.*

Annex 15 to the Convention on Civil Aviation

P-17 – Quality

So, what is "Quality"? Why is it important? Where is it required?

P-17 – Quality

- Annex 15

- ***Data quality.*** A degree or level of confidence that the data provided meet the requirements of the data user in terms of accuracy, resolution and integrity.

P-17 – Quality

- ## Need for Quality

- ***Corrupt or erroneous aeronautical information/data can potentially affect the safety of air navigation***

RNP Approach requires highest quality data
Why?

Conventional Procedure

• Truth used to be an ILS localizer and glide slope beam

• The airplane flies a ground based signal that is always in the same position relative to the runway
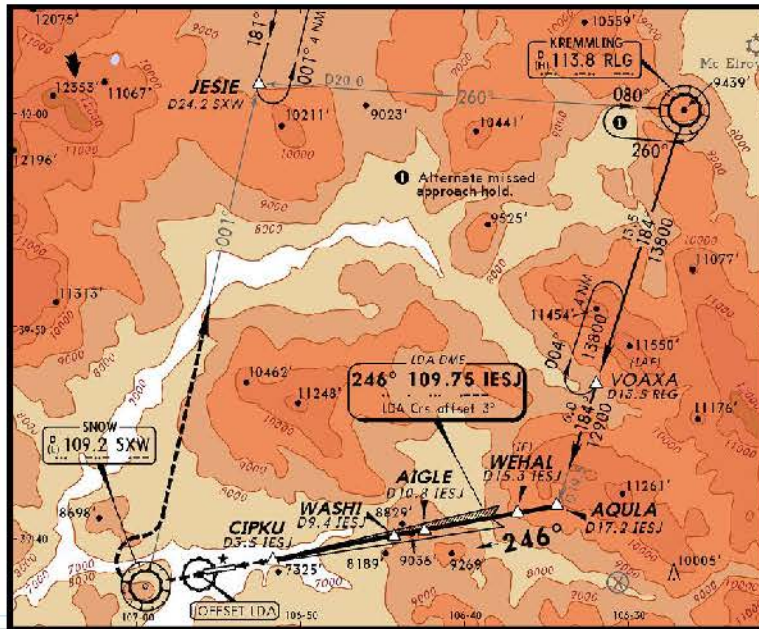

RNP Procedure

• Truth is the database

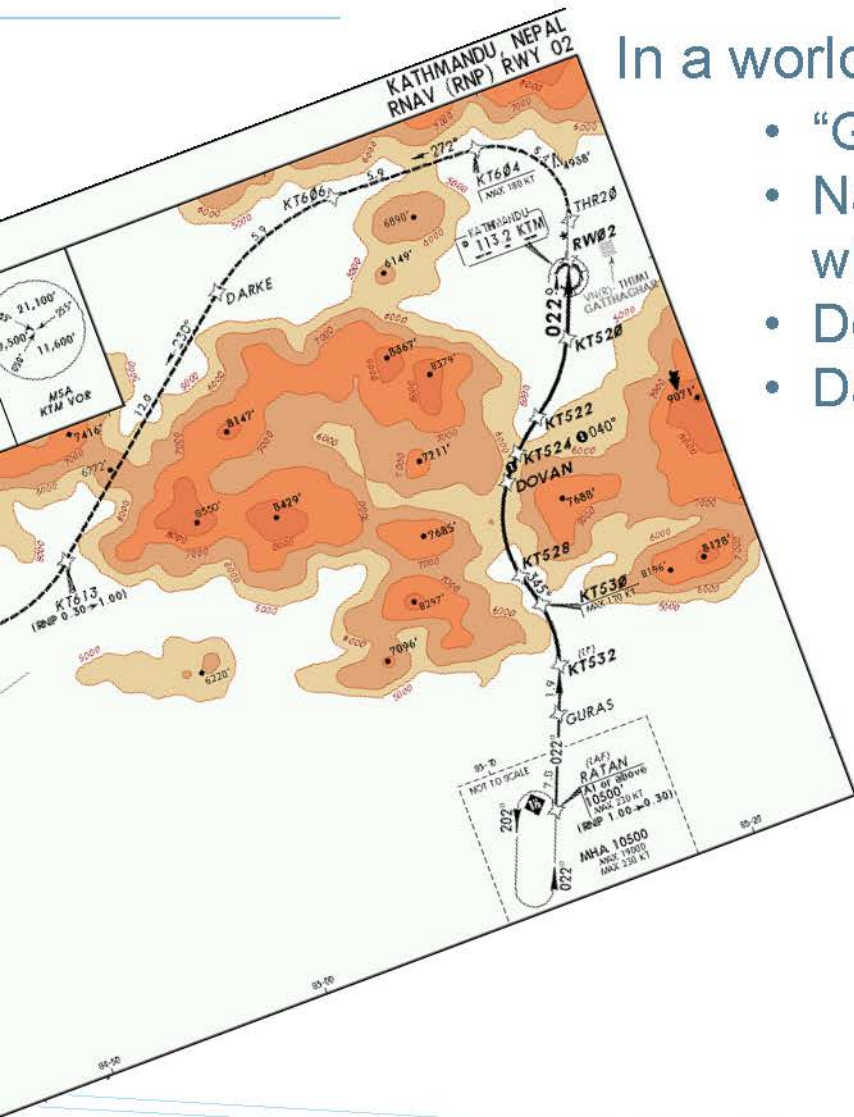• The airplane flies to the waypoint, right or wrong

