

# Building Effective Safety Oversight of AIS and AIM



Federal Aviation  
Administration



Day 3: QMS as the Safety Risk Control



# Objectives

## Recap Day 2

- Surveillance program
- Surveillance techniques
- Audit process



Introduce today's topics...

# Surveillance Program Review



A surveillance program should:

- Be continual or on-going
- Be thorough
- Define State and AIS roles and responsibilities
- Include resolutions

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

# Surveillance Techniques Review

Common techniques include:

- Investigations
- Inspections
- Audits
- Assessments
- Continuous monitoring

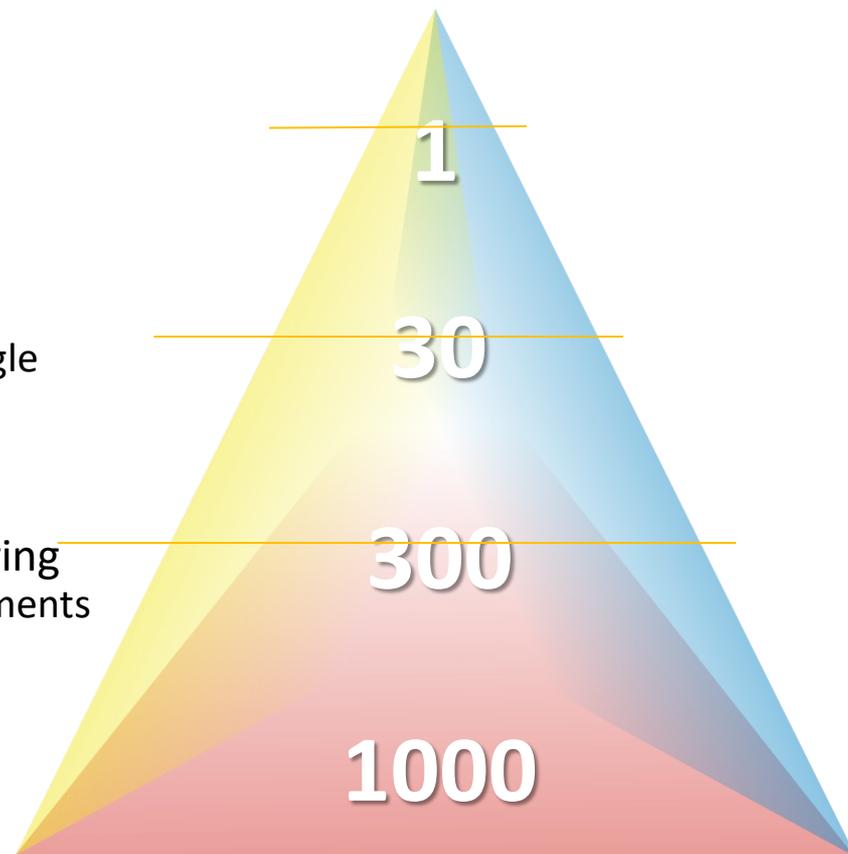


# Surveillance Techniques Review (continued)

**Investigate**  
Cause(s) of a single safety occurrence

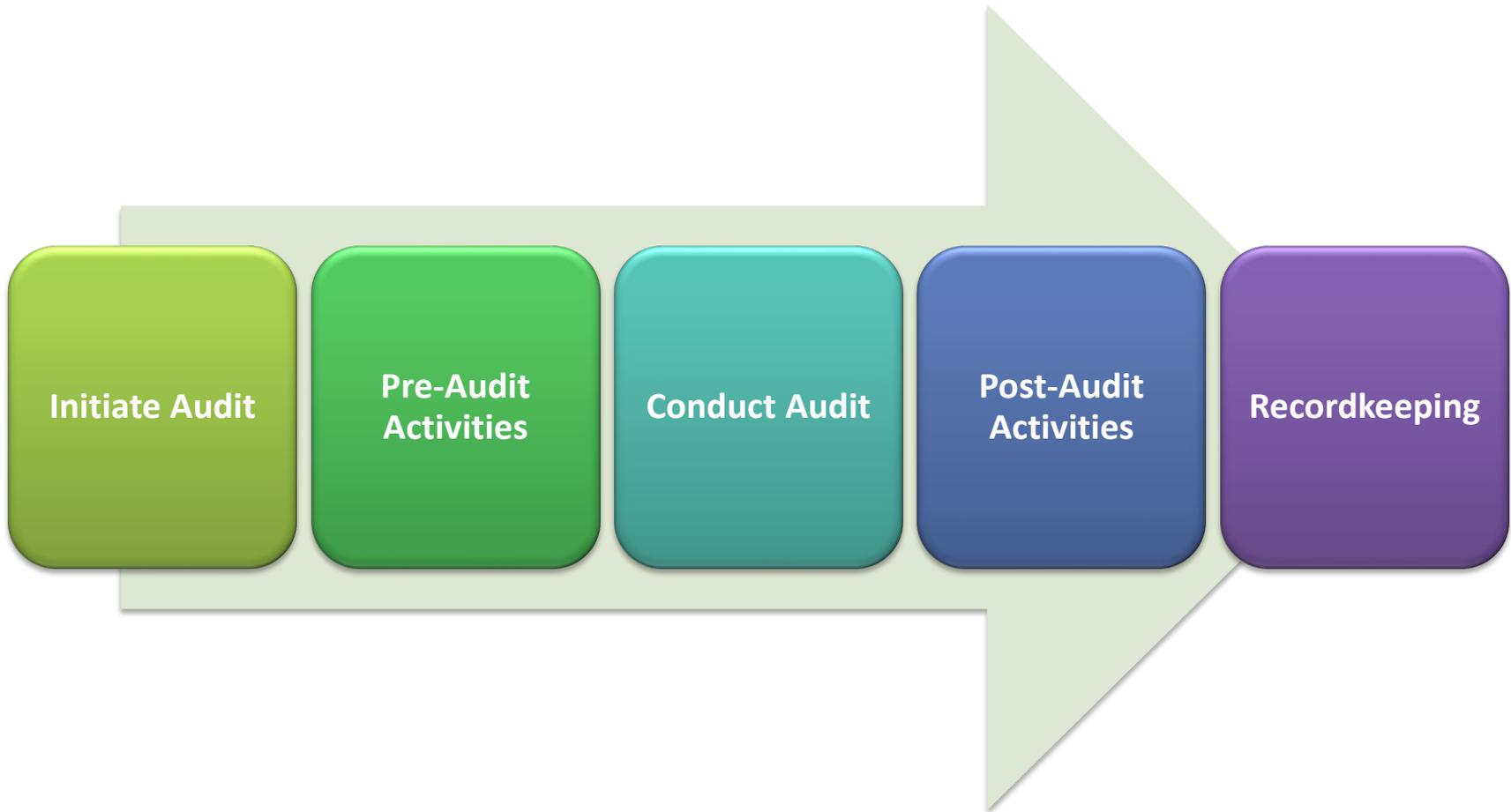
**Inspect**  
Compliance with a specific standard(s) at a single facility  
(or small group of facilities)

**Audit/Assessment/Continuous Monitoring**  
Systemic evaluation of compliance to requirements



Source: Heinrich's Triangle

# The Audit Process Review



# Thoughts or questions



# Day 3 Agenda



- Data and information management
- Quality management system
- Production control and configuration management
- Understanding metadata in safety oversight
- Group metadata exercise and presentations

# Data and Information Management



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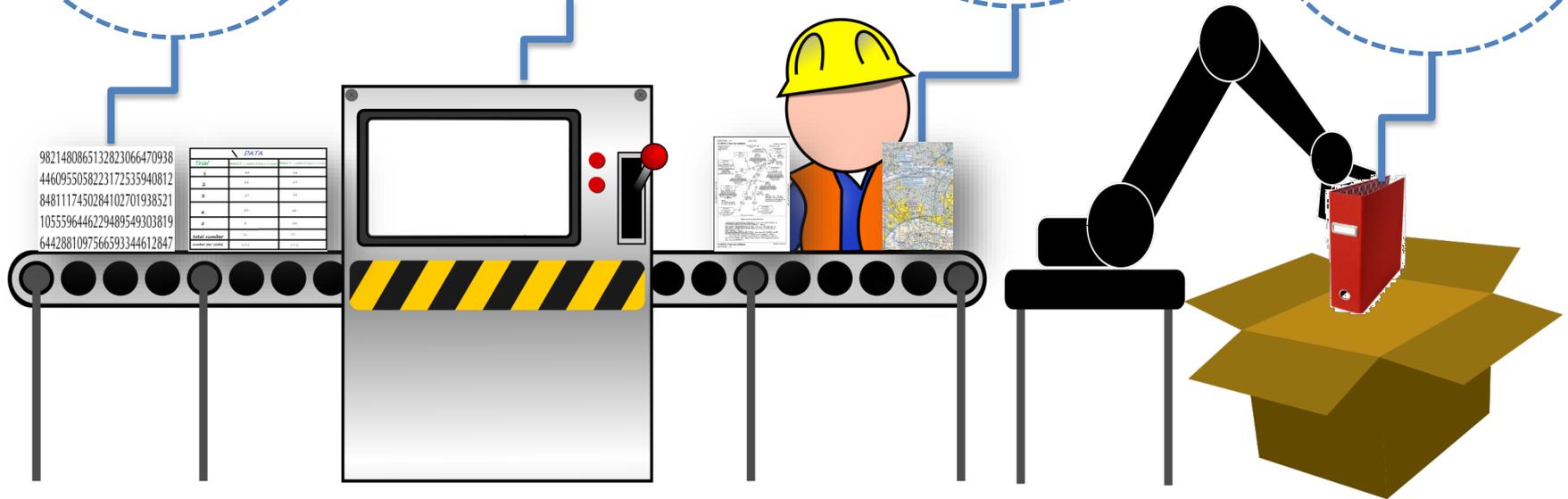
# Module Objectives



- Data, information, and knowledge concepts and how they support ICAO Annex 15 requirements
- Data management and information management
- Metadata, Record Keeping and Artifacts

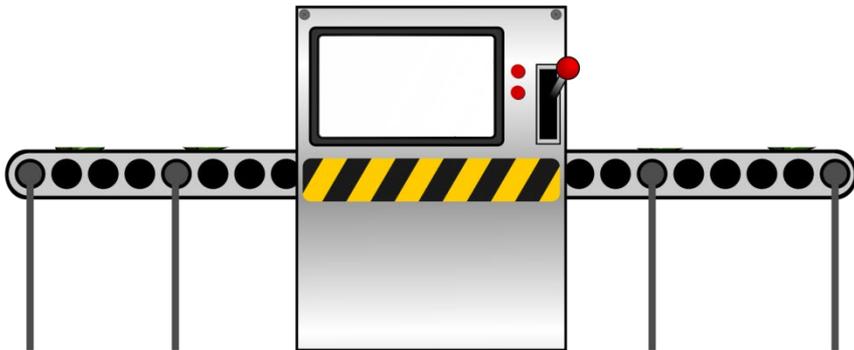
# The Information Factory

Activities in the information production chain



# Let's Build a Factory

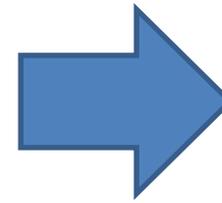
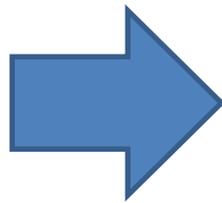
- What are we making?
- What are the performance requirements (specifications) for the product?
- Where do the raw materials come from?
- What is the tolerance for the raw materials?
- How much variation is acceptable?
- What is the process to make the product?
- What resources are needed?
- How do we apply the process to multiple products?
- How do we meet performance requirements?



\*Answers at the end of this presentation

# Building Products and Services

Creating Business and Consumer Value

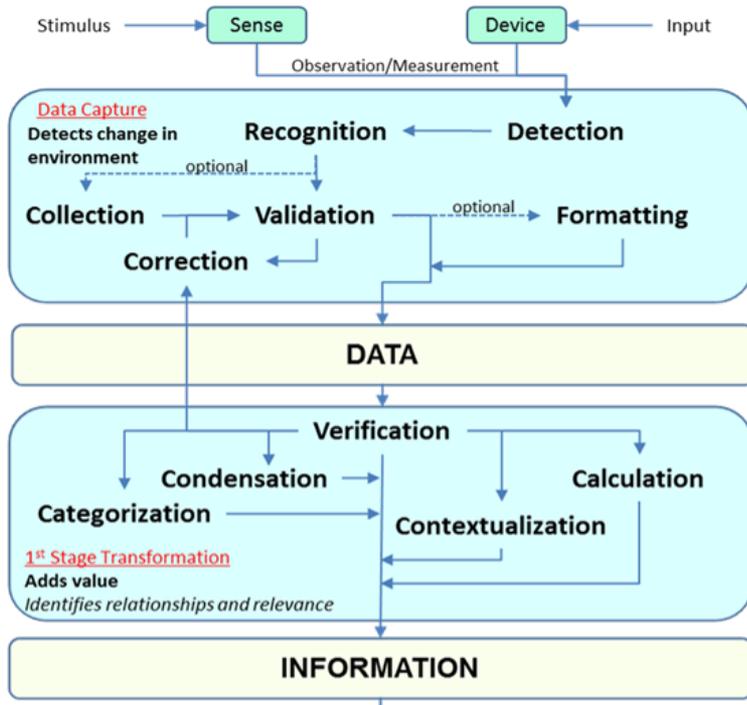


Raw Materials

People, Tools, Process

Product or Service

# Data and Information Management

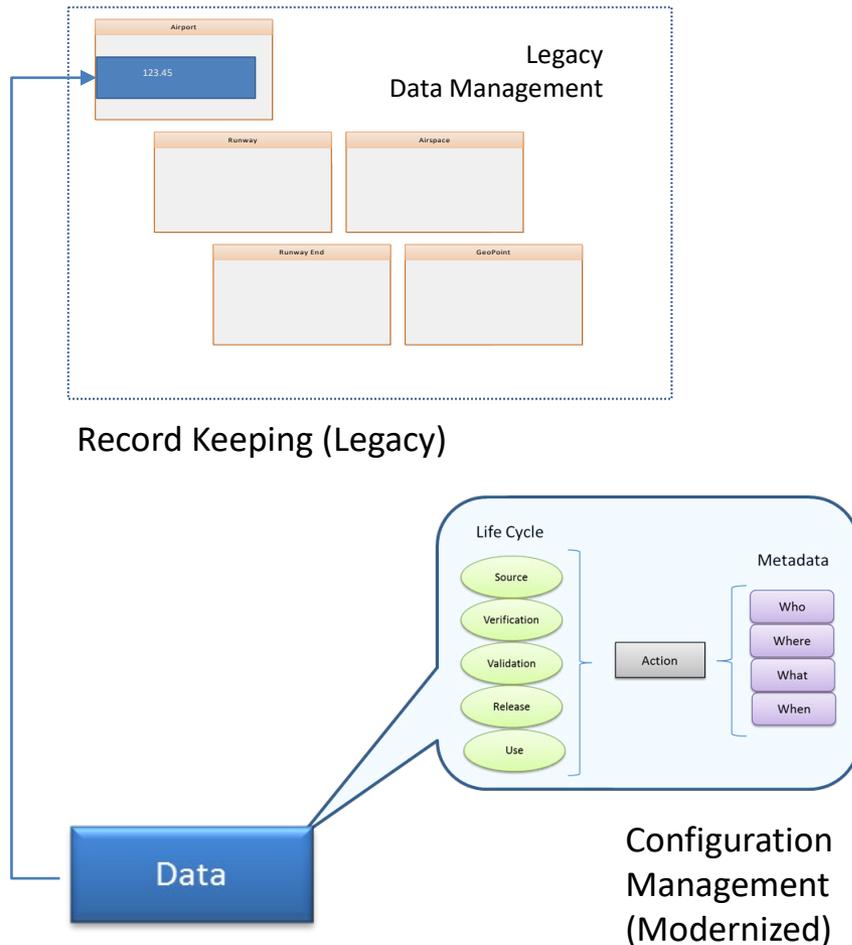


**Data Management** is about managing data throughout its lifecycle

**Information Management** is about providing business context to the data to create value

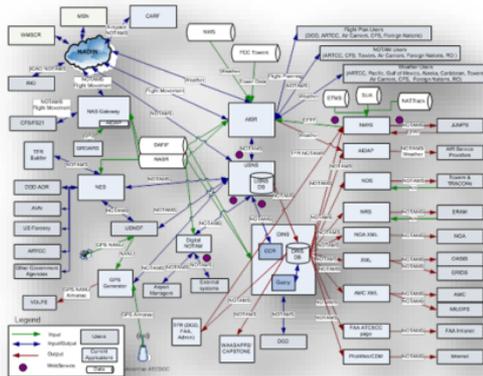
The information product or service provides context to deliver business and consumer value

# Data Management Shift



A paradigm shift from a record-keeping system where the latest version of the data is recorded, to a configuration management system where the life-cycle actions for each piece of data is recorded

# The Information Management Shift



Data Systems  
Focus

What helps systems process  
(Instances)



Information  
Focus

What helps humans understand  
(Relationships)

# Managing Data and Information

## Data Management

Activities to support the management of data (i.e., data assurance)

- Data are raw values
- Structure of data
- Ensure the tolerance (accuracy) requirement

## Information Management

Activities to support the management of information (i.e., the business value)

- Information adds context to data (raw values)
- Format of information
- Ensure the performance requirement of the information

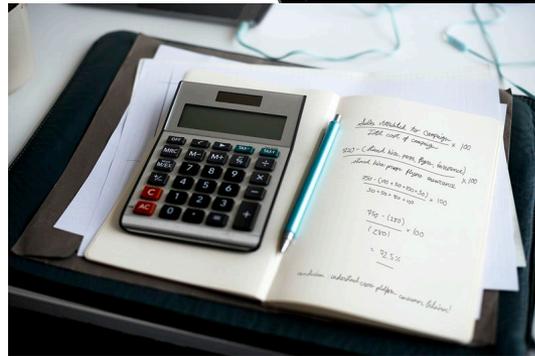
# Where are the Data Requirements?



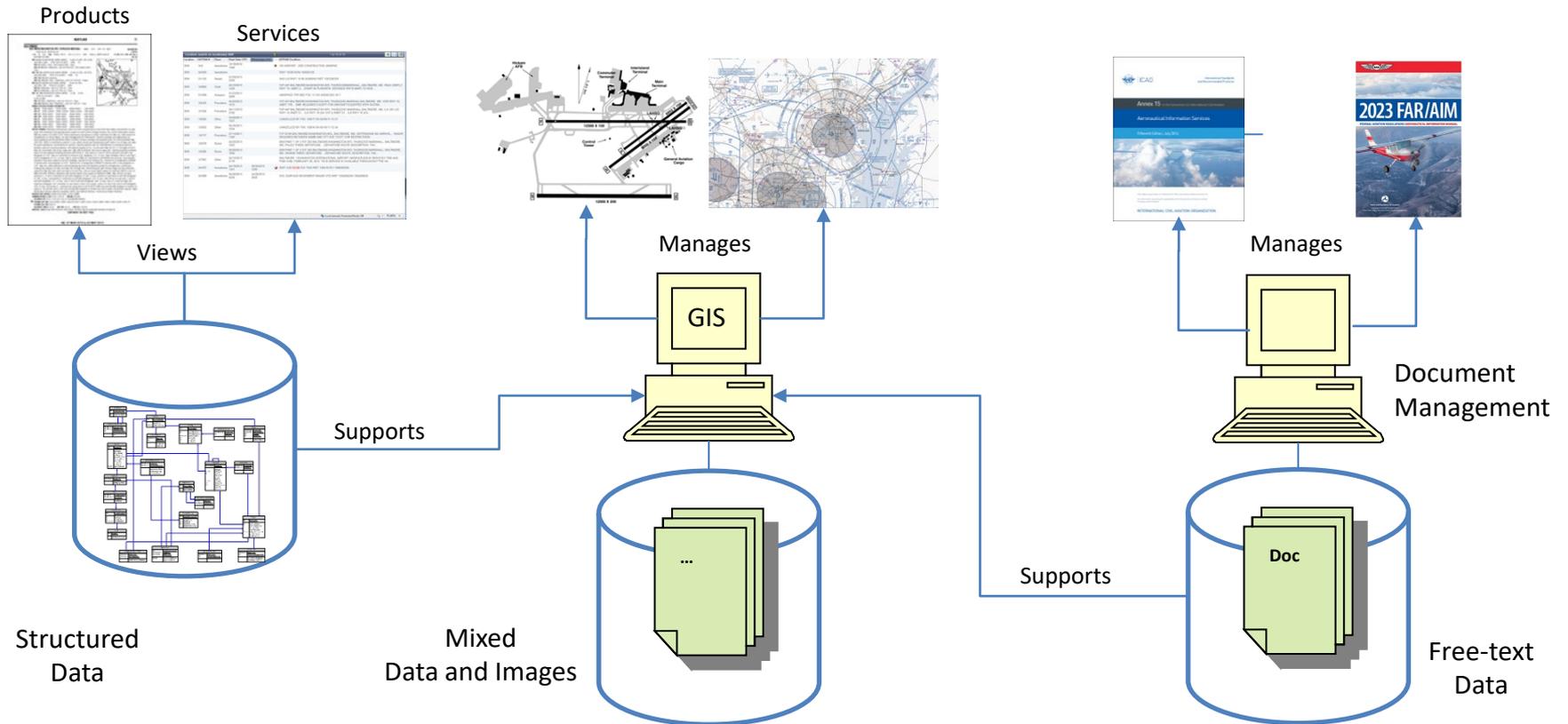
= PANS-AIM Data Catalog  
(Doc 10066)

# Types of Data

- Sensor or measure
- User input
- Interactions
- Calculated
- Metadata



# Diversity of Information Products and Services







# Data or Information?

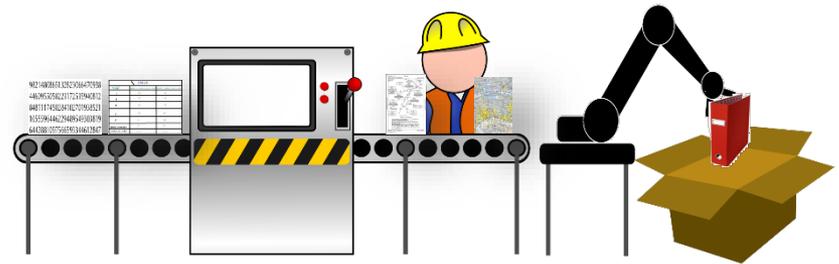
## Data

- 1234.6
- 5/10/23
- 100
- Murray
- Red
- 35000

## Information

- 1234.6 kilos
- May 5<sup>th</sup>, 2023
- 100 degrees Fahrenheit
- Dr. Murray, professor
- A red light at an intersection
- \$35,000

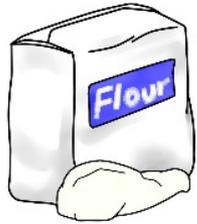




What Happens in the Information Factory?

