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System Wide Information Management

Pierre Truter

Chairman, Information Management Panel

16 March 2016

**"You can't expect to meet the challenges of today with yesterday's tools
and information and expect to be in business tomorrow."**





Objectives

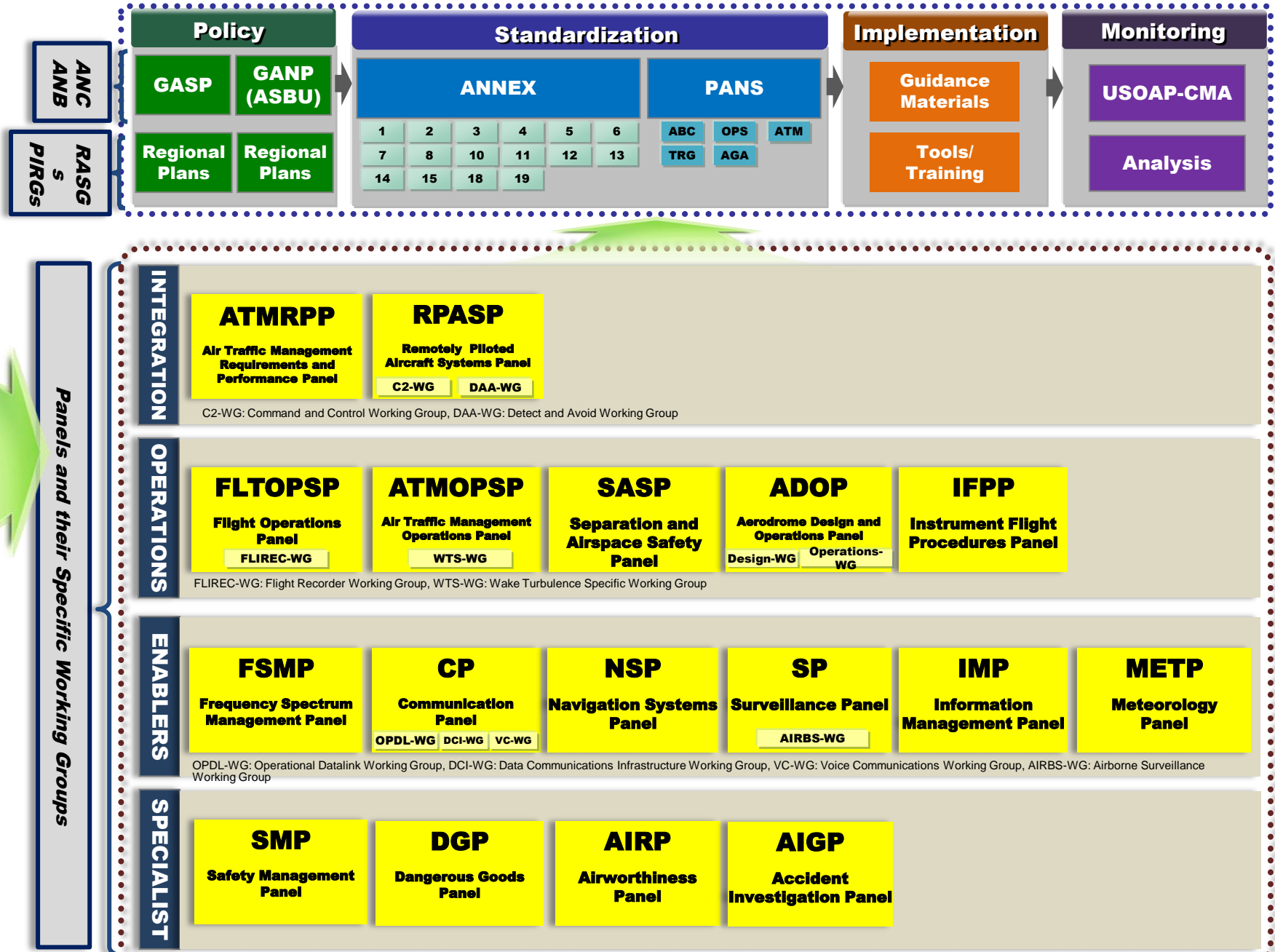
1. **Basic understanding of SWIM**
2. **Global SWIM activities.**
3. **APAC SWIM activities.**

Agenda

1. **What is SWIM and it's current status in ICAO.**
2. **SWIM data standards and it's operational use.**
3. **SWIM R&D activities.**
4. **ASBU Prioritisation.**
5. **APAC regional activities**
6. **Closing and Questions**

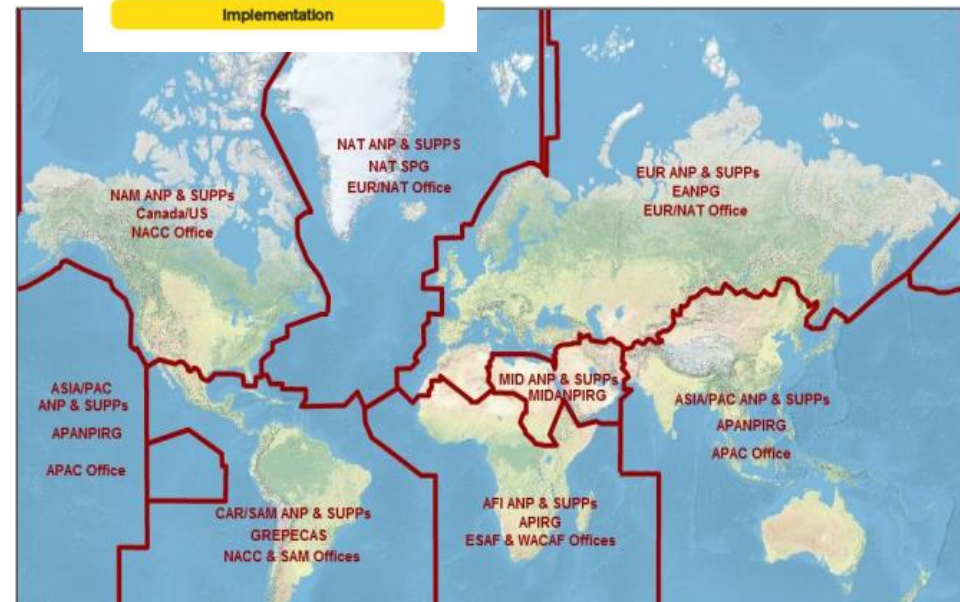
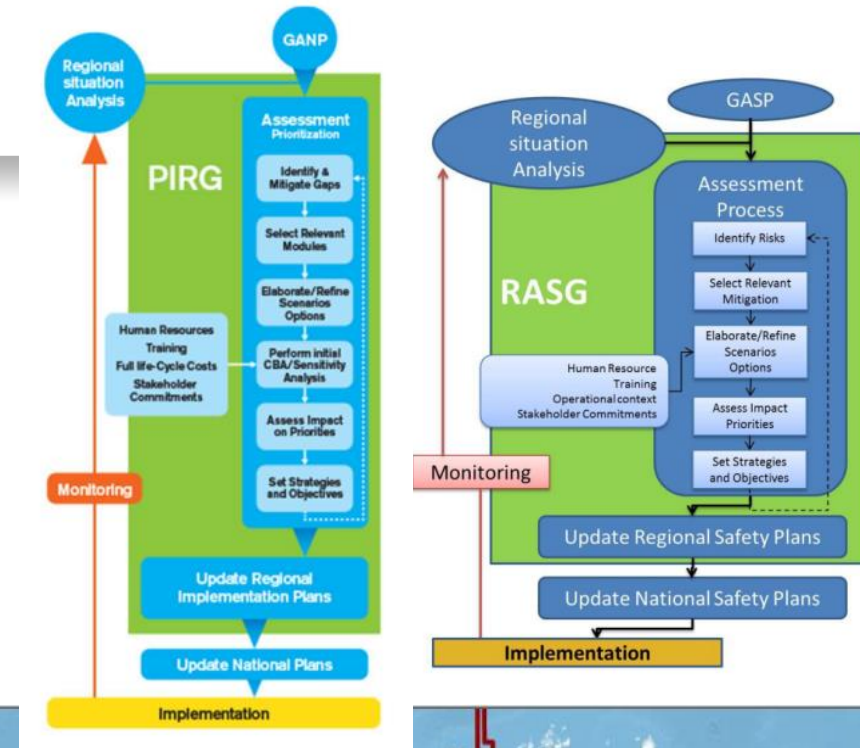
ICAO AIR NAVIGATION WORK SYSTEM

Air Navigation Work Programmes



PIRGs and RASGs

- **Key for Implementation support and monitoring**
- **Essential to know where States struggle**
- **Regional planning is essential to global planning**
- **Path for GANP and GASP update**
- **Consider reporting format**



(Planning and Implementation Regional Groups (PIRG) / Regional Aviation Safety Group (RASG))



Panel Objectives

Define a global interoperability framework describing the functions, architectures and system design requirements.

Define and elaborate on the ATM information management concepts:

- functions and processes required,
- including a business model to provide accredited, quality-assured and timely information required by actors within the air navigation system and used to support operations (including full FF-ICE, digital MET information exchange and NOTAM system review) on a system-wide basis, including avionics.

Identify the quality of service requirements necessary to maintain ATM information security, integrity, confidentiality and availability, and to mitigate the risks of intentional disruption and/or changes to safety-critical ATM information

Panel Objectives

Develop an ATM information service architecture.

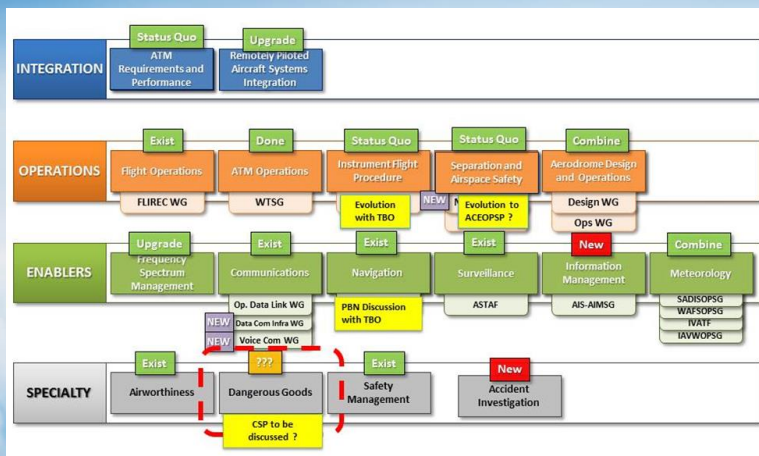
Identify the requirements for SARPs and changes to existing SARPs to support the information requirements in accordance with the Global Air Navigation Plan and:

- a) develop those SARPs necessary to enable SWIM'
- b) update and maintain the information management roadmap.