Consequences

Virtually all worldwide procedures are avalable in on-board navigation databases

In a world based on **conventional navigation**:
- Pilots have a "Ground Truth"
- FMS/GNSS provide guidance to a ground based navaid signal

Consequences
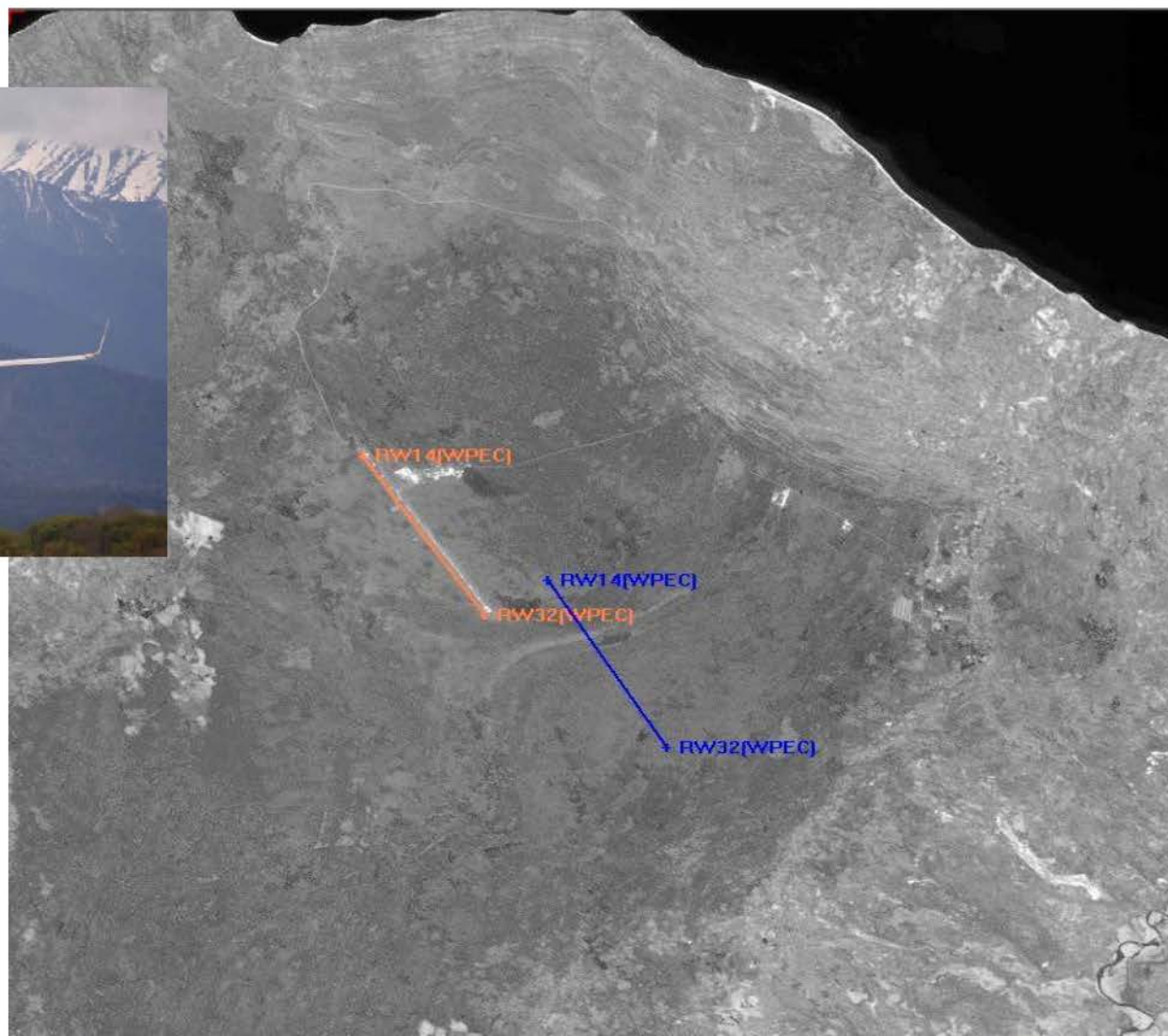
In a world of **Performanced Based Navigation**:

- "Ground Truth" is not available
- Nav system provides guidance to waypoints, wherever the database says they are
- Dependent on accurate data
- Data are <u>mission critical</u>

Data Quality - The "dark side" of PBN?

…. The airplane flies to the waypoint, right or wrong

Actual Runway
Location (orange)

Official AIP Location
(blue)

P-17 – Quality

- <u>Need for Quality</u>

- *The basic characteristics of aeronautical information are those of adequacy, availability and timeliness. The degree to which these and other characteristics fulfil requirements is referred to as <u>quality</u>.*

P-17 – Quality

- <u>Annex 15 – Definitions</u>

- ***Data quality.*** A degree or level of confidence that the data provided meet the requirements of the data user in terms of <u>accuracy, resolution and integrity.</u>

- ***Metadata.*** Data about data (ISO 19115*).
  - *Note.— A structured description of the content, quality, condition or other characteristics of data.*

P-17 – Quality

- ## Annex 15 – Definitions

- ***Quality.*** Degree to which a set of inherent characteristics fulfils requirements (ISO 9000*).

  - *Note 1.— The term "quality" can be used with adjectives such as poor, good or excellent.*

  - *Note 2.— "Inherent", as opposed to "assigned", means existing in something, especially as a permanent characteristic.*

- ***Quality assurance.*** Part of quality management focused on providing confidence that quality requirements will be fulfilled (ISO 9000*).

P-17 – Quality

- Annex 15 – Definitions

- **_Quality control._** Part of quality management focused on fulfilling quality requirements (ISO 9000*).

- **_Quality management._** Coordinated activities to direct and control an organization with regard to quality (ISO 9000*).

P-17 – Quality

- ## Annex 15

- ## *Chapter 2. Responsibilities and Functions*

  – 2.1.4 Each Contracting State shall ensure that the aeronautical data and aeronautical information provided are complete, timely and of required quality in accordance with 3.3.

P-17 – Quality

- ## Annex 15

- ### *Chapter 3. Aeronautical Information Management*

- **3.1 Information management requirements**

- The information management resources and processes established by an aeronautical information service <u>shall </u>be adequate to ensure the timely collection, processing, storing, integration, exchange and delivery of <u>quality-assured</u> aeronautical data and aeronautical information within the ATM system.

P-17 – Quality

- ## Annex 15

- ### *Chapter 3. Aeronautical Information Management*

- ### 3.2 Aeronautical data and aeronautical information validation and verification

- 3.2.1 Material to be issued as part of the Integrated Aeronautical Information Package shall be thoroughly checked before it is submitted to the aeronautical information service, in order to make certain that all necessary information has been included and that it is correct in detail prior to distribution.

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- <u>Annex 15</u>

- *Chapter 3. Aeronautical Information Management*

- **3.2 Aeronautical data and aeronautical information validation and verification**

- 3.2.2 An aeronautical information service <u>shall</u> establish verification and validation procedures which ensure that upon receipt of aeronautical data and aeronautical information, quality requirements (<u>accuracy, resolution, integrity and traceability</u>) are met.