# METADATA, RECORD KEEPING AND ARTIFACTS

# Metadata 101



Batch #



Lot #



Serial #

Food production, drug manufacturing, and aircraft parts production all:

- have systems to manage the source, production, and distribution of their products
- capture metadata about the source; metadata provides the identification and makeup of the product or part that is being provided

➤ Is aeronautical data different?

# Record Keeping

Table

KBWI	
xxx	BWI
Baltimore Washington International	
MD	yyy
KIAD	
xxx1	IAx
Washington Dulles International	
VA	yyy2
KDCA	
xxx2	DCA
Washington National	
DC	yyy3

Record

KIAD	
xxx1	IAx
Washington Dulles International	
VA	yyy1

Element

IAx
-----

ICAO ID	IATA ID	Name	State	Field y
KBWI	BWI	Baltimore..	MD	yyy
KIAD	IAD	Washington D...	VA	yyy1
KDCA	DCA	Washington N...	DC	yyy2

# Record Updates

Record (original)

KIAD	
	IAX
Washington Dulles International	

Record (updated)

KIAD	
	IAD
Washington Dulles International	



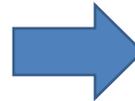
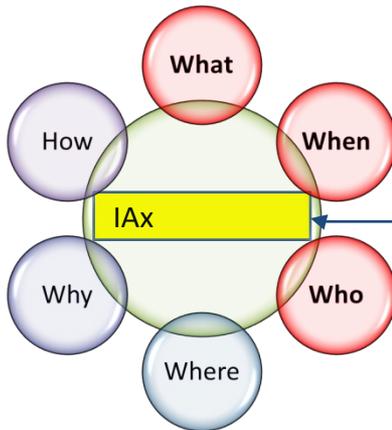
Audit Trail

Modern information systems usually generate an audit trail when the record is updated. This may or may not go to the element level.

# Metadata

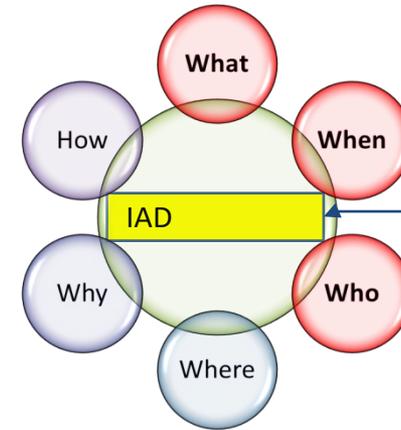
Record (original)

KIAD	
	IAX
Washington Dulles International	



Record (updated)

KIAD	
	IAD
Washington Dulles International	



# Metadata in Credit Card Processing Chain

## 1. TRANSACTION BEGINS

The cardholder purchases goods or services from the merchant.

## 2. AUTHENTICATION

The merchant, in effect, sells the transaction to the "acquirer" and is reimbursed the amount of the sales ticket less a "discount fee," the majority of which is driven by the cost of interchange and which is usually expressed as a percentage + a transaction fee.

## 3. TRANSACTION SUBMITTED

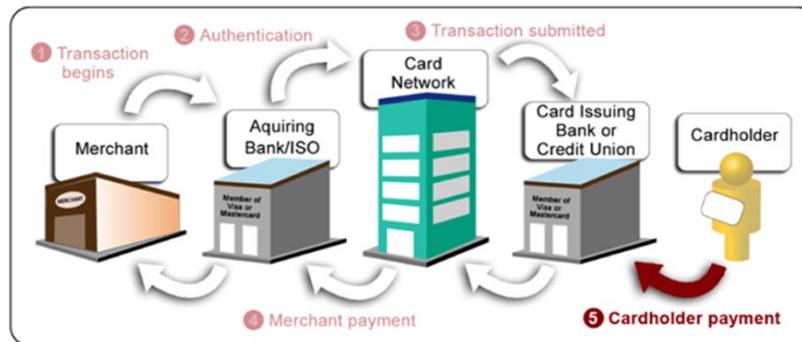
The acquirer then submits the transaction to the issuing bank for payment via the appropriate card network.

## 4. MERCHANT PAYMENT

The issuing bank pays the merchant acquirer, less the interchange fee, who then pays the merchant less the "merchant fees."

## 5. CARDHOLDER PAYMENT

Finally, the cardholder repays the issuer for the goods or services originally purchased from the merchant.



➤ Is aviation different?



Source: <http://www.retailersprocessingnetwork.com/process-of-a-credit-card-transaction.htm>

# Artifacts vs. Metadata

Artifacts



Metadata



Documents to support the processing of data

- Origination
- Receipts
- Checklists
- QA reviews
- Approvals

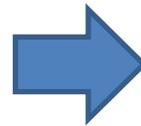
Data to describe the actions supporting the processing of data

- Who
- What
- When
- Why
- Where
- How

Documents are information containers providing data to describe actions performed

# Artifacts are Everywhere

## Work Documents



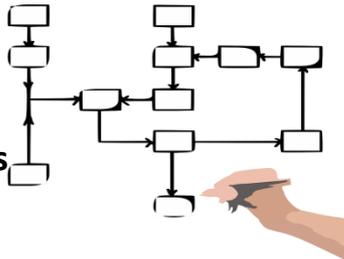
## Products and Services



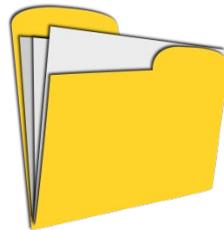
## Origination

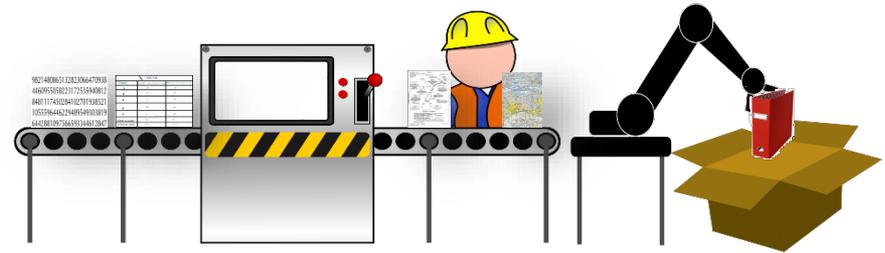


## Standard Operating Procedures



## Checklists





Powering the Data Engine

# KNOWLEDGE AS BUSINESS RULES

# What Does Knowledge Look Like?

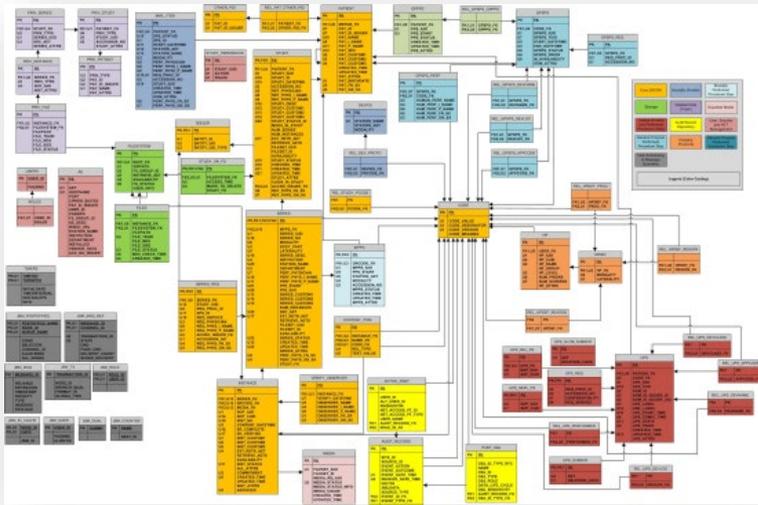
Knowledge comes in many forms:

- Specifications
- Standard operating procedures
- Workflow
- Business rules
- Scenarios
- Formulae (Example:  $\text{DegF} = \text{DegC} * 9/5 + 32$ )
- Data descriptions and catalogs
- Metadata (knowledge about an activity)
- Experience



# How to get ...

...from here (data)...



...to here (product/service)?

People  
Tools  
Process

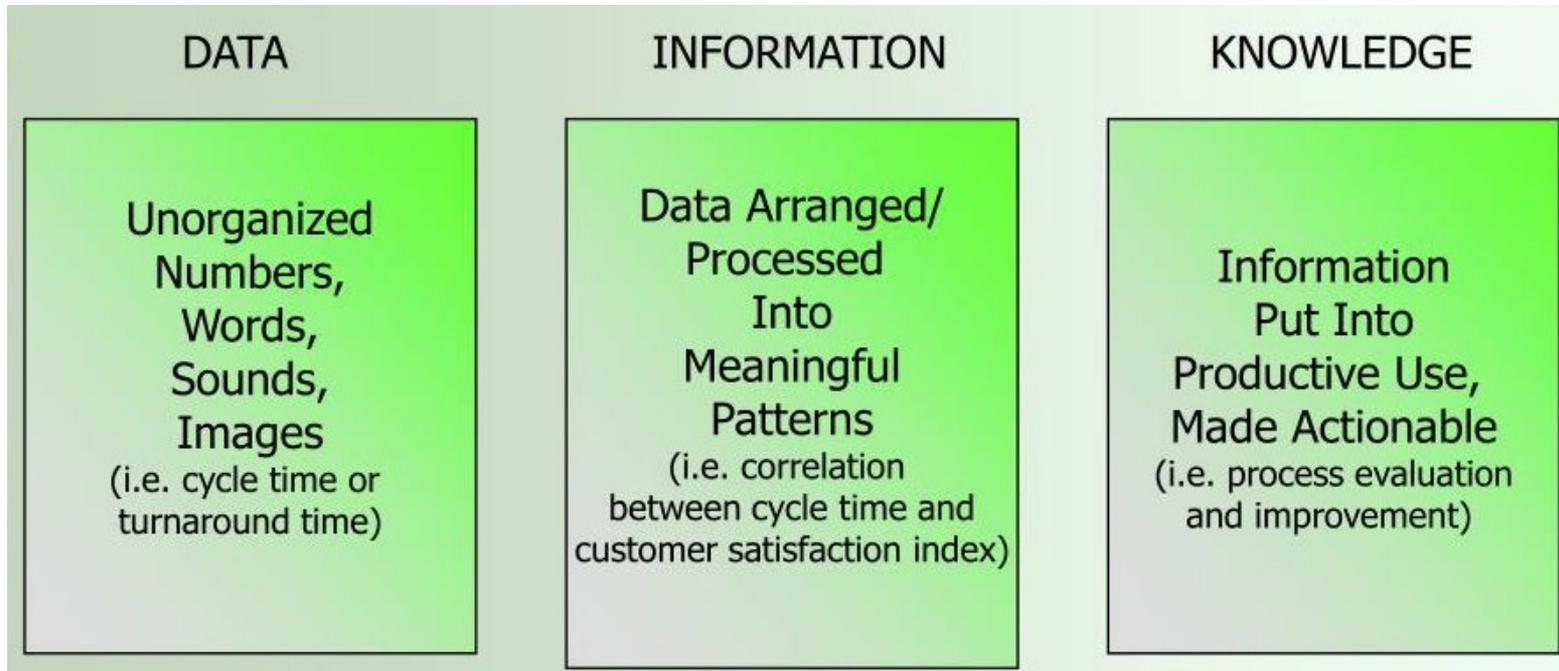


Artifacts  
Metadata



Information Product/Service

# Data, Information and Knowledge



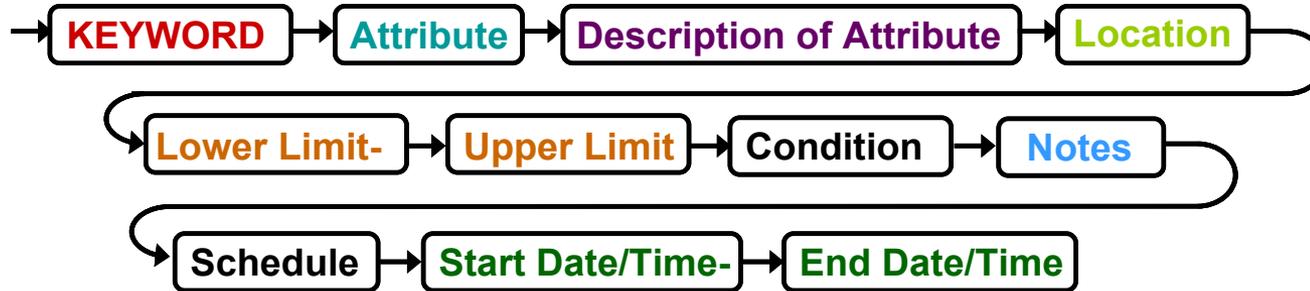
# Scenarios as Knowledge

- What is an event scenario?
  - Condition or event processed to capture rules specific to each category of aeronautical information events
- Each scenario documents:
  - Minimum required data
  - AIXM mapping of NOTAM elements
  - Translations between the digital encoding to FAA legacy, ICAO, and plain language
  - Business rules



# Scenarios as Knowledge

- A NOTAM example:



Domestic ICAO Plain Language

IDFW 06/452 DFW TWY EK BTN RWY 17R/35L AND TWY M CLSD 2306111557 PERM

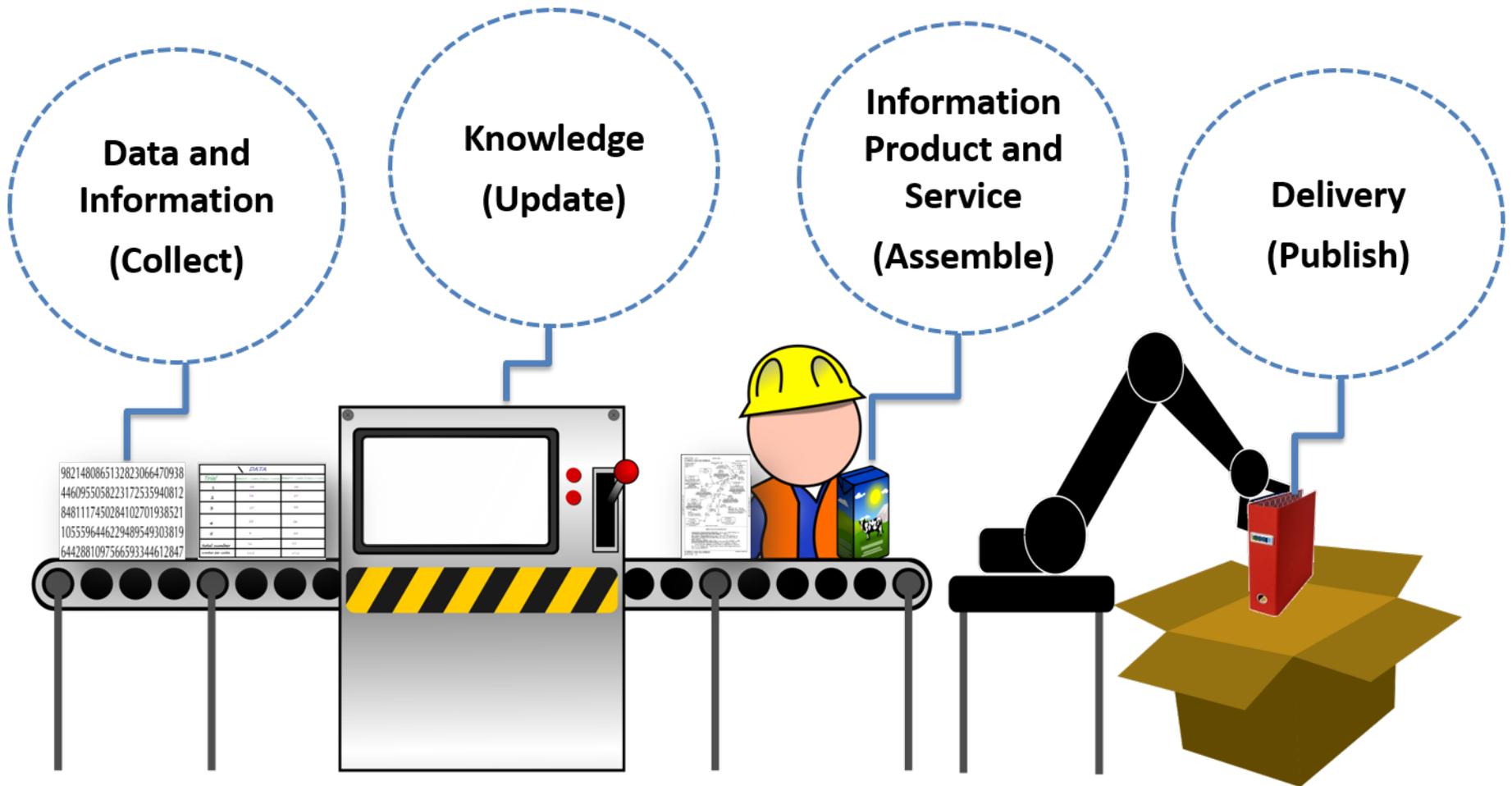
Domestic ICAO Plain Language

06/452 NOTAMR  
 Q) KZFW/QMXLC/IV/M/A/000/999/3253N09702W005  
 A) KDFW  
 B) 2306111557  
 C) PERM  
 E) TWY EK BTN RWY 17R/35L AND TWY M CLSD

Domestic ICAO Plain Language

Issuing Airport: (DFW) Dallas-Fort Worth Intl  
 NOTAM Number: 06/452  
 Effective Time Frame  
 Beginning: Sunday, June 11, 2023 1557 (UTC)  
 Ending: PERM (UTC)  
 Affected Areas  
 Taxiway: EK (between RWY 17R/35L and TWY M)  
 Operating Status: Closed

# AIS: The Information Factory



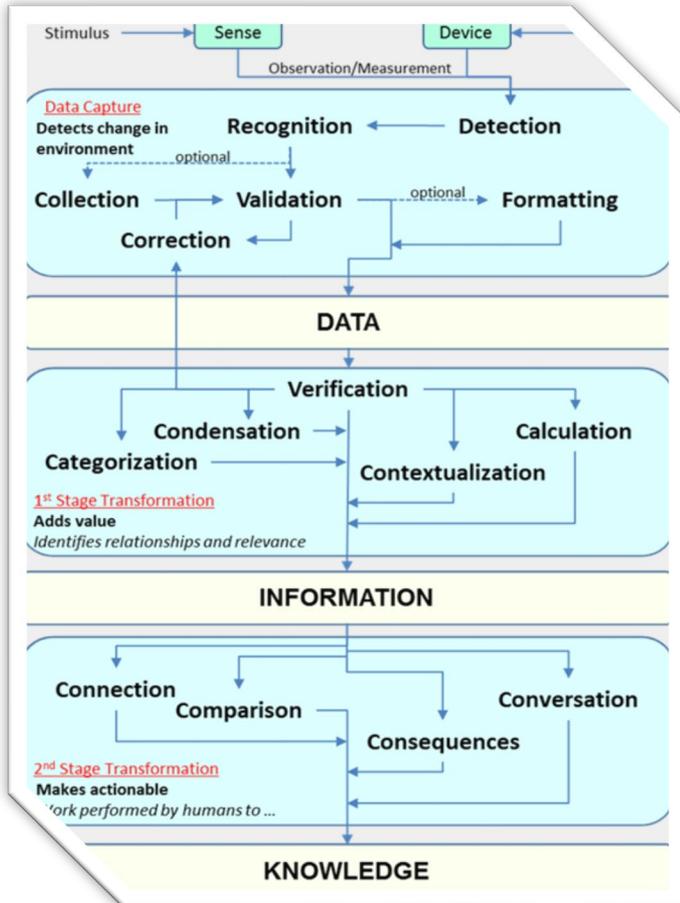
# Thoughts...



We...

