

Building Effective Safety Oversight of AIS and AIM



Federal Aviation
Administration



Day 5: Collaboration and Next Steps

ENJOY YOUR
Friday



Day 5 Objectives

Week review

- Essential safety oversight responsibilities
- AIS requirements
- Surveillance program
- Surveillance techniques
- The audit process
- Critical elements of State safety oversight
- QMS
- Risk-based AIS surveillance program



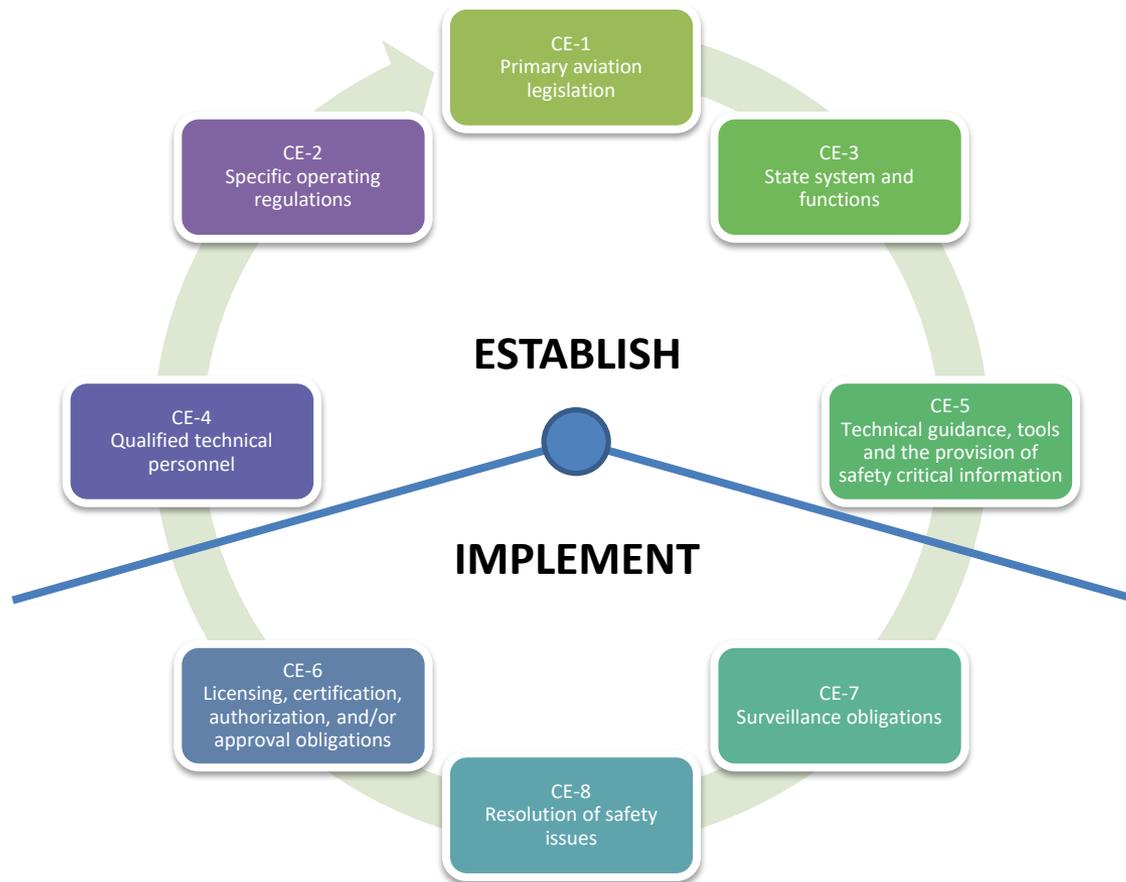
Introduce today's topics...

Essential Safety Oversight Responsibilities Review

- Establish rules
- Perform surveillance
- Resolve safety concerns



CEs of State Safety Oversight Review



AIS Requirements Review

- Provide an Aeronautical Information Service
- Receive, collate or assemble, edit, format, publish or store, and distribute data and information
- Establish formal arrangements between data originators and AIS provider

AIS Requirements Review (continued)

- Aeronautical data and information are:
 - Complete, timely and of required quality
 - Available for the operational requirements of the ATM and flight operations communities
 - Protected using data error detection, security, and authentication techniques
- Issue and receive Notice to Airmen (NOTAM) information by telecommunication



```
A0043/23 NOTAMN
Q) GOOO/QWELE/IV/BO/W/000/045/1408N01603W005
A) GOOO B) 2301182016 C) 2304172359 EST
E) AIR SAFETY OPERATIONS WILL TAKE PLACE WI A CIRCLE OF 5NM RADIUS
CENTRED ON 140841N - 0160316W (KAOLACK A/D) )
F) GND G) FL045
```

AIS Requirements Review (continued)

- Exchange aeronautical data and information with ICAO contracting States
- Implement verification and validation procedures



- Collect and maintain metadata

AIS Requirements Review (continued)

- Automation is introduced to improve timeliness, quality, efficiency and cost effectiveness
- Quality management system (QMS) is implemented and maintained to include all functions of an AIS



AIS Requirements Review (continued)

Products and services:

- Aeronautical Information Publication
- AIP Amendments and Supplements
- Aeronautical Information Circulars
- NOTAMs
- Pre-flight and Post-flight Information Services
- Aeronautical Charts in accordance with ICAO Annex 4



Surveillance Program Review

- Continuously monitor competency of individuals
 - Ensure competencies by conducting comprehensive assessments
- Continuously monitor the capacity to maintain safe and regular air traffic operations
 - Require ANSPs to demonstrate their ability to conduct operations and maintenance in accordance with requirements



Source: Concepts discussed in ICAO Safety Oversight Manual, Doc 9734-A

Surveillance Techniques Review

Investigate

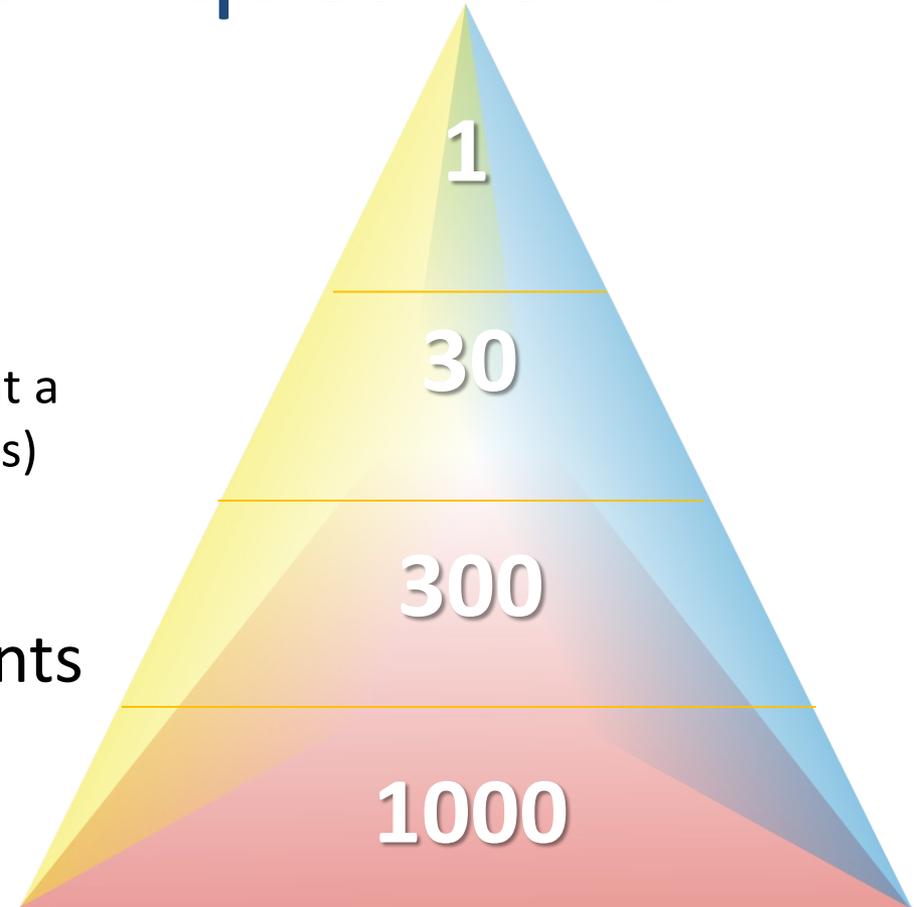
Cause(s) of a single safety occurrence

Inspect

Compliance with a specific standard(s) at a single facility (or small group of facilities)