P-17 – Quality

- Annex 15

- *Chapter 3. Aeronautical Information Management*
- **3.3 Data quality specifications**
- The information management resources and processes established by an aeronautical information service shall be adequate to ensure the timely collection, processing, storing, integration, exchange and delivery of quality-assured aeronautical data and aeronautical information within the ATM system.

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- Annex 15

- *Chapter 3. Aeronautical Information Management*
- **3.3 Data quality specifications**

  - ACCURACY

  - RESOLUTION

  - INTEGRITY.

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- ## Annex 15

- ## *DEFINITION*
    - ACCURACY
    - A degree of conformance between the estimated or measured value and the true value.

    - *Note.— For measured positional data the accuracy is normally expressed in terms of a distance from a stated position within which there is a defined confidence of the true position falling.*

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- <u>Annex 15</u>

- ***Chapter 3. Aeronautical Information Management***
- **3.3 Data quality specifications**
  - <u>ACCURACY</u>
  - Accuracy specified in
    - Annex 11 *Air Traffic Services*, Chapter 2
    - Annex 14 *Aerodromes* Volumes I and II, Chapter 2
    - Annex 15 Appendix 8 (for electronic terrain and obstacle data)

APPENDIX 5.   AERONAUTICAL DATA QUALITY REQUIREMENTS

Excerpt

Table 1.   Latitude and longitude

Latitude and longitude	Accuracy Data type	Integrity Classification
Flight information region boundary points	2 km declared	1×10^{-3} routine
P, R, D area boundary points (outside CTA/CTR boundaries)	2 km declared	1×10^{-3} routine
P, R, D area boundary points (inside CTA/CTR boundaries)	100 m calculated	1×10^{-5} essential
CTA/CTR boundary points	100 m calculated	1×10^{-5} essential
En-route navaids and fixes, holding, STAR/SID points	100 m surveyed/calculated	1×10^{-5} essential
Obstacles in Area 1 (the entire State territory)	50 m surveyed	1×10^{-3} routine
Obstacles in Area 2 (the part outside the aerodrome/heliport boundary)	5 m surveyed	1×10^{-5} essential
Final approach fixes/points and other essential fixes/points comprising the instrument approach procedure	3 m surveyed/calculated	1×10^{-5} essential

Note 1.— See Annex 15, Appendix 8, for graphical illustrations of obstacle data collection surfaces and criteria used to identify obstacles in the defined areas.

Note 2.— In those portions of Area 2 where flight operations are prohibited due to very high terrain or other local

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- Annex 15

- *DEFINITION*

  - RESOLUTION

  - A number of units or digits to which a measured or calculated value is expressed and used.

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- Annex 15

- ***Chapter 3. Aeronautical Information Management***
- **3.3 Data quality specifications**
    - RESOLUTION
    - Specified in
        - Annex 15 Appendices 1 and 7
        - **Recommendation.**— *The resolution of the data features contained in the database should be commensurate with the data accuracy requirements.*

Excerpt

Table A7-1.   Latitude and longitude

Latitude and longitude	Publication resolution	Integrity classification
Flight information region boundary points	1 min	routine
P, R, D area boundary points (outside CTA/CTR boundaries)	1 min	routine
P, R, D area boundary points (inside CTA/CTR boundaries)	1 sec	essential
CTA/CTR boundary points	1 sec	essential
En-route NAVAIDS, intersections and waypoints, and holding, and STAR/SID points	1 sec	essential
Obstacles in Area 1 (the entire State territory)	1 sec	routine
Aerodrome/heliport reference point	1 sec	routine
NAVAIDS located at the aerodrome/heliport	1/10 sec	essential
Obstacles in Area 3	1/10 sec	essential
Obstacles in Area 2	1/10 sec	essential
Final approach fixes/points and other essential fixes/points comprising the instrument approach procedure	1/10 sec	essential
Runway threshold	1/100 sec	critical
Runway end	1/100 sec	critical
Runway holding position	1/100 sec	critical
Taxiway centre line/parking guidance line points	1/100 sec	essential
Taxiway intersection marking line	1/100 sec	essential
Exit guidance line	1/100 sec	essential
Aircraft stand points/INS checkpoints	1/100 sec	routine
Geometric centre of TLOF or FATO thresholds, heliports	1/100 sec	critical

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- **Annex 15**

- ***DEFINITION***

  - INTEGRITY (Aeronautical Data)

  - A degree of assurance that an aeronautical data and its value has not been lost or altered since the data origination or authorized amendment.