Develop transition strategies and guidance necessary for the implementation of global SWIM and new information exchange formats, including future avionic requirements.

Identify and plan for anticipated data and information flows in relation to future ATM requirements and capabilities and assess the capacity of appropriate Facilities to support them.

IMP, CP, METP and ARMRPP coordination





Information Management Panel and other ICAO Panel's Co-ordination

- **IMP = Information Management Panel.**
- **CP = Communications Panel.**
- **METP = Meteorology Panel.**
- **ATMRPP = ATM Requirements & Performance Panel.**



Future Joint Panel Meetings and Papers

- **Joint IMP and METP Ad-Hoc working group - Met will develop a high-level Met SWIM Plan, for IMP to review its alignment with AIXM/FIXM.**
- **IMP and CP Paper. Impact of SWIM (Registries) on future networks.**
- **Joint IMP and ATMRPP meeting – Nov 2016, Montreal.**



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System Wide Information Management (SWIM)



ICAO Doc 10039

Scope of the SWIM Manual

Limited to articulating the concept for SWIM necessary to:

- achieve global interoperability.
- describe a common framework to facilitate discussion and promote interoperability.

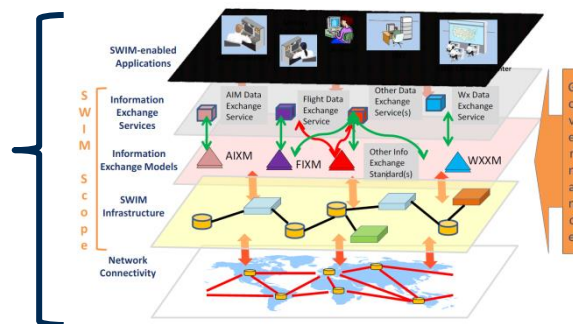
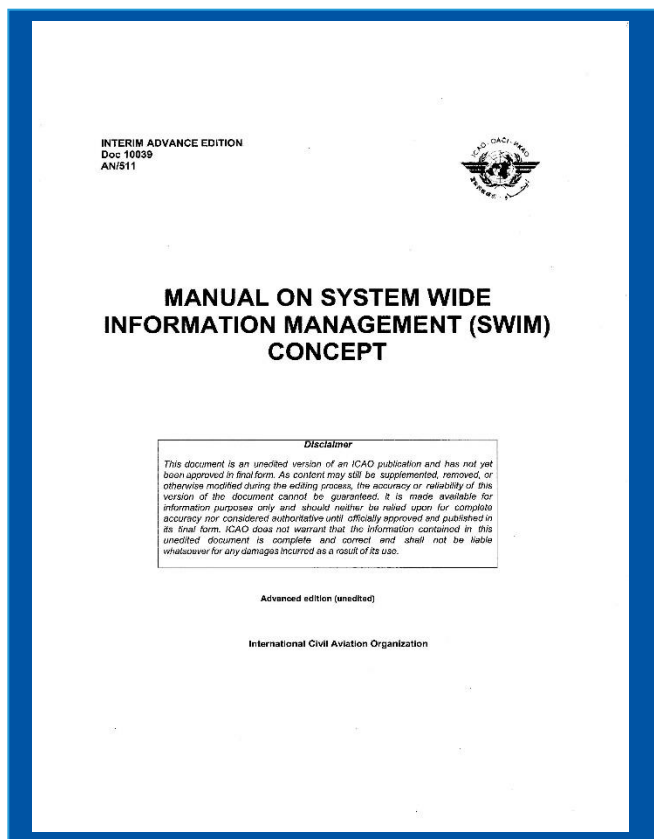


Figure 2. SWIM Global Interoperability Framework

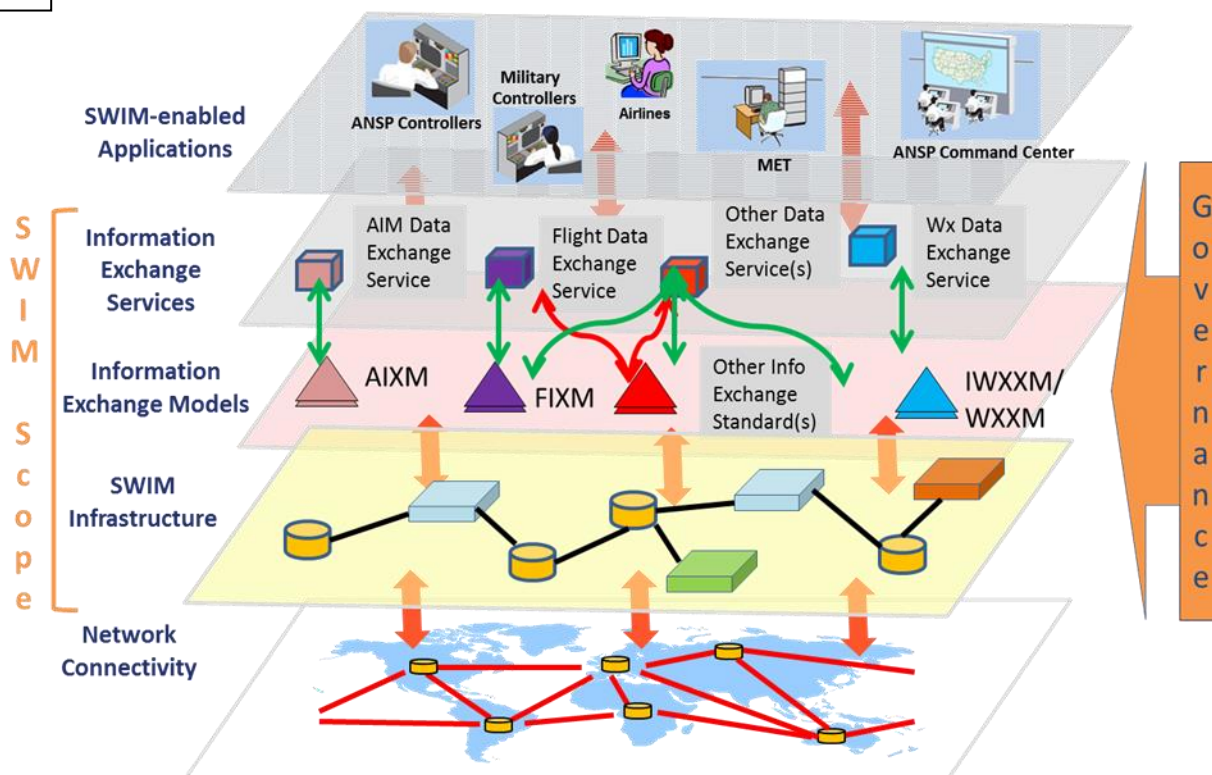
Doc 10039
AN/511

MANUAL ON SYSTEM WIDE
INFORMATION MANAGEMENT
(SWIM) CONCEPT

Disclaimer
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Advanced edition (continued)

**Definition : SWIM consists of
standards, infrastructure & governance
enabling the management of ATM information
and its exchange between qualified parties
via interoperable services."**



Purpose and Objective of the SWIM Manual

Purpose of the manual is:

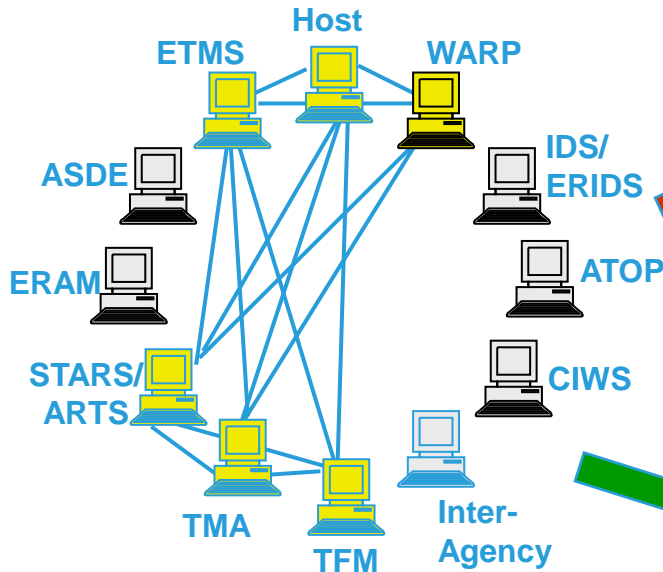
- to provide a vision for interoperable global information management.
- address the transition to a mixed operational environment.

The objectives are as follows:

- to assist in the creation of a common lexicon when states/groups desire to work together.
- to provide a background framework for states to implement SWIM.

State of the System

Today



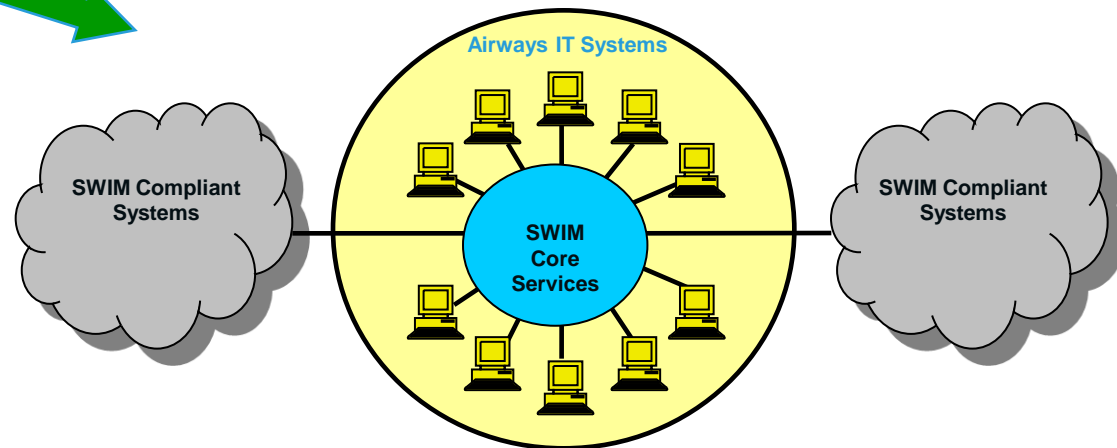
IT in the NAS Today

- Existing point-to-point hardwired National Airspace Systems.
- Unique interfaces, custom designs and ICD's for every interface.
- High IT cost and low ROI.
- No agile services delivery.
- Duplication of master data.