Continuously Monitor through audits and assessments

Systemic evaluation of compliance to requirements

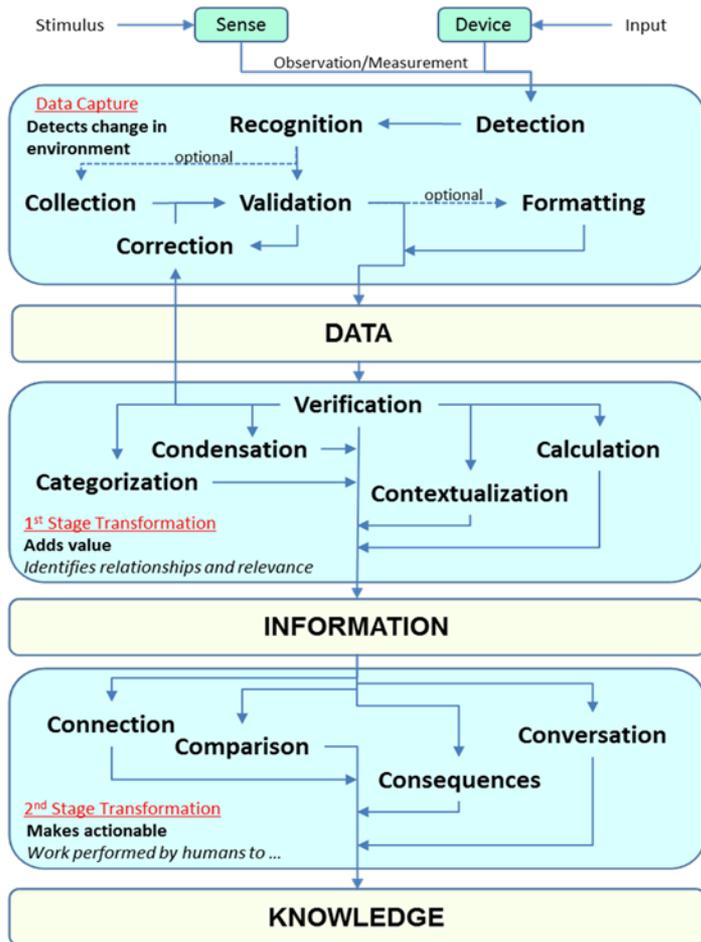


Source: Heinrich's Triangle

The Audit Process Review



Data, Information and Knowledge Review



Data Management is about management of data elements



Information Management is about managing the value chain to create context to data

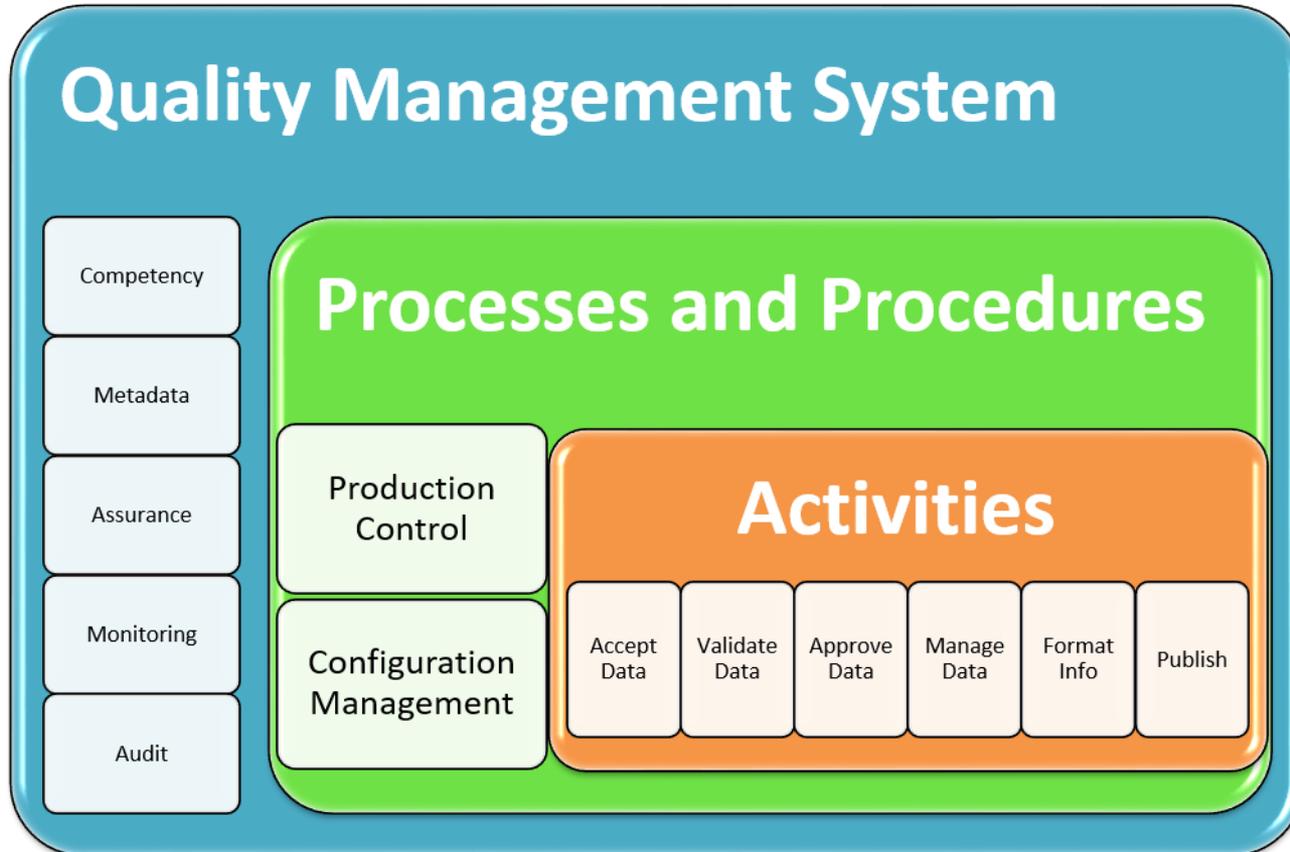


Knowledge Management is about managing the relationship between information and **actions**

QMS Review



Linking QMS and AIS Activities Review



Production Management Review

Information Hazards

- Incorrect Data
- Incomplete Data
- Unsynchronized Data
- Untimely Data
- Data Availability
- Unprotected

Production Control

- Management of the production workflow to coordinate the configuration management of deliverables or outcomes

Configuration Management

- Management of changes to a system (data, products, services) to ensure the performance requirements of the system are maintained

USOAP CMA Audit Areas

Primary aviation legislation and
civil aviation regulations (LEG)

Civil aviation organization
(ORG)

Personnel licensing and
training (PEL)
Annexes 1 and 19

Aircraft operations (OPS)
Annexes 6, 9, 18, 19 and
PANS-OPS

Airworthiness of aircraft
(AIR)
Annexes 6, 7, 8, 16 and 19

Aircraft accident and
incident investigation (AIG)
Annexes 13 and 19

Air navigation services (ANS)
Annexes 2, 3, 4, 5, 10, 11, 12,
15, 19 and PANS-ATM

Aerodromes and ground
aids (AGA)
Annexes 14 and 19

Risk-Based AIS Surveillance Program Review

What could go wrong?