- Collect data, develop information and publish products and services
- Use knowledge to assure quality
  - QMS
  - Configuration management
  - Production control
- Use metadata and artifacts to provide traceability and mitigate risk

Risk can occur at any level





# Questions and Discussion

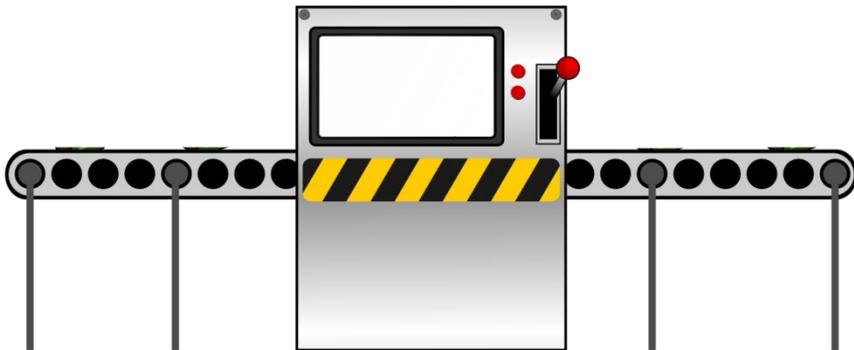


# References

- ICAO Annex 4
- ICAO Annex 11
- ICAO Annex 14
- ICAO Annex 15
- PANS-AIM/Data Catalogue, Doc 10066
- <https://notams.aim.faa.gov/notamSearch/disclaimer.html>

# Let's Build a Factory

- What are we making?
  - AIP, NOTAM, charts
- What are the performance requirements (specifications) for the product?
  - ICAO Annex 15 (standards)
- Where do the raw materials come from?
  - Data originators
- What is the tolerance for the raw materials?
- How much variation is acceptable?
  - Data quality requirements (ICAO Annex 15)
- What is the process to make the product?
  - Documented procedures (standard operating procedures)
- What resources are needed?
  - Competent personnel, funding, technology
- How do we apply the process to multiple products?
  - Production control and configuration management
- How do we meet performance requirements?
  - Quality management system



# Quality Management System



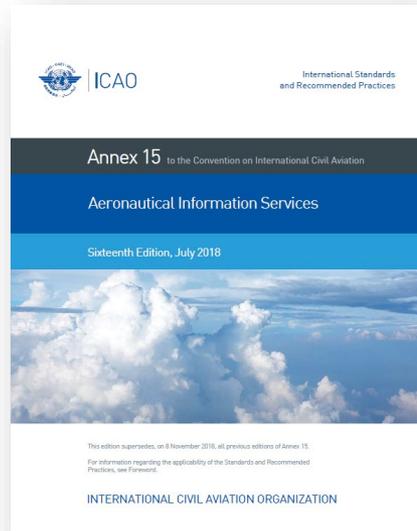
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# Module Objectives



- Present the Quality Management System (QMS) as described in ICAO Annex 15
  - Describe means of compliance to meet QMS requirements
  - Discuss how a QMS functions as a safety risk control in the management of aeronautical information, data, products and services
- Industry QMS standards



ICAO Standards

# QUALITY MANAGEMENT SYSTEM

# ICAO QMS Standards



## ICAO Definitions

### Chapter 3.6 Quality management system

3.6.1 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

### 2.2 AIS responsibilities and functions

2.2.1 An AIS shall ensure that aeronautical data and aeronautical information necessary for the safety, regularity or efficiency of air navigation are made available in a form suitable for the operational requirements of the air traffic management community

Resource: Annex 15, July 2018, Amendment 42

# QMS Requirements



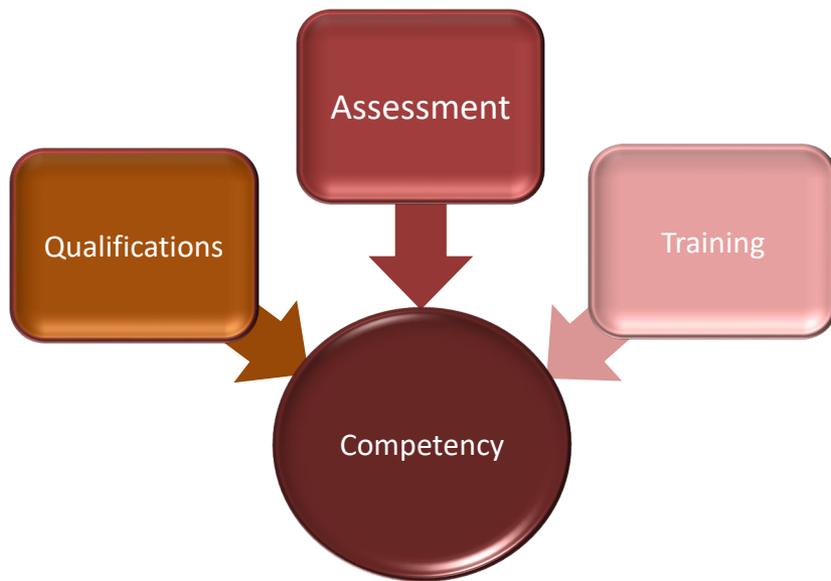
## ICAO Definition

Chapter 3.6, Quality management system

3.6.1 Quality management systems shall be implemented and maintained...

The execution of such quality management systems shall be made demonstrable for each function stage.

Resource: Annex 15, July 2018, Amendment 42



# Competency

ICAO Annex 15, Chapter 3.6 Quality management system

3.6.4 Within the context of the established quality management system, the competencies and the associated knowledge, skills and abilities required for each function shall be identified, and personnel assigned to perform those functions shall be appropriately trained.

Resource: Annex 15, July 2018, Amendment 42

# FAA Credentialing

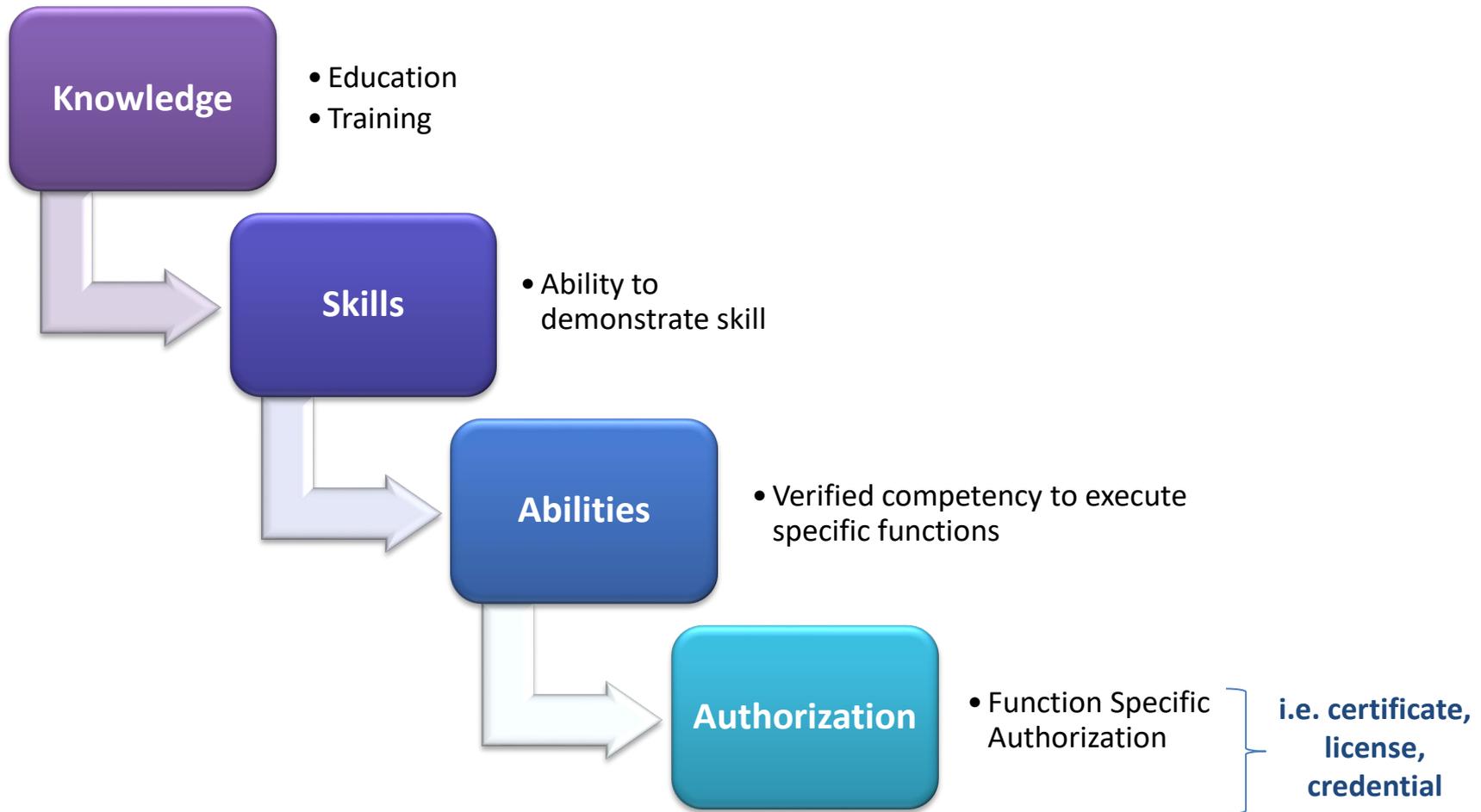


The FAA provides independent oversight of how personnel are trained and certified to perform direct safety-related air traffic control services or certification on certifiable systems, sub-systems, and equipment supporting the National Airspace System. It ensures operational personnel have the required knowledge, skills and abilities to perform their assigned functions

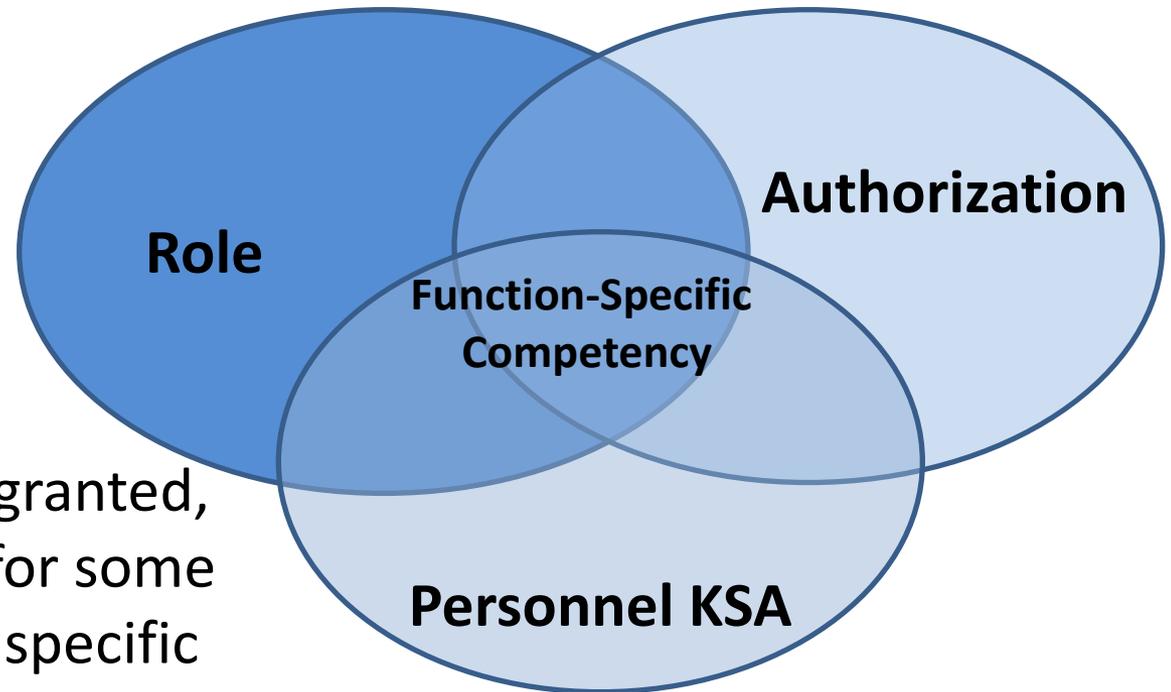
While technically not a license, a credential acts like a license in that the holder is authorized to perform the duties as defined on the credential document

Resource: FAA Order 8000.90B, Air Traffic Safety Oversight Credentialing and Control Tower Operator Certification Programs

# Knowledge, Skills and Abilities



# Role-based Competency Framework

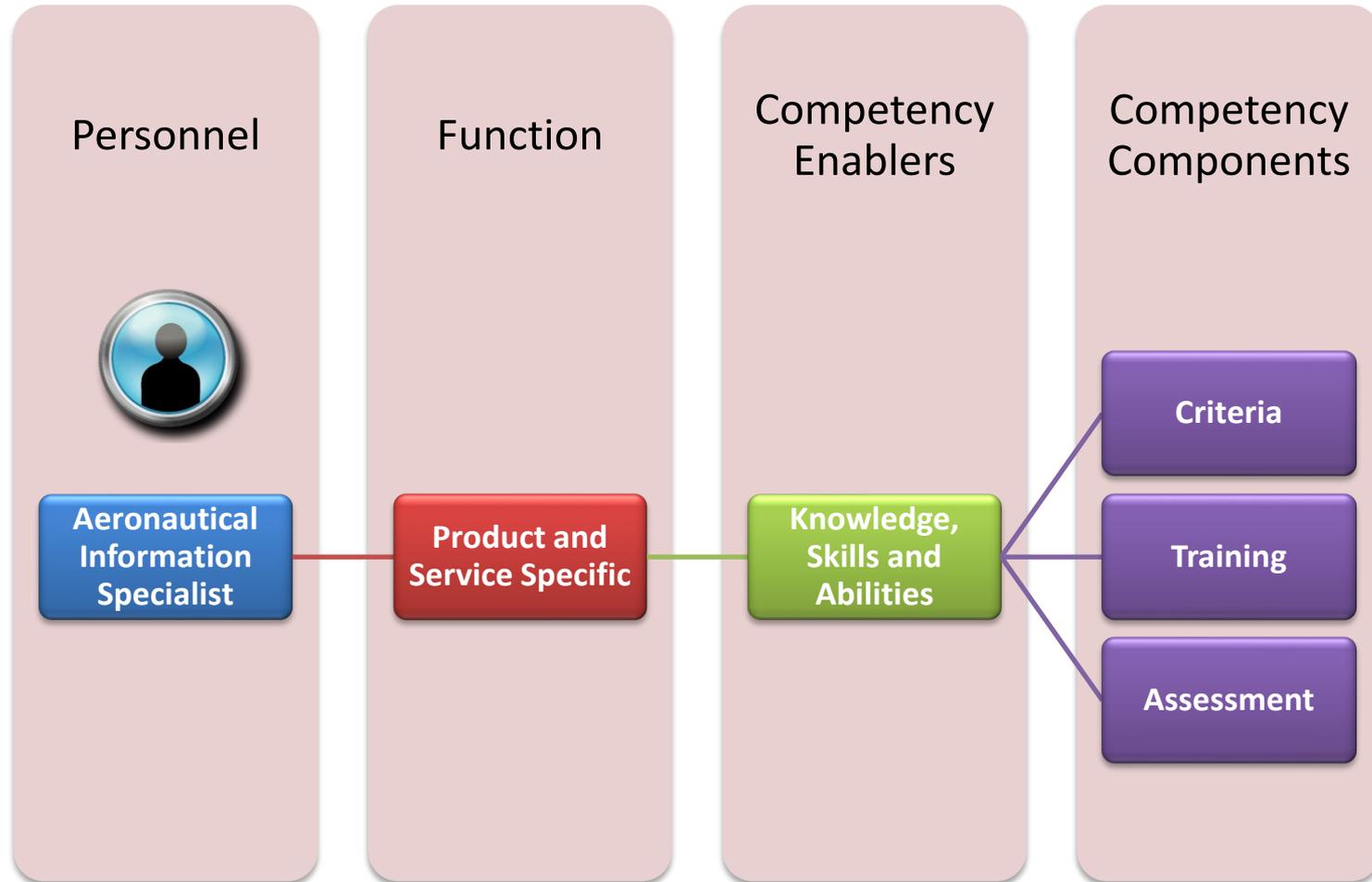


The authorization, once granted, is good unless removed for some reason, but the function specific competency can expire or be on hold.

Proficiency can lapse.

*Competencies are measured by initial and periodic assessments to maintain proficiency.*

# AIS Competency Management Structure



Resource: Manual on Aeronautical Information Services Training, Doc 9991.

# Competency Management

3.6.4 Within the context of the established quality management system, the competencies and the associated knowledge, skills and abilities required for:

- 1 Each function shall be identified, and
- 2
- 3 Personnel assigned to perform those functions shall be appropriately trained.
- 4 Processes shall be in place to ensure that personnel possess the competencies required to perform specific assigned functions.
- 5 Appropriate records shall be maintained so that the qualifications of personnel can be confirmed.
- 6 Initial and periodic assessments shall be established that require personnel to demonstrate the required competencies.

Periodic assessments of personnel shall be used as a means to detect and correct shortfalls.

Source: Annex 15, July 2018, Amendment 42

# Sample Competency Audit Survey

Group		1 Identify competencies	2 Document process to manage, conduct, record	3 Employees appropriately trained	4 Records maintained	5 Initial Assessment of competencies	5 Periodic Assessment of competencies	6 Means to detect & correct shortfalls	Access only by authorized personnel
1	Airport Survey								
2	AIS- Airports								
3	AIS- Airspace								
4	AIS - Procedures								
5	Obstacle Evaluation								
6	Obstacle Verification		✓						
7	Airport Mapping		✓						
8	Instrument Flight Procedures		✓						
9	IFP Charting		✓						
10	Visual Charting		✓						
11	En Route Charting								
12	RADAR Video Maps								
13	NOTAMS – Policy								
14	NOTAM Originators								
15	State NOTAM Office								



# Competency Training Syllabus

## VERTICAL OBSTRUCTIONS SYLLABUS

### Course Overview

This training syllabus, used in conjunction with the OJT Rubric – Vertical Obstructions (VO), is designed to provide a structured training approach for Aeronautical Safety of Navigation VO analysts. The trainer will instruct in knowledge, skills, and abilities (KSA) required to maintain a Vertical Obstruction rating under the FAA Credentialing structure. Introduction/Overview – ISO and Security procedures

- Phase 1 - Basic
  - AOE Functions – Actions, Layers, Search, History
    - Production – Shapefile and feature creation and manipulation
    - Attributions – Accuracies, DEM, and codes
    - Maintenance
  - RemoteView Functions – Imagery Research, Search, Ordering
    - Production – Open Imagery, Saving, Graphics, Auto Review, MSP, Shapefiles
    - Attribution – Shapemaster, Codes, Accuracies, DEM
    - Maintenance
- Phase 2 – Proficient
  - Source Supplement

- Phase 3 – Advanced
  - Database Functions – Java Basics, Search, Map, Query, Diagnostics
  - Production – Access Files, managing Layers, Find matches, Accept/Update/Commit
  - Attributions – Accuracies, DEM, and codes
  - Maintenance
- Metrics

### Learning Objectives

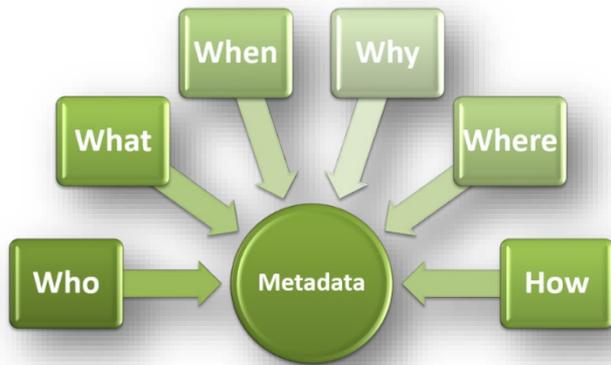
- Student should be able to understand, analyze, edit, manipulate, and commit Vertical Obstructions.
- Student should be able to understand, analyze, manipulate, and collect Vertical Obstructions from RemoteView.
- Student should be able to manage Vertical Obstruction datasets.

### Target Audience

This course is required for analysts who collect Vertical Obstructions.

### Course Procedure

#### Training Overview



# Metadata

Metadata. Data about data (ISO 19115\*)

(Note.— A structured description of the content, quality, condition or other characteristics of data.)

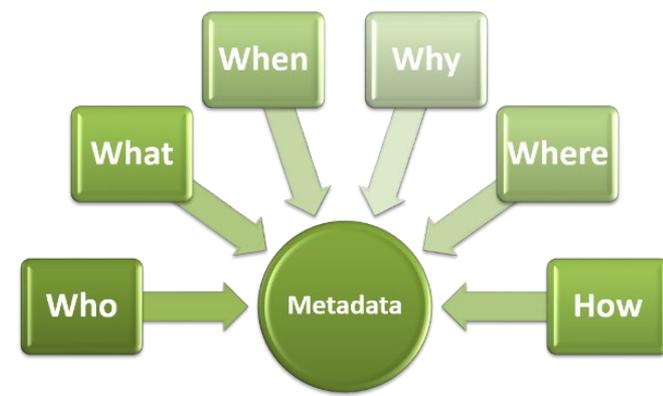
## ICAO Definition

3.6.5 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 is 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.

Resource: Annex 15, July 2018, Amendment 42

# Metadata (continued)

## ICAO Definition



4.2.1 Metadata shall be collected for aeronautical data processes and exchange points.

4.2.2 Metadata collection shall be applied throughout the aeronautical information data chain, from origination to distribution to the next intended user.

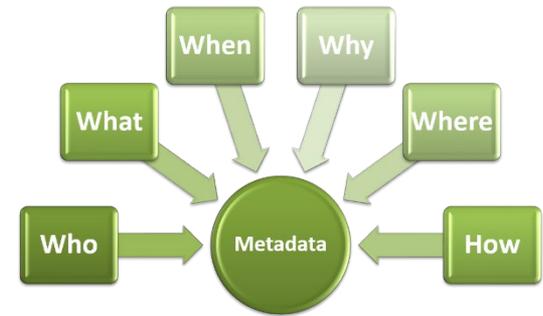
## PANS-AIM

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

- a) the names of the organizations or entities performing actions of originating, transmitting or manipulating the data;
- b) the action performed; and
- c) the date and time the action was performed.

# Metadata (continued)

## ICAO Definition



5.3.1.2 Each data set shall be provided to the next intended user together with at least the minimum set of metadata that ensures traceability.

## PANS-AIM

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

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

# Metadata (continued)



Authoritative	<b>Who</b>	<ul style="list-style-type: none"><li>• created the data?</li><li>• manages the data?</li></ul>	Required
	<b>What</b>	<ul style="list-style-type: none"><li>• is the data content?</li><li>• source data was used?</li></ul>	Required
Timely	<b>When</b>	<ul style="list-style-type: none"><li>• is the time period of the content?</li><li>• was the data created?</li></ul>	Required
	<b>Why</b>	<ul style="list-style-type: none"><li>• was the data created?</li><li>• are there missing values?</li></ul>	
Discoverable	<b>Where</b>	<ul style="list-style-type: none"><li>• is the study area?</li><li>• can I access the data?</li></ul>	
Accurate	<b>How</b>	<ul style="list-style-type: none"><li>• was the data created?</li><li>• is the data distributed?</li></ul>	

# Artifacts vs. Metadata

## Artifacts



Documents that support a process

- Origination documents
- Receipts
- Checklists
- QA reviews
- Approvals

## Metadata

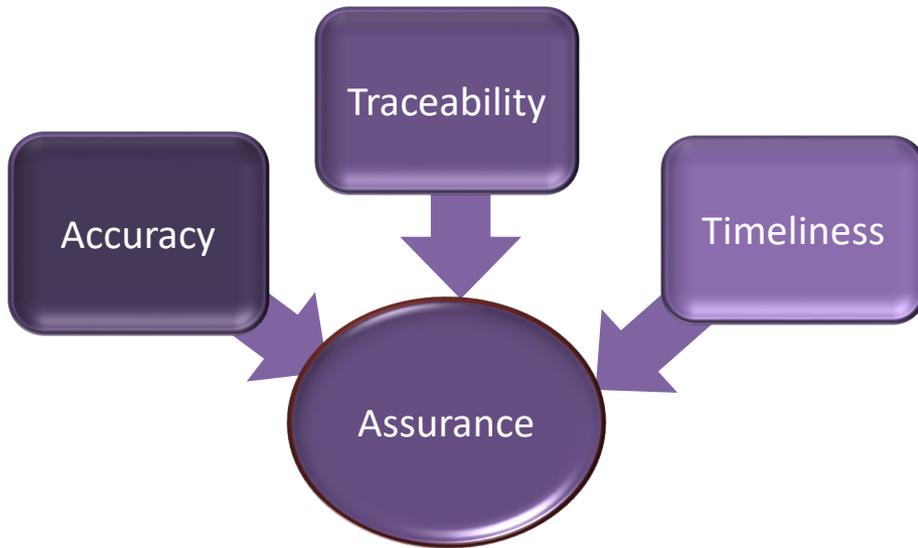


Data that describes the actions supporting a process

- Who
- What
- When
- Why
- Where
- How



# Quality Assurance



## ICAO Definition

3.6.6 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.

