



# 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.**

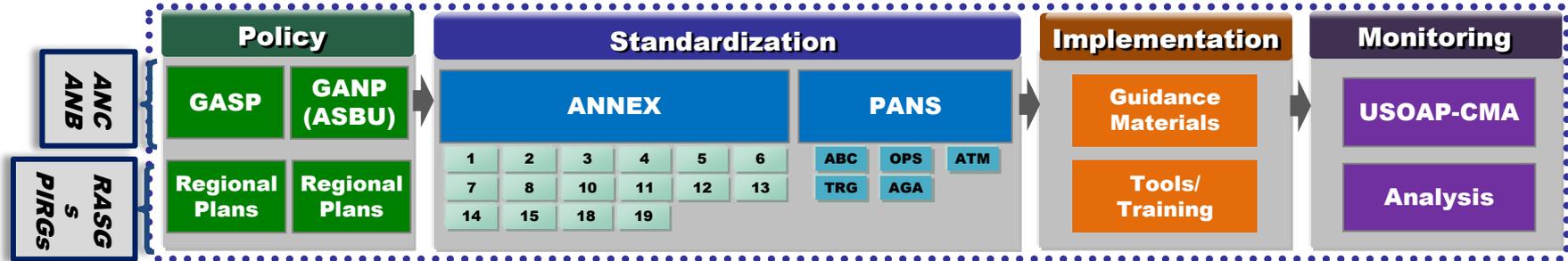


# Agenda

- 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



**INTEGRATION**

**ATMRPP**  
Air Traffic Management Requirements and Performance Panel

**RPASP**  
Remotely Piloted Aircraft Systems Panel

C2-WG    DAA-WG

C2-WG: Command and Control Working Group, DAA-WG: Detect and Avoid Working Group

**OPERATIONS**

**FLTOPSP**  
Flight Operations Panel  
FLIREC-WG

**ATMOPSP**  
Air Traffic Management Operations Panel  
WTS-WG

**SASP**  
Separation and Airspace Safety Panel

**ADOP**  
Aerodrome Design and Operations Panel  
Design-WG    Operations-WG

**IFPP**  
Instrument Flight Procedures Panel

FLIREC-WG: Flight Recorder Working Group, WTS-WG: Wake Turbulence Specific Working Group

**ENABLERS**

**FSMP**  
Frequency Spectrum Management Panel

**CP**  
Communication Panel  
OPDL-WG    DCI-WG    VC-WG

**NSP**  
Navigation Systems Panel

**SP**  
Surveillance Panel  
AIRBS-WG

**IMP**  
Information Management Panel

**METP**  
Meteorology Panel

OPDL-WG: Operational Datalink Working Group, DCI-WG: Data Communications Infrastructure Working Group, VC-WG: Voice Communications Working Group, AIRBS-WG: Airborne Surveillance Working Group

**SPECIALIST**

**SMP**  
Safety Management Panel

**DGP**  
Dangerous Goods Panel

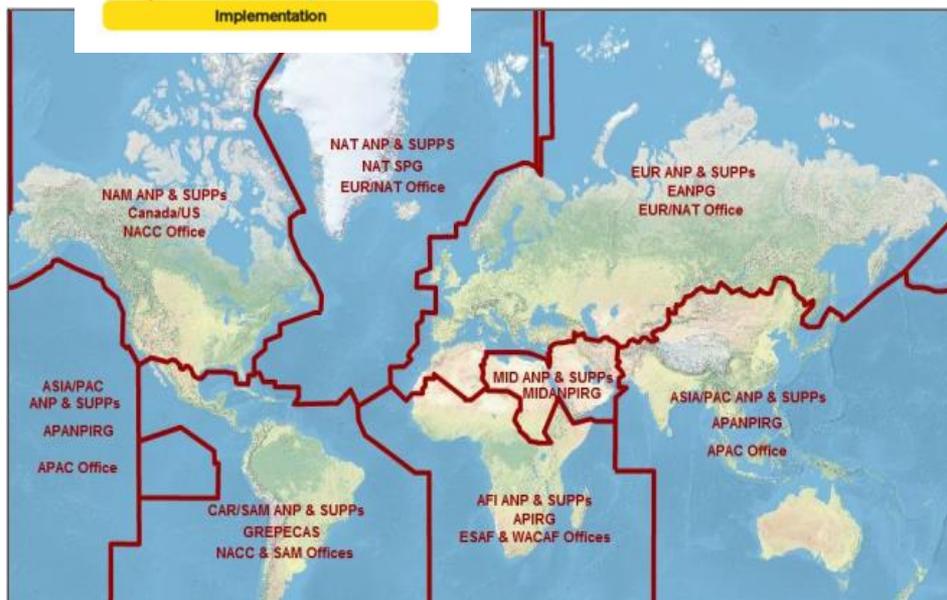
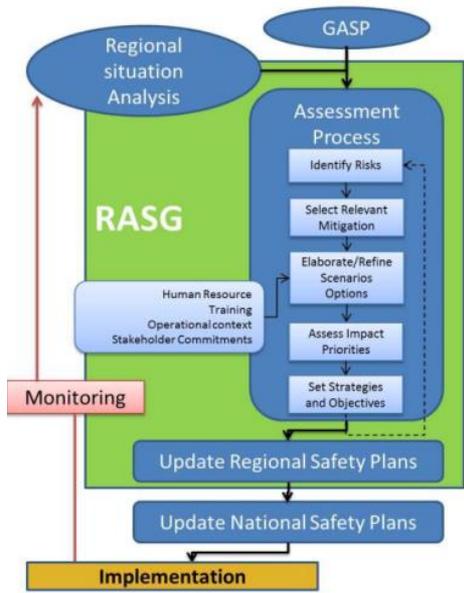
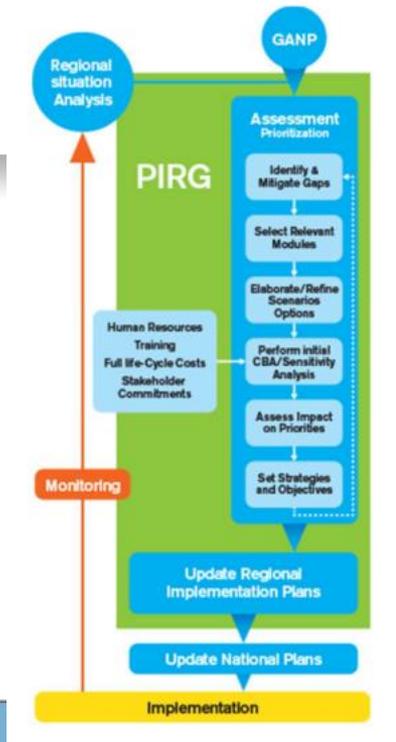
**AIRP**  
Airworthiness Panel

**AIGP**  
Accident Investigation Panel

Panels and their Specific Working Groups

# 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:

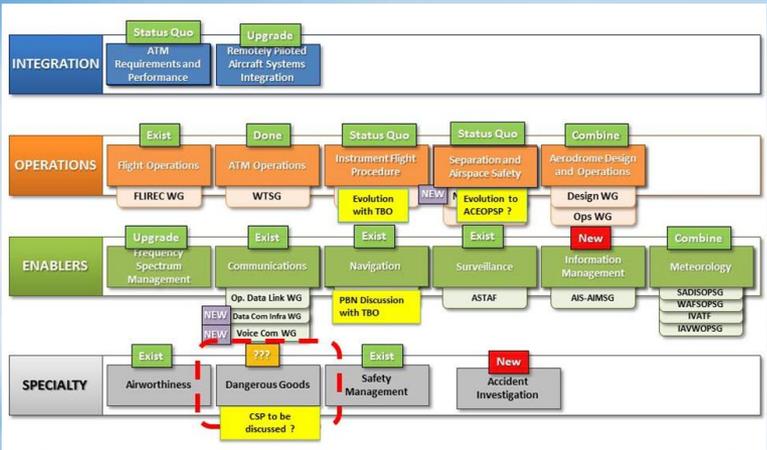
- a) develop those SARPs necessary to enable SWIM'
- b) update and maintain the information management roadmap.

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.