Data and Information Hazards

Incorrect

Incomplete

Untimely

Unsynchronized

Unavailable

*Unprotected

What does risk look like?

Variation

Competency

Business Rules

Process

Traceability

What prevents things from going wrong?

Controls/Barriers

Formal Arrangements

QMS

Production Control

Configuration Management

How will I know if controls are working?

Safety Oversight Activities

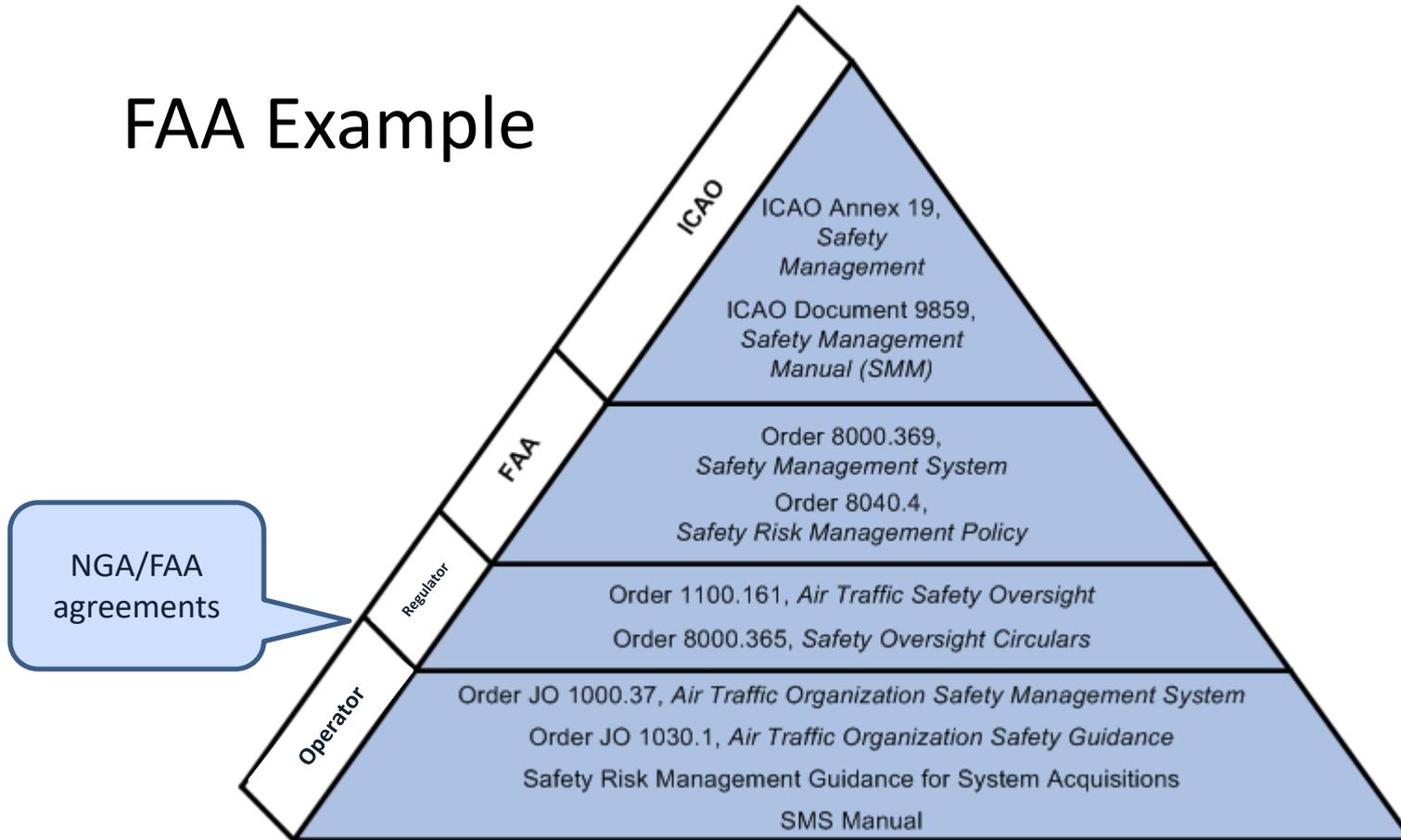
Continuous Monitoring

Audits and Assessments

Inspections

SMS Operating Requirements

FAA Example



Develop a Surveillance Plan

- What are the objectives?
- What will be observed, and why?
- How will it be observed?
- What techniques to be used?
- Will this be scheduled or unscheduled surveillance?
- When will it be observed?
- With what frequency?



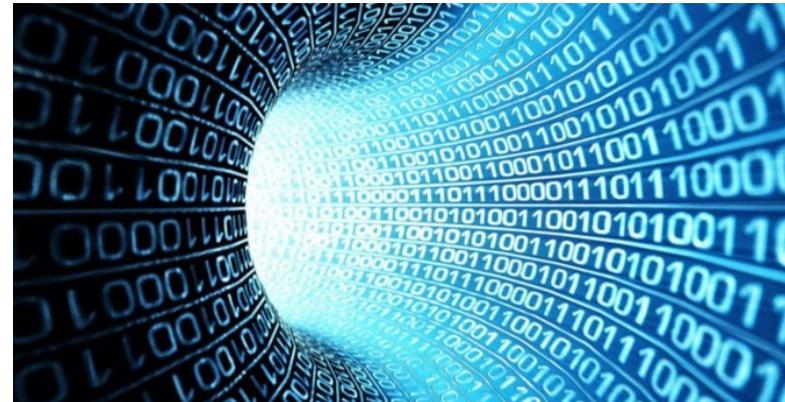
Thoughts or Questions?



Day 5 Agenda



- “Going Digital” and Data Sets
- Collaboration and Sharing of Safety Work
- Closing Remarks
- Comment and feedback



Going Digital and Digital Data Sets



Federal Aviation
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Module Objectives