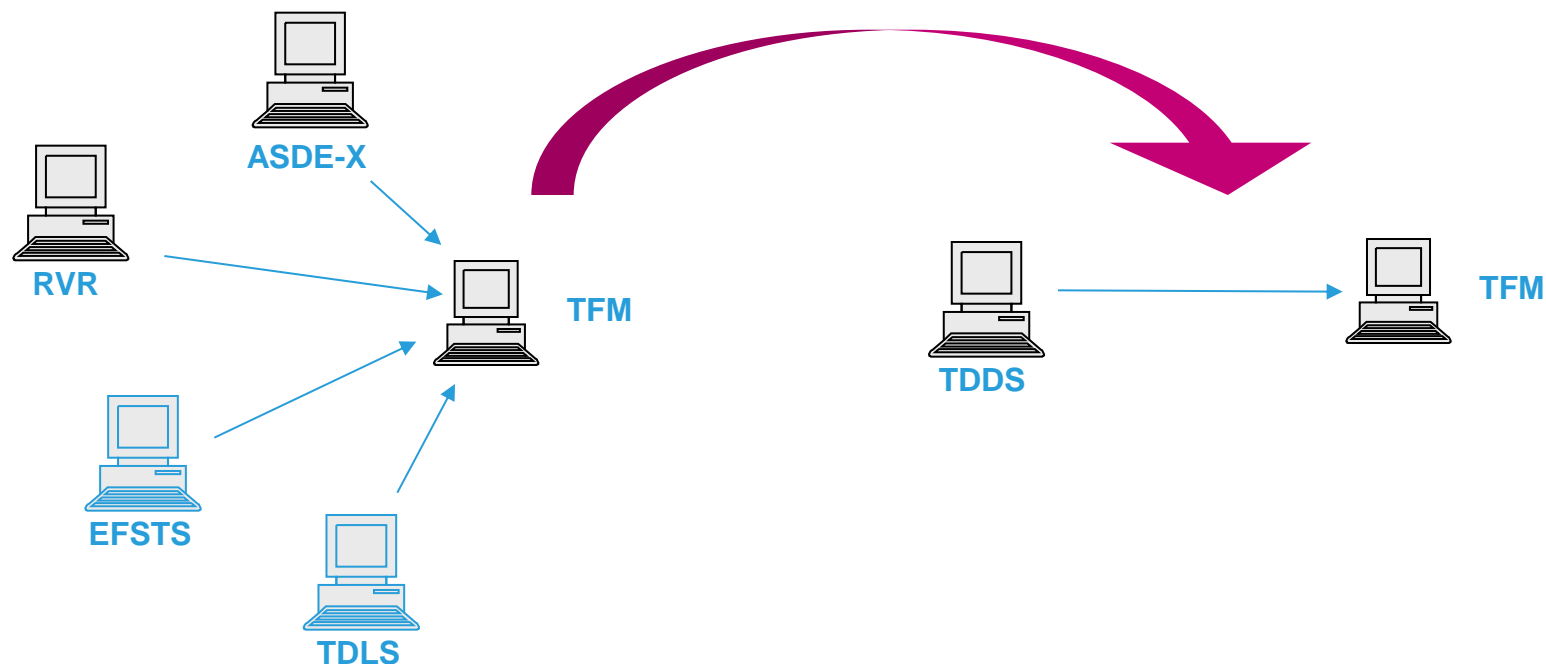
Business as Usual

- More point-to-point unique interfaces.
- Costly development, test, maintenance.
- New decisions linked to old data constructs.
- Cumbersome data access outside of Airways IT.

Enterprise Management (Implementing SOA)



Communicating via SWIM: One Example



TFM planned to
develop several
unique interfaces to
collect surface data

With SWIM, TFM
will have one
interface to acquire
the same data

SWIM Benefits

1. Improve decision making during all stages of flight through:
 - Improve shared situational awareness; and
 - Improved availability of quality data and information from authoritative sources
2. Increased system performance;
3. More flexible and cost effective communications by the application of common standards for information exchange;
4. Loose coupling which minimises the impact of change between information producers and consumers;
5. Support of ATM service delivery management.

SWIM use of Service Oriented Architecture (SOA)

When empowered by SOA, SWIM will enable stakeholders to capitalise on opportunities, new services and capabilities by drawing upon industry best practice which have been proven to provide these benefits:

1. More agile service delivery;
2. Cost reduction;
3. Return on Investment (ROI);
4. Meet IT Goals; The technology value of SWIM includes;
 - a. Simpler systems;
 - b. Lowering maintenance costs;
 - c. Enhancing architectural flexibility;
 - d. Lowering integration costs.

Future - 2 Tier Global system

(Modern and Legacy ANSPs)

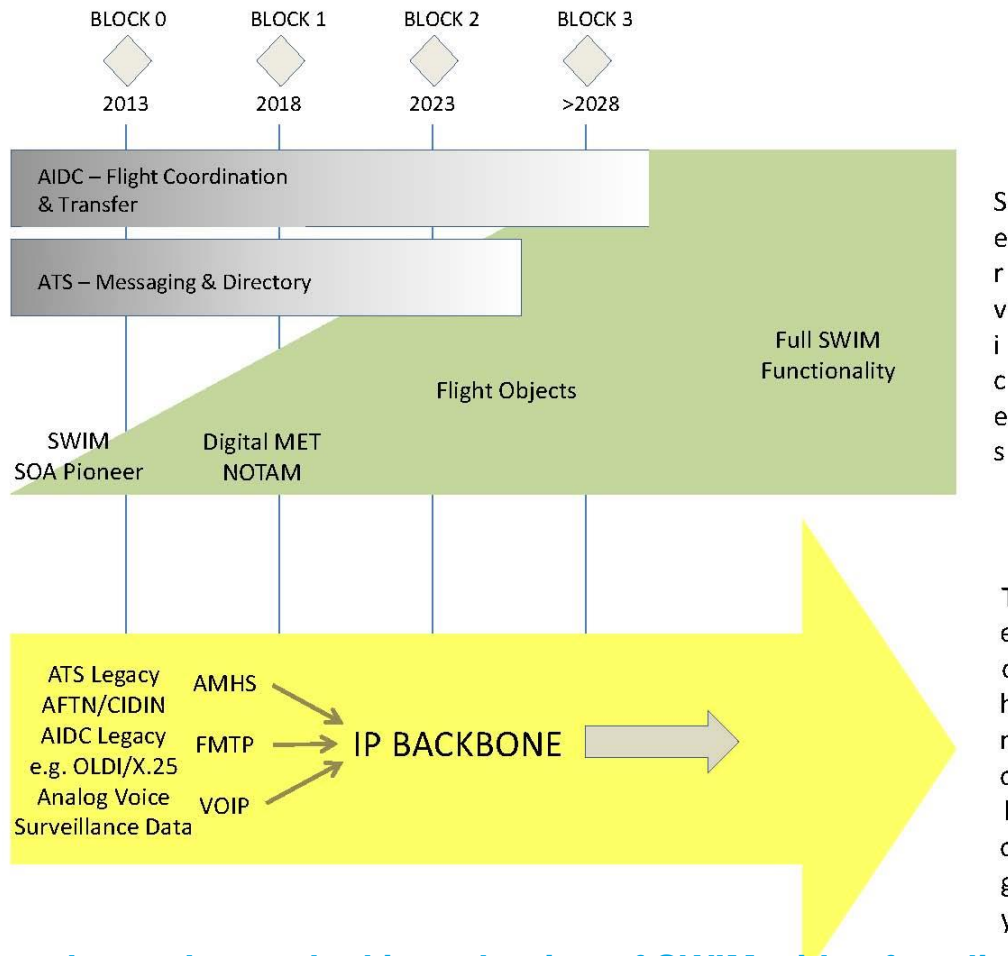
ICAO Doc 10039, paragraph 2.4.4 states:

“SOA is being pursued internally by ANSPs that have a large number of ATM systems which need to cooperate in order to provide ATM functions. ANSPs and other stakeholders with few systems may opt to retain their current architectures as long as the SWIM information services that they wish to provide/consume are exposed externally in a standardised SWIM manner.”

Other industry uses of SOA:

1. Military – Net Centric Warfare (C₄I₂).
2. Banking – Society for Worldwide Interbank Financial (SWIFT).

ICAO Doc 10039



This figure shows the gradual introduction of SWIM with a few digital services and an eventual merging into full SWIM functionality.



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SWIM Data Models



Aviation Data Exchange models

AIXM - Aeronautical Information Exchange Model

www.aixm.aero

WXXM – Weather Information Exchange Model

www.wxxm.aero

AIDX - Aviation Information Data Exchange

www.aidx.aero

FIXM - Flight Information Exchange Model

www.fixm.aero



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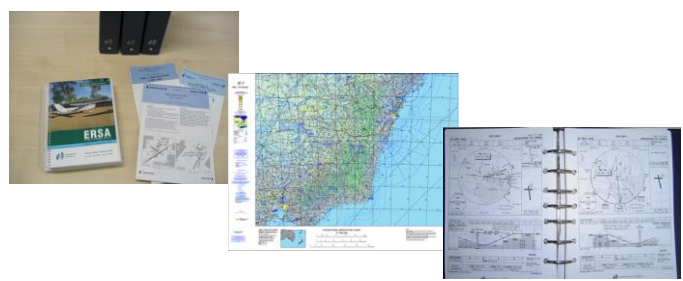
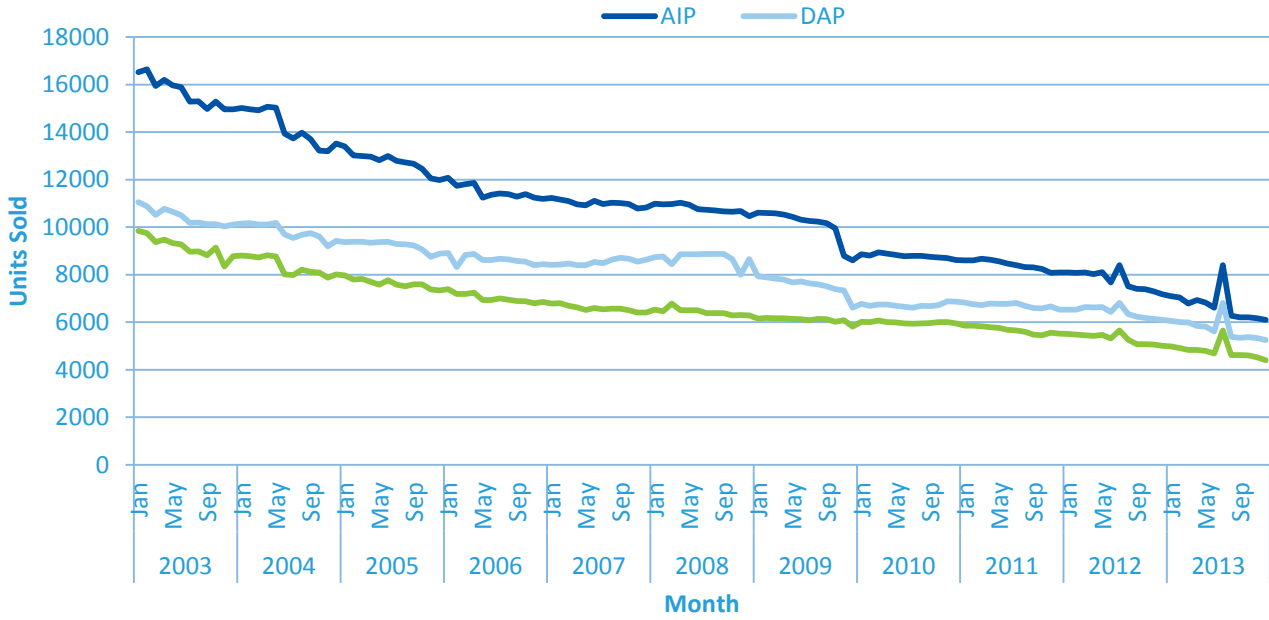
AIXM - Aeronautical Information Exchange Model