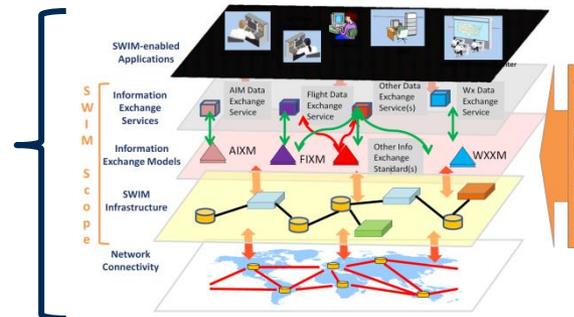
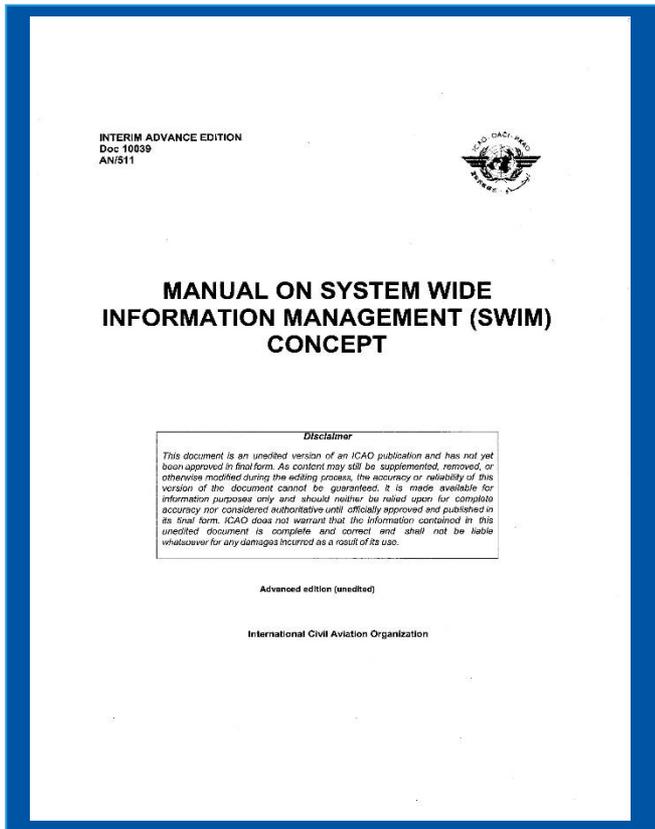


Figure 2. SWIM Global Interoperability Framework



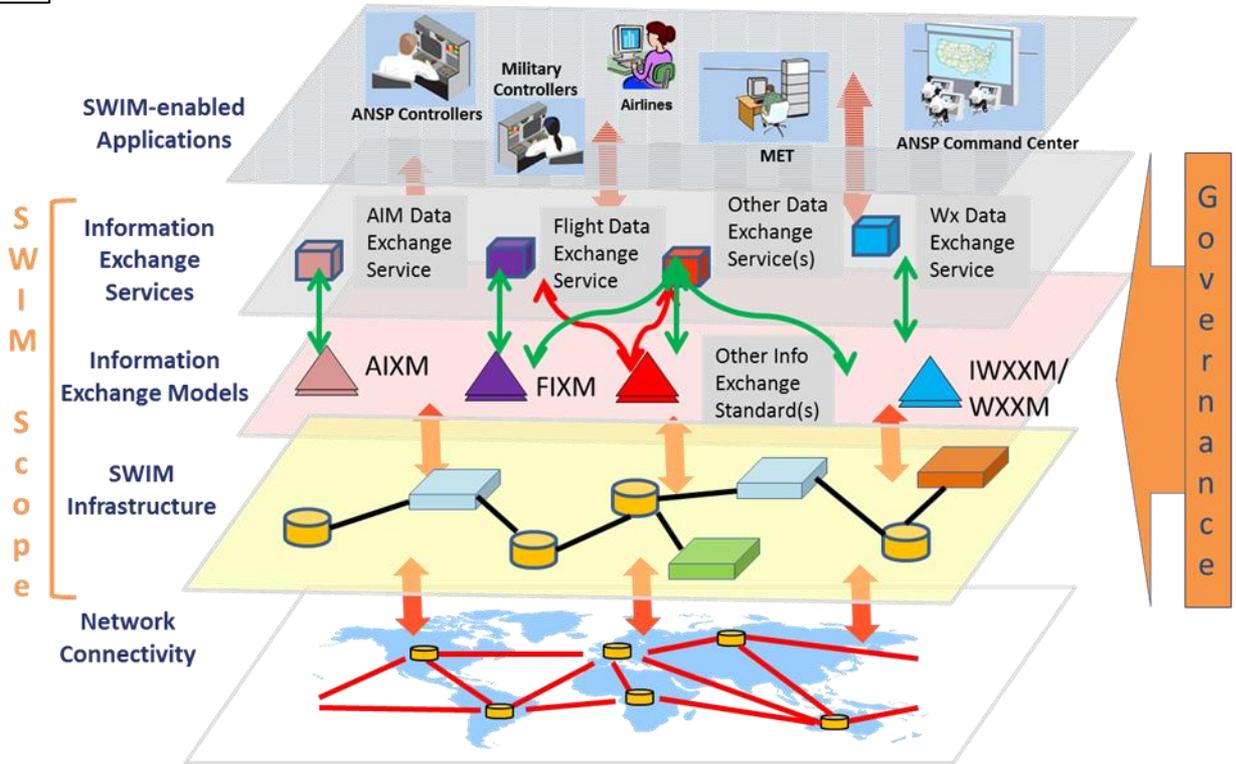
**Doc 10039  
AN/511**

**MANUAL ON SYSTEM WIDE  
INFORMATION MANAGEMENT  
(SWIM) CONCEPT**

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Authorized edition (unlimited)

**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.

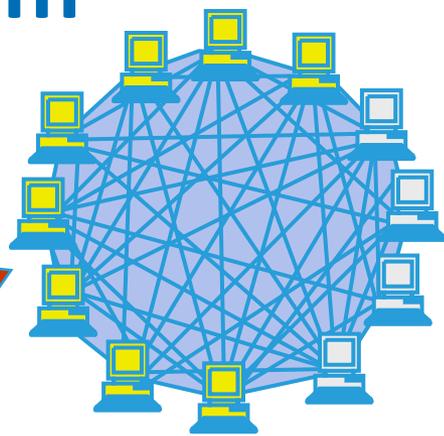
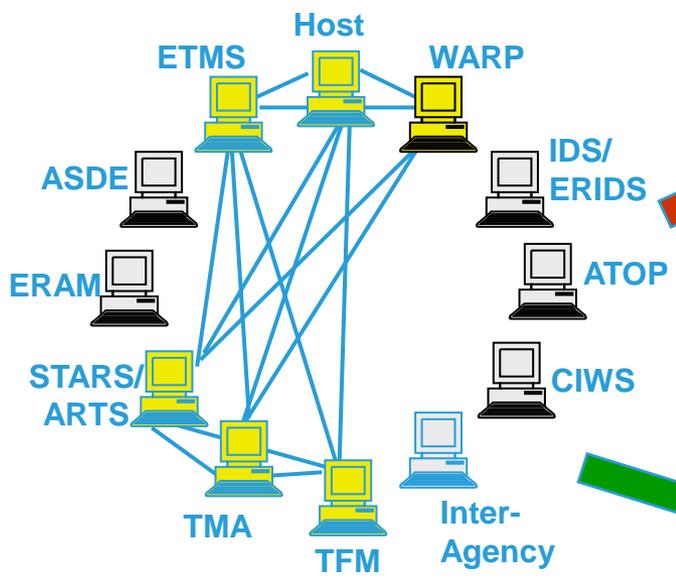
## The objectives are as follows:

- 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

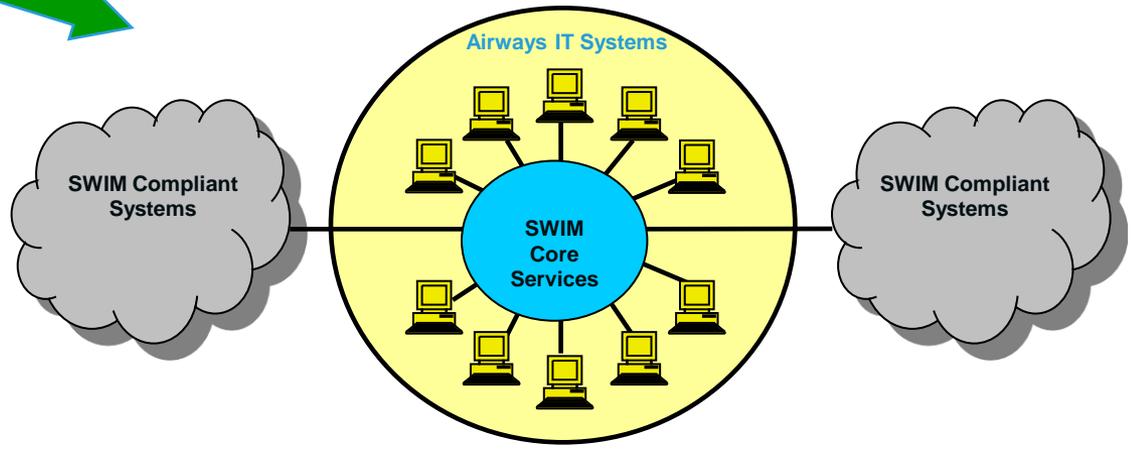
## Today



## 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.

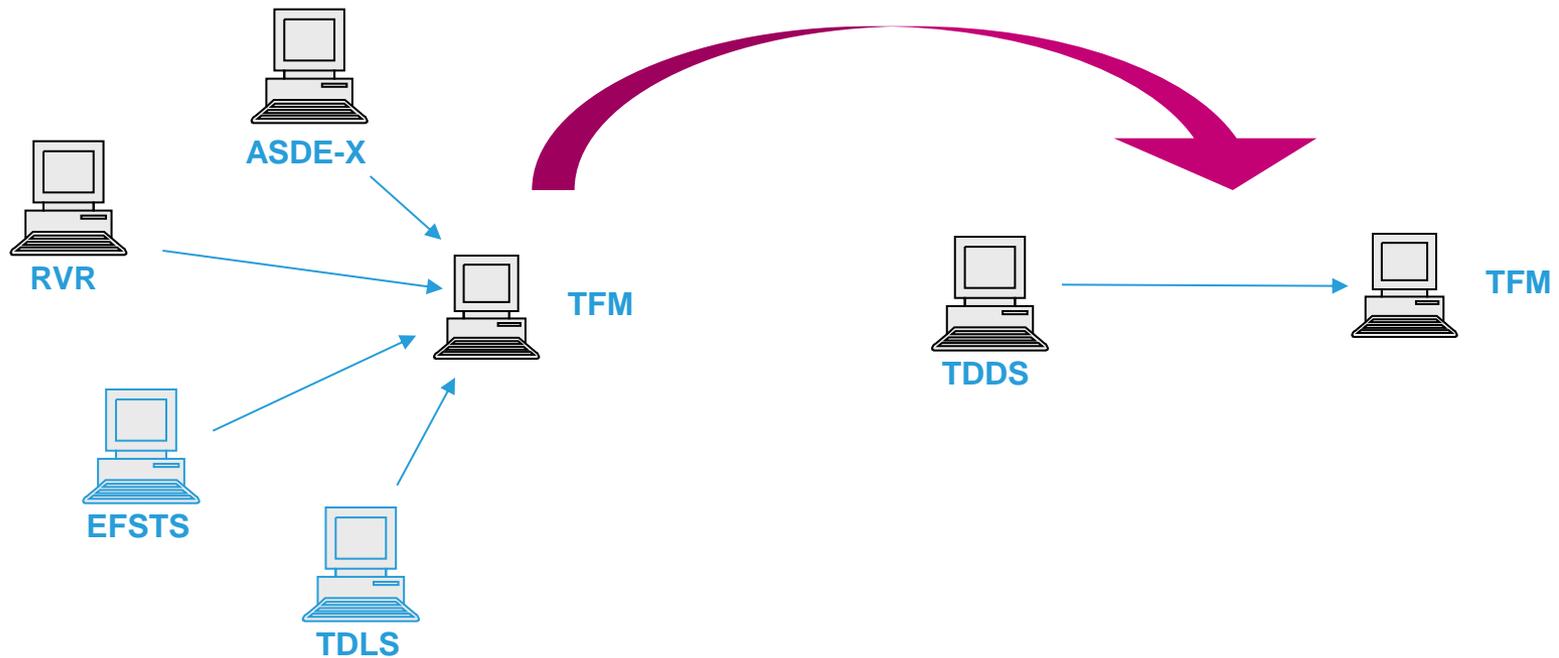
## Enterprise Management (Implementing SOA)



## 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.

## 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:

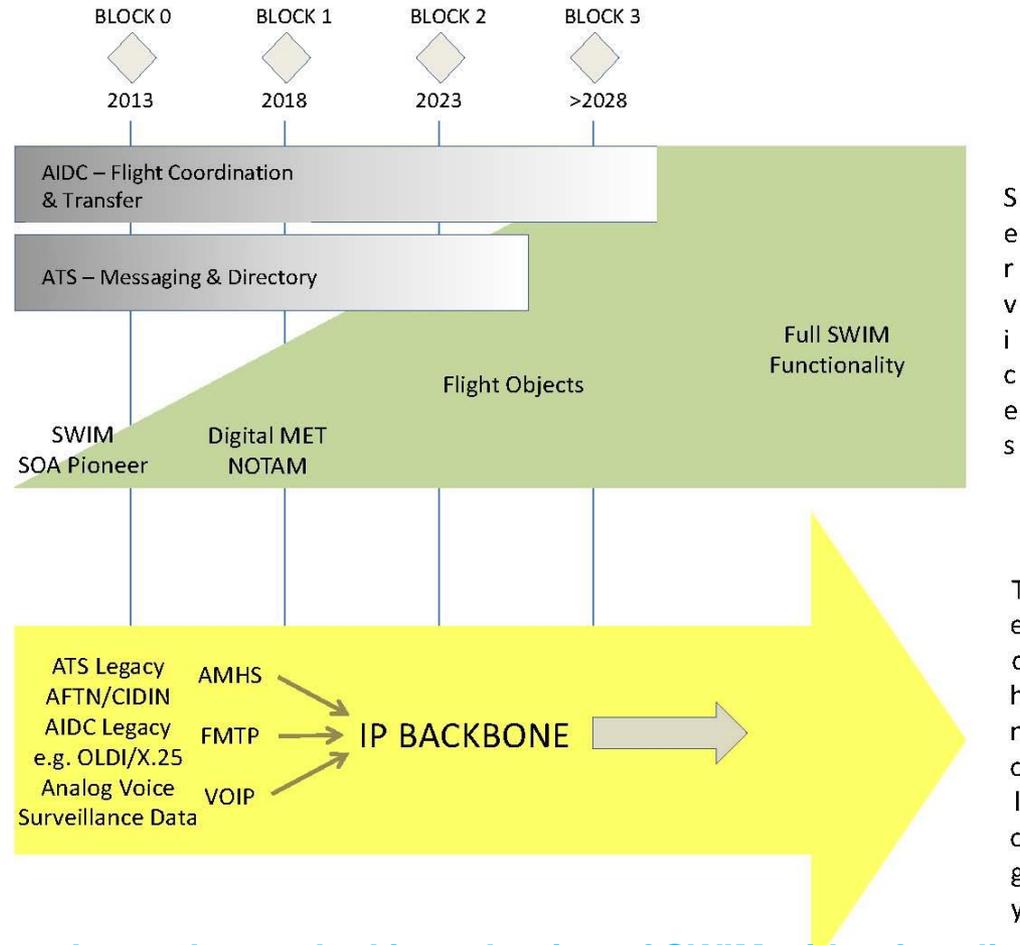
“SOA is being pursued internally by ANSPs that have a large number of ATM systems which need to cooperate in order to provide ATM functions. ANSPs and other stakeholders with few systems may opt to retain their current architectures as long as the SWIM information services that they wish to provide/consume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