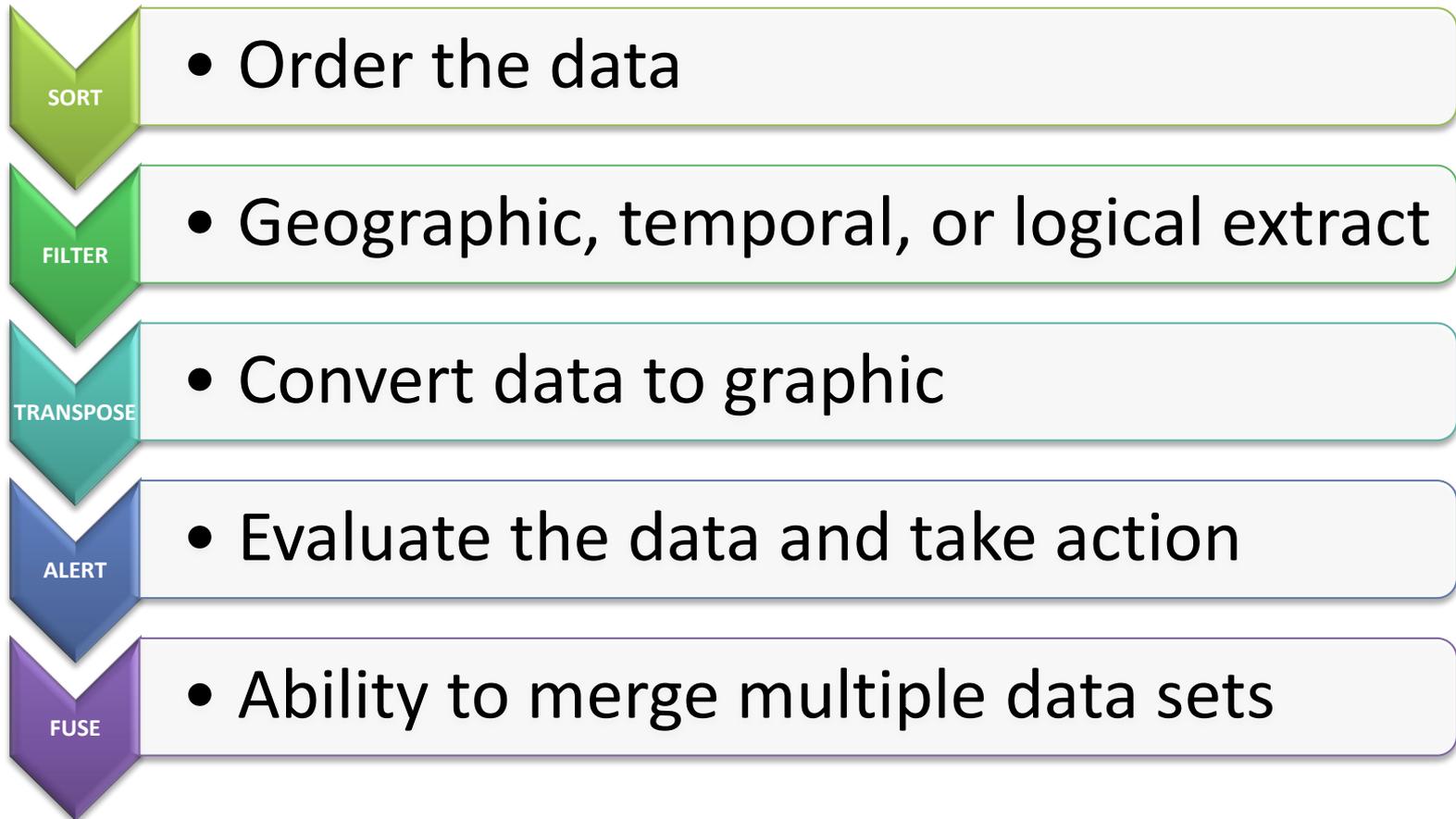
- Understand what “going digital” means
- Understand digital distribution
- Introduce the ICAO data sets and accompanying metadata requirements
- Oversight of the digital transition