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- Annex 15

- *Chapter 3. Aeronautical Information Management*
- **3.3 Data quality specifications**

  – INTEGRITY

  – Shall be maintained throughout the data process, from origin to distribution to the user

  – 3 integrity specifications

    - Routine data
    - Essential data
    - Critical data

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- <u>Annex 15</u>

- ***Integrity classification (aeronautical data).*** Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data are classified as:

- a) ***routine data****:* there is a <u>very low probability</u> when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;

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- <u>Annex 15</u>

- ***Integrity classification (aeronautical data).*** Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data are classified as:

- b) ***essential data****:* there <u>is a low probability</u> when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe

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- ## Annex 15

- ***Integrity classification (aeronautical data).*** Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data are classified as:

- c) ***critical data****:* there is a <u>high probability</u> when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.

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- ## Annex 15

- ***Integrity classification (aeronautical data).*** Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data are classified as:

- a) *routine data:* there is a very low probability when using corrupted routine data that the continued safe flight and

- landing of an aircraft would be severely at risk with the potential for catastrophe;

- b) *essential data:* there is a low probability when using corrupted essential data that the continued safe flight and

- landing of an aircraft would be severely at risk with the potential for catastrophe; and

3.3.3   Integrity

3.3.3.1   The integrity classification related to aeronautical data shall be as provided in Tables A7-1 to A7-5 of Appendix 7.

3.3.3.2   The integrity of aeronautical data shall be maintained throughout the data process from survey/origin to distribution to the next intended user (the entity that receives the aeronautical information from the aeronautical information service provider). Based on the applicable integrity classification, the validation and verification procedures shall:

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 may 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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- Annex 15

- ***DEFINITION***
  - TRACEABILITY
  - Ability to trace the history, application or location of that which is under consideration (ISO 9000*).
    - *Note.— When considering product, traceability can relate to:*
    - *— the origin of materials and parts;*
    - *— the processing history; and*
    - *— the distribution and location of the product after delivery.*

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- ## Annex 15

- ## *Other SARPS related to quality*

    - 3.4 – Metadata (data about data)
    - 3.5 – Data Protection
    - 3.6 – Use of automation

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- <u>Annex 15</u>

- ***Metadata***
  - What is it?

  - Who understands it?

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- **Annex 15**

- ***Metadata***
  - What is it?

  - Data about Data
  - (Information about Information)

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- <u>Annex 15</u>

- **3.4 Metadata**

- 3.4.1 Metadata shall be collected for aeronautical data processes and exchange points. This metadata collection shall be applied throughout the aeronautical information data chain, from survey/origin to distribution to the next intended user.

- *Note.— ISO Standard 19115 specifies requirements for geographic information metadata.*

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- Annex 15

- **3.4 Metadata**

- 3.4.2 The metadata to be collected shall include, as a minimum:

- a) the name of the organizations or entities performing any action of originating, transmitting or manipulating the data;

- b) the action performed; and

- c) the date and time the action was performed.

Workshop Program

DAY 1	Tuesday 3 June 2014
Time	**Subject**
0830 - 0930	Registration/Welcome/Introductions
0930 – 0945	Workshop Outline/Overview
0945 - 1000	AIM Transition – Why?
1000 - 1030	Morning Tea/Coffee Break
1030 - 1100	ICAO and AIM Transition
1100 – 1130	Asia/Pacific Region AIM Planning
1130 - 1200	Regional AIM Transition Status and Reporting
1200 – 1300	Lunch
1300 - 1330	AIM Transition Roadmap and Phases
1330 – 1430	Information Management Concepts
1430 – 1500	Day 1 Review

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IS THIS METADATA?