## Other industry uses of SOA:

1. Military – Net Centric Warfare (C<sub>4</sub>I<sub>2</sub>).
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.



# SWIM Data Models





# Aviation Data Exchange models

*AIXM - Aeronautical Information Exchange Model*

**[www.aixm.aero](http://www.aixm.aero)**

*WXXM – Weather Information Exchange Model*

**[www.wxxm.aero](http://www.wxxm.aero)**

*AIDX - Aviation Information Data Exchange*

**[www.aidx.aero](http://www.aidx.aero)**

*FIXM - Flight Information Exchange Model*

**[www.fixm.aero](http://www.fixm.aero)**



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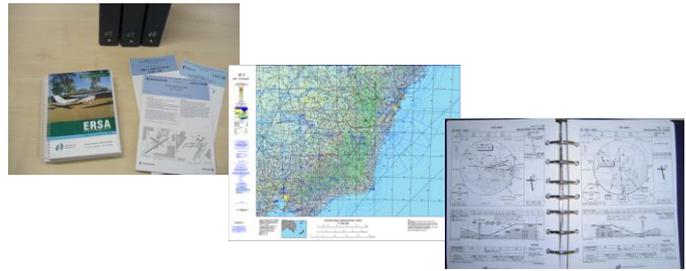
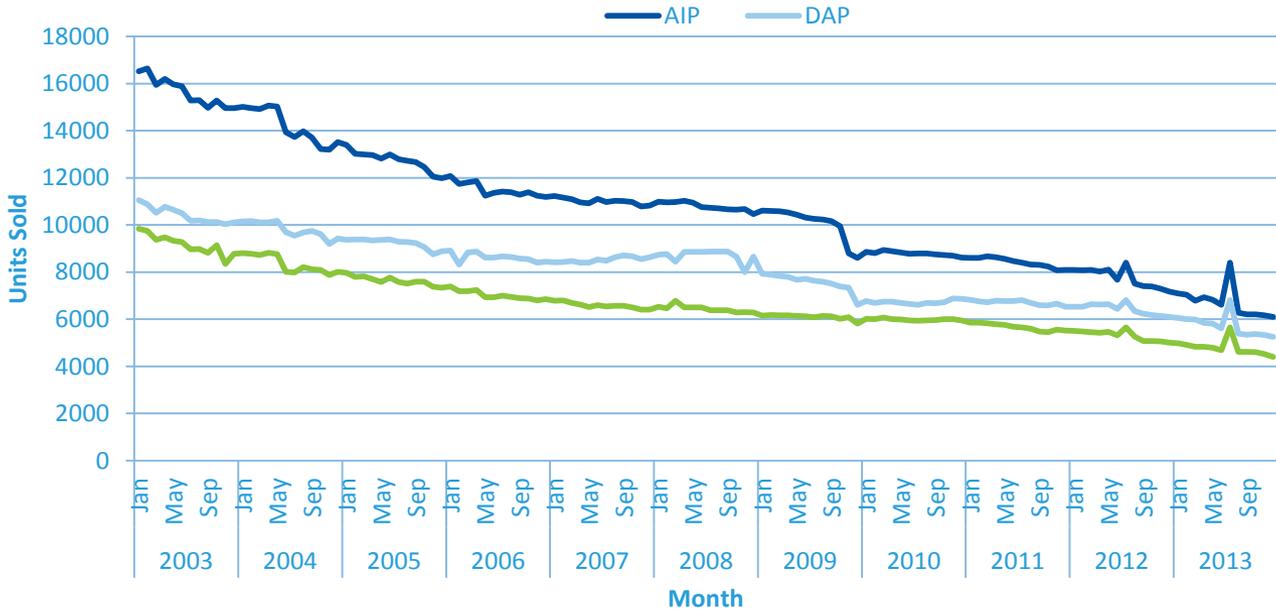
# AIXM - Aeronautical Information Exchange Model





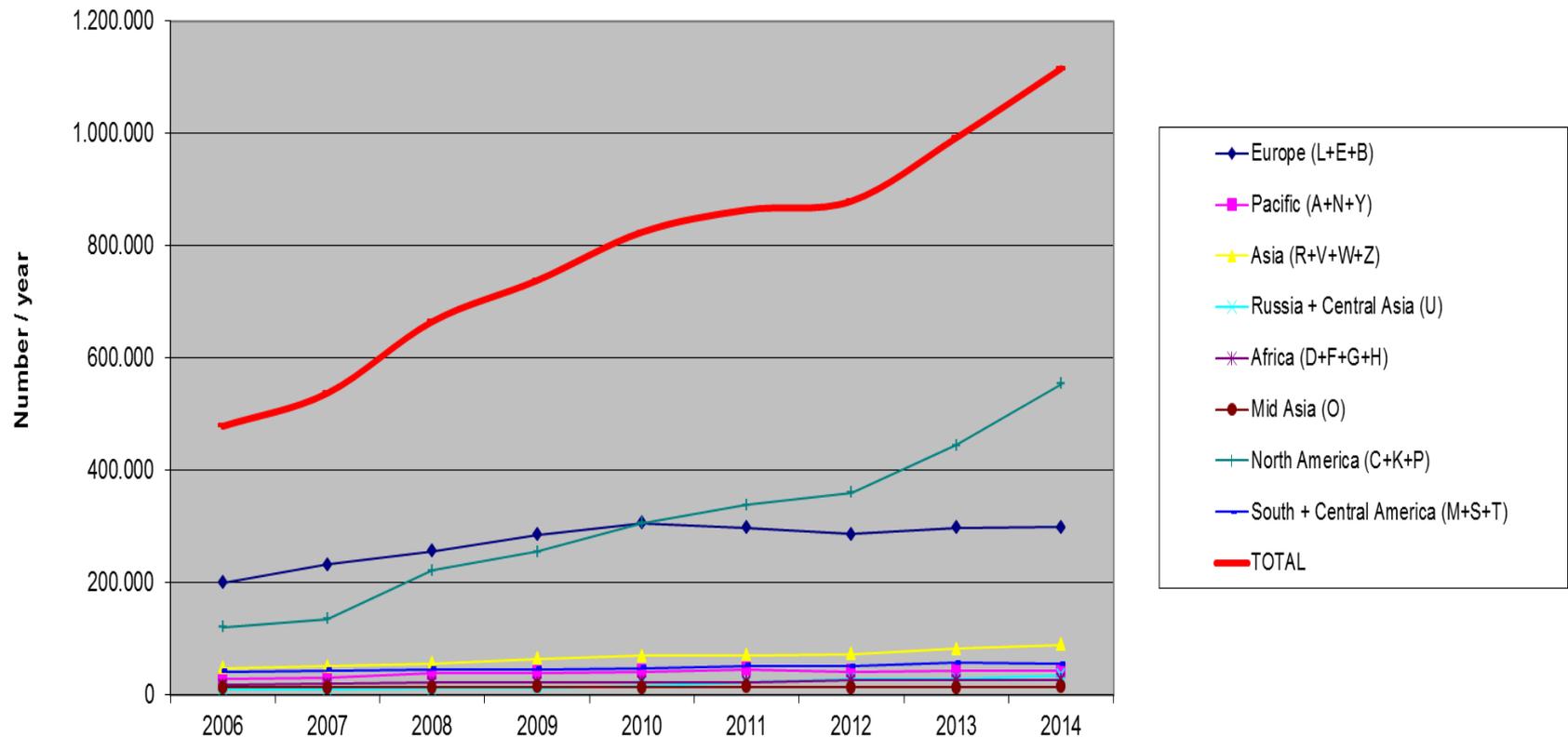
# Digital Disruption of the ATC Business Model