Resource: Annex 15, July 2018, Amendment 42

# Data Quality Assurance

- Accuracy
  - Shall be in accordance with its intended use.
- Resolution
  - Shall be commensurate with the actual data accuracy.
- Integrity
  - Shall be maintained throughout the data process from origination to distribution to the next intended user
- Traceability
  - Shall be ensured and retained as long as the data is in use
- Timeliness
  - Shall be ensured by including limits on the effective period of the data elements
- Completeness
  - Shall be ensured in order to support the intended use

Resource: Annex 15, July 2018, Amendment 42

# Line of Sight



## QMS

- 3.6.1 QMS implemented and maintained encompassing all functions of an aeronautical information service, made demonstrable for each function stage.

## Planning

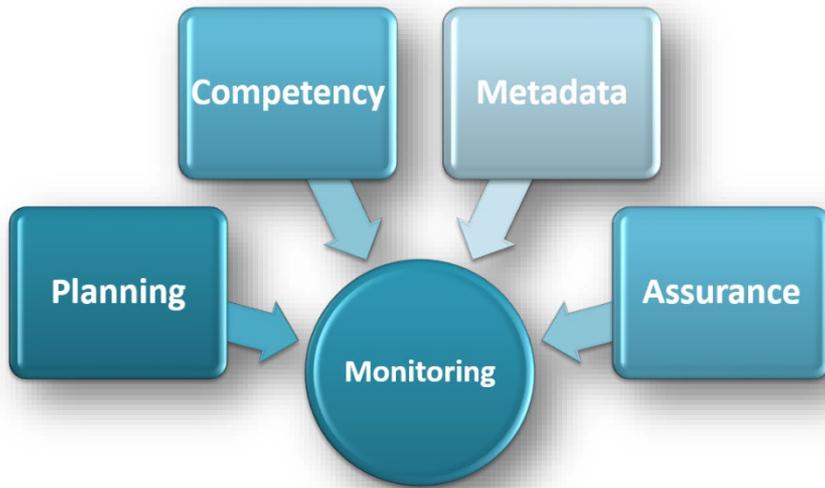
- 3.6.5 QMS includes the necessary policies, processes and procedures.

## Metadata

- 4.4.2 Metadata collected and be applied throughout the aeronautical information data chain.

## Assurance

- 3.6.5 the data traceability requirements are met through the provision of appropriate metadata.



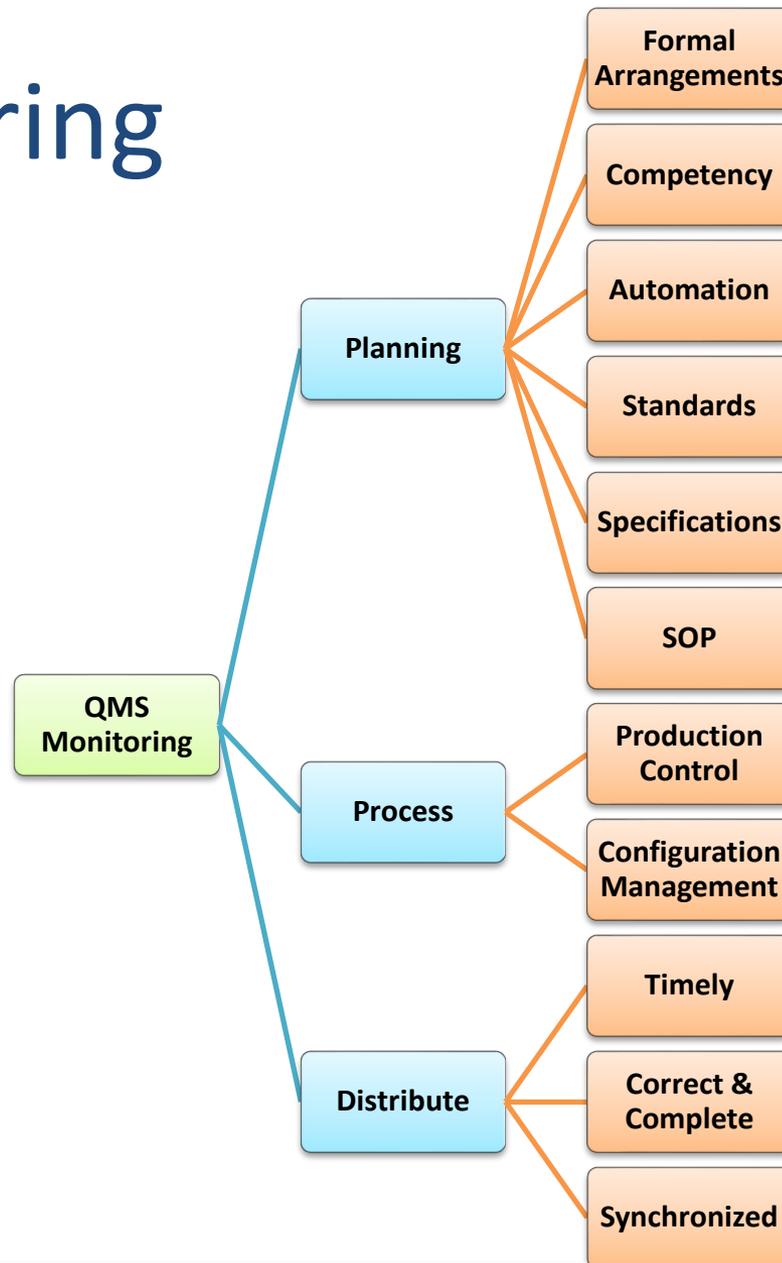
# Monitor

## ICAO Definition

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

Resource: Annex 15, July 2018, Amendment 42

# Monitoring



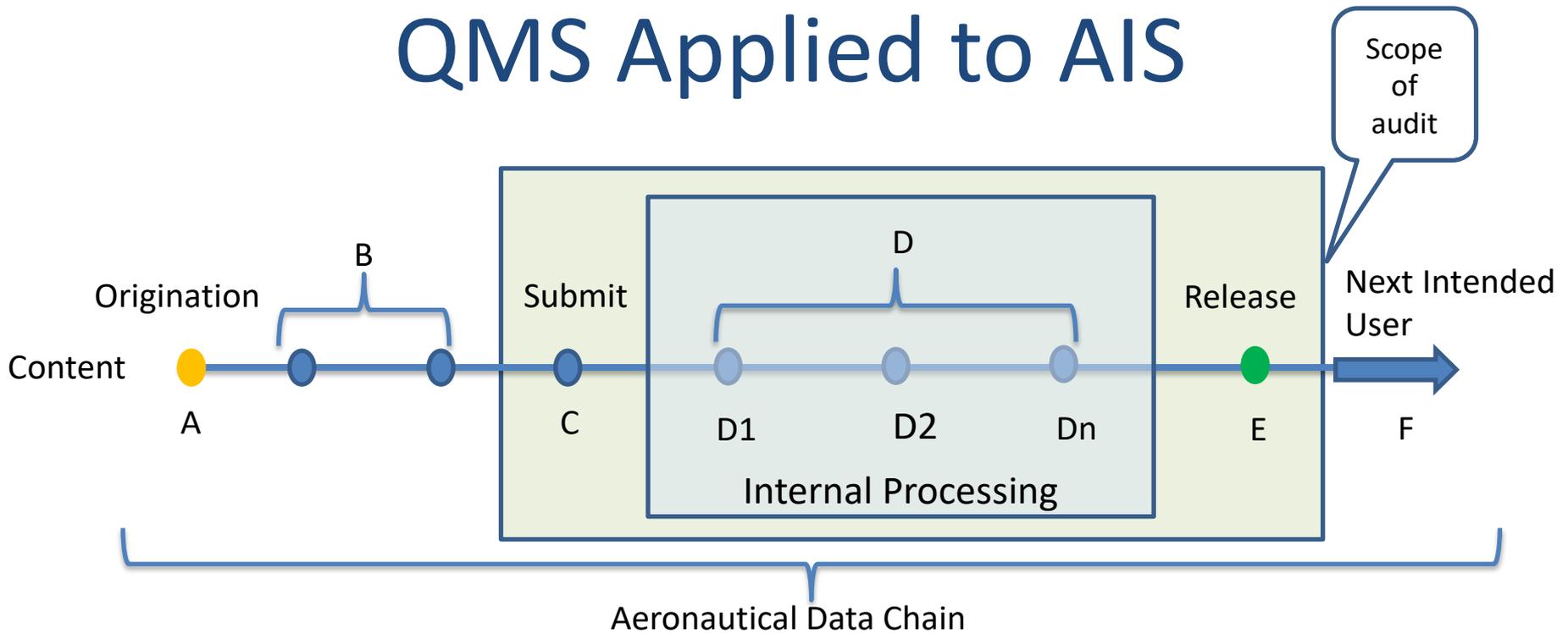


# Audit

## ICAO Definition

3.6.8 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.

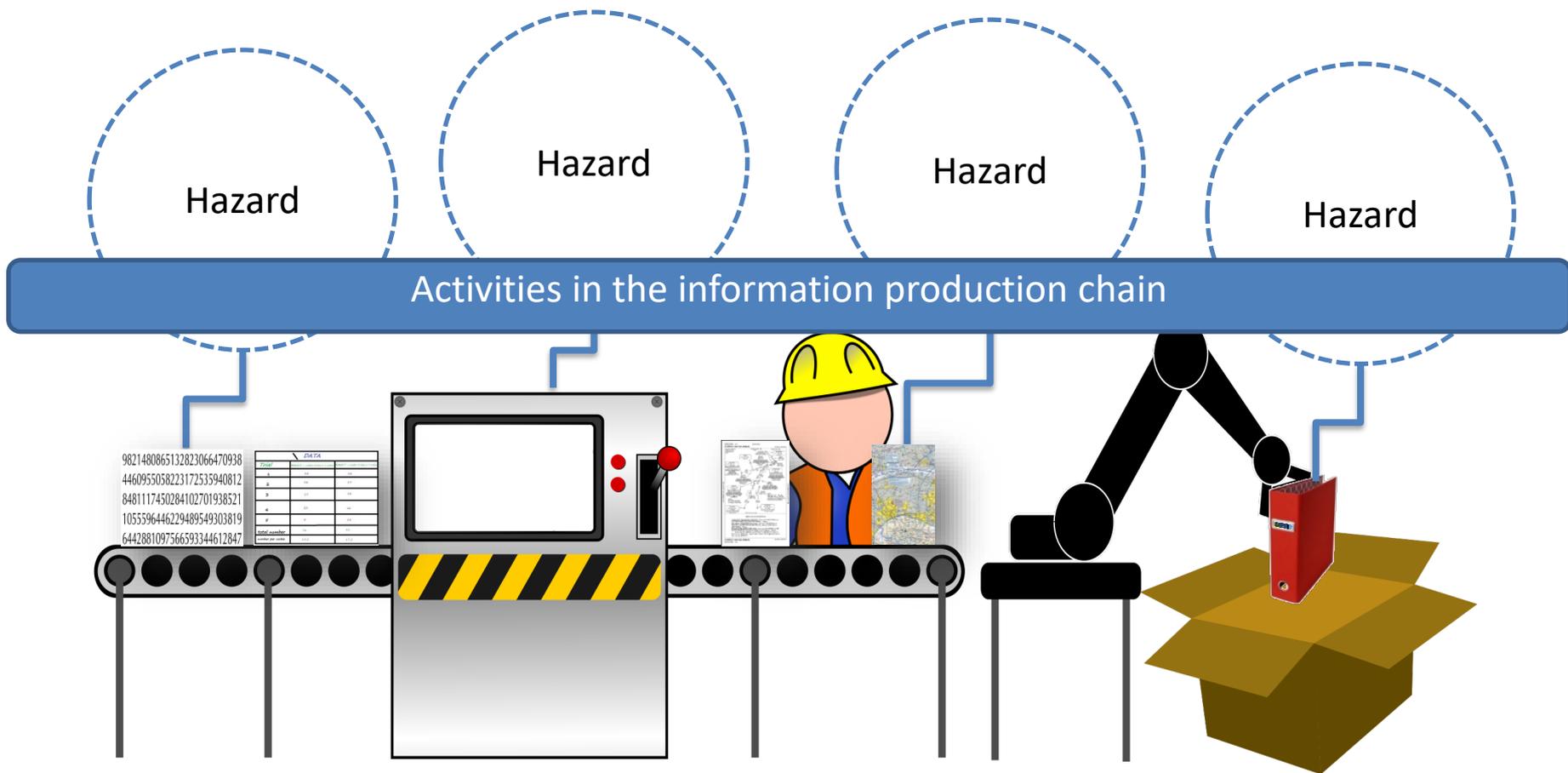
# QMS Applied to AIS



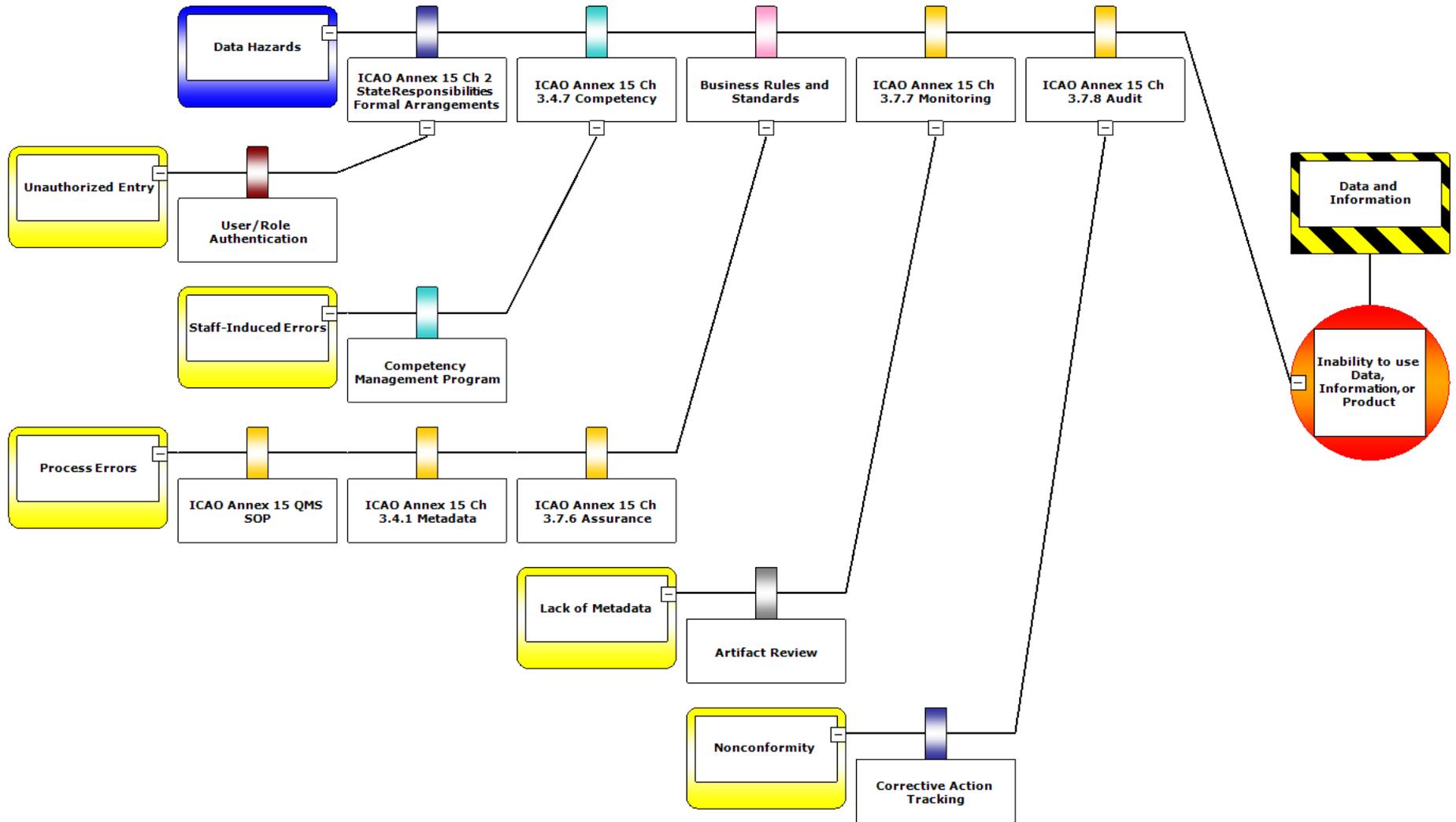
Activity	Description
A	Origination
B	Pre-AIS processing
C	Submission to AIS
D	AIS Internal Processing
E	Release by AIS
F	Downstream Processing

Source: FAA Air Traffic Safety Oversight Service, Audit Report, Aeronautical Data Metadata, ADT-FY15-010; dated May 14, 2015

# AIS: What are the Safety Risk Controls?



# Annex 15 QMS as the Safety Risk Control







# Thoughts...

ICAO Annex 15 requires QMS implementation

A QMS includes:

- Competency
- Metadata
- Assurance
- Monitoring
- Audit

A QMS helps:

- Meet aeronautical information performance requirements
- Control products, services and process outcomes

QMS = safety management control

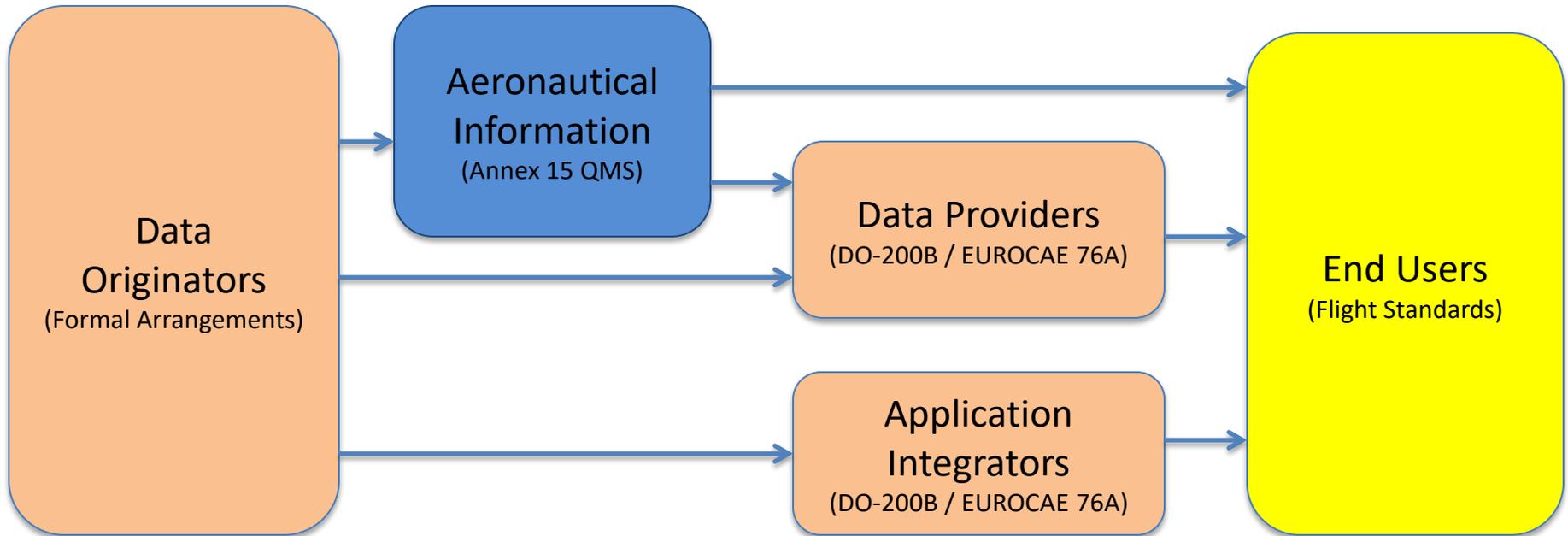


Industry Standards for Processing Aeronautical Data

# **RTCA DO-200B**

# **EUROCAE ED-76A**

# Data Chain Overview



Resource: RTCA DO-200B Figure 1-2, Aeronautical Data Chain Participants and Flow of Aeronautical Data

# Data Quality Requirements

## 2.3.2 Data Quality Characteristics

- Accuracy
- Resolution
- Integrity
- Traceability
- Timeliness
- Completeness
- Format



Resource: RTCA DO-200B

# Aeronautical Data Processing Requirements

- 2.4.1 Data Processing Procedure Requirements
- 2.4.2 Data Alteration Communication Requirement
- 2.4.3 Data Configuration Management
- 2.4.4 Competency Management
- 2.4.5 Aeronautical Data Tool Qualification
- 2.4.6 Defining Data Security Requirements



Resource: RTCA DO-200B, Ch. 2.4 Defining Aeronautical Data Processing Requirements

# Data Configuration Management

2.4.3.2 The following requirements apply to data placed under configuration management:

- Each distinct version of data element or data set shall be assigned an unique identification
- Configuration management procedures shall ensure that a data element cannot be changed without changing the data element identification



Resource: RTCA DO-200B, Ch. 2.4 Defining Aeronautical Data Processing Requirements

# Data Configuration Management (continued)

These records shall be sufficient to allow the following to be established:

- That data element has not been separated from its correct label
- The start and end dates of the period of validity of the data element
- The date of production of the data element
- The supplier of each data value contained within the data element or data set
- The procedures used to produce the data elements
- Verification and Validation checks, including feedback comparison output as relevant



Resource: RTCA DO-200B, Ch. 2.4 Defining Aeronautical Data Processing Requirements

# Data Configuration Management (continued)

A copy of each data element shall be retained for a period determined by the Configuration Management Plan.