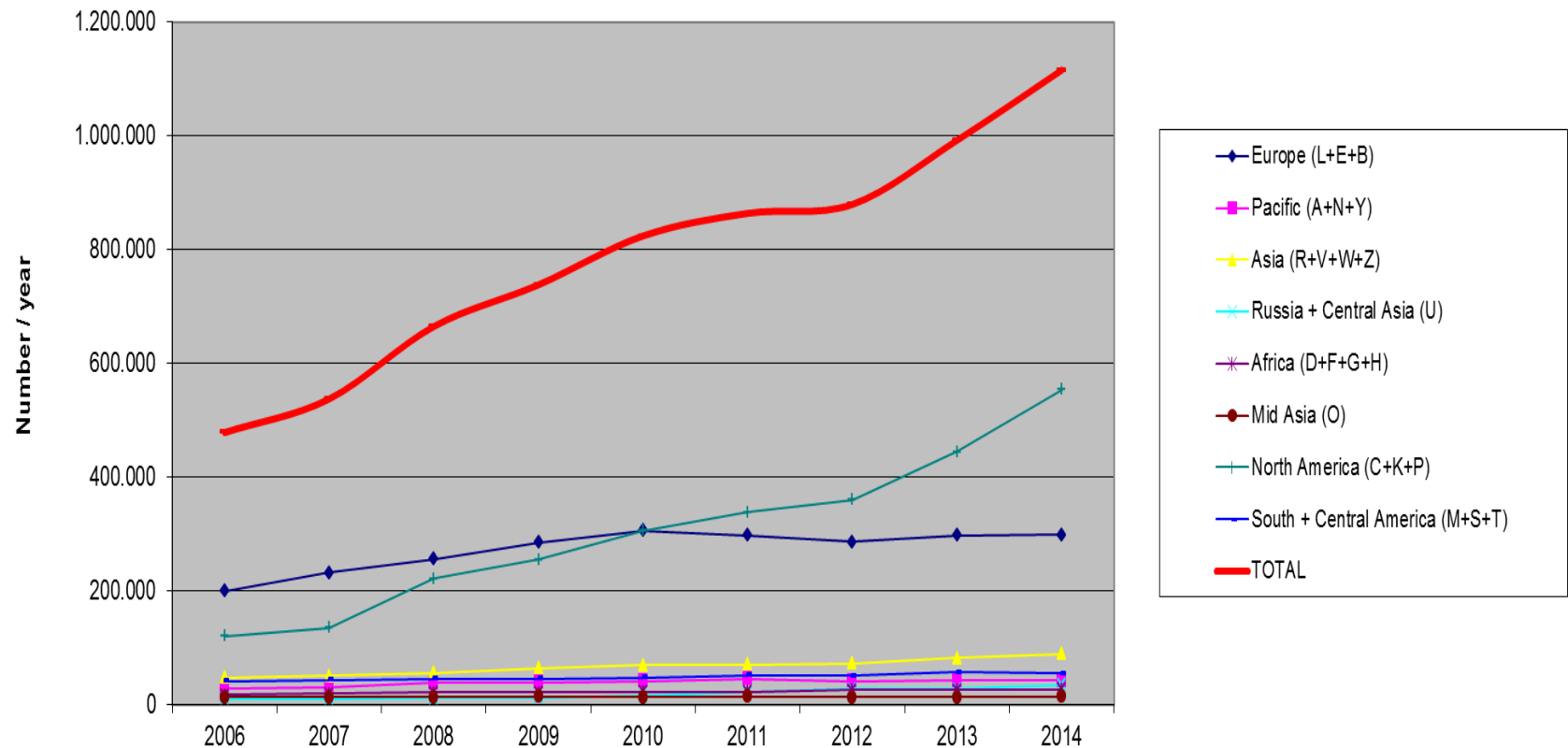
Digital Disruption of the ATC Business Model

Sale of Paper Products by Month
Jan 2003 - Dec 2013



NOTAM – Numbers going wild

(International) NOTAM Trends





Aero Glass
<http://glass.aero/>



www.glass.aero

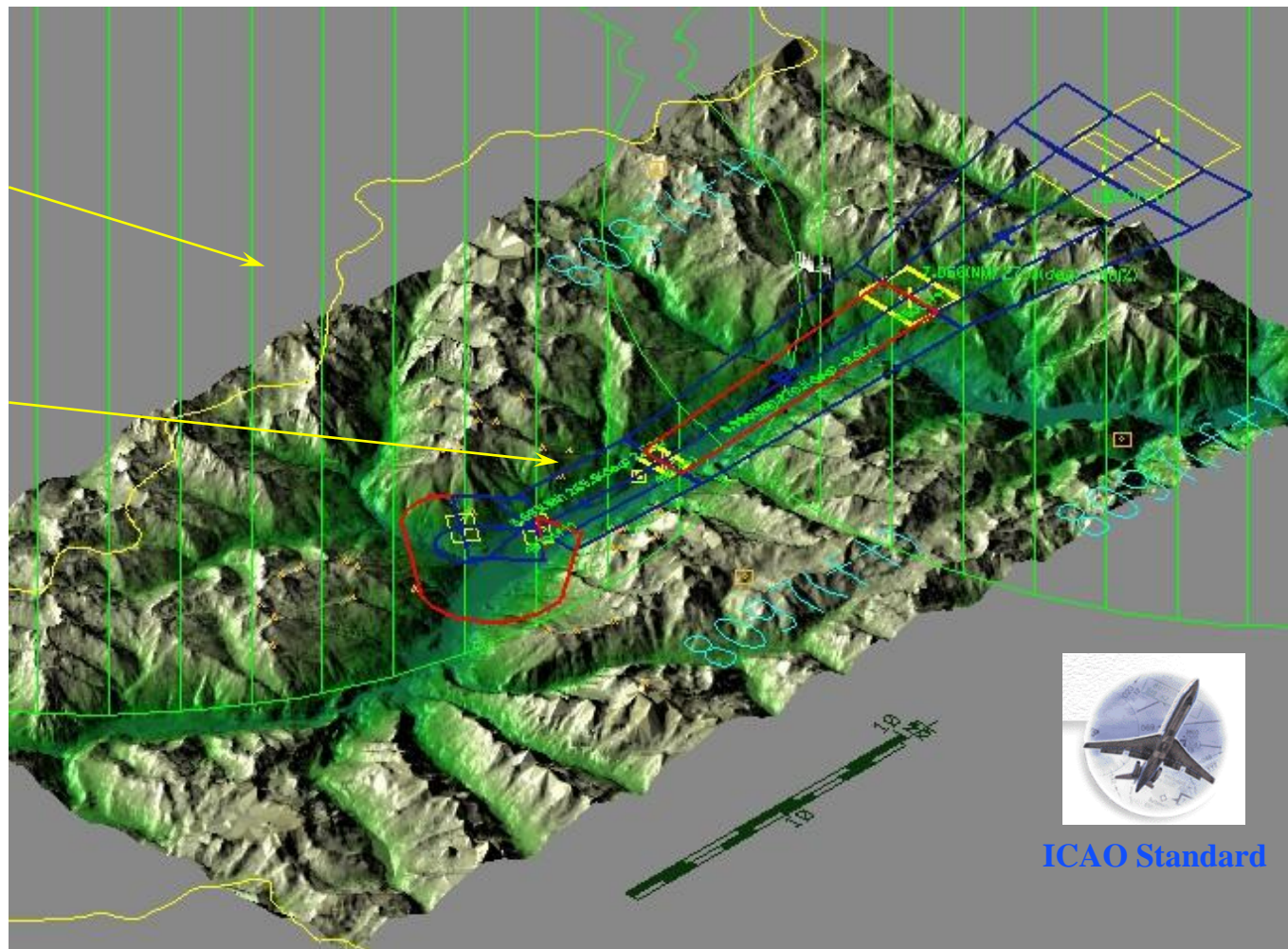


FPDAM GNSS & DME/DME Approach

Instrument Flight Procedures

Multi DME Update Area

GNSS Approach
And Missed Approach
Area





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FIXM - Flight Information Exchange Model