Sale of Paper Products by Month  
Jan 2003 - Dec 2013



# NOTAM – Numbers going wild

(International) NOTAM Trends





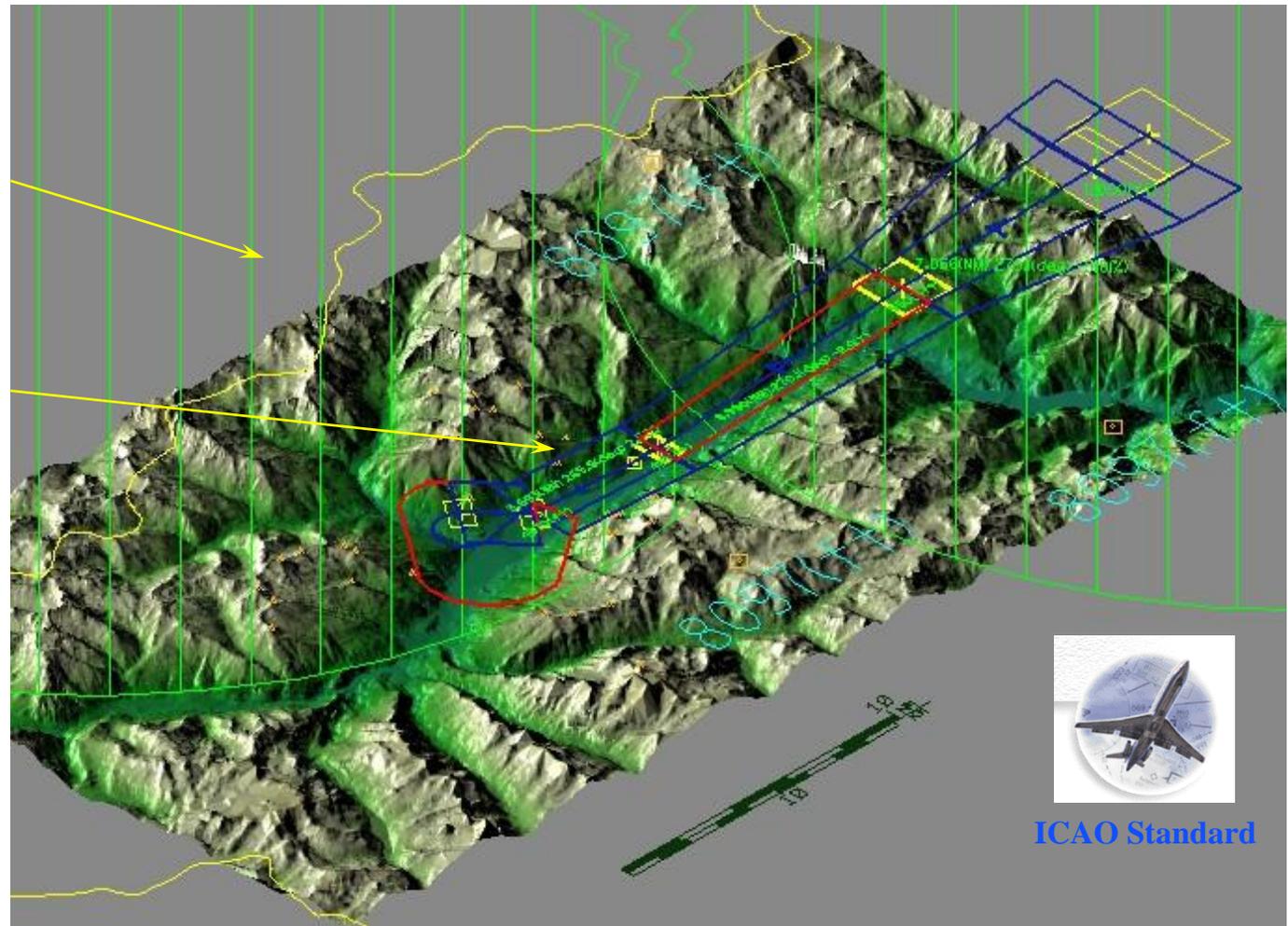


# FPDAM GNSS & DME/DME Approach

## Instrument Flight Procedures

Multi DME Update Area

GNSS Approach And Missed Approach Area



ICAO Standard



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# **FIXM - Flight Information Exchange Model**





# Current ICAO 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)

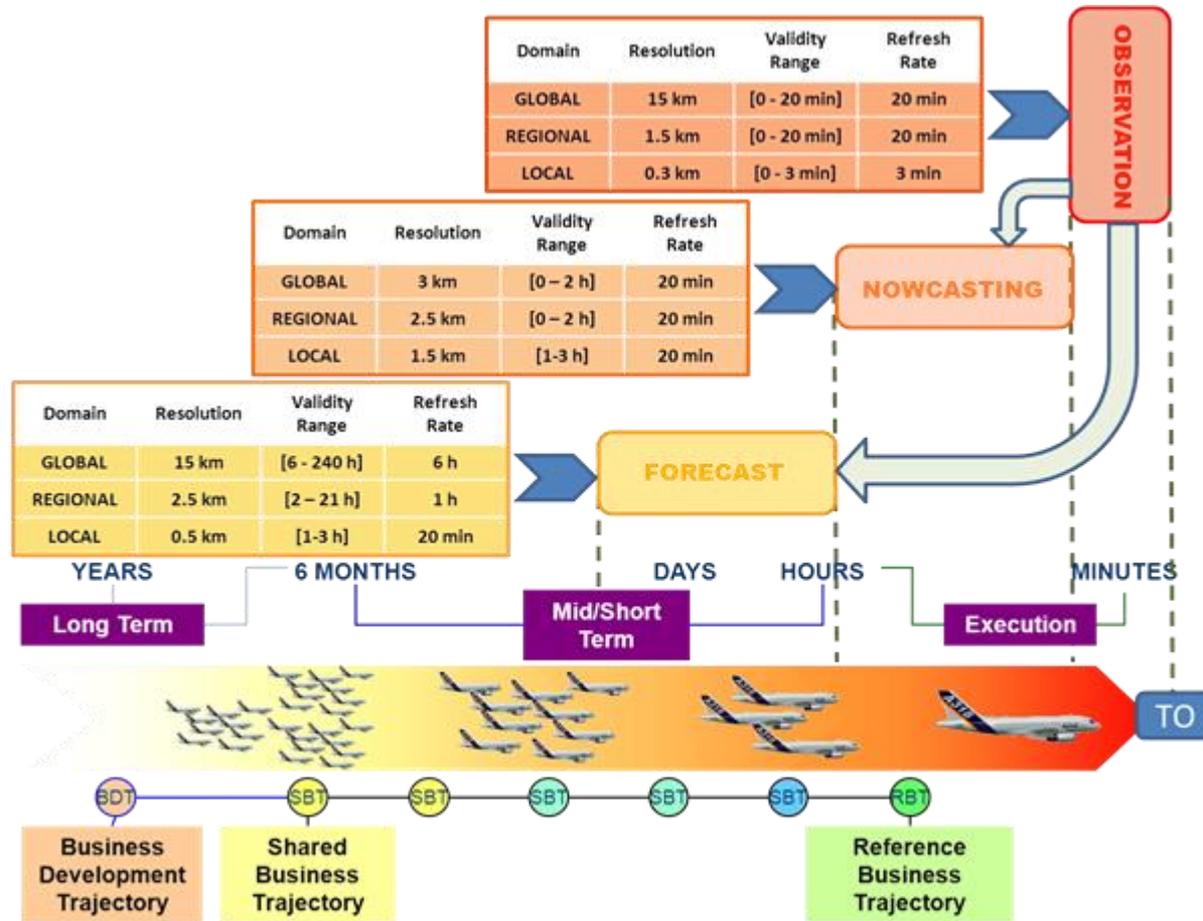
## WXXM

- 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





# 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

**Custom business rules and alerts**

**Predicted gate conflict alerts**

**Operations Timeline**

Flight	Estimated Landing	Estimated Take Off
DAL1803	19:03	19:03
ASQ5219	19:04	19:04
TRS688	19:04	19:04
DAL444	19:04	19:04
ASQ5170	19:05	19:05
DAL2043	19:05	19:05
DAL1730	19:05	19:05
N1ED	19:06	19:06
ASQ5219	19:06	19:06
ASQ5472	19:06	19:06
DAL117	19:07	19:07
TRS985	19:07	19:07
ASQ5212	19:08	19:08
FLG3940	19:08	19:08
DAL240	19:08	19:08
TCF1204	19:09	19:09
ASQ5472	19:09	19:09
DAL1710	19:10	19:10
DAL1647	19:10	19:10
DAL1782	19:10	19:10
EGF3833	19:11	19:11
EJA979	19:11	19:11
TRS274	19:03	19:03
COM369	19:04	19:04
DAL1425	19:04	19:04
DAL25	19:05	19:05
EJM301	19:05	19:05
LXJ536	19:05	19:05
ASQ5527	19:06	19:06
N729KF	19:06	19:06
LXJ517	19:06	19:06
N118GA	19:07	19:07
EJM685	19:07	19:07
DAL2286	19:08	19:08
TRS880	19:08	19:08
ASH3804	19:08	19:08
DAL2210	19:09	19:09
DAL11	19:09	19:09
CHO5844	19:10	19:10
DAL335	19:10	19:10
DAL1534	19:11	19:11

**Airport Demand Summary**

Airport Arrivals (190 Sch, 218 Est) Last Updated 07/2...