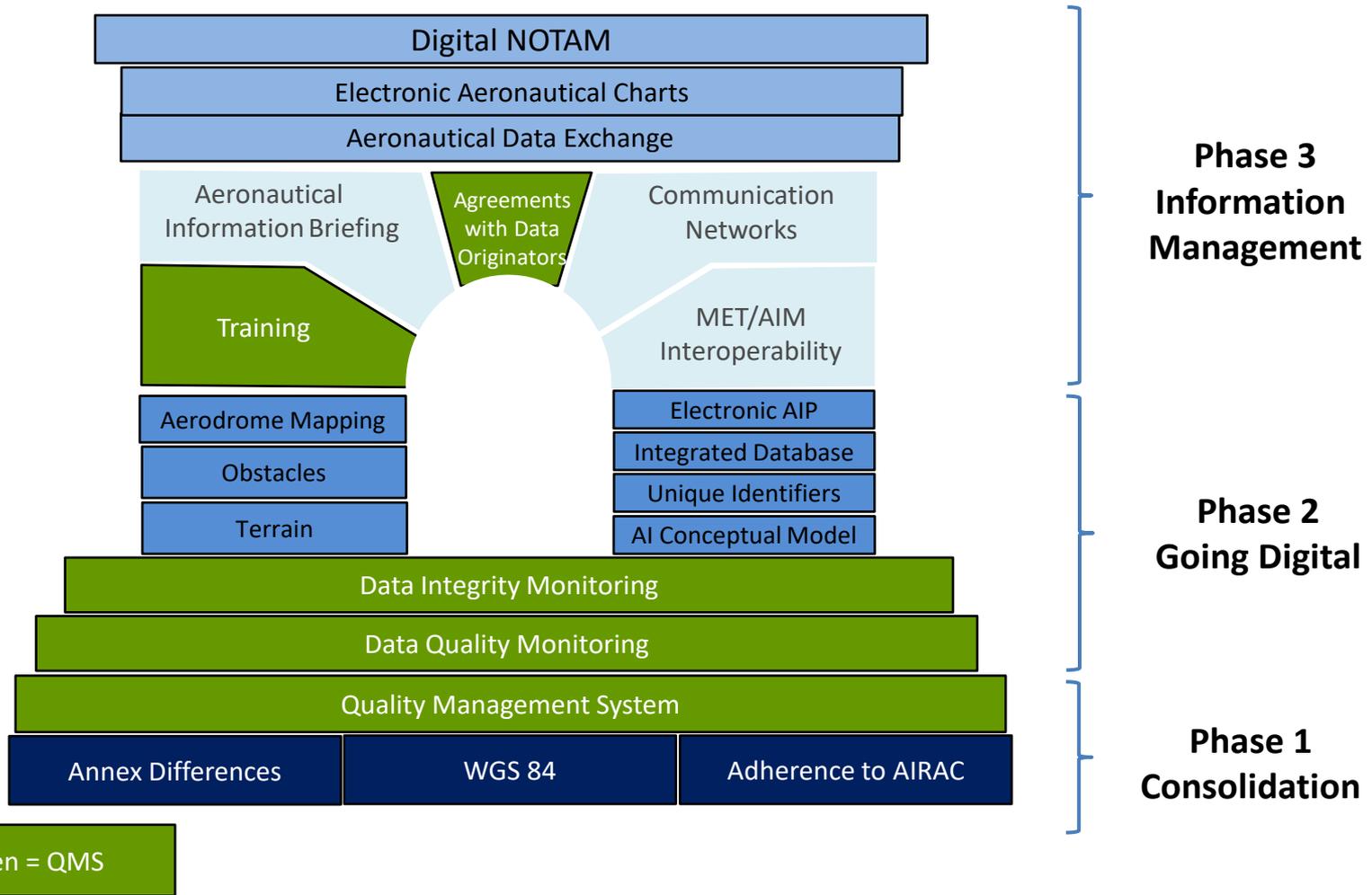
GOING DIGITAL

The Digital Goal

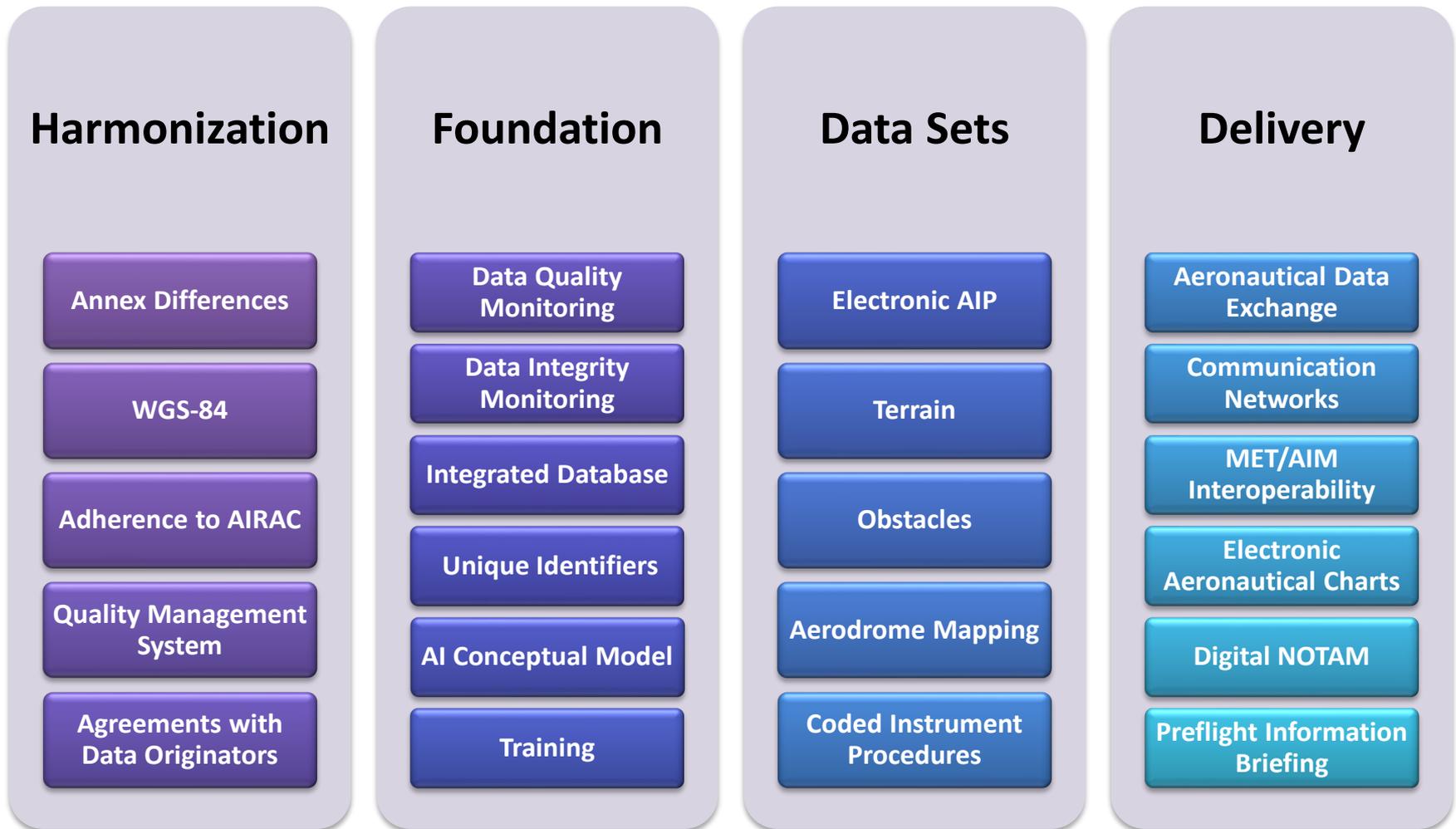


Source: 2006 Global AIS Congress, Madrid Spain Presentation by Captain Ed Lyons, FedEx