The method of storage and the numbers of copies maintained shall be such that:

1. The integrity of each data element can be assured for the entire period that it is retained
2. Data storage media is protected against physical damage and degradation



Resource: RTCA DO-200B, Ch. 2.4 Defining Aeronautical Data Processing Requirements

# Quality Management Requirements

- 2.5.1 Quality Management Procedure Requirements
- 2.5.2 Quality Management Control
- 2.5.3 Review
- 2.5.4 Document Control Requirements
- 2.5.5 Quality Records
- 2.5.6 Management Reviews



Resource: RTCA DO-200B, Ch. 2.5 Defining Quality Management Requirements

# Compliance

## 3.1 Demonstration of Compliance

- Shall demonstrate such compliance to the applicable sections
- Compliance, normally, demonstrated by audit

## 3.2 Audit Objectives

- The audit shall confirm that the QMS meets all requirements and that any compliance deviations have been coordinated, documented, and tracked

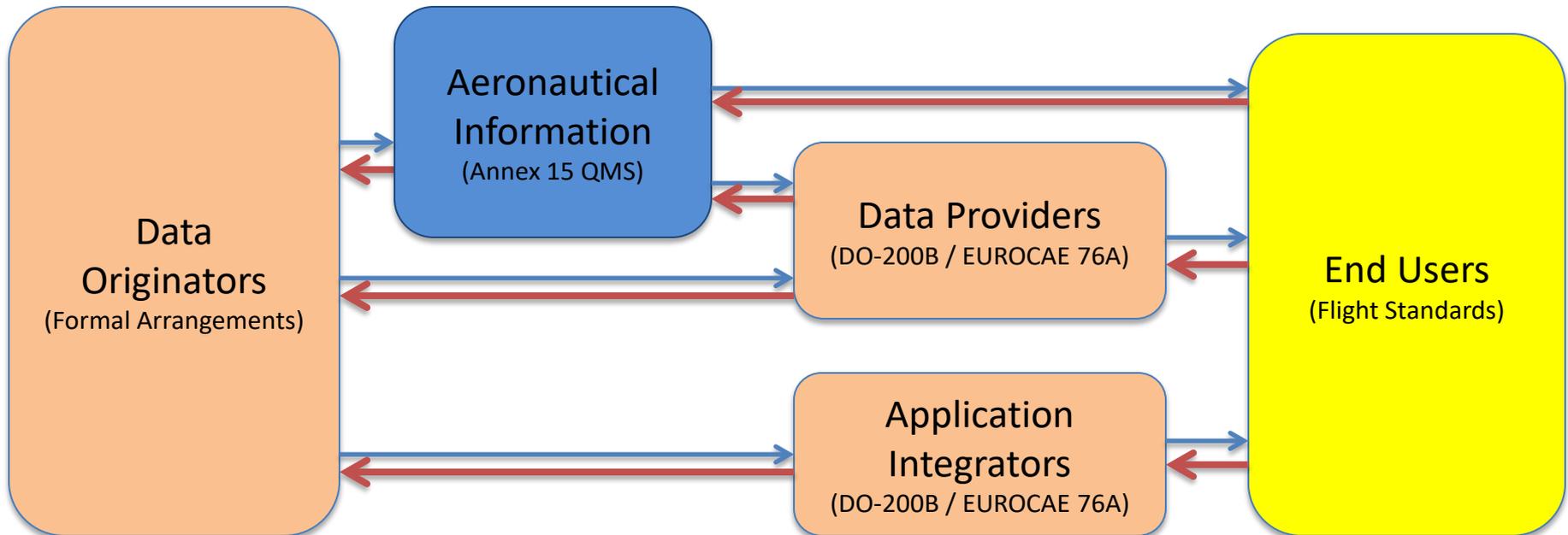
## 3.3 Audit Procedures

## 3.4 Audit Report



Resource: RTCA DO-200B, Ch. 3 Compliance

# Data Chain with Feedback





# Questions and Discussion



# References

- ICAO Annex 15
- PANS-AIM/Data Catalogue, Doc 10066
- FAA Order 8000.90B, Air Traffic Safety Oversight Credentialing and Control Tower Operator Certification Programs
- FAA Air Traffic Safety Oversight Service, Audit Report, Aeronautical Data Metadata, ADT-FY15-010; dated May 14, 2015
- NGA Sample Competency Syllabus:
  - Aeronautical Analyst, Vertical Obstructions
- Lessons from Peter Drucker, Peter Drucker
- Famous principle from Tom DeMarco
- RTCA DO-200B
- EUROCAE ED-76A

# Production Control and Configuration Management



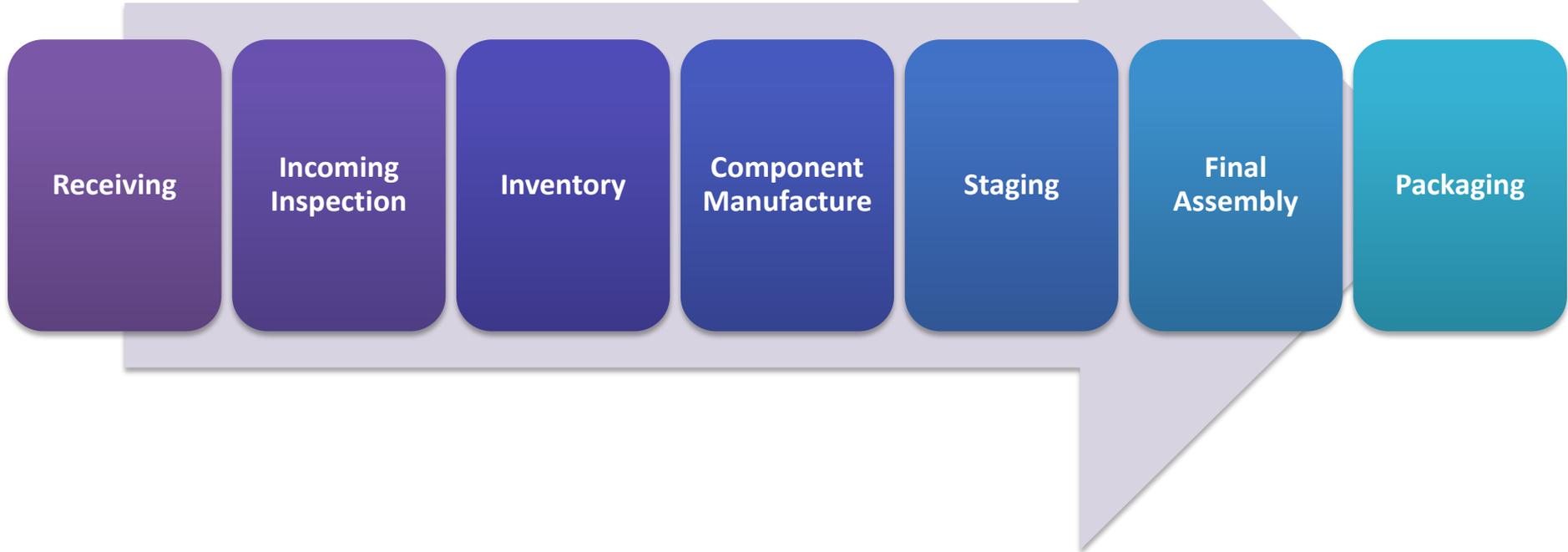
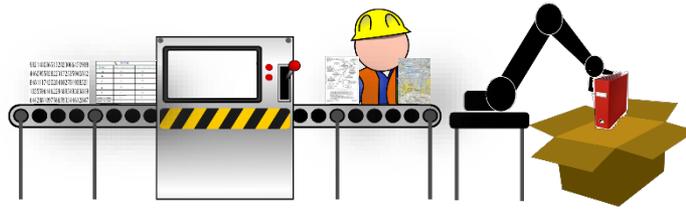
Federal Aviation  
Administration



# Module Objectives

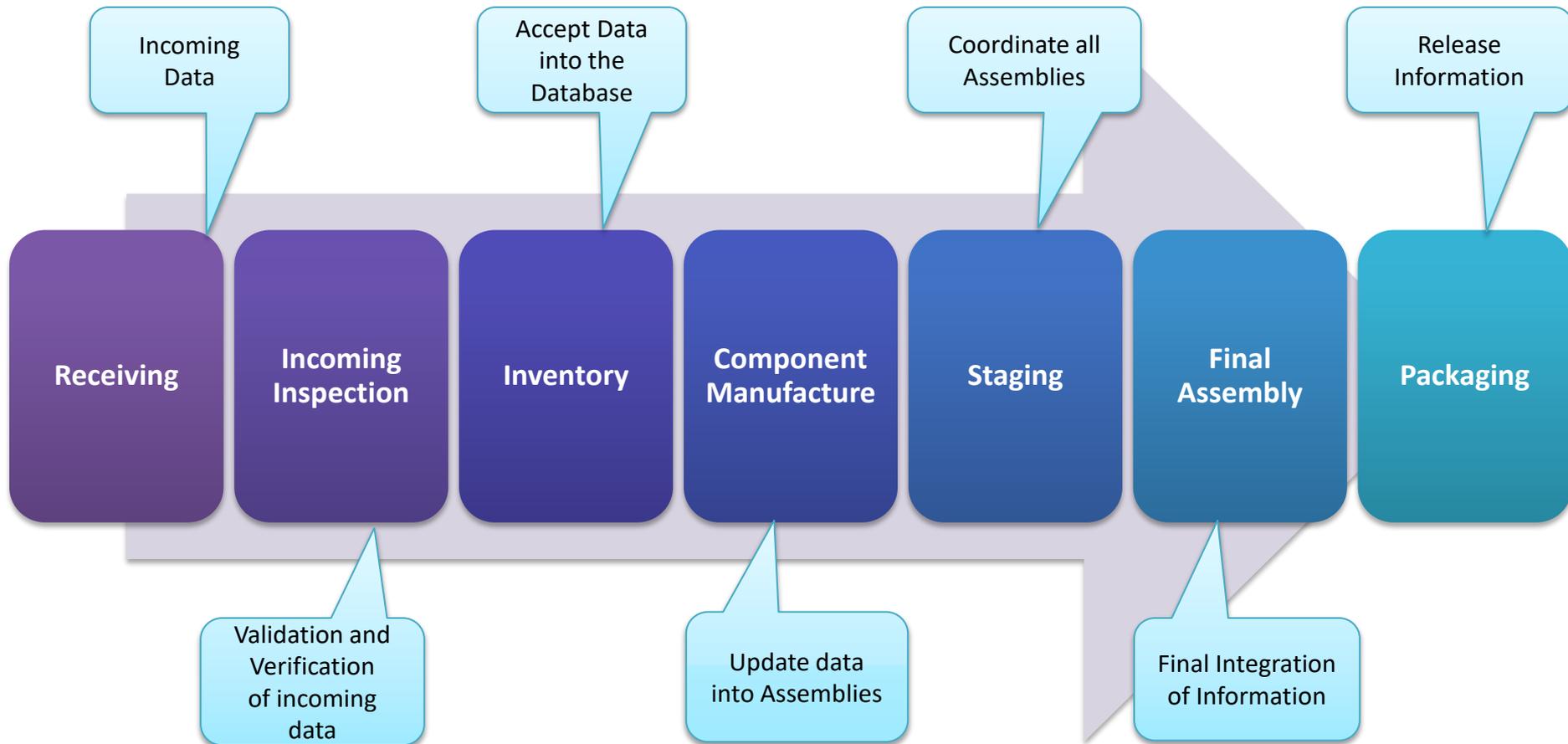
- Discuss a production process and the relationship to the aeronautical information process
- Introduce production management components
- Detail production control and configuration management
- Link to QMS requirements

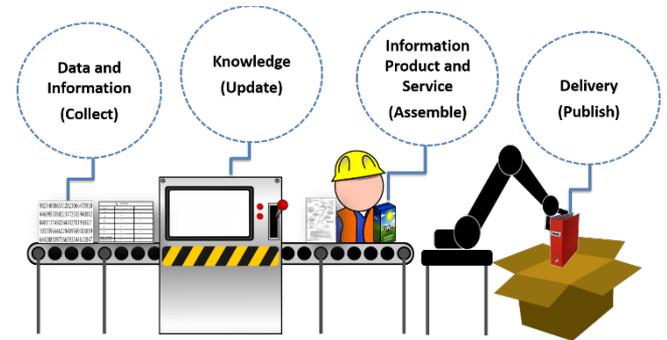
# Production Process





# Aeronautical Information Process





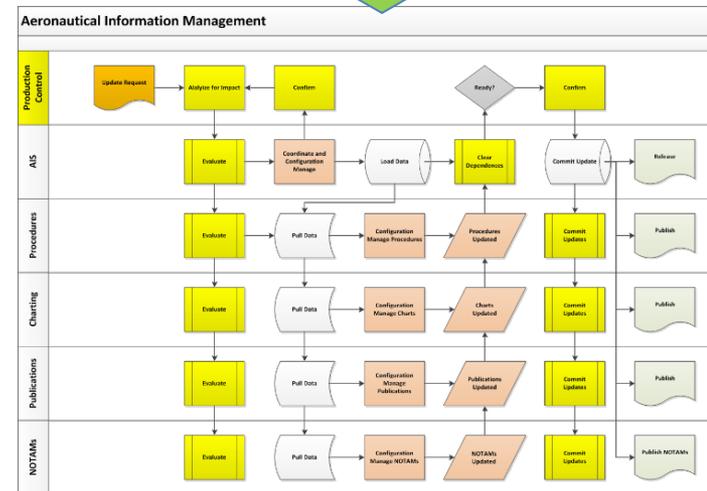
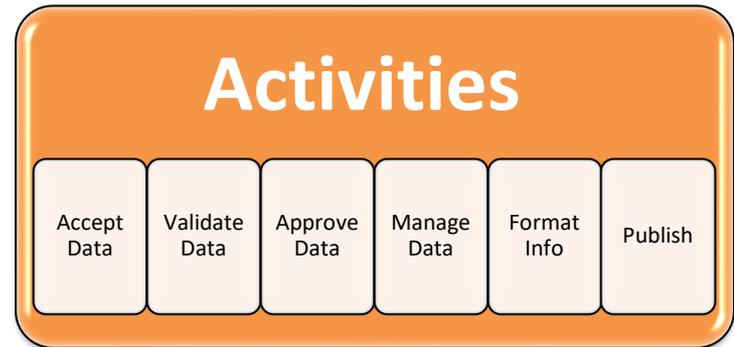
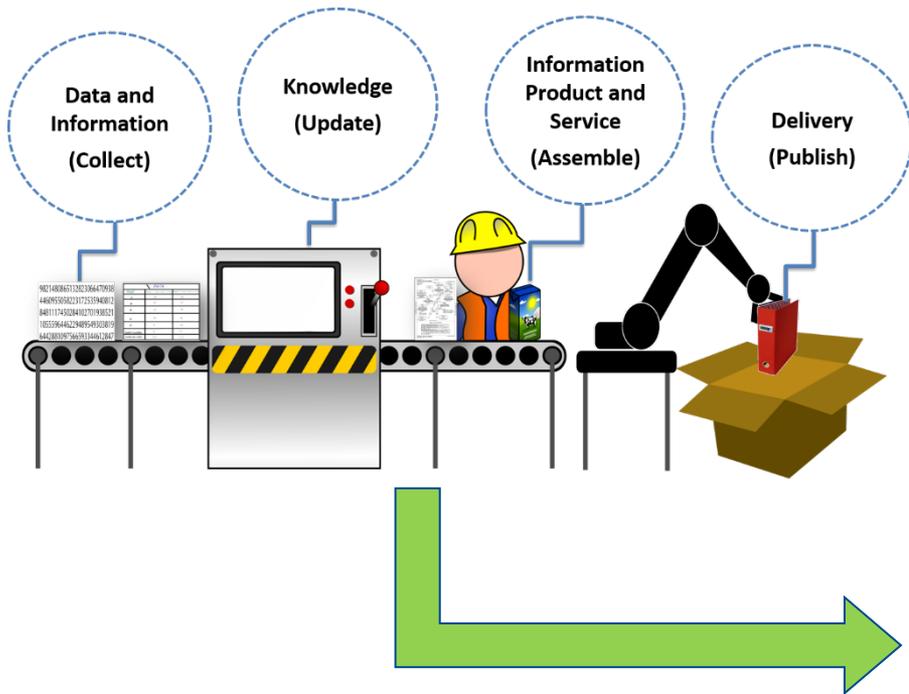
Production Control of Workflow

Configuration Management of Products and Services

# PRODUCTION MANAGEMENT

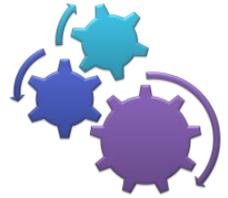
# Production Management

## Managing the Factory



Workflow

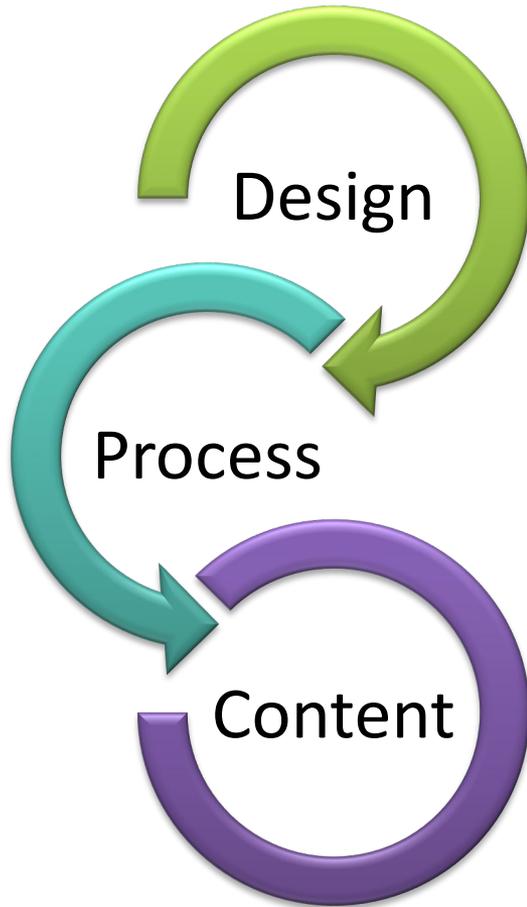
# Information Factory



## Managing Aeronautical Information

What are we going to build?	Aeronautical product/service (AIP, NOTAM)
What are the performance requirements (specifications) for our products?	Annex 15 Standards
What are the tolerances for our raw materials (data)? How much variation is acceptable?	Data quality requirements (Annex 15)
Where do we get our raw data?	Data originators
What is our process to build products?	Documented procedures (SOP)
What resources are needed to execute the process?	Competent personnel
<b>How do we apply our process to multiple products?</b>	<b>Production control and configuration management</b>
How do we know we will meet the performance requirements?	Quality Management System

# Production Management



## Production Control

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

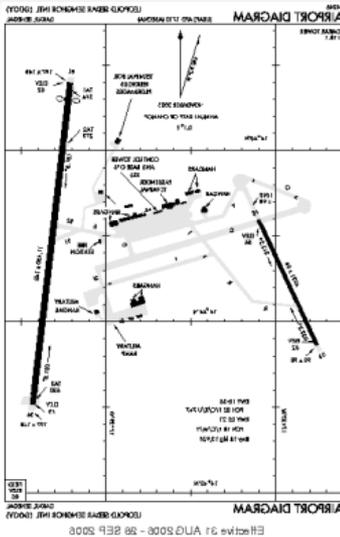
## Configuration Management

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

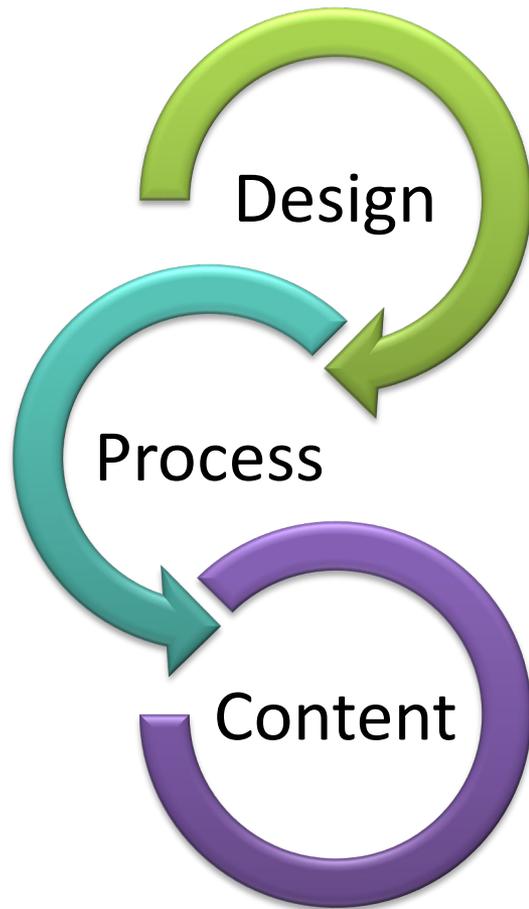
# Questions to Consider



- What ingredients are listed on the butter or milk?
- Is there any ingredient in the butter that is spoiled?
- What changes did Chef Catherine make to the pasta recipe that turned it yellow?
- Would you expect the Aeronautical Information Office who produced the airport diagram to be any different?