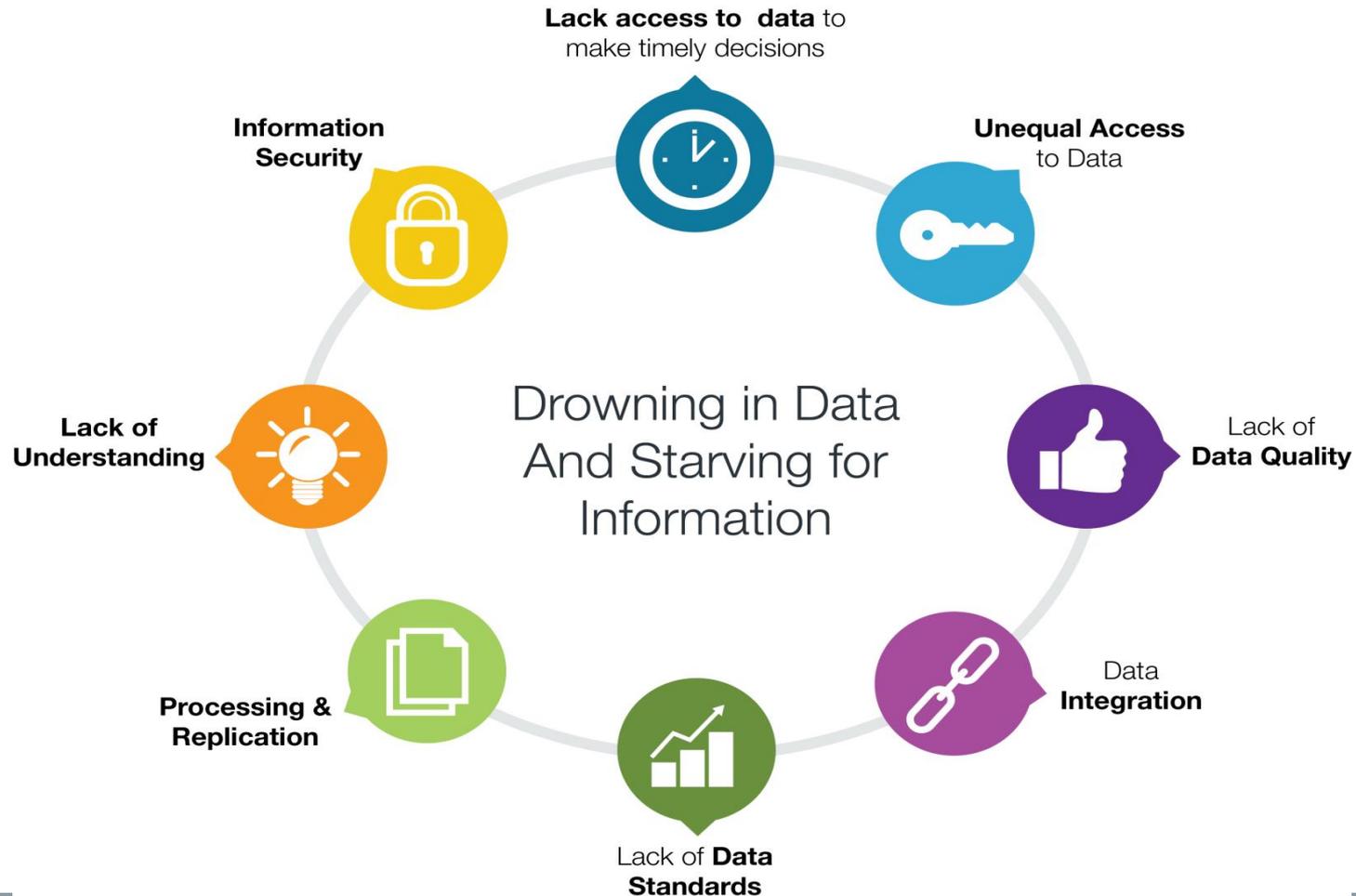
Time	Scheduled	Estimated (FAA)
19:30	45	66
20:00	56	52
20:30	35	49
21:00	54	51

Graphical and tabular views

Advanced flight and demand forecasts



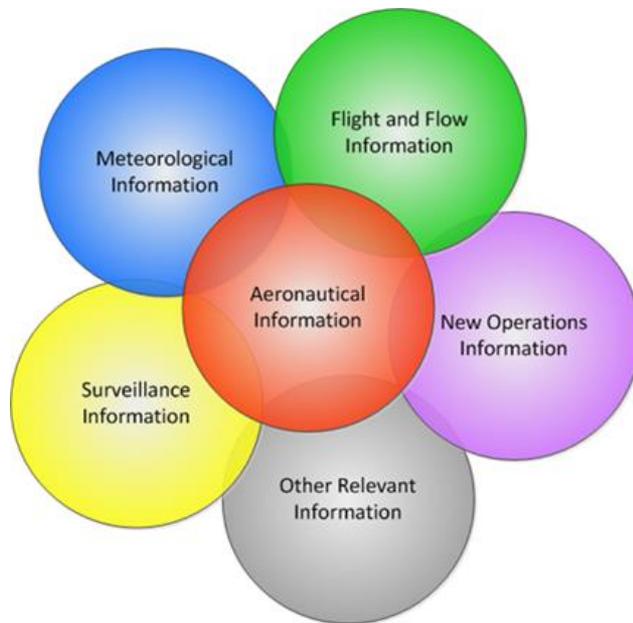
# What is our information management challenge?





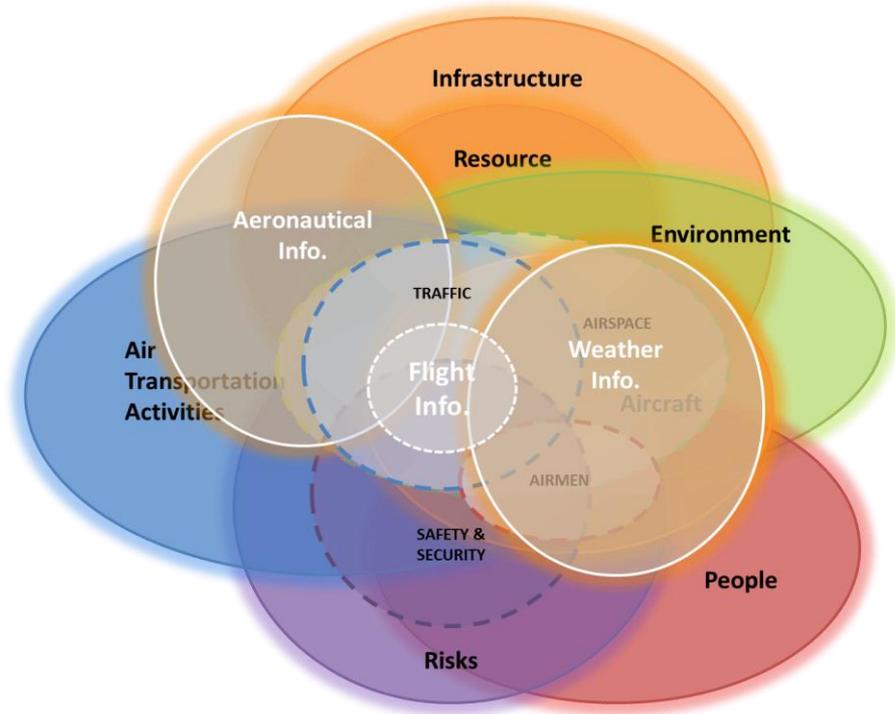
# How do we see Information Domains?