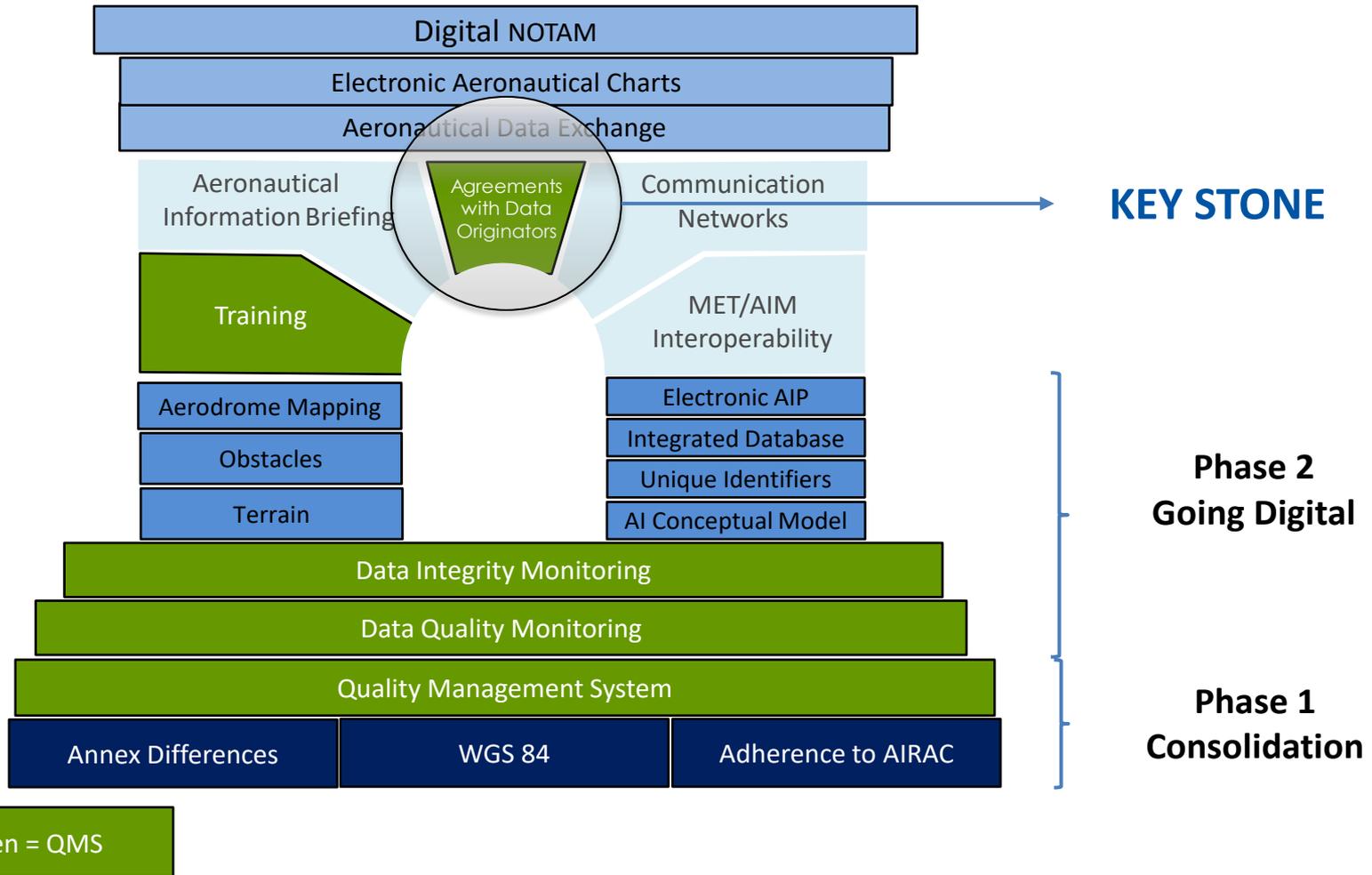
ICAO Roadmap - Going Digital



AIS to AIM Roadmap Framework

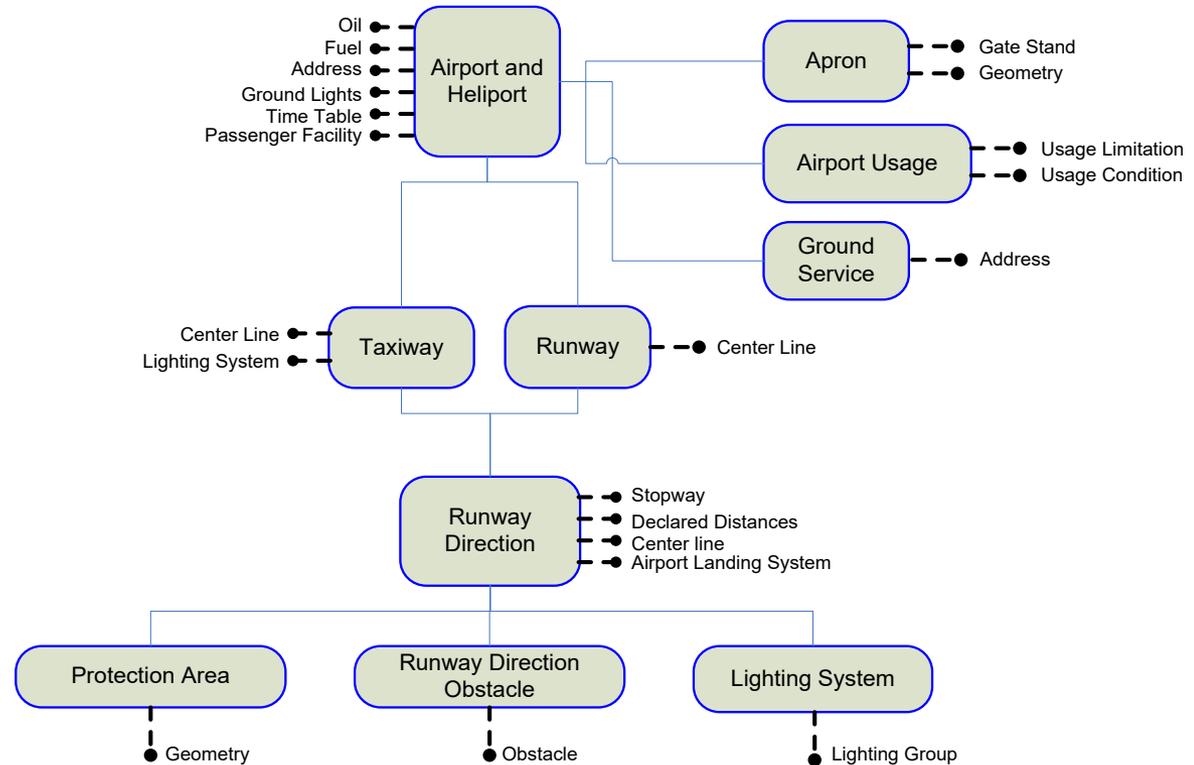
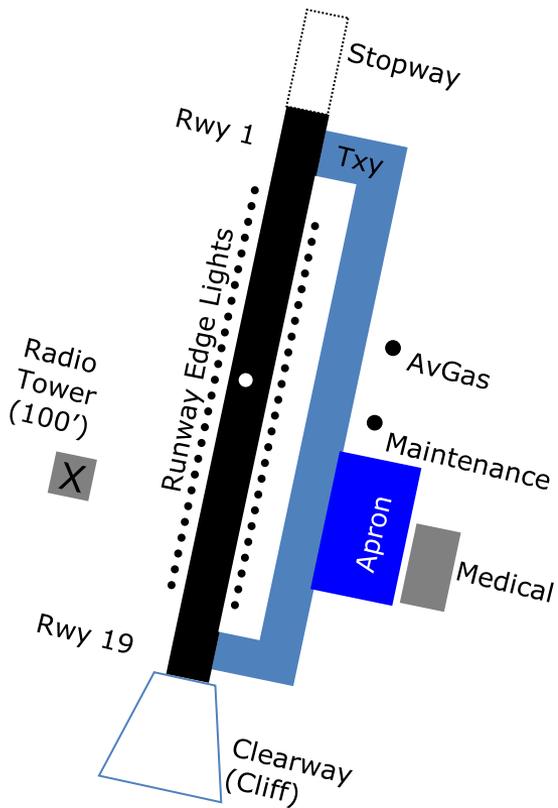


Formal Agreements



What Does “Going Digital” Mean?

Airports and Runways Example



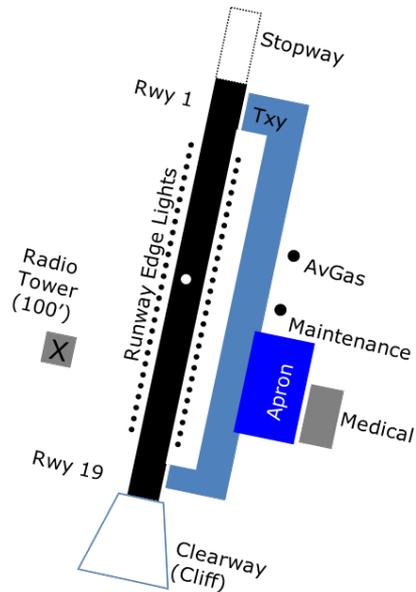


UNDERSTANDING DIGITAL DISTRIBUTION

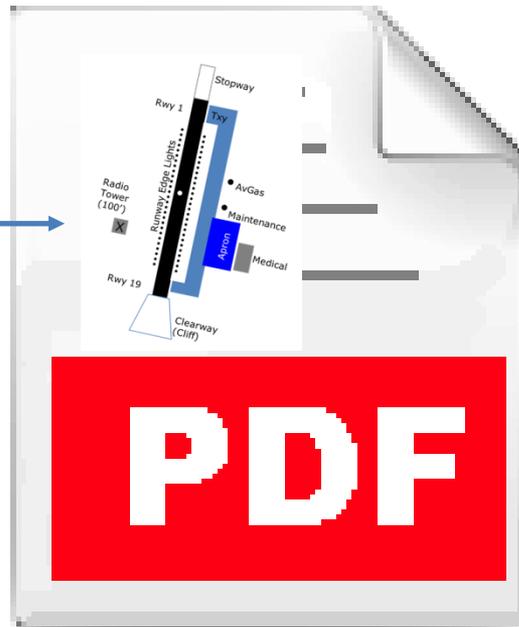
Distribution Media

Electronic Distribution

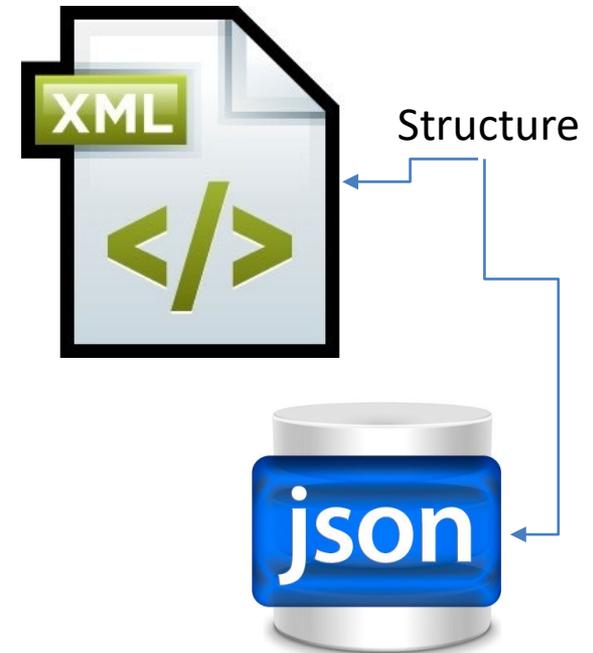
Paper (Analog Container)



PDF (Electronic Container)

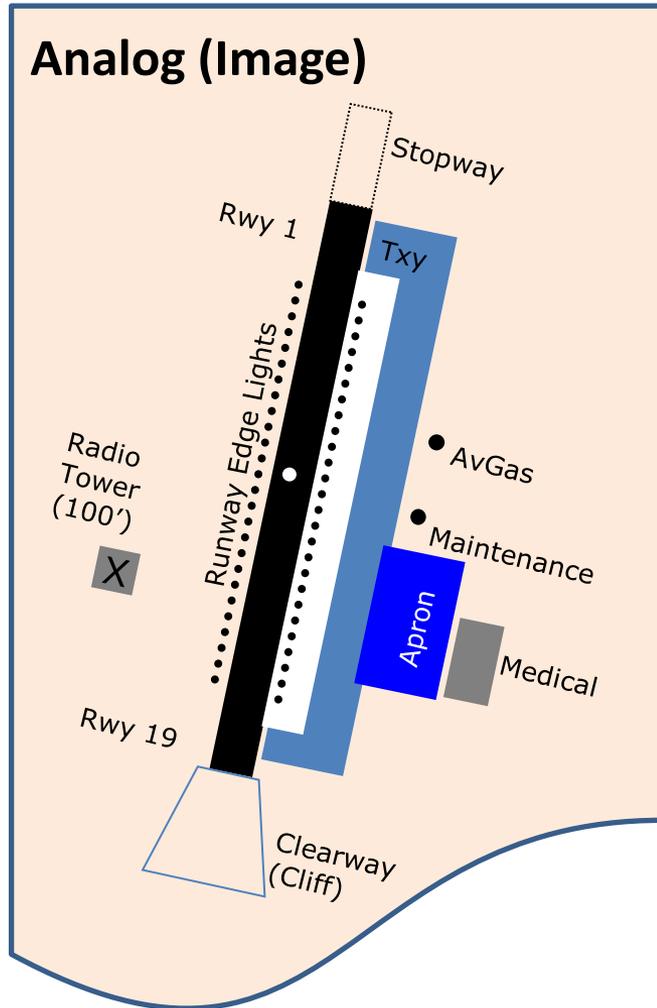


Digital data set
(Digital Container)