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ACTION PERFORMED

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NAME OF ORIGINATING ORGANIZATION

ACTION PERFORMED

DATE AND TIME ACTION PERFORMED

P-17 – Quality

- <u>Annex 15</u>

<u>Quality Management System</u>

P-17 – Quality

- Annex 15

- *Chapter 3. Aeronautical Information Management*

- **3.7 Quality management System**

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

P-17 – Quality

- ## Annex 15

- ### *Chapter 3. Aeronautical Information Management*
- ### 3.7 Quality management System
- 3.7.4 Within the context of the established quality management system, the competencies and the associated knowledge, skills and abilities required for each function <u>shall</u> be identified, and personnel assigned to perform those functions <u>shall</u> be appropriately trained.   Processes shall be in place to ensure that personnel possess the competencies required to perform specific assigned functions.
- …..Records
- …..Periodic Assessments.

P-17 – Quality

- Annex 15

- *Chapter 3. Aeronautical Information Management*
- **3.7 Quality management System**
- 3.7.5 Each quality management system shall include the necessary policies, processes and procedures, including those for the use of metadata, to ensure and verify that aeronautical data are traceable throughout the aeronautical information data chain so as to allow any data anomalies or errors detected in use to be identified by root cause, corrected and communicated to affected users.

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- Annex 15

- *Chapter 3. Aeronautical Information Management*
- **3.7 Quality management System**
- 3.7.6 The established quality management system shall provide users with the necessary assurance and confidence that distributed aeronautical data and aeronautical information satisfy the aeronautical data quality requirements for accuracy, resolution and integrity as specified in 3.2 and 3.3 and that the data traceability requirements are met through the provision of appropriate metadata as specified in 3.4. The system shall also provide assurance of the applicability period of intended use of aeronautical data as well as that the agreed distribution dates will be met.

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- ## Annex 15

- ### *Chapter 3. Aeronautical Information Management*

- **3.7 Quality management System**

- 3.7.7 All necessary measures shall be taken to monitor compliance with the quality management system in place.

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- ## Annex 15

- ### *Chapter 3. Aeronautical Information Management*

- **3.7 Quality management System**

- 3.7.8 Demonstration of compliance of the quality management system applied shall be by audit. If nonconformity is identified, initiating action to correct its cause shall be determined and taken without undue delay. All audit observations and remedial actions shall be evidenced and properly documented.

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- Annex 15

- *Chapter 3. Aeronautical Information Management*

- **3.7 Quality management System**

- **Notes/Recommendations**

- Applicable to the whole aeronautical information data chain

- Letters of Agreement (LOA) between originator and distributor

- Should follow ISO 9000 series of QA standards and be certified by an approved organization

P-17 – Quality

- ## Annex 15

- ### *Chapter 3. Aeronautical Information Management*

- **3.7 Quality management System**

- **Notes/Recommendations**

- An ISO 9000 certificate issued by an accredited certification body – an acceptable means of compliance

- ISO 9000 series of QA standards provide a basic framework for a QA programme.

  - Details to be formulated by each State; usually unique to the State organization

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- <u>Annex 15</u>

- ***Chapter 3. Aeronautical Information Management***
- **3.7 Quality management System**
- **Notes/Recommendations**
- Supporting material for processing aeronautical data – the development and application of aeronautical databases;
  - RTCA Document DO-2001
  - EUROCAE Document ED-76

P-17 – Quality

- <u>Quality Guidance on Quality?</u>

- *ICAO Manual on the Quality Management System for Aeronautical Information Services*

- Developed by ICAO AIS – AIM Study Group
  http://www.icao.int/safety/ais-aimsg/Lists/Meetings/AllItems.aspx

- In late draft stage

- ***Expected to be finalized 2nd or 3rd Qtr 2014 (?)***

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Sneak preview

P-17 – Quality

- **<u>DRAFT</u>** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- Guidance material to provide assistance in the planning and implementation of a QMS for AIM
  - To fulfil the requirements of Annex 15
- Key elements for understanding of the requirements for a QMS
  - Assist in the development of State quality manuals
- The basis for the provision of aeronautical information satisfying timeliness and quality requirements of Annex 15

P-17 – Quality

- **DRAFT** ICAO Manual on the Quality Management System for Aeronautical Information Services

- **Policies on quality systems for AIM**
  - Need for quality
  - Need for a QMS
  - Relevant provisions in ICAO Annexes/DOCS
  - The data quality process
  - The relationship between quality and safety

P-17 – Quality

- **DRAFT** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- **Concepts and Vocabulary**

  – Standards and ISO

  – Background to ISO 9000: 2000 Series

  – What is quality?