This is how users see information



This is how we manage data

**ICAO Information Areas**

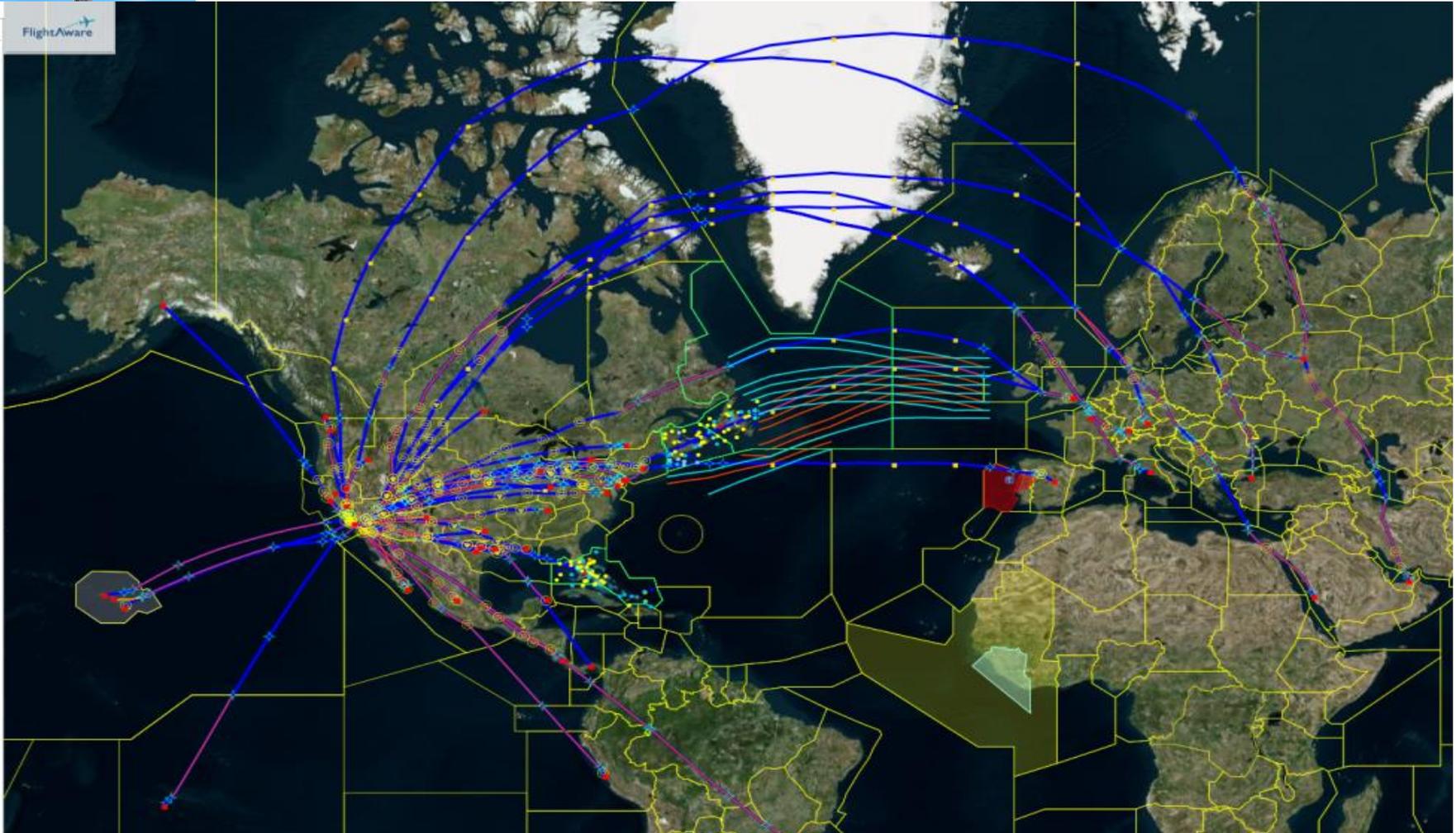


**Information Domains**

Significant overlap with traditional areas



# How real is this all ?



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



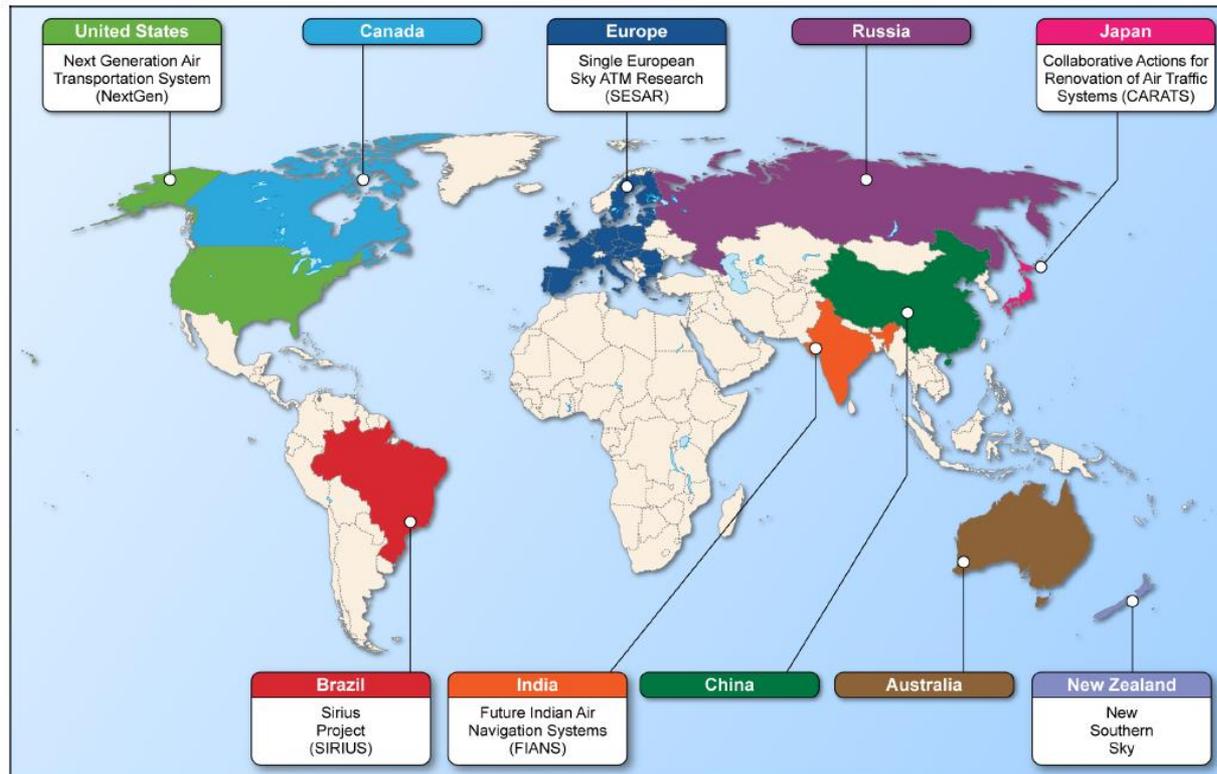
# How real is this all ?

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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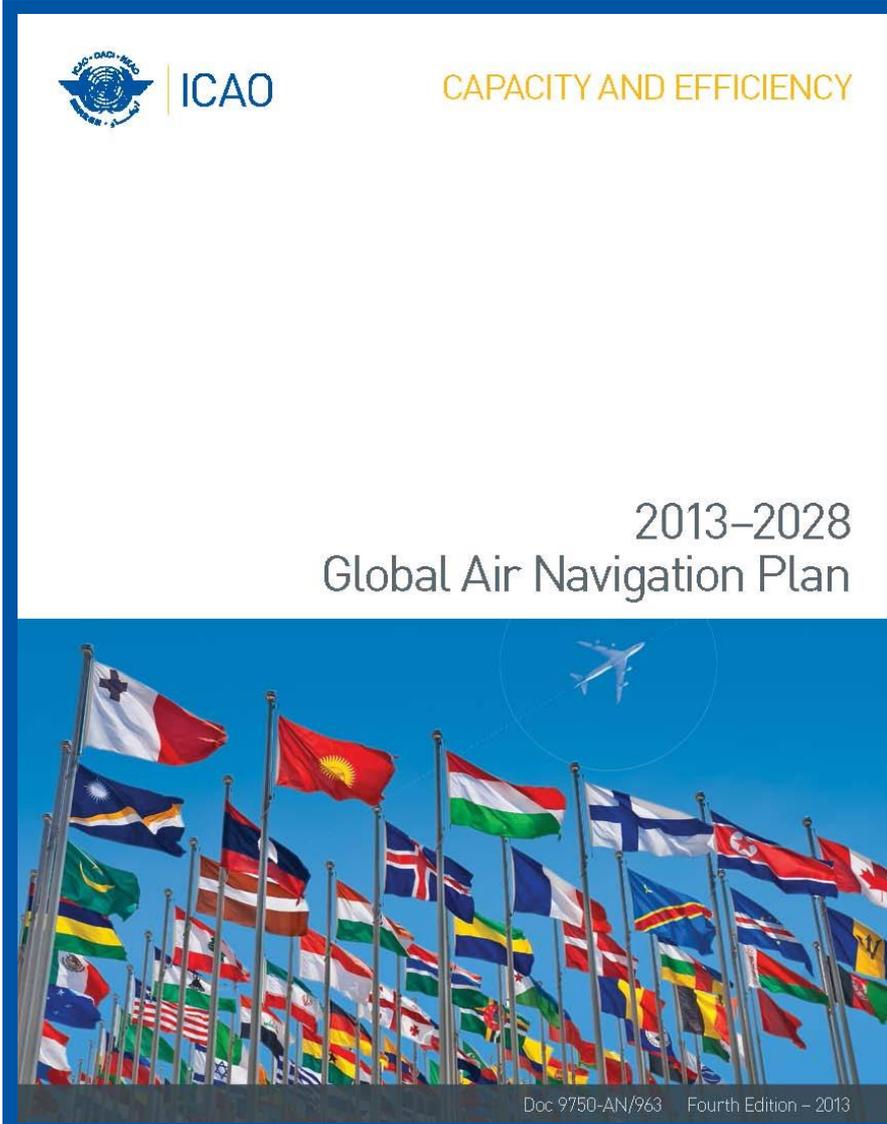
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# ASBU Prioritisation