Analog vs. Digital

Distribution



Digital (XML Structured Data in a digital data set (Container))

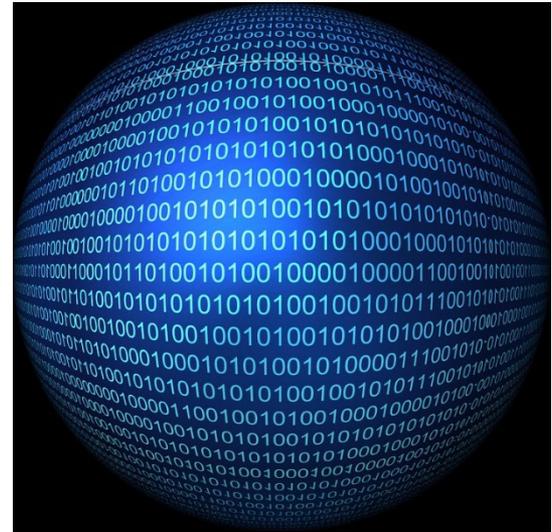
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<Rwy>  
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  <valWid>500</valWid>  
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    <RwyUid>  
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    <geoLong>59.00E</geoLong>  
  </RcpUid>  
  <codeDatum>WGE</codeDatum>  
</Rcp>
```

XML

Distribution Recap

- Paper
 - Legacy delivery of AIS products
- Electronic/PDF
 - Transmission of a scanned image
- Digital data set
 - Distribution of information, in a designated format, to allow query, filter, alert, and transformation capabilities
 - Fused to create new information or products and services





DIGITAL DATA SETS

Annex 15 Digital Data Sets

5.3.1.1 Digital data shall be in the form of the following data sets:

- a) AIP data set;
- b) terrain data sets;
- c) obstacle data sets;
- d) aerodrome mapping data sets; and
- e) instrument flight procedure data sets.



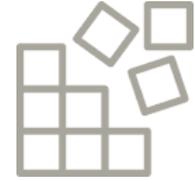
Annex 15 Data Sets

- 5.3.1.2 Each data set shall be provided to the next intended user together with a minimum set of metadata that ensures data traceability.
- 5.3.1.3 A checklist of valid data sets shall be regularly provided.



Data Set Metadata

PANS-AIM



5.3.2 Each data set shall include the following minimum set of metadata:

- a) the name of the organization or entities providing the data set;
- b) the date and time when the data set was provided;
- c) validity of the data set; and
- d) any limitations with regard to the use of the data set.

Aeronautical Information Model

PANS-AIM

5.3.1.5 The aeronautical information model used should:

- a) use the Unified Modelling Language (UML) to describe the aeronautical information features and their properties, associations and data types;
- b) include data value constraints and data verification rules;
- c) include provisions for metadata as specified in 4.2 and 5.3.2; and
- d) include a temporality model to enable capturing the evolution of the properties of an aeronautical information feature during its life cycle.



Resource: ICAO PANS-AIM, July 2018, Edition 1

Aeronautical Data Exchange Model

PANS-AIM

5.3.1.6 The aeronautical information model used should:

- a) apply a commonly used data encoding format;
- b) cover all the classes, attributes, data types and associations of the aeronautical information model detailed in 5.3.1.5; and
- c) provide an extension mechanism by which groups of users can extend the properties of existing features and add new features which do not adversely affect global standardization.



Resource: ICAO PANS-AIM, July 2018, Edition 1



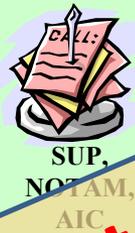
OVERSIGHT OF THE DIGITAL TRANSITION

Risks in Going Digital

Managing Product

AIS

publish documents



Document content and format per ICAO Annex

- Appendix 1 – AIP
- Appendix 6 – NOTAM

Change = Potential Risk to the Airspace System

AIM

manage data



- Aeronautical Information Exchange Model (AIXM)
- AIXM Conceptual Model (AICM)
- Aeronautical Information Reference Model (AIRM)
- Electronic AIP (eAIP)

Managing Data

Source: EUROCONTROL

Thoughts...



- A collection of digital data representing an information product
 - A container of data and information conforming to all specifications including format
 - The data set metadata is about the container – not the contents and is required to be published with the data set
- Traceability to manage the data set remains a requirement
- Assessing risk in the digital transformation



Questions and Discussion



References

- ICAO Annex 15
- ICAO Roadmap for the Transition from AIS to AIM
- PANS-AIM/Data Catalogue, Doc 10066
- EUROCONTROL
- *Roadmap for the Transition from AIS to AIM*, Roberta Luccioli (ICAO), Dakar, Senegal 2013
- <http://www.slideshare.net/OpenDataSupport/introduction-to-metadata-management>

Collaboration and Sharing of Safety Work



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Module Objectives

Importance of collaboration in relation to

- Aeronautical information products and services
- Performance monitoring
- Safety culture





AERONAUTICAL INFORMATION PRODUCTS AND SERVICES

Drivers for AIS Collaboration



- Increased dependence on data and information
 - Delivering information as a service rather than a standardized presentation (i.e. chart, AIP)
 - Distributing in multiple formats
- Increased complexity in both the management of data chains and meeting the demand for digital data products and services
- May have a lower ratio of safety inspectors to service providers

Promoting AIS Collaboration



- Build relationships between:

AIS providers

Other State AIS

Originators

Regulators

Aviation associations

Third party providers

- Maintain awareness of international standards and recommended practices
- Establish harmonized requirements and guidance material
- Share safety information and best practices, including audit topics and checklists

AIS providers are geographically separated, use differing technologies and require independent safety oversight

Promoting AIS Collaboration (continued)

- Develop safety performance indicators
- Monitor trends and overall results of performance metrics
- Promote QMS standardization
- Develop personnel exchange programs for the purposes of attaining technical expertise and sharing resources
- Ensure competitive compensation



Promote a positive AIS safety culture

Opportunities to Increase AIS Collaboration

- Establish regular meetings between oversight and AIS
- Participate in ICAO meetings, working groups and events
- Participate in industry activities
- Form or join associations





PERFORMANCE MONITORING

Collaboration and Performance Monitoring

Monitoring and measurement to include:

- Select safety monitoring indicators
- Set alerts and targets relevant for the aviation system
- Track performance against the indicators and targets
- Record and analyze data to identify trends



Source: ICAO Safety Management Manual, Doc 9859

Strategies to Promote Performance Monitoring

- Contribute to ICAO monitoring efforts
 - Regional and cross-boundary occurrences
- Use ICAO established reporting requirements
- Consider adopting indicators used by others
- Establish reasonable performance targets based on data and information





SAFETY CULTURE

Safety Culture

SKYbrary Definition

The way safety is perceived, valued, and prioritized reflects the commitment and importance to safety at all levels of an organization including regulators and AIS.