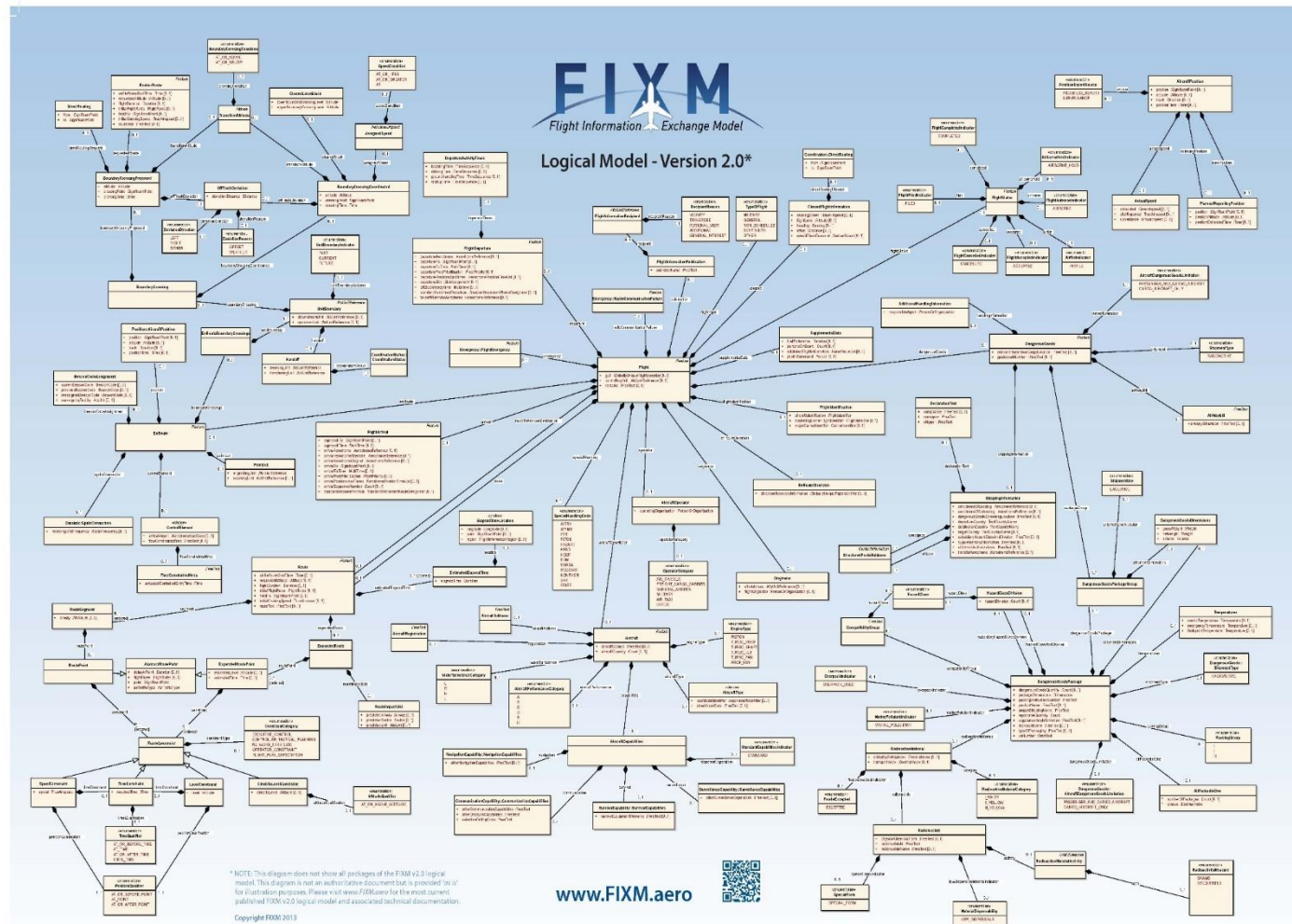
Current ICAO Flight Plan

This is a detailed view of the current ICAO Flight Plan form (FPL). It includes sections for flight details, aircraft information, and communication data. The form is structured with various fields and checkboxes for different types of flights and equipment.

This is a detailed view of the International Flight Plan form (FPL). It includes sections for flight details, aircraft information, and communication data. The form is structured with various fields and checkboxes for different types of flights and equipment.



Future Flight Plan





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iWXXM - Weather Information Exchange Model





ICAO and WMO Packages



ICAO Responsibility

Aviation requirements and regulation

ICAO Meteorological Information Exchange Model (IWXXM)

METAR, SPECI, TAF, and SIGMET representations

Simple Aeronautical Features (SAF)

Simplified features from the aeronautical domain



WMO Responsibility

Weather regulation and technical implementation

Meteorological Community Exchange Model (METCE)

WMO logical data model, specifically Observations and Measurements (O&M) specializations

Observable Property Model (OPM)

Qualifications and constraints on observed properties



Standards Relationship



ICAO Annex 3 products:
METAR/SPECI,
TAF, SIGMET



US Specializations of
ICAO Annex 3 products:
US METAR/SPECI,
US TAF, US SIGMET



Next-generation aviation
weather products:
Contours, aircraft
reports, gust front,
motion vector, etc.

Next-generation products may feed into
IWXXM over time

IWXXM and WXXM

IWXXM

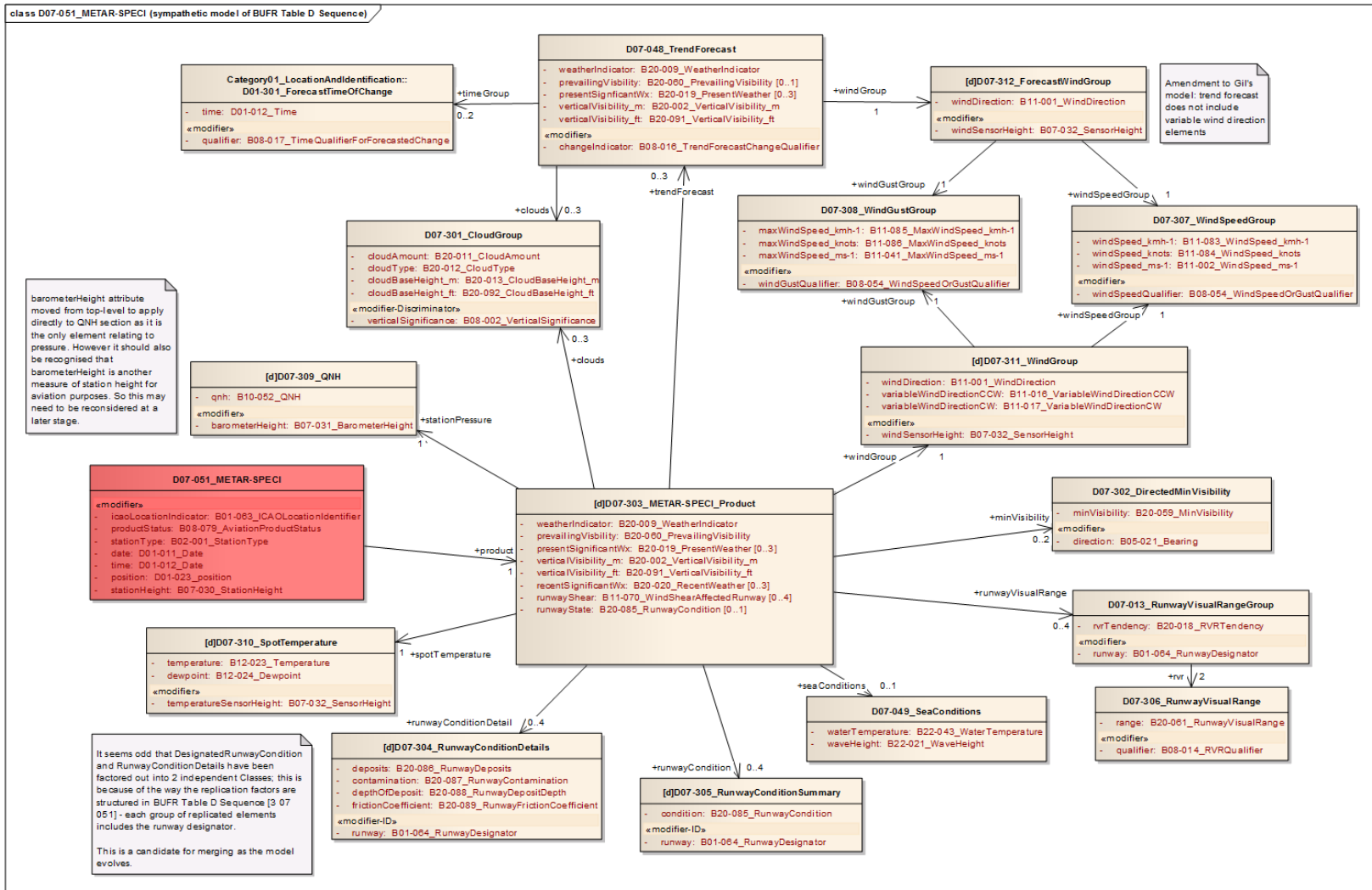
- Strict and complete representation of ICAO Annex 3 products – METAR, SPECI, TAF, SIGMET (**regulated** products)
- Business rules strongly enforced
- Managed by ICAO and WMO
- Updated on roughly the same time scale as ICAO Annex 3 (currently 3 years)

WXXM

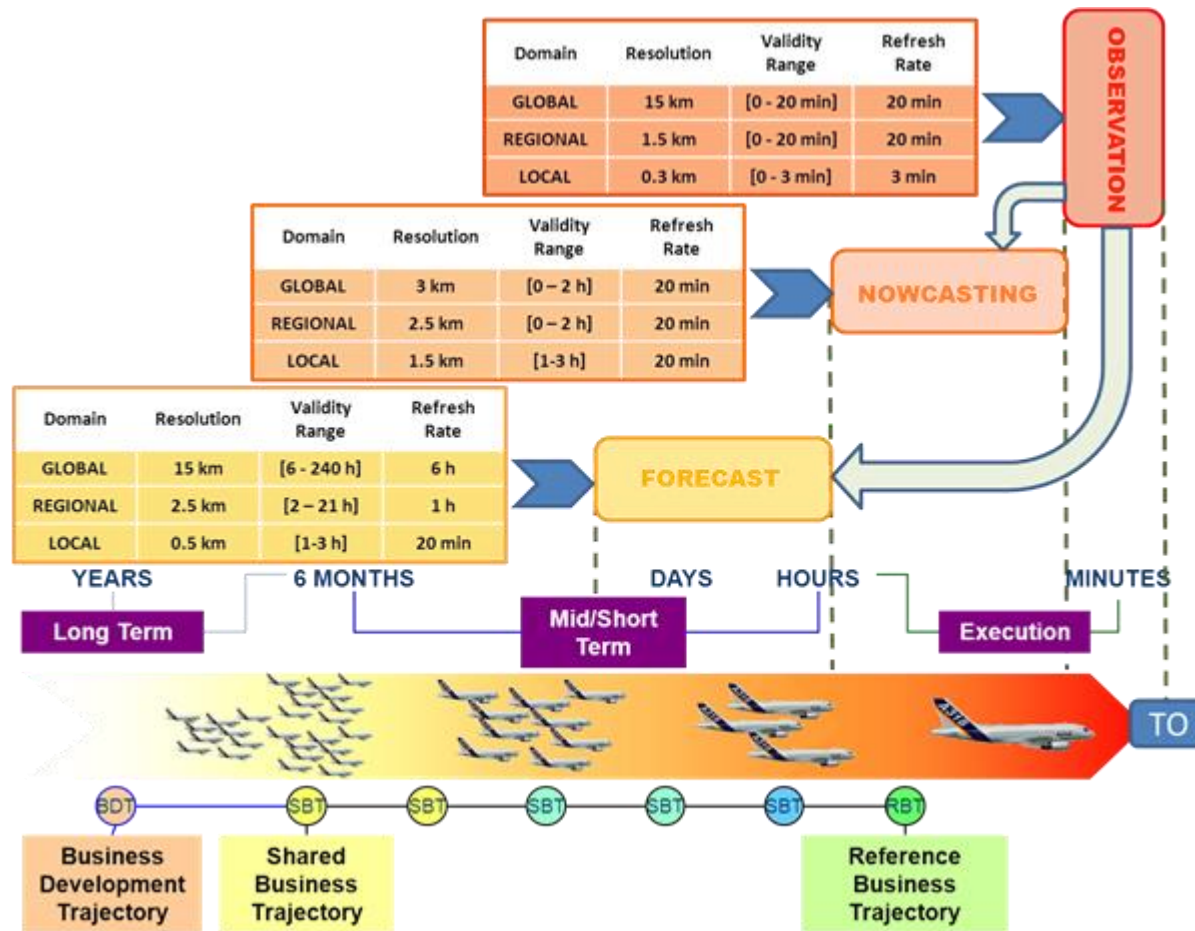
- Next-generation aviation and weather data representations
- General purpose, reusable data types (aerial report, profile, trajectory, area forecast, point forecast, etc.)
- Open/extensible content policy
- Many products and data types beyond ICAO Annex 3
- Managed by Eurocontrol, FAA, and other partners
- Updated roughly every year



