International Civil Aviation Organization

DP 10

QMS for Aeronautical Information Services

Michael Hohm
Technical Officer, AIM, ICAO
Date

Importance of QMS for AIS/MAP

- Annex 15 implies need for QMS:
  - "Corrupt or erroneous AI/data can potentially affect safety of air navigation"
- Basic AI characteristics are:
  - Adequacy
  - Availability
  - Timeliness
- "Quality" is degree to which these and other characteristics fulfil requirements

Importance of QMS for AIS/MAP

- Need for quality is greater than ever in current environment:
  - Higher accuracy of data required to support RNAV, RNP & data-dependent airborne computer-based nav systems
- Quality requirements evolved to include:
  - Integrity
  - Accuracy
  - Order of publication & charting resolution
  - Protection of electronic data

Importance of QMS for AIS/MAP

- Annex 15 specifies quality requirements for aeronautical data
- Requires States to introduce quality system to implement QM at each stage of AI:
  - Originating
  - Collating
  - Editing
  - Formatting
  - Storing
  - Publishing
  - Distributing
- Recommends quality requirements be met by quality system compliant with ISO 9001

ISO 9000 & Customer Focus

- ISO 9000 emphasizes customer satisfaction
- Customer will determine acceptability of product/service delivered
- In AIM context, customer is user of AI/data:
  - Pilots
  - Aircraft operators
  - ATC
  - Flight planning organizations
  - General aviation
  - Data vendors
  - Etc.

A Process Approach

- *Process*: set of activity that transform inputs to outputs
  - Requires resources
- *Process approach*: application of system of processes, together with identification and interaction of these processes, and their management
- Process approach is at core of ISO 9001
- Process may be linked to previous to succeeding process
- ISO QMS requirements focus on systematically identifying, organizing, documenting, managing and improving processes, and interactions between processes
- All activities and resources related to AIM have to be managed as a process
  - including operational and administrative

Data Quality Process

- Extends from original data sources through AIS & publication to end-users
- QMS required for all organizations operating within total aeronautical data chain
- Data supply chain management based on QMS
  - and supported by Service Level Agreements (SLAs)

Annex 15, QMS & ISO 9000

- Annex 15 recommends ISO 9000 be used when developing QMS for AIM
- New ICAO Manual under development
- Guidance to meet Annex 15 requirements for States to introduce QMS for AIS
  - Addresses key requirements of QMS
  - Development of quality manual
  - Methodology & concepts derived from
    - ISO 9001:2008 – *QMS Requirements*
    - ISO 9000:2005 – *QMS Fundamentals & Vocabulary*

ISO 9001:2008 QMS

- Specifies QMS requirements for all organizations, products and services
- Only standard in ISO 9000:2000 family that can be used for certification of system
- AIS provider can only seek QMS certification after validating that every ISO 9001:2008 requirement is met

ISO 9001:2008 QMS (cont'd)

- ISO 9001:2008 only defines fundamental requirements and framework for certification
- Each AIS provider needs to formulate its own QMS based on its own needs, processes & circumstances
- Most AIS providers will already have system in place to address ISO requirements
  - Will be able to address ISO 9001:2008 in a simple & cost-effective manner

ISO 9001:2008 & Process Approach

- Process approach must be follow as per ISO 9001:2008
- To develop and maintain effective QMS
- AIS provider needs to identify and manage numerous linked processes, such as:
  - Process for review of requirements related to products
  - Process for provision of such products
  - Process for monitoring quality of products

ISO 9001:2008 Structure

- Clause 1 – Scope
- Clause 2 – Normative reference
- Clause 3 – Terms and definitions
- Claude 4 – QMS
- Claude 5 – Management responsibility
- Clause 6 – Resource management
- Clause 7 – Product realization
- Clause 8 – Measurement, analysis and improvement

ISO 9001:2008 Structure (Cont'd)

- First 3 clauses set the stage for requirements
- The *Shall* clauses (requirements) are stipulated in last 5 clauses
- QMS described in clause 4 encompasses 4 major groups of processes, within process-based QMS
- They are described in clauses 5 to 8:
  - Management responsibility
  - Resource management
  - Product realization
  - Measurement, analysis and improvement

General Requirements for QMS Implementation

- Identify processes needed for QMS
- Determine sequence and interaction of processes
- Determine criteria and methods required to ensure effective operation and control of these processes
- Ensure availability of information necessary to support operating and monitoring of processes
- Measure, monitor and analyse processes, and implement action necessary to achieve planned results and continual improvement

Management Responsibility

- AIM managers have responsibilities within quality system, related to:
  - Quality policy
  - Commitment to quality
  - Customer focus
  - Planning
  - Management representation
  - Management review

QMS Documentation

- ISO 9000 requires QMS be properly documented
- Different documentation levels exist (4)
- QMS documentation includes:
  - Quality & objectives
  - Quality manual
  - Documented procedures
  - Work instructions/operational procedures
  - External docs which can include specifications, statutory and regulatory requirements, standards, codes, etc.
  - Forms and records
  - Quality plans, usually used in complex projects, products, processes or contracts