A safety culture can be **positive**, **negative**, or **neutral**



Source: SKYbrary: Category: Safety Culture (http://www.skybrary.aero/index.php/Category:Safety_Culture)



Positive Safety Culture



An organization with a positive safety culture recognizes and promotes:

- Safety as a business imperative
- Safety over other pressures (economic, societal, etc.)
- Safety as everyone's responsibility



Source: SKYbrary Toolbox: Safety Culture, A1.3 What is a "good" safety culture? (http://www.skybrary.aero/index.php/Solutions:Safety_Culture)

Positive Safety Culture (continued)

Reporting

- Encourages employees to divulge information about all safety hazards they encounter

Just

- Holds employees accountable for deliberate violations of the rules but encourages and rewards them for providing essential safety-related information

Flexible

- Adapts effectively to changing demands and allows quicker, smoother reactions to unusual events

Learning

- Willing to change based on safety indicators and hazards uncovered through assessments, data, and incidents

Source: James Reason, *Managing the Risks of Organizational Accidents*, Hants: Ashgate, 1997, p. 196



Negative Safety Culture



An organization with a negative safety culture :

- Does not address concerns about safety
- Does not learn from safety events
- Does not include safety management in decision-making
- Believes safety is someone else's responsibility



Source: SKYbrary Toolbox: Safety Culture, A1.3 What is a "good" safety culture? (http://www.skybrary.aero/index.php/Solutions:Safety_Culture)

Measuring Safety Culture

A safety culture assessment establishes a shared understanding of the organization's safety culture and identifies its strengths and weaknesses.

- Strategies for assessing safety culture:
 - Collaborate with an external, independent team
 - Appoint an internal “champion”
 - Seek contribution and involvement



Source: SKYbrary Toolbox: Safety Culture, B1.1-3 (http://www.skybrary.aero/index.php/Solutions:Safety_Culture)

Safety culture assessment process

1. Pre-Launch
2. Data Collection
3. Analysis
4. Diagnosis

Measure Safety Culture

Step 1 Pre-Launch

Determine how to conduct the assessment

- Surveys
- Audits
- Interviews
- Observations

OR

- Tests
- Simulations
- Scenarios
- Self-evaluations

Measuring Safety Culture

Step 2 –Data Collection

A questionnaire to collect data about the safety culture

- Set of statements to agree or disagree with
- Responses indicate how an organization approaches and manages safety
- Helps an organization appreciate safety

Data Safety Culture Questionnaire Form							
<i>This form is used to assess the safety culture related to data for a particular programme (the DSC value).</i>							
You play a key role in protecting the organisation from data safety risks and your views are important. This self-assessment survey is designed to assess our current level of data safety culture within the programme. The output can help us to improve our safety position.							
Please tick the box which reflects your view and answer as honestly as possible. Space is provided for explanatory comments. Your response will only be of value if it reflects what you actually believe is the case, rather than what you believe should happen.							
If you would like to remain anonymous please print and send this form by post.							
The survey should take no longer than 10 minutes. It is anticipated that this form will be used on a regular basis (e.g. annually).							
Programme Name:							
Completed By:		Date Completed:					
<i>Answer each question as you see it - there is no right answer!</i>							
QUESTION 1 – MY VIEW OF OUR SUPPLY							
		Don't Know	Strongly Disagree	Disagree	Maybe	Agree	Strongly Agree
1a	I see data as an important factor in the safety of my programme.	<input type="checkbox"/>					
1b	I am familiar with the safety aspects of our data.	<input type="checkbox"/>					

Source: Safety Culture in Air Traffic Management: A White Paper; FAA/EUROCONTROL AP 15/UK SCSC Data Safety Guidance



Measuring Safety Culture

Step 3 - Analysis

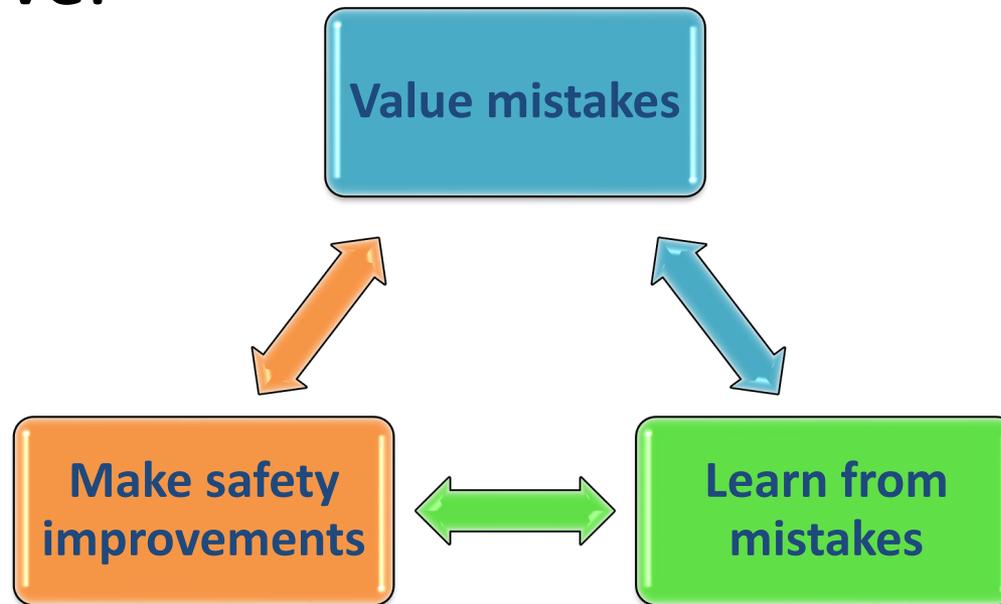
Evaluate the safety culture survey results

- Identify opportunities from the assessment
 - Encourage open discussion of safety concerns
 - Establish and encourage voluntary safety reporting
 - Setting clear goals
 - Provide adequate training
 - Learning from experience



Analysis of Safety Culture, continued

Voluntary safety reporting programs are a component of a positive safety culture and are non-punitive.



Voluntary Reporting Philosophy

Analysis of Safety Culture, continued

Successful voluntary safety reporting programs require:

- Incentives to report
- Legal protections of identities and reported information
- Collaboration and agreements between regulator and service provider(s)
- Dedicated program manager
- Documented processes for handling and analysis
- Resolution of identified safety issues
- Access to safety information



Safety Culture

Step 4 - Diagnosis

A safety culture assessment:

- provides an organization with a basic understanding of the safety related perceptions and attitudes of its managers and staff.
- can help an organization to identify areas that are considered more problematic than others.
- provide material for further analysis of underlying “root causes” and for generating improvement ideas from staff directly involved in the issues.

Thoughts...

- Promote AIS collaboration
- Performance monitoring
- Measure the safety culture



Questions and Discussion



References

- CANSO – The Transition from AIS to AIM
- EUROCONTROL Key Performance Indicators for the Provision of Originated Data
- UK Data Safety Initiative Working Group, Data Safety Guidance (SCSC-127B)
- *Moving Towards a Collaborative Decision Support System for Aeronautical Data*, by Rahayu, Rusu and Torabi (2010)
- *Do You Have a Safety Culture?* by Robert Sumwalt
- Safety Culture in Air Traffic Management: A White Paper
- SKYbrary Safety Culture Toolbox (www.skybrary.aero)
- *Managing the Risks of Organizational Accidents*, Hants: Ashgate, 1997, by James Reason
- Candace Buchanan, et.al (Department of State)
- <https://www.linkedin.com/advice/3/how-do-you-assess-safety-culture-your-workplace>
- [ii17.full.pdf \(bmj.com\)](#) Safety culture assessment: a tool for improving patient safety in healthcare organizations by V F Nieva, J Sorra

Building Effective Safety Oversight of AIS and AIM

Closing



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Thank you and Goodbye!