# Production Management



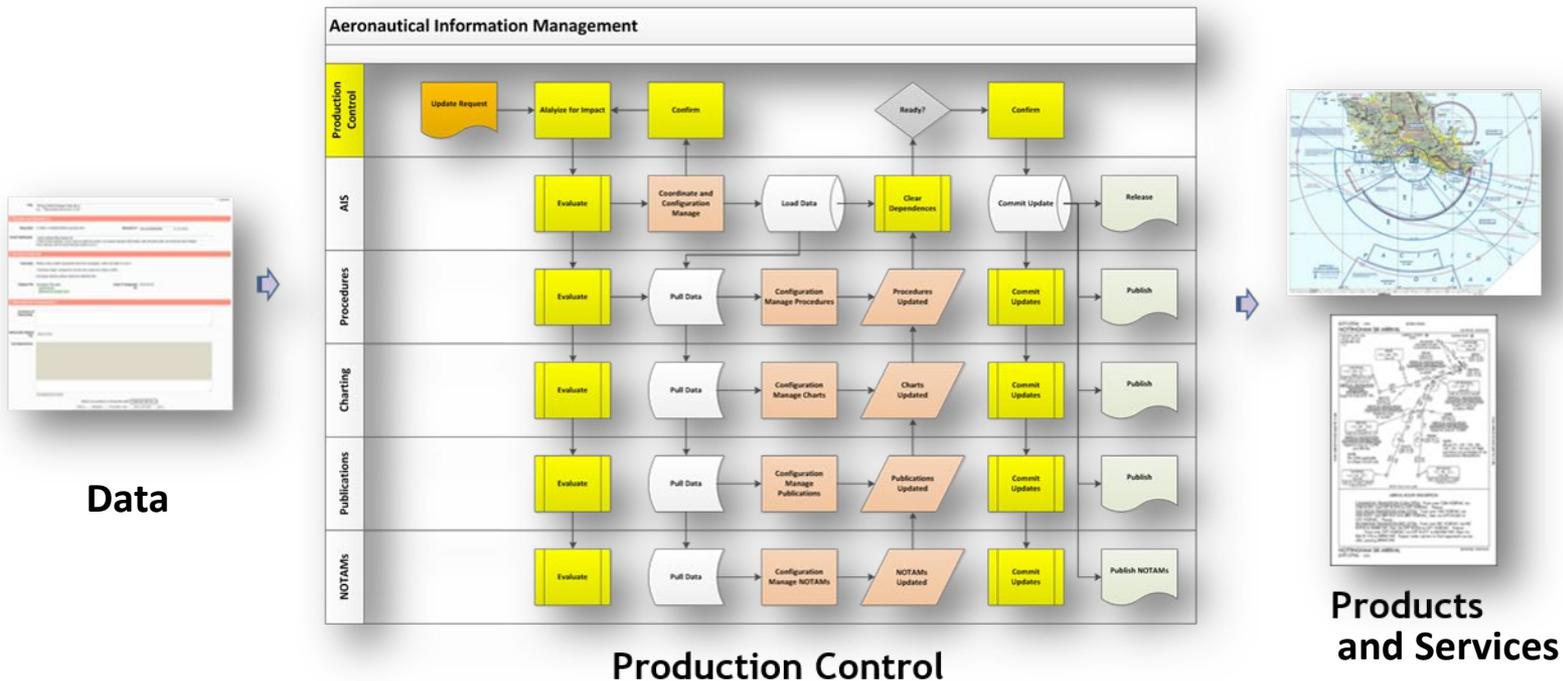
## Production Control

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

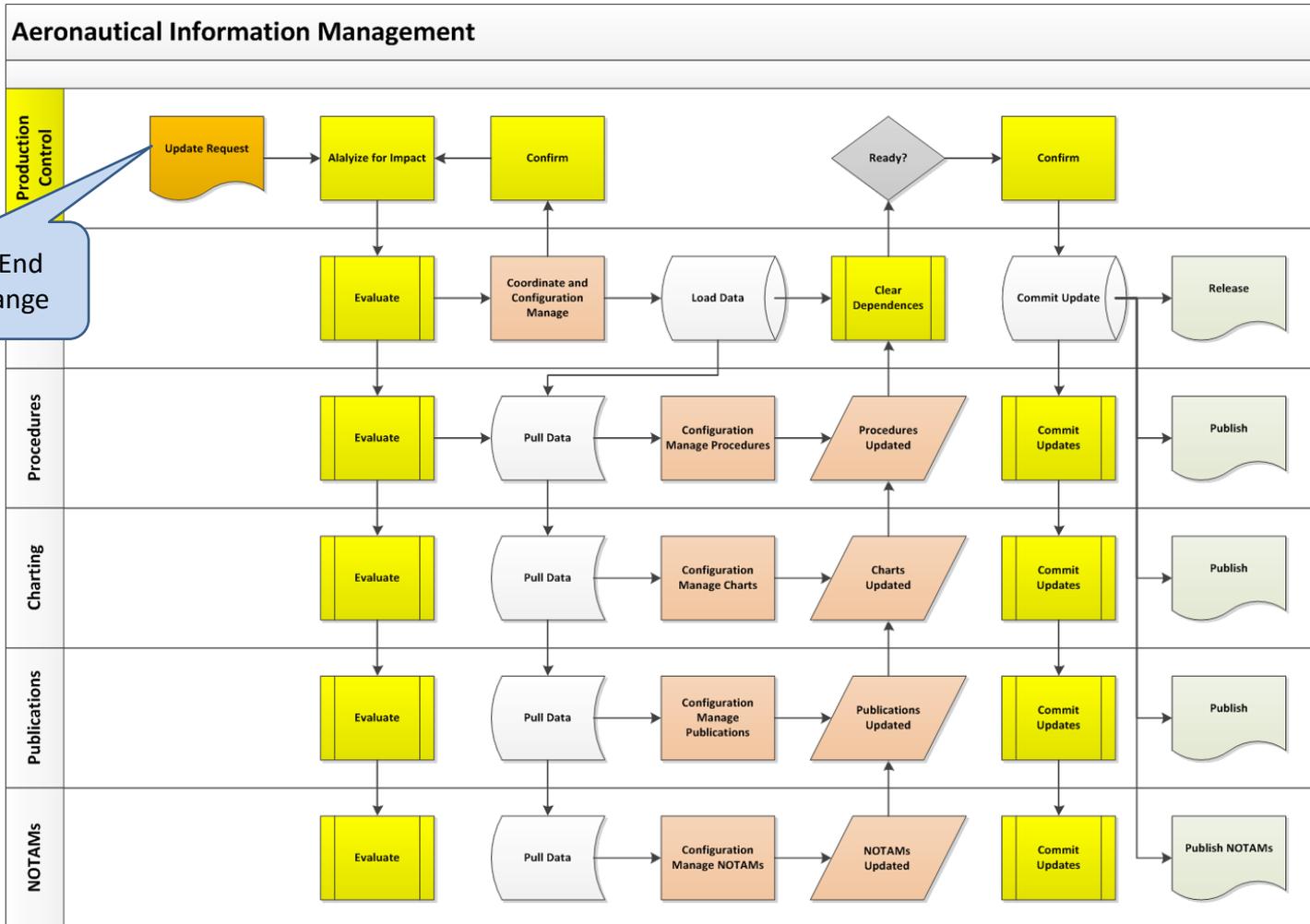
## Configuration Management

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

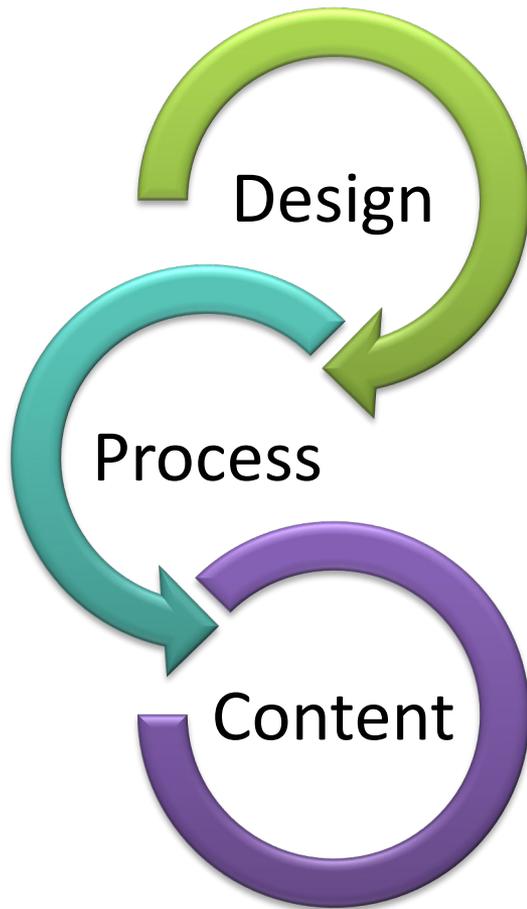
# Synchronized Data Across Multiple Products and Services



# Production Control Example



# Production Management



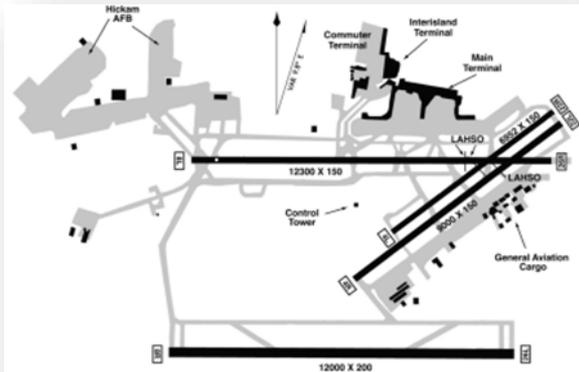
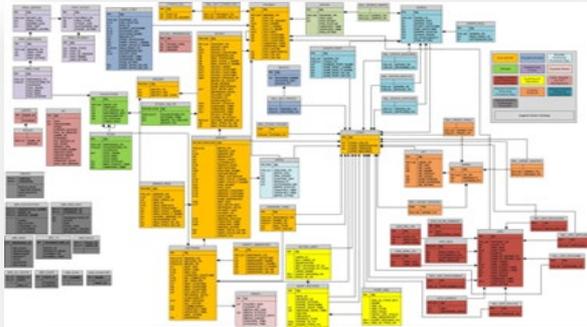
## Production Control

- 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

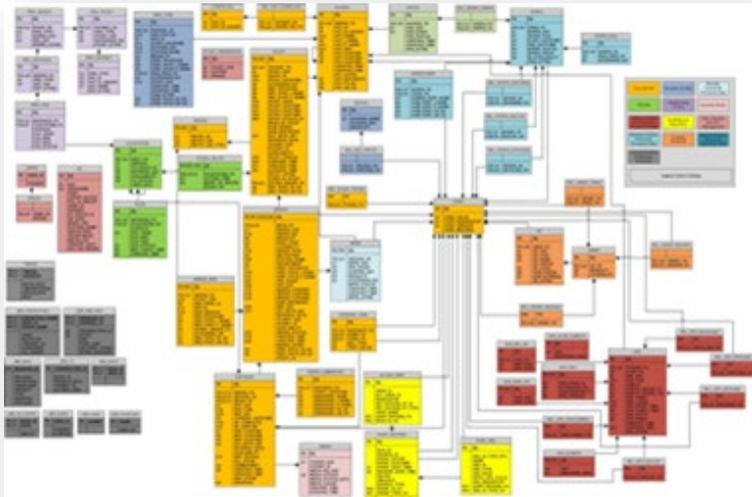
# What is Managed?



## Configuration Items

- Exchange model
- Data element
- Feature
- Document
- Chart
- Process
- Database
- Publication

# What is Managed? (continued)



Exchange Model (Structure)  
AIXM

Database (Container)  
Data feature

Data Feature (Content)

- Runway
- Obstacle

# What is Managed? (continued)



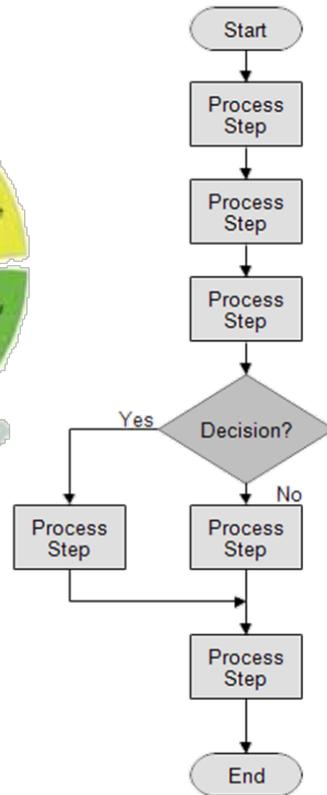
## Chart (Container)

- Content depicted as features
- Feature is the visual representation of data element(s)
- Visualization standard(s)

## Feature (Content)

- Airspace
- Airport
- Navaid
- Obstacle
- Route

# What is Managed? (continued)



Standard operating procedures and processes are normally documented and retained

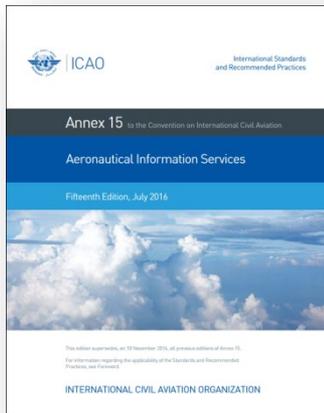
- Is it important to know information (who, what, why) about changes to a process?
- If so, what information is retained?

# What is Managed? (continued)

CONDITIONS				ACTIONS
CompanyInfo.type	CompanyInfo.initialListingStandard	CompanyInfo.approval	CompanyInfo.totalRevenue	CompanyInfo.violationCode = {value}
"company"	"PriceStandard"	true	"="	"APS"
		false	"="	"DPS"
	"ValuationStandard"	true	< 10000	"ALVS"
		>= 10000	"AHVS"	
		false	< 10000000	"DD"
		>= 10000000	"TBR"	
	"Equity"	true	< 20000	"E1"
			< 200000	"E1B"
			between 20000 and 2000000	"E2"
			> 2000000	"E3"
			false	"="
	"PureValuation"	true	< 30000	"OP"
between 30000 and 3000000			"LOP"	
> 3000000		"HOP"		
false		< 50000000	"DOP"	
	>= 50000000	"RDOP"		
"fund"	"Fund"	true	"="	"ATF"
		false	"="	"DTF"

Business rules used by automated system

# What is Managed? (continued)



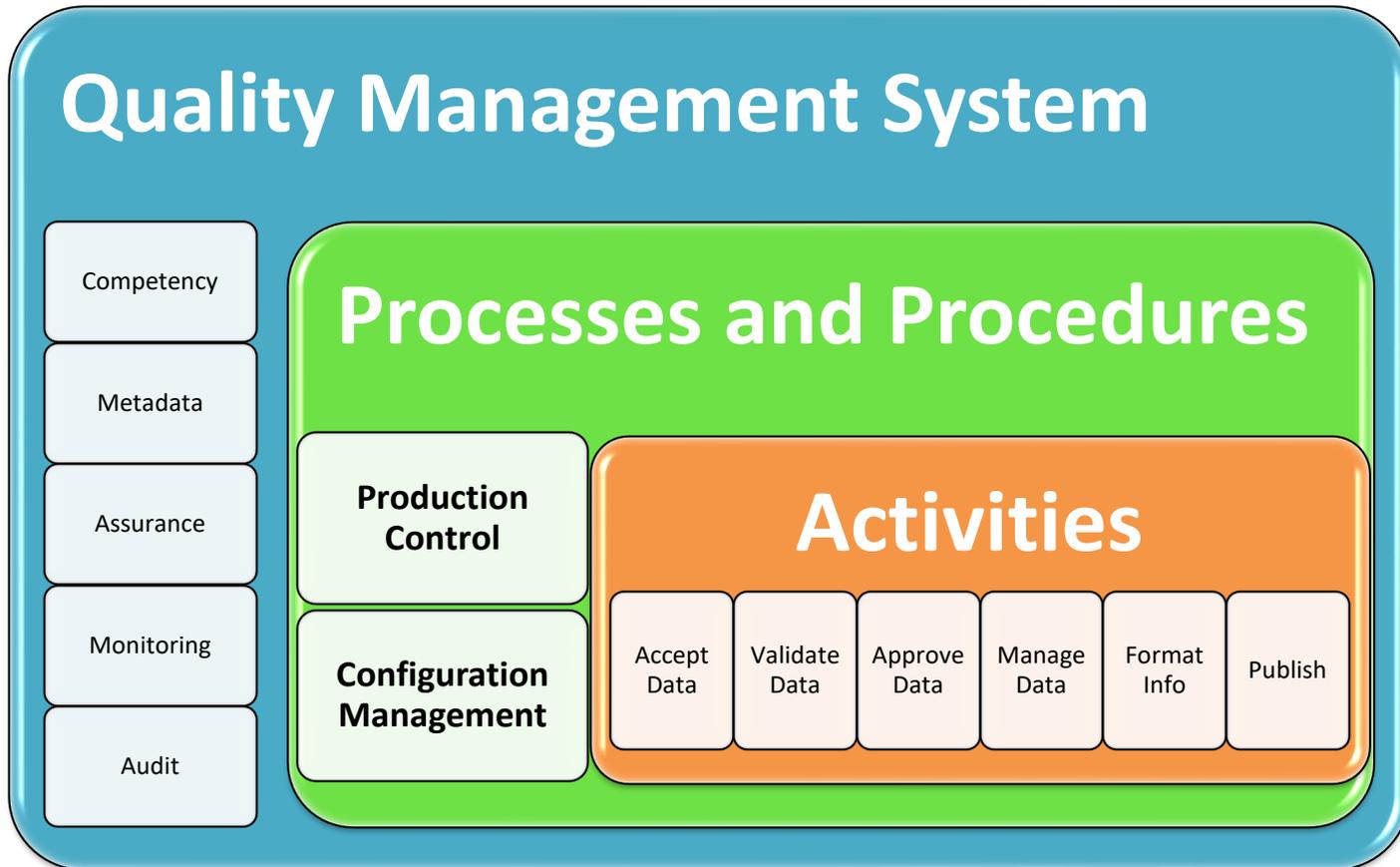
A document or publication is a container

➤ How do we manage revisions?

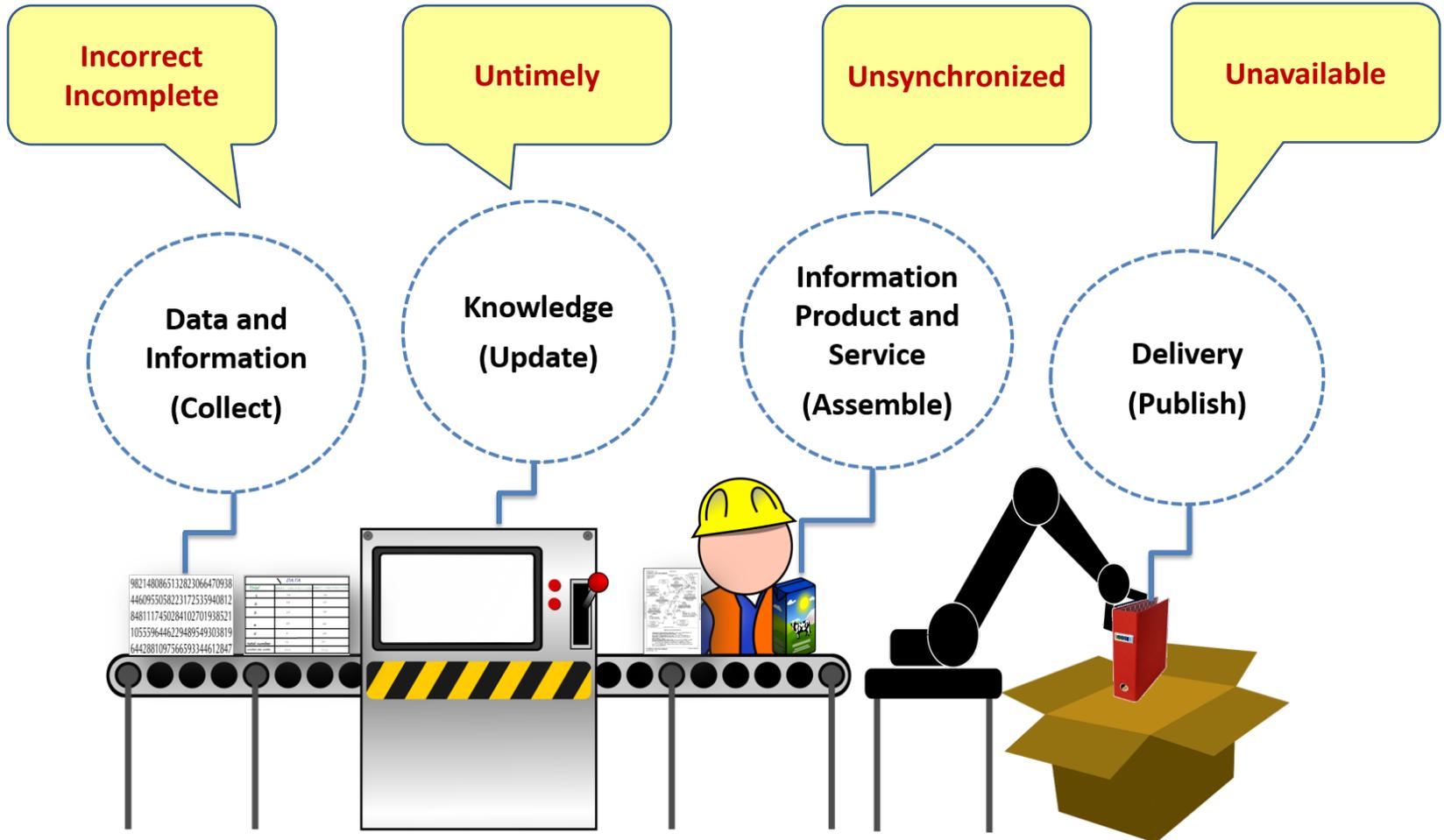
➤ What information do we keep about the different revisions?



# Linking to QMS



# What Could Go Wrong?



# AOV Risk-Based AIS Surveillance Program

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?