METAR / SIGMET model



Met Information Services to support TBO





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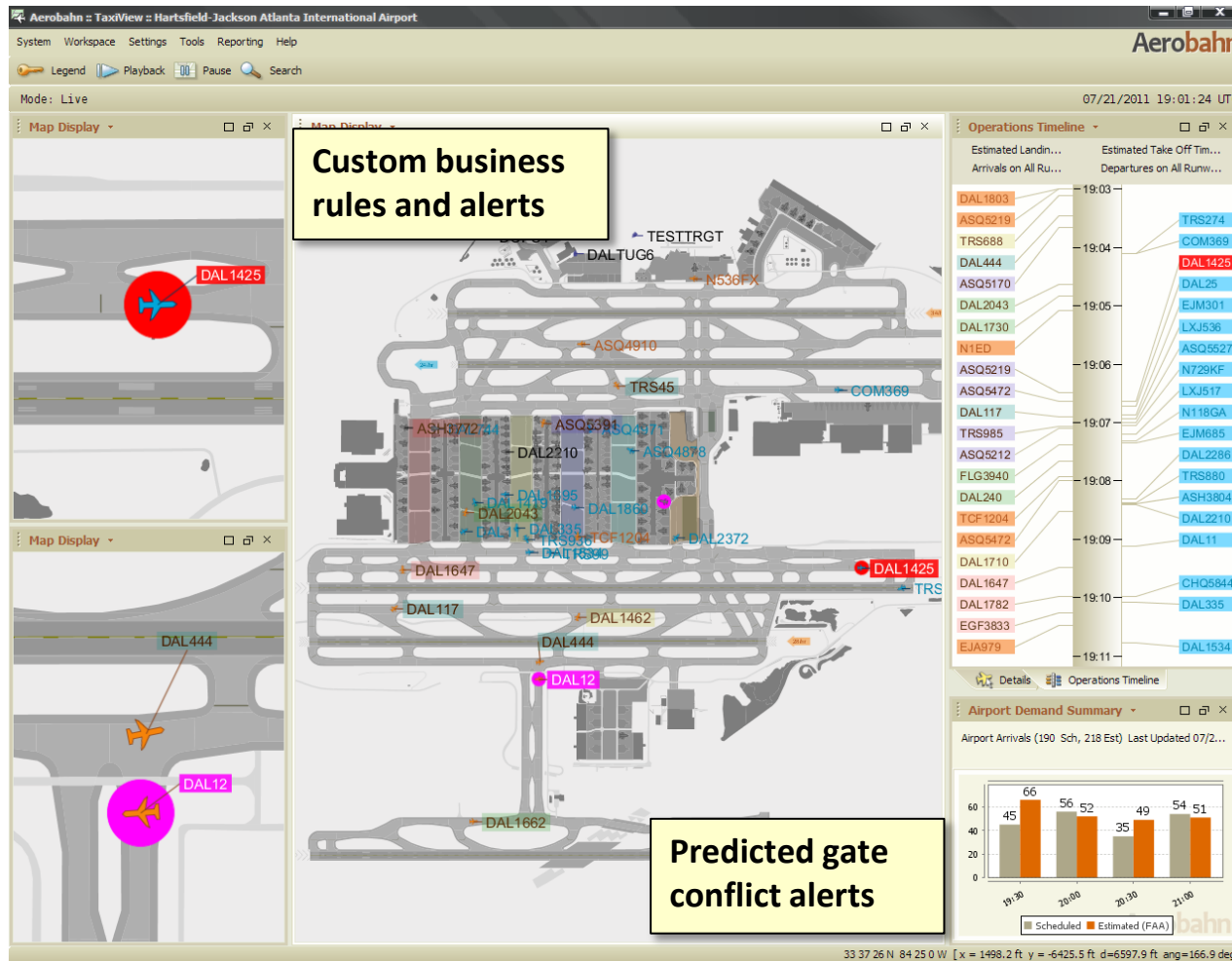
AIDX - Aviation Information Data Exchange



- The "AIDX" initiative as defined by International Air Transport Association, Air Transport Association and Airports Council International (IATA/ATA/ACI).
- Is the new official world standard for exchanging flight data between airlines, airports, vendors and systems.
- Airport CDM – information sharing is essential in that it forms the foundation for all the other elements and must be implemented first.

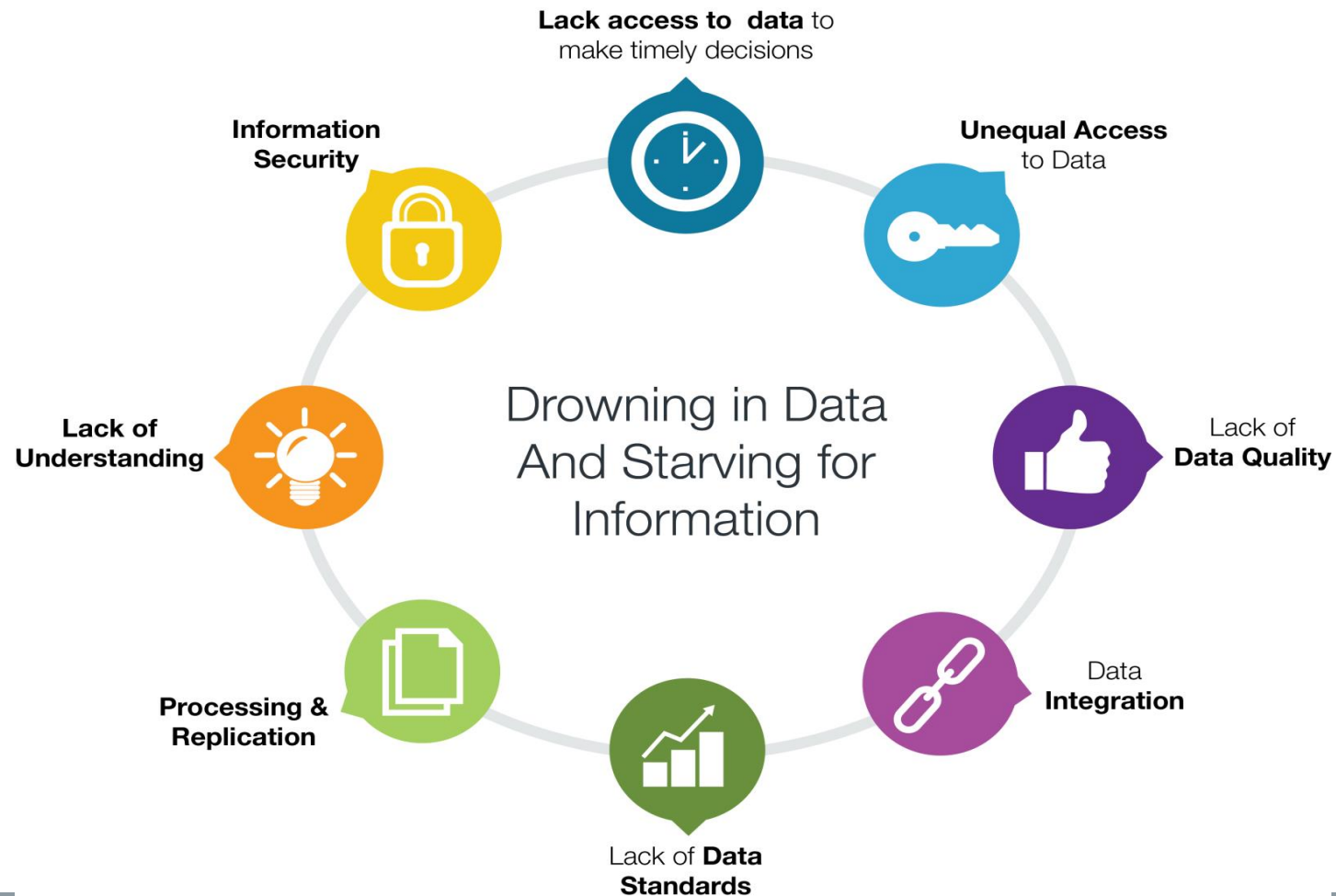


ATC SURFACE MANAGER



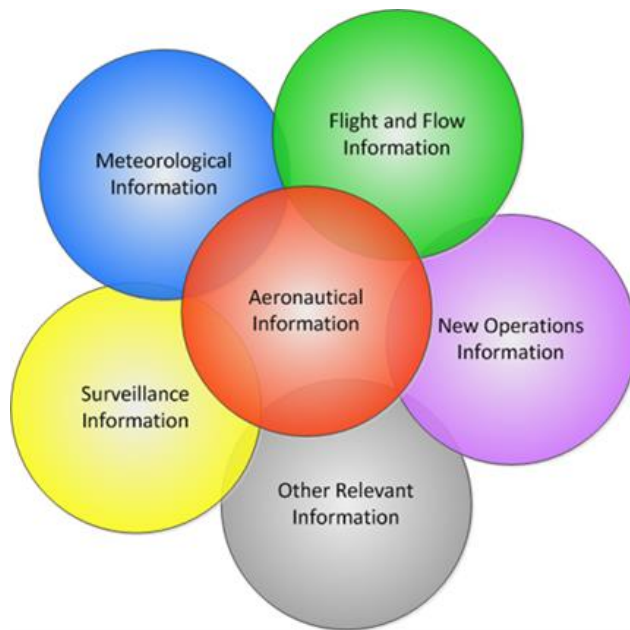


What is our information management challenge?