Documentation Requirements

- Documentation for QMS must include:
  - Documented procedures
  - Documents required by organization to ensure effective operation and control of its processes
- Extent of QMS depends on following and may be in any form or type of medium:
  - Size and type of organization
  - Complexity and interaction of processes
  - Competence of personnel

Auditing Process

- ISO requires audit criteria – set of policies, procedures or requirements used as reference
- Those materials are contained in QMS documentation
- During audit, certification body/registrar will try to:
  - Verify of AIS provider is doing what it says it will do (QMS doc)
  - Confirm if QMS is effectively implemented
- Real importance of audit is to confirm that QMS is effectively implemented and maintained
  - So that benefits of establishing the system are realized

Process Auditing Approach

- Since ISO 9000:2000 promotes “process approach”, audit emphasizes practice of process auditing
  - Identifies inputs/outputs of subject process and determines if process is capable of delivering desired output consistently

Process Auditing Approach

- When auditing a process, auditors will look for:
  - Inputs and outputs of subject process
  - Process activities
  - Process ownership
  - Quality objectives
  - Continual improvement of process
  - Interrelation and interaction with other processes
  - Risks to process

Initiating a QMS

- Senior management support for implementation of QMS for AIM should be obtained
- Initial steps for senior management planning to implement QMS:
  - Learn about ISO
  - Formulate quality policy and establish quality objectives of AIM
  - Convey quality policy and quality objectives to entire AIM organization
  - Define roles and responsibilities of quality manager
  - Appoint quality manager
  - Arrange ISO training for quality manager
  - Arrange ISO training for staff

QMS Implementation Project

- Phase 1 – Planning
  - Review existing quality system and assess where is need to develop and extend existing features of system to meet ISO 9001
- Phase 2 – Design
  - Provide all components of QMS capable of producing quality in reliable and repeatable manner and ensure capability can be proven by audit
- Phase 3 – Deployment & testing
  - Implementation of QMS / activation of PDCA cycle
- Phase 4 – Certification
  - Certify QMS by approved organization in accordance with ISO 9001:2008, as recommended in Annex 15

Data Quality Process

- In order to ensure end-to-end integrity of aeronautical data, data process must be fully identified, mapped and understood
- Establishment of process is critical as it identifies key participants, processes, inputs and outputs that must be addressed un any regularized process

AI Data Process

- End-to end data quality made up of 3 key elements of a process:
  - Inputs
  - Actions
  - Outputs
- Data originators initiate inputs to process
  - E.g. Surveyors, ATS personnel, service organizations, etc.
- Activities then performed to turn inputs into outputs
  - These form actions associated processes
- Outputs of process are products that meet needs of users of data
  - Human or system-based users (e.g. pilot using info from AIP or FMS using integrated geospatial data)

Generic Process for AI/Data

- Data/info is provided by defined/approved/certified ISO 9001:2008, ISO accredited companies in accordance with legal and regulatory requirements
- Data/info is held in electronic media (standard worksheets that are used throughout process)
- In order to ensure data/info is received at next activity without change, CRC value needs to be calculated (CRC wrapping)
- Data/info transferred electronically is encrypted to provide further protection to integrity
- Data/info is checked/verified by responsible organization if provided by subcontractor
- Data/info transferred electronically to AIS
- AIS verifies completeness & integrity
- AIS processes data to publication using electronic media

Relevant Provisions in Annexes & Docs

- Annex 15 – SARPs related to QMS in Chapter 3, Section 3.2:
  - States ensure QMS implemented & maintained for AIS
  - QMS should cover whole data chain
  - QMS should follow ISO 9000 and be certified by approved organization
  - Assigned personnel
    - Skills/knowledge for each function in QMS defined
    - Personnel properly trained & records maintained
    - Assessments conducted to verify personnel skills/competencies
  - QMS ensures traceability of data to detect anomalies/errors
    - Identify root cause, correct and communicate to affected users

Relevant Provisions in Annexes & Docs

- Annex 15 – SARPs related to QMS in Chapter 3, Section 3.2 (cont'd):
  - QMS provides users with assurance and confidence that distributed data is adequate for use
  - States shall monitor compliance with QMS
  - Order of accuracy of data (95% confidence level) based upon Annex 11, Chapter 2 & Annex 14, Vol. I & II
  - 3 types of positional data shall be identified:
    - Surveyed points (Rwy thresholds, nav aids, positions, etc.)
    - Calculated points (mathematical calculations from surveyed points of points in space/fixes)
    - Declared points (e.g. flight information region boundary points)

Relevant Provisions in Annexes & Docs

- Annex 4 – Section 2.17 "Aeronautical Data" and Appendix 6 "Aeronautical Data Quality Management":
  - Contain similar provisions
  - Annex 4 refers to data quality requirements in Annex 15
- Doc 8126 "AIS Manual" – Chapter 1:
  - Refers to need for quality system
- Required accuracy, resolution and integrity of data are outlines in chapter 2 of Doc 9674, "WGS-84 Manual"
- QA of data required for quality of instrument flight procedure is set out in Doc 9906 "QA Manual for Flight Procedure Design"

Regional Aspects of AI/Data Quality

USOAP Compliance Checklists Annexes 4 & 15


ICAO
Uniting Aviation on
Safety | Security | Environment