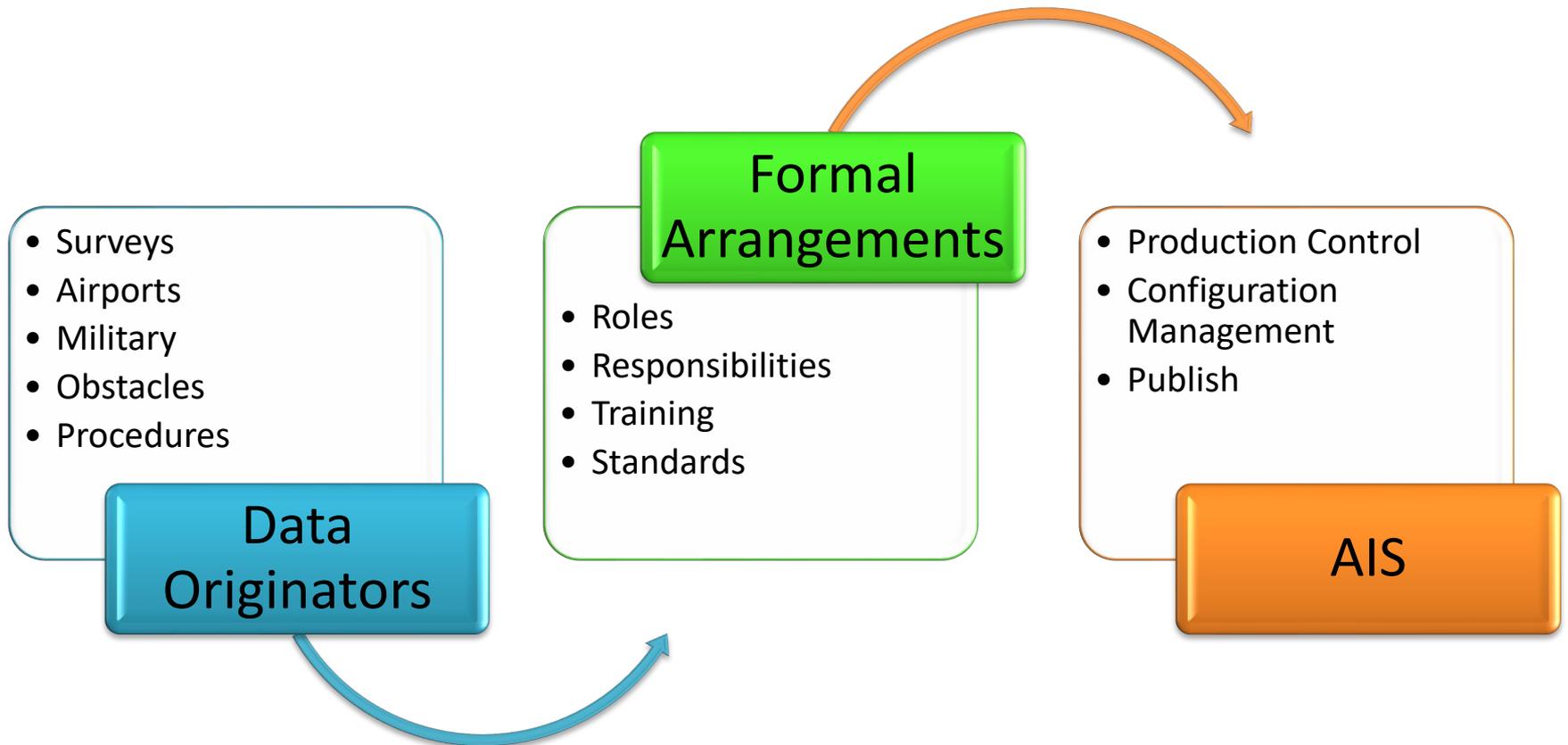
Safety Oversight Activities

Continuous Monitoring

Audits and Assessments

Inspections

# Formal Arrangements



# Quality Management System



# Production Control

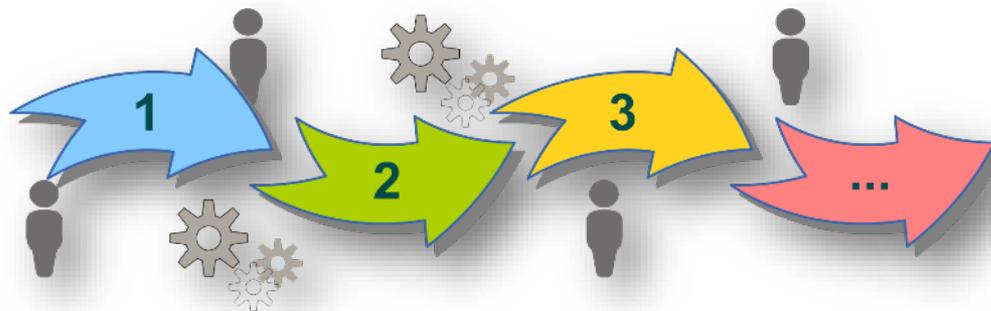
## Data and Information Hazards

Incorrect  
Incomplete  
Unsynchronized  
Untimely  
Unavailable



## Production Control

Manage workflow to coordinate the configuration management of deliverable(s)



# Configuration Management

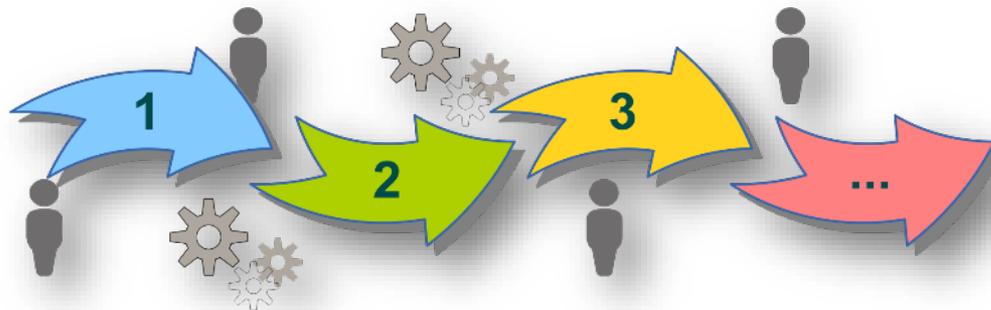
## Data and Information Hazards

Incorrect  
Incomplete  
Unsynchronized  
Untimely  
Unavailable



## Configuration Management

Manage changes to a system  
(data, products, services) to  
ensure performance  
requirements are maintained



# AOV Risk-Based AIS Surveillance Program

What could go wrong?

Data and Information Hazards

Incorrect

Incomplete

Untimely

Unsynchronized

Unavailable

\*Unprotected

What does risk look like?

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How will I know if controls are working?

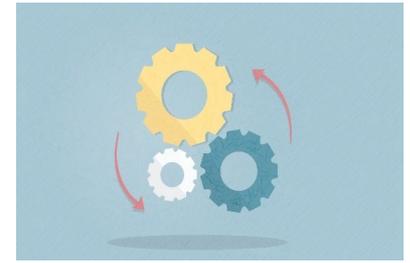
Safety Oversight Activities

Continuous Monitoring

Audits and Assessments

Inspections

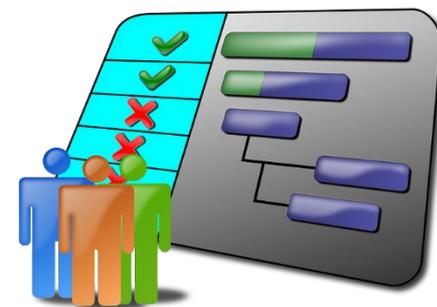
# Thoughts...



- Production control is the management of the data chain from origination to publication
- Databases and products share a common production but have their own configuration management for synchronization
- There is a significant dependency on metadata for traceability
- A single change can affect the content management of multiple products and services

# Thoughts (continued)...

- Configuration management is the management of changes to a system to ensure performance requirements are maintained through configuration items:
  - AIXM (structure)
  - Database, chart, document (container)
  - Element or feature (content)
  - Publication (visualization)
- Provides traceability within a product or database
- Manages business rules and production control





# Questions and Discussion



# References

- ICAO Annex 15

# Understanding Metadata in Safety Oversight



Federal Aviation  
Administration



# Metadata

- ICAO metadata requirements review
- Metadata types
  - Container metadata
  - Digital Data set metadata
  - Activity metadata
- Applying metadata to safety oversight

# ICAO Annex 15 Standards Review

## ICAO Definition

3.6.5 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 is 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 affecter



Resource: Annex 15, July 2018, Amendment 42

# ICAO Annex 15 Standards Review Metadata



## ICAO Definition

4.2.1 Metadata shall be collected for aeronautical data processes and exchange points.

4.2.2 Metadata collection shall be applied throughout the aeronautical information data chain, from origination to distribution to the next intended user.

## PANS-AIM

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

- a) the names 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.

Resource: Annex 15, July 2018, Amendment 42, PANS-AIM, July 2019, Edition 1

# ICAO Annex 15 Standards Review

## Data Set Metadata



### ICAO Definition

5.3.1.2 Each data set shall be provided to the next intended user together with at least the minimum set of metadata that ensures traceability.

### PANS-AIM

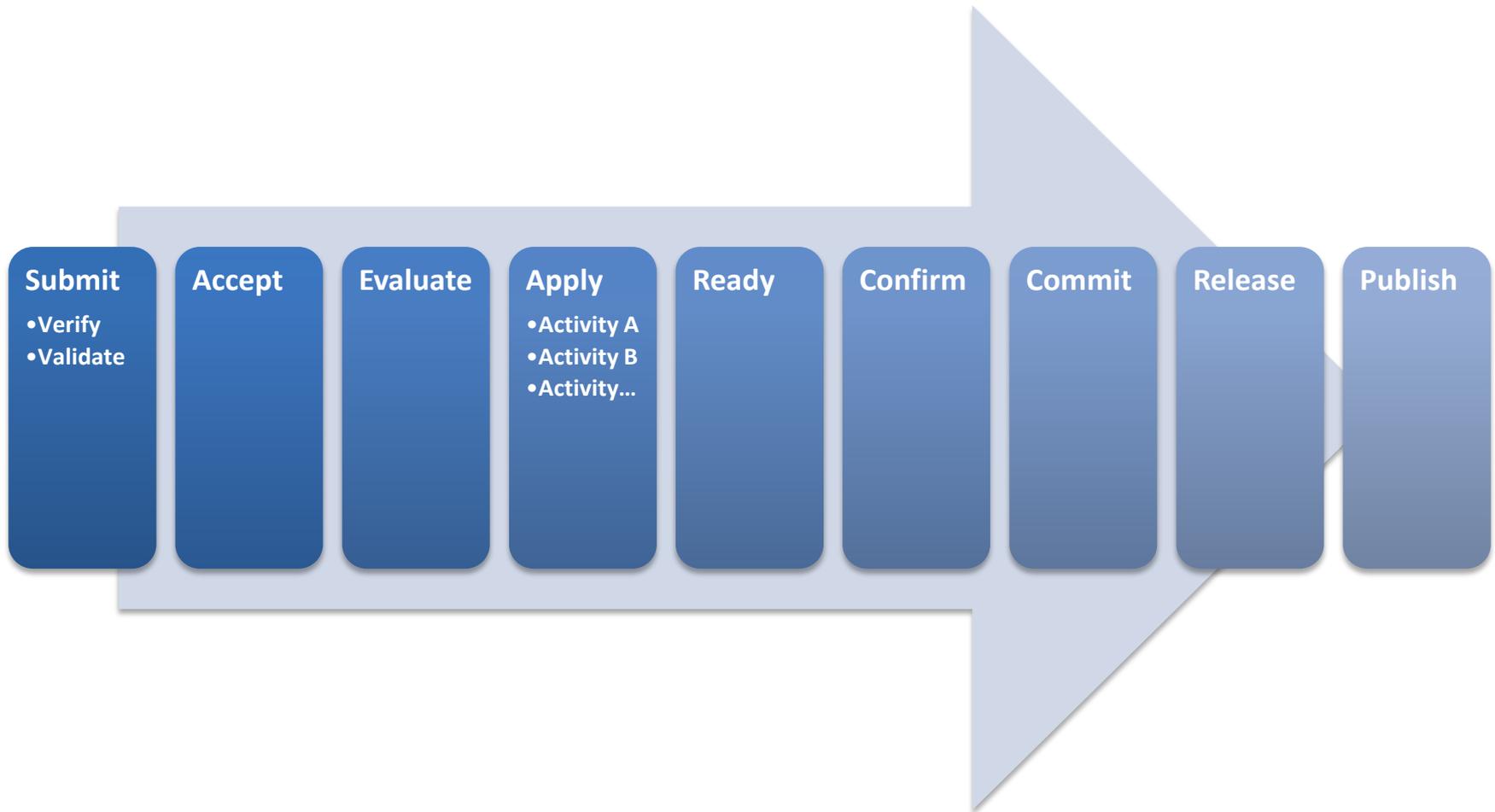
5.3.2 Each data set shall include the following minimum set of metadata:

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

Resource: Annex 15, July 2018, Amendment 42, PANS-AIM, July 2019, Edition 1.

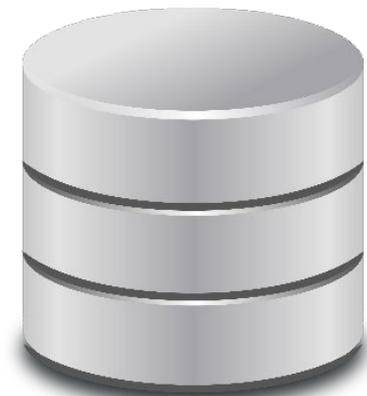
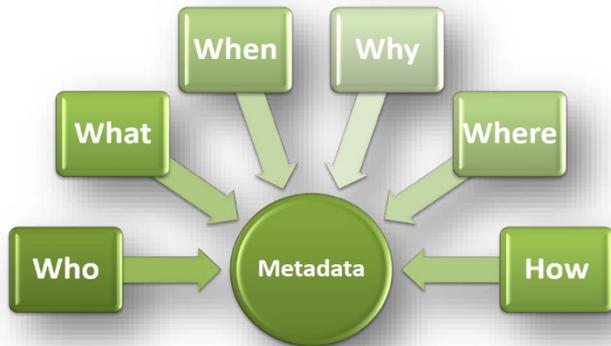
# Metadata Collection Points

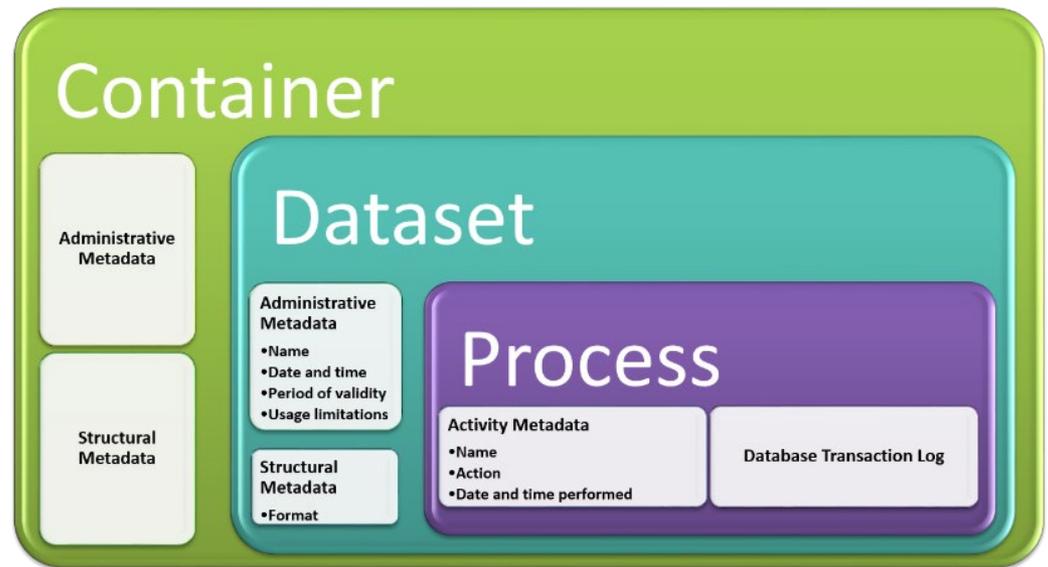
(Hypothetical)



# Key Metadata Requirements

- Ensure and verify aeronautical data are traceable for any action performed throughout the data chain
- Ensure data sets contain information about the provider and limitations of use of the data



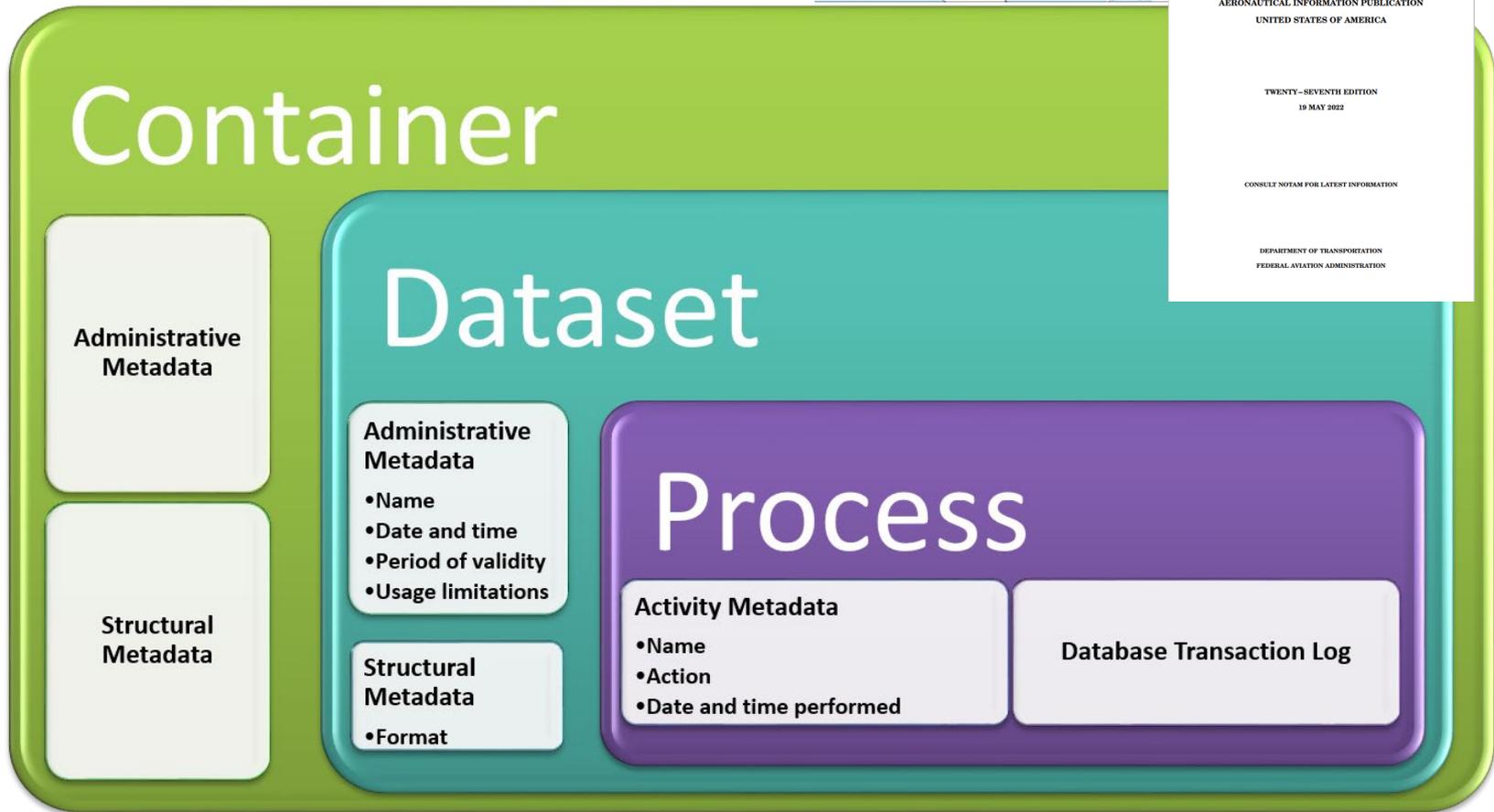
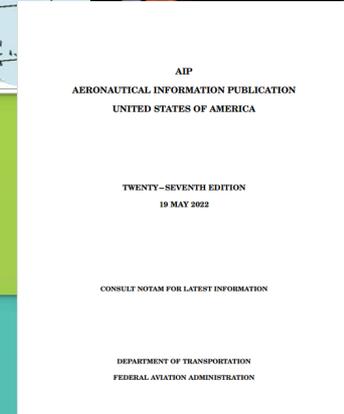
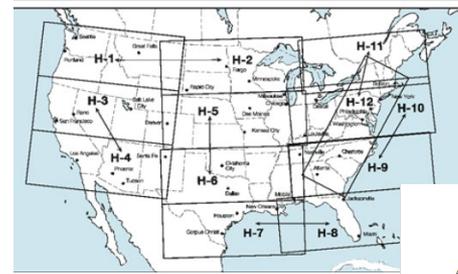


A deeper exploration into types of metadata

# METADATA TYPES



# Metadata Types



# Data Set Metadata

Date	Queue	Action	Facility	What	Who	Remark
23 Aug 2019 1330	AIS	Submission	ABC	Element X	ABC Airport Authority (Jane Doe)	Submission by airport
23 Aug 2019 1400	AIS	Accept	ABC	Element X	ANSP AIS (Sara Tomo)	Received by AIS, enters workflow
23 Aug 2019 1445	AIS	Evaluate	ABC	Element X	ANSP AIS (Tommy Ojo)	Evaluated, No errors detected
23 Aug 2019 1445	AIS	Update DB	ABC	Element X	ANSP AIS (Tommy Ojo)	
23 Aug 2019 1445	AIS	Product Analysis	ABC	Element X	AIS Analysis Scenario	2 Products affected (A and B)
23 Aug 2019 1445	Chart B	Geo Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	AIS	Authority Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	Pub A	Temporality Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	AIP	AIP Inclusion Rule	ABC	Element X	Rule Engine	
23 Aug 2019 1445	Pub A	Submission	ABC	Element X	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	Chart B	Submission	ABC	Element X	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	AIP	Submission	ABC	Element X	AIS Submission Scenario	
23 Aug 2019 1445	Pub A	Evaluate	ABC	Element X	Product Mgr (Sam Oto)	Required by product
23 Aug 2019 1445	Pub A	Accept	ABC	Element X	Product Mgr (Sam Oto)	
23 Aug 2019 1448	Pub A	Apply Transaction	ABC	Element X	Product Mgr (Sam Oto)	
23 Aug 2019 1525	Chart B	Evaluate	ABC	Element X	Product Mgr (Jane Wi)	Not required by product
23 Aug 2019 1525	Chart B	Tolerance Rule Check	ABC	Element X	Rule Engine	No change from current view

Administrative Metadata: information to help manage a resource, such as when and how it was created, file type and other technical information, and who can access it

Structural Metadata: information on how the data was created

Resource: <http://marciazeng.slis.kent.edu/metadatabasics/types.htm>

# Process Metadata

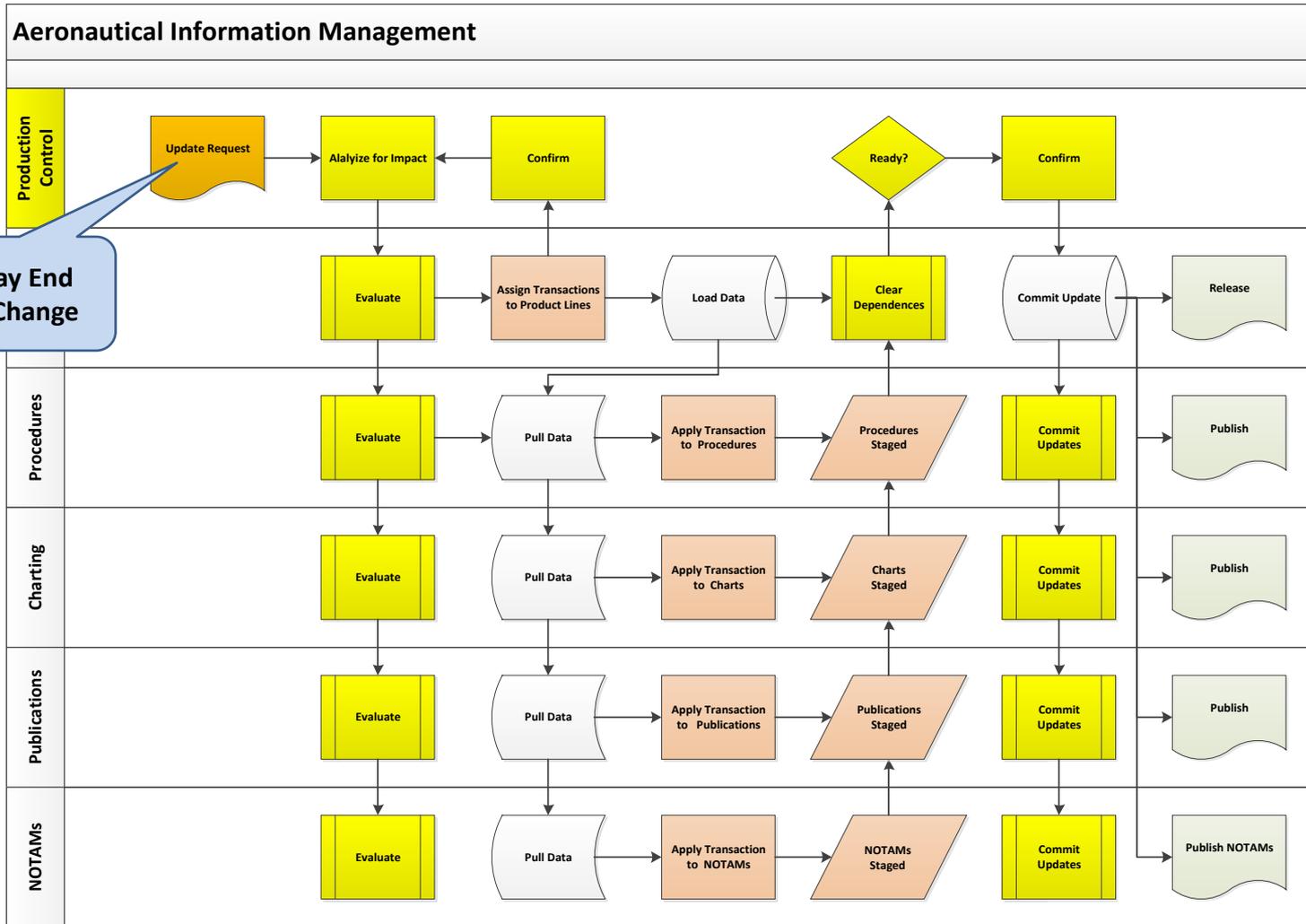


- The activities performed throughout the process
- ICAO Annex 15 requirements
  - Who did what, when?