  – Quality control, assurance and improvement

  – QMS

  – Quantifying quality costs

  – Quality Management principles

  – The ISO 9000 series of standards

P-17 – Quality

- **DRAFT** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- **ISO 9001: 2008 QMS**

- Structure

- Process model and general requirements

- Management responsibility

- Administration

- Resource management

- Product development

- Design and/or development planning

- Customer satisfaction

P-17 – Quality

- **DRAFT** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- **QMS Documentation**

- Structure and general requirements

- Documentation

- Documented procedures

- Document master List

- Quality manual

- Document control (master copy, owner, controlled and uncontrolled copies, quality records)

P-17 – Quality

- **DRAFT** ICAO Manual on the Quality Management System for Aeronautical Information Services

- **Auditing Processes**
- Audit objectives
- Audit types
- Process auditing approach
- Certification/registration audit
- Surveillance

P-17 – Quality

- **DRAFT** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- **Non-conformance reports and corrective action**
- Meaning of certification and registration
- Control of non-conforming product
- Corrective action and error analysis
- Error tracking process
- Change procedures

P-17 – Quality

- **DRAFT** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- **Steps to Certification and other Practical Issues**
- Meaning of certification and registration
- Control of non-conforming product
- Corrective action and error analysis
- Error tracking process
- Change procedures

P-17 – Quality

- **DRAFT** ICAO Manual on the Quality Management System for Aeronautical Information Services

- **Steps to Certification and other Practical Issues**
- Responsibility for initiating a QMS
- QMS implementation project

P-17 – Quality

- **DRAFT** ICAO Manual on the Quality Management System for Aeronautical Information Services

- **The data quality process**
- Generic aeronautical information data process
- Organizations in the supply chain
- Generic data process
- Generic process – a high level view
- Aeronautical data processing model
- How to connect and enhance quality at key steps
- Measurement of integrity

P-17 – Quality

- **DRAFT** ICAO Manual on the Quality Management System for Aeronautical Information Services

- **SMS and QMS**

- Introduction to SMS

- Relationship between SMS and QMS

- Integration principle and method of QMS and SMS

P-17 – Quality

- **DRAFT** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- **Appendices**
- Checklist for Development of a QMS for AIM
- Template of a Quality Manual
- Samples of Quality Manuals
- Sample of a Certification/Registration Audit
- Samples of Templates and Planning QMS Implementation into AIM

P-17 – Quality

- **<u>DRAFT</u>** <u>ICAO Manual on the Quality Management System for Aeronautical Information Services</u>

- **Appendices**
- Quality Audit Tool
- Service Level Agreements
- The AIS Data Process (ADP) and Static Data Procedures (SDPs)
- Differences between ISO 9001:2000 and ISO 9001:2008

P-17 – Quality

- That's all very nice, but

- What do we do while we're waiting?

P-17 – Quality

- Guidance Manual for Aeronautical Information Services (AIS) in the Asia/Pacific Region - 2002 Edition

- EUROCONTROL AIS Quality Assurance Compendium

P-17 – Quality

- <u>Summary</u>

- 4 Interrelated AIS – AIM Transition Steps
  - Phase 1 – P-17 Quality
  - Phase 2 – P-01 Data Quality Monitoring
  - Phase 2 – P-02 Data Integrity Monitoring
  - Phase 3 – P-18 Agreements with Data Originators

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- <u>Summary</u>

- Annex 15 Definitions
  - Data Quality
  - Metadata
  - Quality
  - Quality Assurance
  - Quality Control
  - Quality Management

P-17 – Quality

- <u>Summary</u>

- Annex 15 SARPS Related to Quality
  - Responsibilities and Functions
  - Information Management Requirements
  - Aeronautical Data and Aeronautical Information
    - Validation and verification
  - Data Quality Specifications
    - Accuracy, resolution, integrity
  - Traceability

P-17 – Quality

- <u>Summary</u>

- ICAO Draft Manual on the Quality Management System for Aeronautical Information Services

- Guidance Manual for Aeronautical Information Services (AIS) in the Asia/Pacific Region

- EUROCONTROL AIS Quality Assurance Compendium

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Questions?