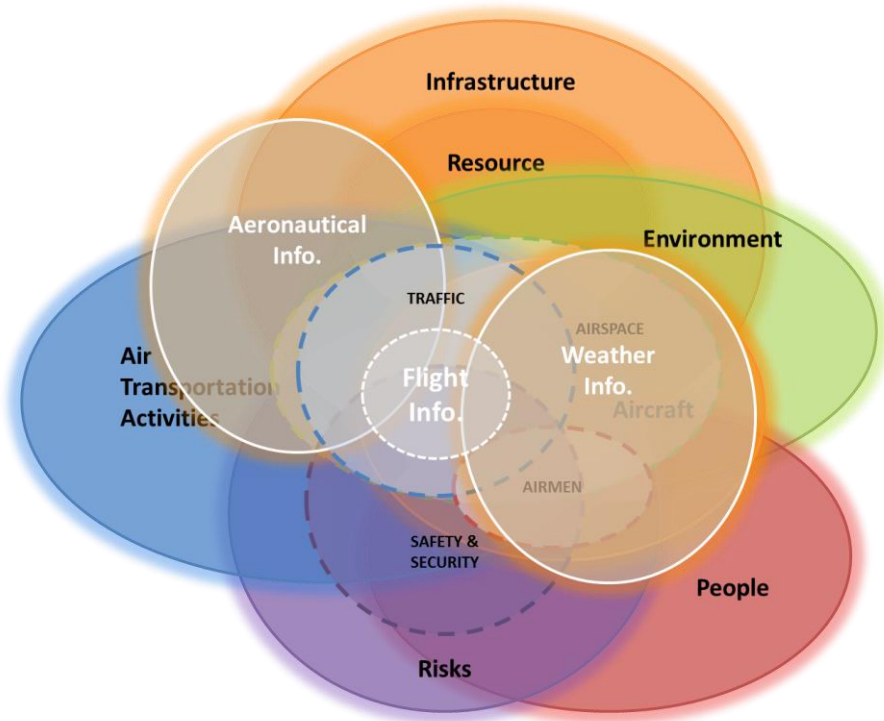
How do we see Information Domains?

This is how users see information



This is how we manage data

ICAO Information Areas



Information Domains

Significant overlap with traditional areas



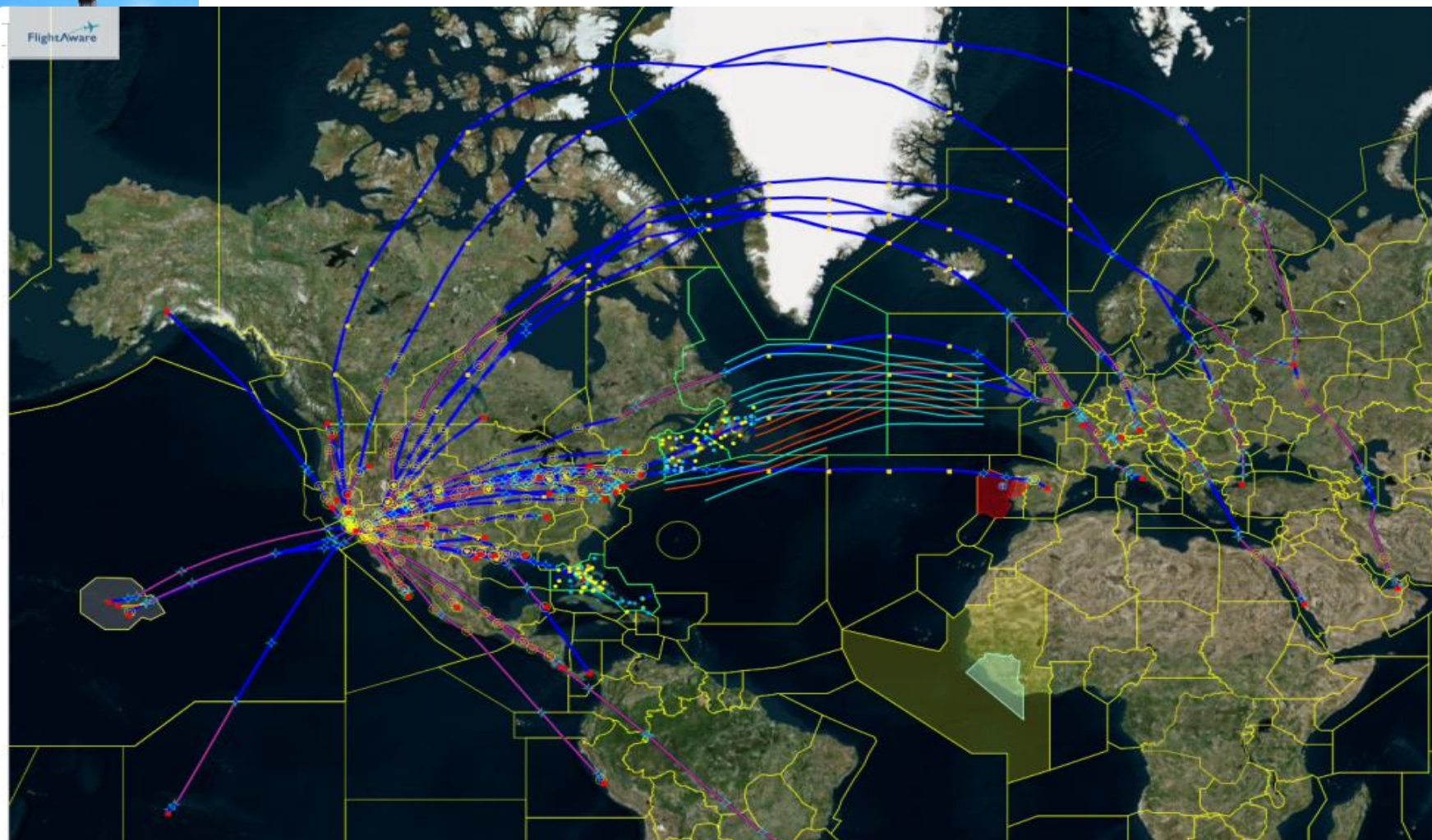
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How real is this all ?



Sources: NM, EAD, NAT Tracks, FAA NASR56, FlightAware, WAFC, ...



How real is this all ?

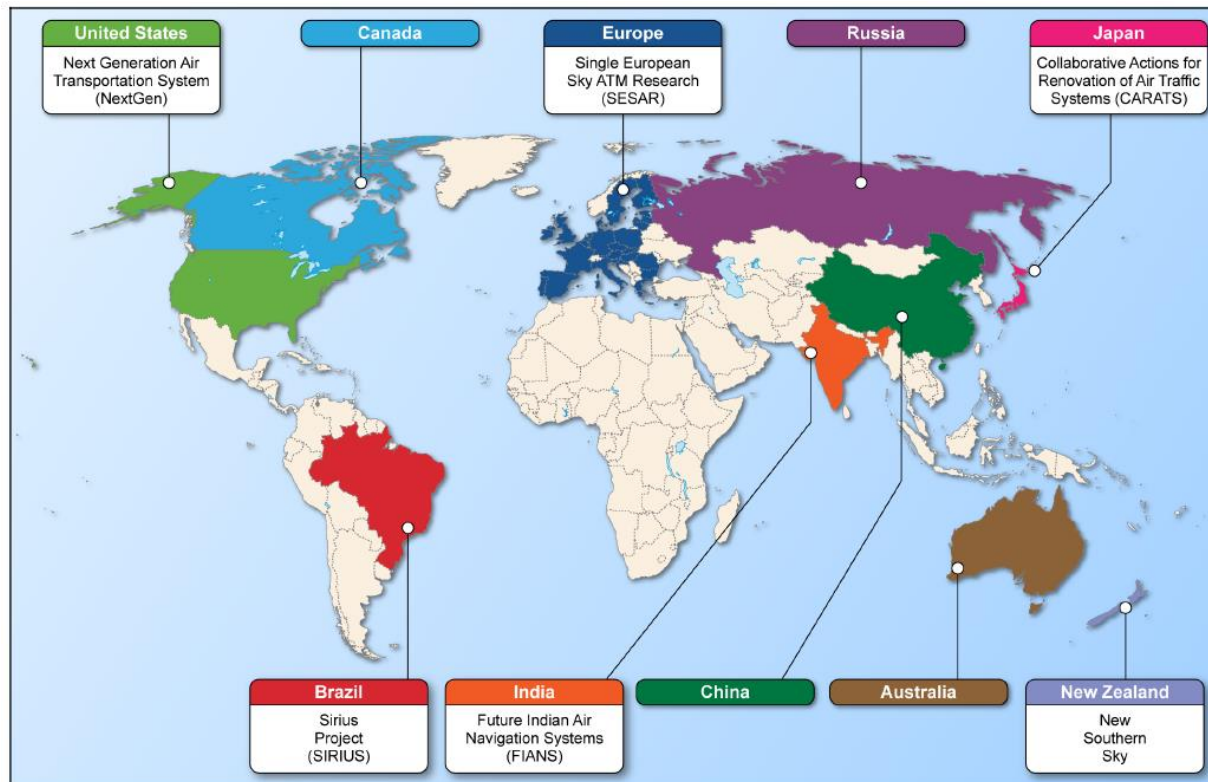
METAR: SADIS only for weather stations with location indicator starting with Y.
Surveillance: live FlightAware. Green spots are flight position for aircraft id starting with QFA.



Sources: EAD, FlightAware, Air Services Australia, SADIS, ...



Examples of Air-Traffic Management (ATM) modernisation programs worldwide.



Source: GAO. | GAO-15-608

Note: Canada, China and Russia have modernisation programs underway, but do not have umbrella names for these programs. All these countries are members of the Information Management Panel.