- Create
- Read
- Update
- Delete



# Activity Metadata Example



# Metadata and Safety Oversight

## Conduct surveillance

- What questions can be asked or answered?
- Are all the metadata questions being asked (who, what, when...)?
- What evidence can be collected?
- Is the metadata complete?
- Is the metadata retained?



# Thoughts...

## Metadata:

- Is collected and maintained throughout process and delivery of aeronautical information
- Types are numerous, each having their own purpose and all are important
- Assures traceability of aeronautical data, information, products and services
- Relates to QMS assurance and monitoring





# Questions and Discussion



# References

- ICAO Annex 15
- <http://marciazeng.slis.kent.edu/metadatabasics/types.htm>
- PANS-AIM/Data Catalog, Doc 10066

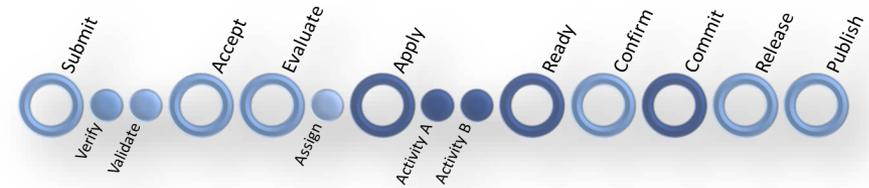


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# Workshop Exercise #3



Understanding Metadata in Safety Oversight



Workshop Exercise

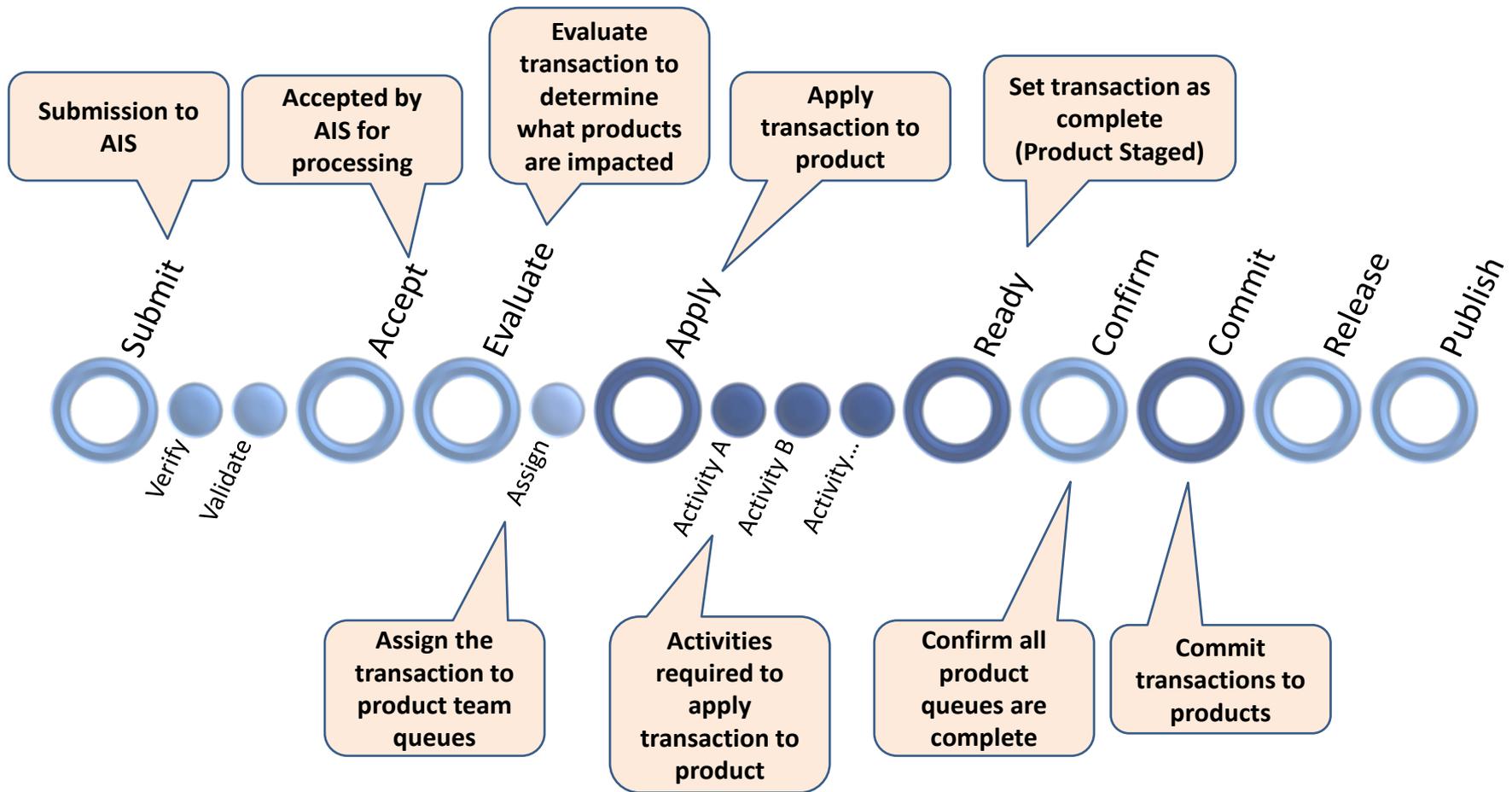
# UNDERSTANDING ACTIVITY METADATA

# Filter the Metadata Instructions

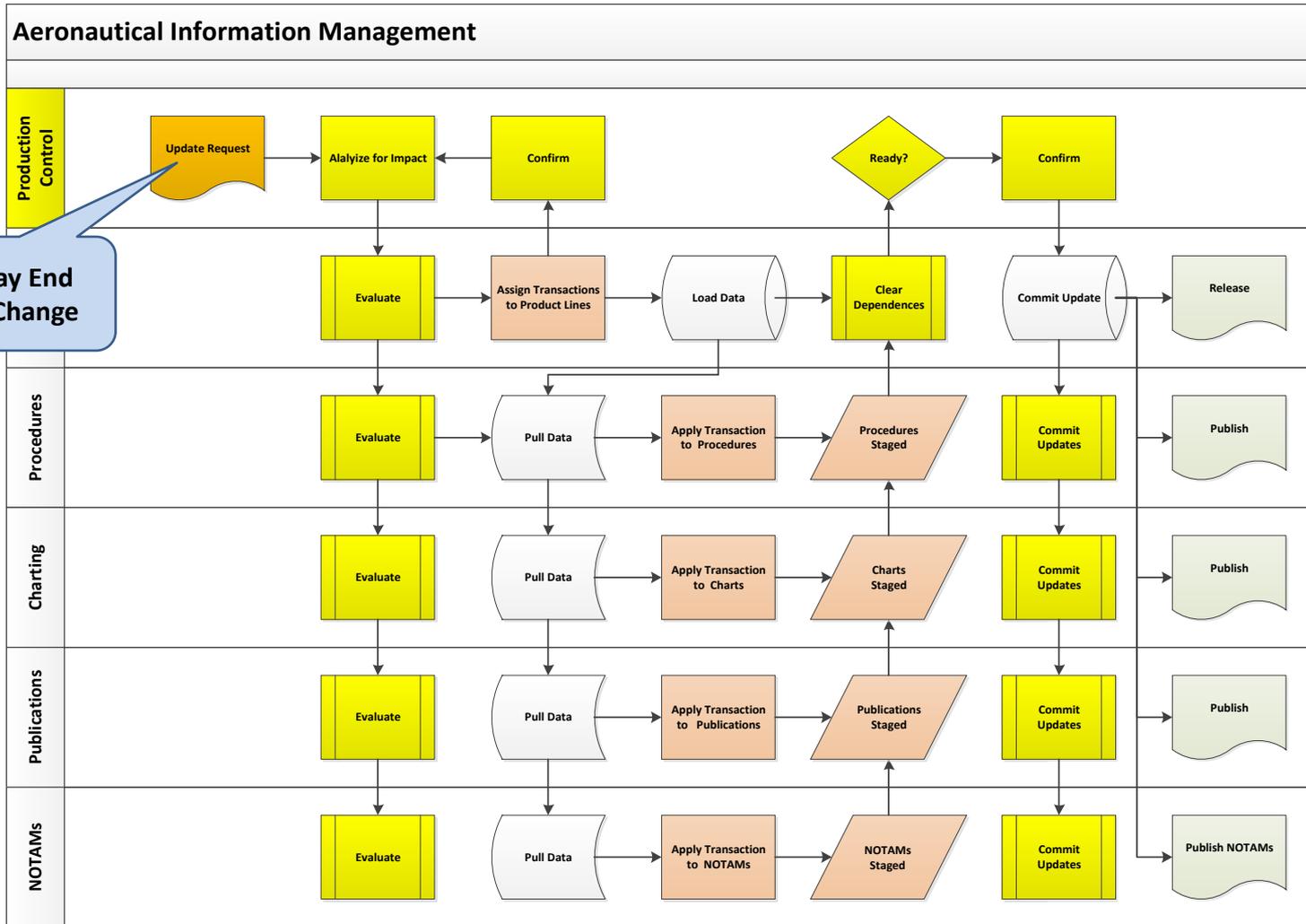
Date	Queue	Action
23 Aug 2019 1330	AIS	Submission
23 Aug 2019 1400	AIS	Accept
23 Aug 2019 1445	AIS	Evaluate
23 Aug 2019 1445	AIS	Update DB
23 Aug 2019 1445	AIS	Product Analysis
23 Aug 2019 1445	Chart B	Geo Rule Check
23 Aug 2019 1445	AIS	Authority Rule Check
23 Aug 2019 1445	Pub A	Temporality Rule Check
23 Aug 2019 1445	AIP	AIP Inclusion Rule
23 Aug 2019 1445	Pub A	Submission
23 Aug 2019 1445	Chart B	Submission
23 Aug 2019 1445	AIP	Submission
23 Aug 2019 1445	Pub A	Evaluate
23 Aug 2019 1445	Pub A	Accept
23 Aug 2019 1448	Pub A	Apply Transaction
23 Aug 2019 1525	Chart B	Evaluate

- Access the **Sample Activity Metadata** file in the Activities folder on the ICAO WACAF website drive
- Be ready to follow-along with presenter instructions

# AIS Activity Workflow (Hypothetical)

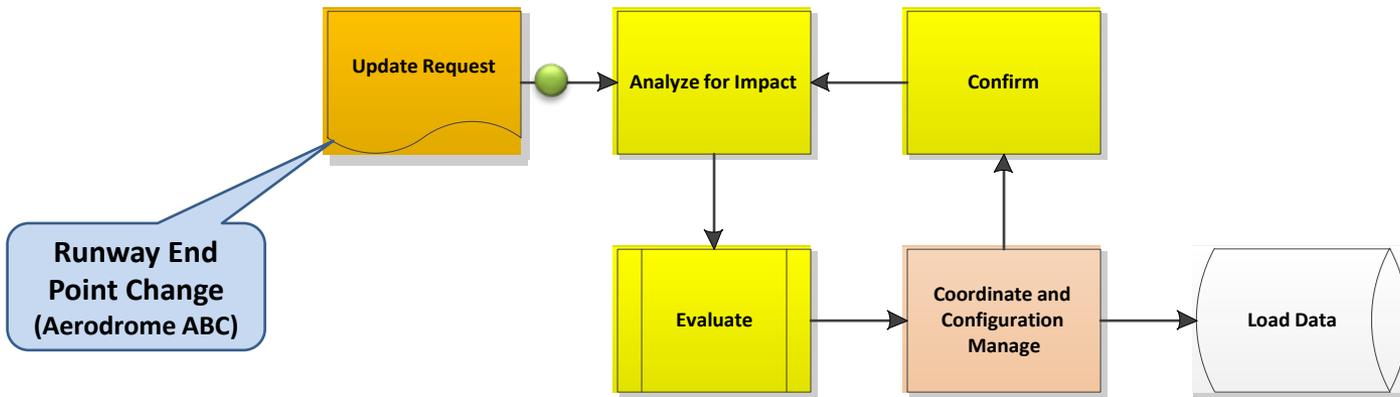


# Production Control Example



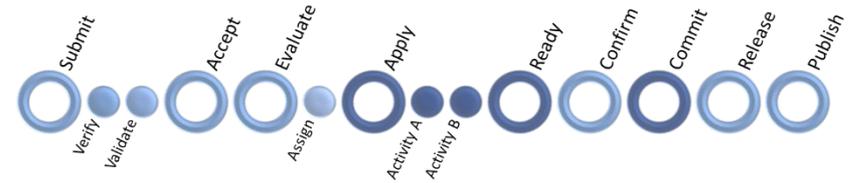
Runway End Point Change

# Initial Metadata Generation



Timestamp	Queue	Action	What	Who	Remark
23 Aug 2019 1330	AIS	Submission	Element X	ABC Airport Authority (Jane Doe)	Submission by airport
23 Aug 2019 1400	AIS	Accept	Element X	ANSP AIS (Sara Tomo)	Received by AIS, enters workflow
23 Aug 2019 1445	AIS	Evaluate	Element X	ANSP AIS (Tommy Ojo)	Evaluated, No errors detected
23 Aug 2019 1445	AIS	Product Analysis	Element X	AIS Analysis Scenario	2 Products affected (A and B)
23 Aug 2019 1445	Pub A	Submission	Element X	AIS Submission Scenario	
23 Aug 2019 1445	Chart B	Submission	Element X	AIS Submission Scenario	

# What's Next?



Timestamp	Queue	Action	What	Who	Remark
23 Aug 2019 1330	AIS	Submission	Element X	ABC Airport Authority (Jane Doe)	Submission by airport
23 Aug 2019 1400	AIS	Accept	Element X	ANSP AIS (Sara Tomo)	Received by AIS, enters workflow
23 Aug 2019 1445	AIS	Evaluate	Element X	ANSP AIS (Tommy Ojo)	Evaluated, No errors detected
23 Aug 2019 1445	AIS	Product Analysis	Element X	AIS Analysis Scenario	2 Products affected (A and B)
23 Aug 2019 1445	Pub A	Submission	Element X	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	Chart B	Submission	Element X	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	Pub A	Evaluate	Element X	Product Mgr (Sam Oto)	Required by product
23 Aug 2019 1445	Pub A	Accept	Element X	Product Mgr (Sam Oto)	
23 Aug 2019 1448	Pub A	Apply	Element X	Product Mgr (Sam Oto)	
23 Aug 2019 1525	Chart B	Evaluate	Element X	Product Mgr (Jane Wi)	Not required by product
23 Aug 2019 1525	Chart B	Dismiss	Element X	Product Mgr (Jane Wi )	

# Learning Question

How could you identify all of the data features contained in Pub A?

Timestamp	Queue	Action	What	Who	Remark
23 Aug 2019 1330	AIS	Submission	Element X	ABC Airport Authority (Jane Doe)	Submission by airport
23 Aug 2019 1400	AIS	Accept	Element X	ANSP AIS (Sara Tomo)	Received by AIS, enters workflow
23 Aug 2019 1445	AIS	Evaluate	Element X	ANSP AIS (Tommy Ojo)	Evaluated, No errors detected
23 Aug 2019 1445	AIS	Product Analysis	Element X	AIS Software	2 Products affected (A and B)
23 Aug 2019 1445	Pub A	Submission	Element X	AIS Software	Submit for evaluation
23 Aug 2019 1445	Chart B	Submission	Element X	AIS Software	Submit for evaluation
23 Aug 2019 1445	Pub A	Evaluate	Element X	Product Mgr (Sam Oto)	Required by product
23 Aug 2019 1445	Pub A	Accept	Element X	Product Mgr (Sam Oto)	Accept as Update or Insert
23 Aug 2019 1448	Pub A	Apply	Element X	Product Mgr (Sam Oto)	
23 Aug 2019 1525	Chart B	Evaluate	Element X	Product Mgr (Jane Wi)	Not required by product
23 Aug 2019 1525	Chart B	Dismiss	Element X	Product Mgr (Jane Wi)	

# Follow Along Activity

## Data Filters

- What updates were submitted in 2017?
- How many facilities had update requests?
- Were there any updates to facility ABD?
- How many updates affected each product line?

Date	Queue	Action	Facility	What	Who	Remark
23 Aug 2019 1330	AIS	Submission	ABC	Element X	ABC Airport Authority (Jane Doe)	Submission by airport
23 Aug 2019 1400	AIS	Accept	ABC	Element X	ANSP AIS (Sara Tomo)	Received by AIS, enters workflow
23 Aug 2019 1445	AIS	Evaluate	ABC	Element X	ANSP AIS (Tommy Ojo)	Evaluated, No errors detected
23 Aug 2019 1445	AIS	Update DB	ABC	Element X	ANSP AIS (Tommy Ojo)	
23 Aug 2019 1445	AIS	Product Analysis	ABC	Element X	AIS Analysis Scenario	2 Products affected (A and B)
23 Aug 2019 1445	Chart B	Geo Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	AIS	Authority Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	Pub A	Temporality Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	AIP	AIP Inclusion Rule	ABC	Element X	Rule Engine	
23 Aug 2019 1445	Pub A	Submission	ABC	Element X	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	Chart B	Submission	ABC	Element X	AIS Submission Scenario	Submit for evaluation

# Tracking Scenarios and Rules

Date	Queue	Action	Facility	What	Who	Remark
23 Aug 2019 1330	AIS	Submission	ABC	Element X	ABC Airport Authority (Jane Doe)	Submission by airport
23 Aug 2019 1400	AIS	Accept	ABC	Element X	ANSP AIS (Sara Tomo)	Received by AIS, enters workflow
23 Aug 2019 1445	AIS	Evaluate	ABC	Element X	ANSP AIS (Tommy Ojo)	Evaluated, No errors detected
23 Aug 2019 1445	AIS	Update DB	ABC	Element X	ANSP AIS (Tommy Ojo)	
23 Aug 2019 1445	AIS	Product Analysis	ABC	Element X	AIS Analysis Scenario	2 Products affected (A and B)
23 Aug 2019 1445	Chart B	Geo Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	AIS	Authority Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	Pub A	Temporality Rule Check	ABC	Element X	Rule Engine	
23 Aug 2019 1445	AIP	AIP Inclusion Rule	ABC	Element X	Rule Engine	
23 Aug 2019 1445	Pub A	Submission	ABC	Element X	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	Chart B	Submission	ABC	Element X	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	AIP	Submission	ABC	Element X	AIS Submission Scenario	
23 Aug 2019 1445	Pub A	Evaluate	ABC	Element X	Product Mgr (Sam Oto)	Required by product
23 Aug 2019 1445	Pub A	Accept	ABC	Element X	Product Mgr (Sam Oto)	
23 Aug 2019 1448	Pub A	Apply Transaction	ABC	Element X	Product Mgr (Sam Oto)	
23 Aug 2019 1525	Chart B	Evaluate	ABC	Element X	Product Mgr (Jane Wi)	Not required by product
23 Aug 2019 1525	Chart B	Tolerance Rule Check	ABC	Element X	Rule Engine	No change from current view
23 Aug 2019 1525	Chart B	Dismiss	ABC	Element X	Product Mgr (Jane Wi)	
21 Aug 2019 1330	AIS	Submission	ABD	Element R	ABD Airport Authority	Submission by airport
21 Aug 2019 1400	AIS	Accept	ABD	Element R	ANSP AIS (Sara Tomo)	Received by AIS, enters workflow
21 Aug 2019 1445	AIS	Evaluate	ABD	Element R	ANSP AIS (Tommy Ojo)	Evaluated, No errors detected
21 Aug 2019 1445	AIS	Update DB	ABD	Element R	ANSP AIS (Tommy Ojo)	
21 Aug 2019 1445	AIS	Product Analysis	ABD	Element R	AIS Analysis Scenario	2 Products affected (A and B)
23 Aug 2019 1445	AIP	AIP Inclusion Rule	ABD	Element R	Rule Engine	
21 Aug 2019 1445	Pub A	Submission	ABD	Element R	AIS Submission Scenario	Submit for evaluation
21 Aug 2019 1445	Chart B	Submission	ABD	Element R	AIS Submission Scenario	Submit for evaluation
23 Aug 2019 1445	Chart B	Evaluate	ABD	Element R	Product Mgr (Sam Oto)	Required by product
23 Aug 2019 1445	Chart B	Accept	ABD	Element R	Product Mgr (Sam Oto)	
23 Aug 2019 1445	Chart B	Activity 1	ABD	Element R	Carto (Mike H)	Updated Location
23 Aug 2019 1445	Chart B	Activity 2	ABD	Element R	Carto QA (Mike K)	Verified Location
23 Aug 2019 1448	Chart B	Apply Transaction	ABD	Element R	Product Mgr (Sam Oto)	Product is ready
23 Aug 2019 1448	Chart B	Commit	ABD	Element R	Automation	
23 Aug 2019 1525	Pub A	Evaluate	ABD	Element R	Product Mgr (Jane Wi)	Not required by product



# Questions and Discussion