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SWIM Global R&D activities



1. FAA Mini Global Demonstration –
Integrating information towards
digital ATM.
 - Program overview
 - Mini Global – SESAR Interoperability
Scenario Overview
2. SESAR SWIM Global Demo
 - Airservices Digital NOTAM demo



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ASBU Prioritisation

Global Air Navigation Plan (2013-2028)





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CAPACITY AND EFFICIENCY

2013–2028 Global Air Navigation Plan

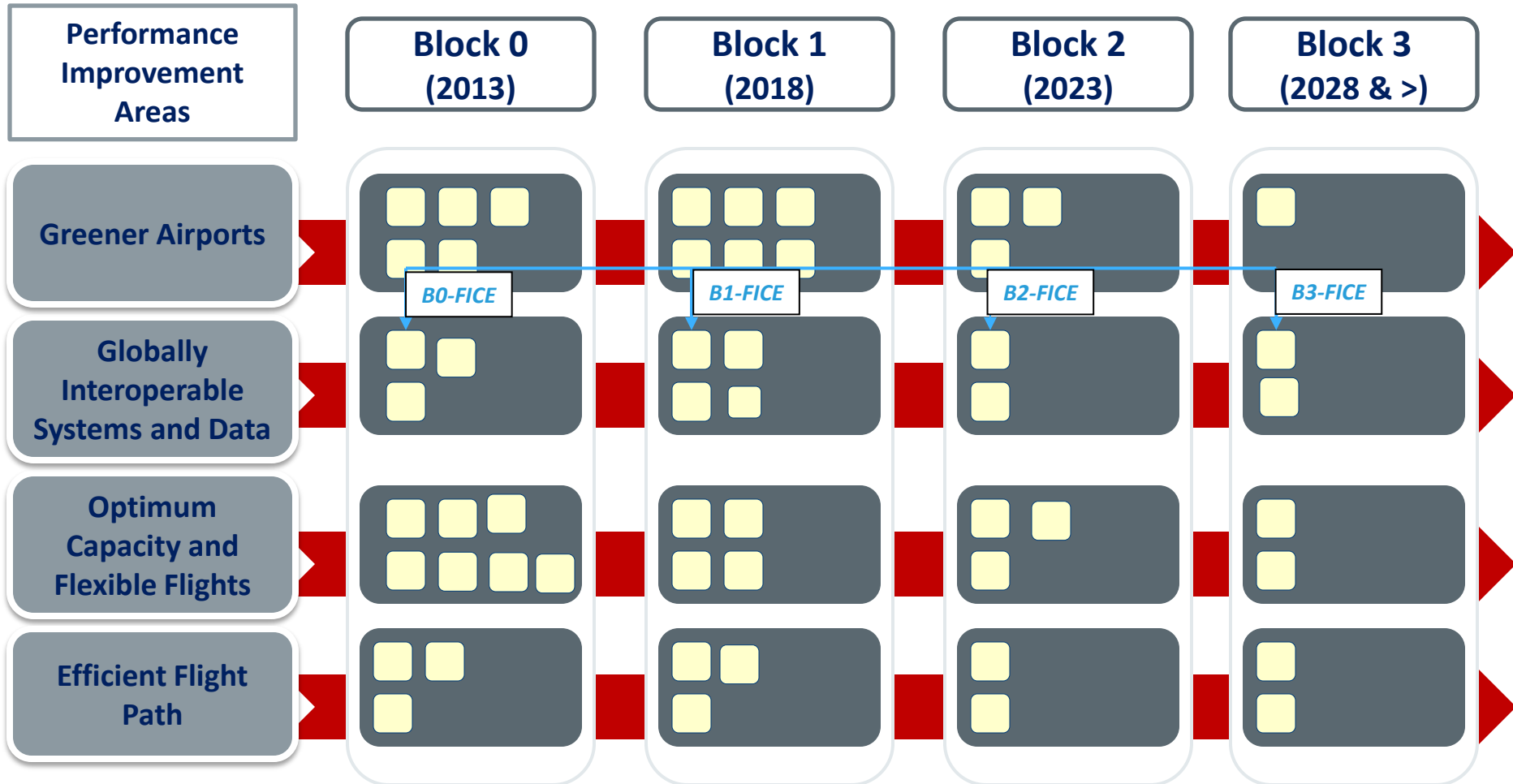


Doc 9750-AN/963 Fourth Edition – 2013



INTERNATIONAL CIVIL AVIATION ORGANIZATION
A United Nations Specialized Agency

Aviation System Block Upgrades



ASBU Prioritisation Categorisation

The proposed categories are:

- **Essential (E):** These are the ASBU modules that provide substantial contribution towards global interoperability, safety or regularity.
- **Desirable (D):** These are the ASBU modules that, because of their strong business and/or safety case, are recommended for implementation almost everywhere.
- **Specific (S):** These are the ASBU modules that are recommended for implementation to address a particular operational environment or mitigate identified risks.
- **Optional (O):** These are the ASBU modules that address particular operational requirements and provide additional benefits that may not be common everywhere.

ASBU Essential Modules

The Essential Modules are:

- **FICE (Flight/Flow Information for a Collaborative Environment).**

Implement ground-ground exchanges using common flight information reference model, FIXM, XML and the flight object used before departure and exchange and distribution of information for multicentre operations using flight object implementation and IOP standards

- **DATM (Digital Air Traffic Management Information).**

Initial introduction of digital processing and management of information, by the implementation of AIS/AIM making use of AIXM, moving to electronic AIP and better quality and availability of data. Implementation of the ATM information reference model integrating all ATM information using UML and enabling XML data representations and data exchange based on internet protocols with WXXM for meteorological information.

- **SWIM (System Wide Information Management).**

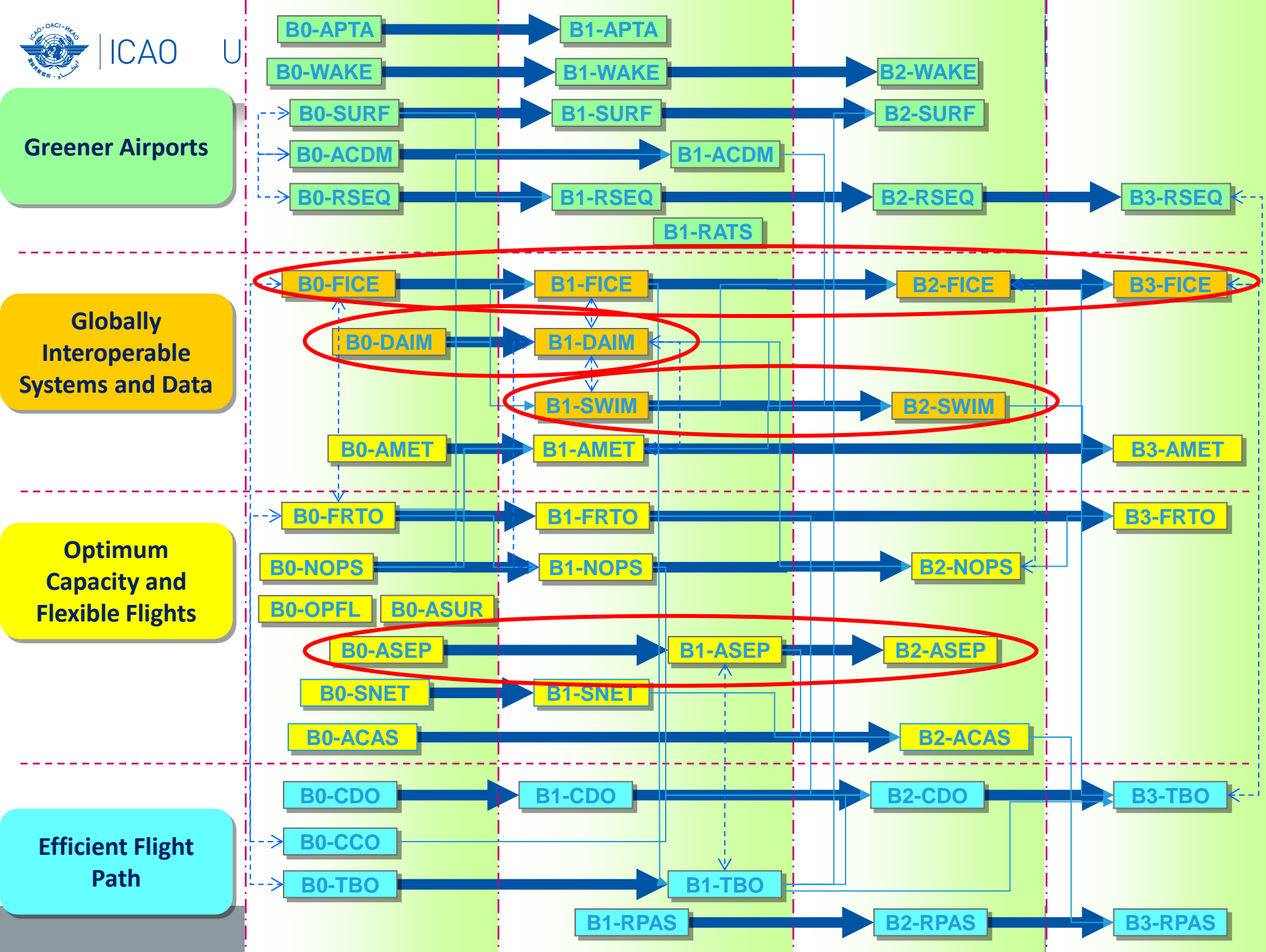
Implementation of SWIM services (applications and infrastructure) creating the aviation intranet based on standard data models, and internet based protocols to maximise interoperability. Connection of the aircraft an information node in SWIM enabling participation in collaborative ATM processes with access to rich voluminous dynamic data including meteorology.

- **ASAS (Airborne Separation Assurance Systems).**

Create operational benefits through precise management of intervals between aircraft whose trajectories are common or merging, thus maximizing airspace throughput while reducing ATC workload and enabling more efficient aircraft fuel burn reducing environmental impacts.



U





Closing

- **Next Panel Meetings**
 - **25 to 29 April 2016 – Paris**
 - **14 to 18 November - Montreal**
- **Expectation of additional working groups.**
 - **Cyber security.**
- **Global Aeronautical Distress and Safety System (GADSS)**
 - **Develop GADSS Information Management Framework.**
 - **Develop GADSS communication Framework.**
 - **Assess feasibility of new provisions to require ANSPs to share aircraft position data.**

“The ATM community will depend on information management, shared on a system-wide basis, to make informed collaborative decisions for best business and operational outcomes. Within the ATM system, based on this operational concept, it will be the information itself that will be of significance and not the technology that supports it.”



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(WACAF) Office
Dakar

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North Atlantic
(EUR/NAT) Office
Paris

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(MID) Office
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Southern African
(ESAF) Office
Nairobi

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THANK YOU