Global Air Navigation Plan (2013-2028)

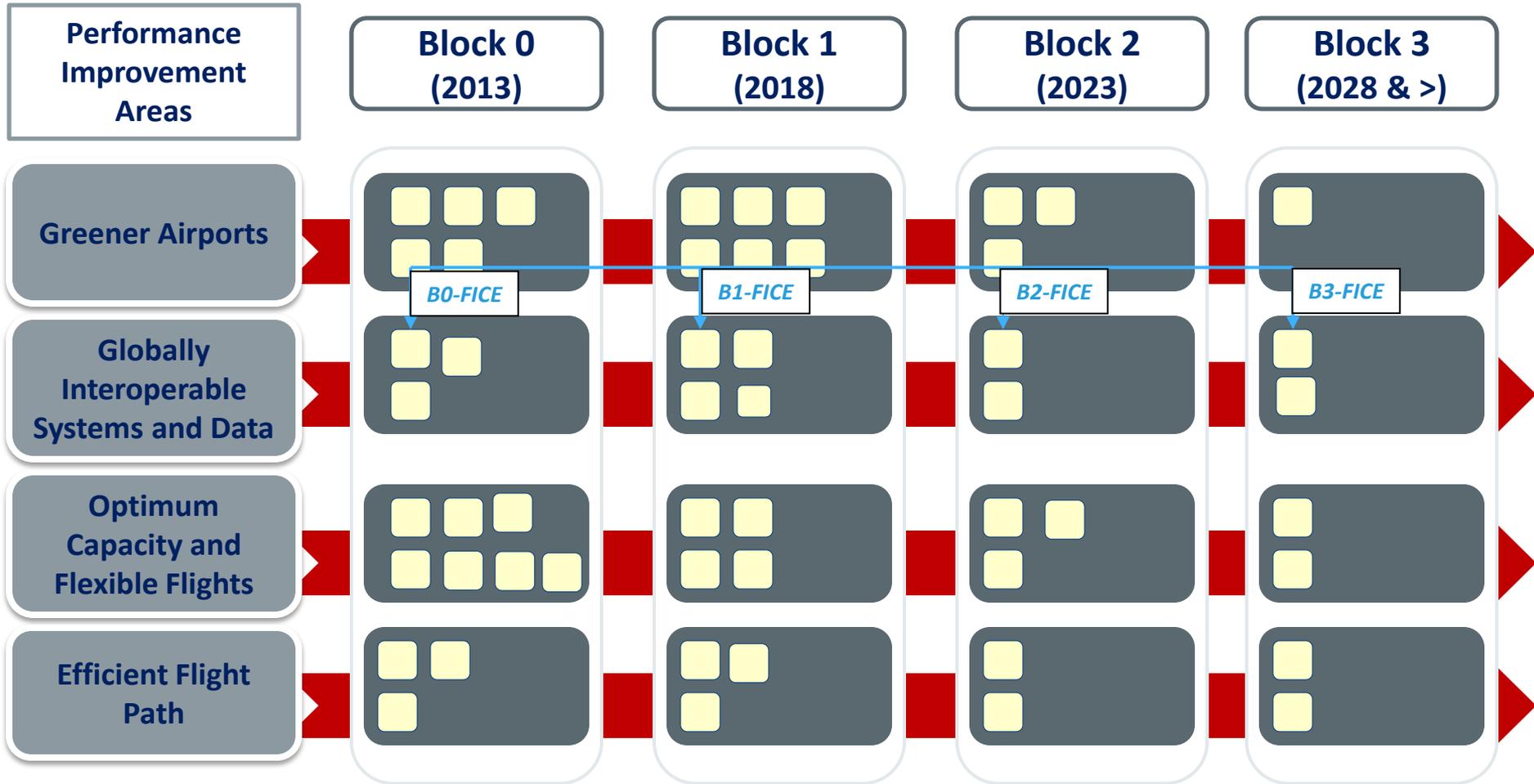




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A United Nations Specialized Agency



# 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.

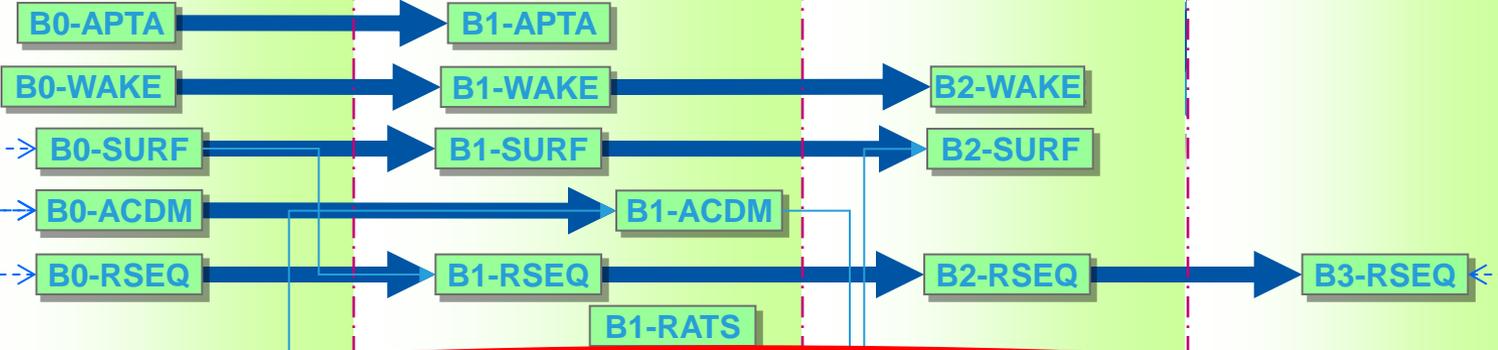
- **SWIM (System Wide Information Management).**

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.

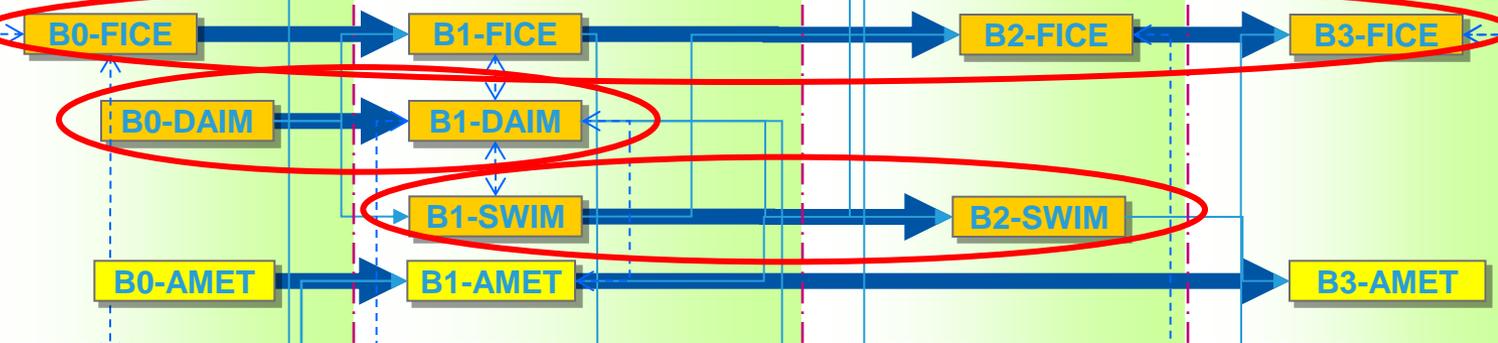
- **ASAS (Airborne Separation Assurance Systems).**

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.

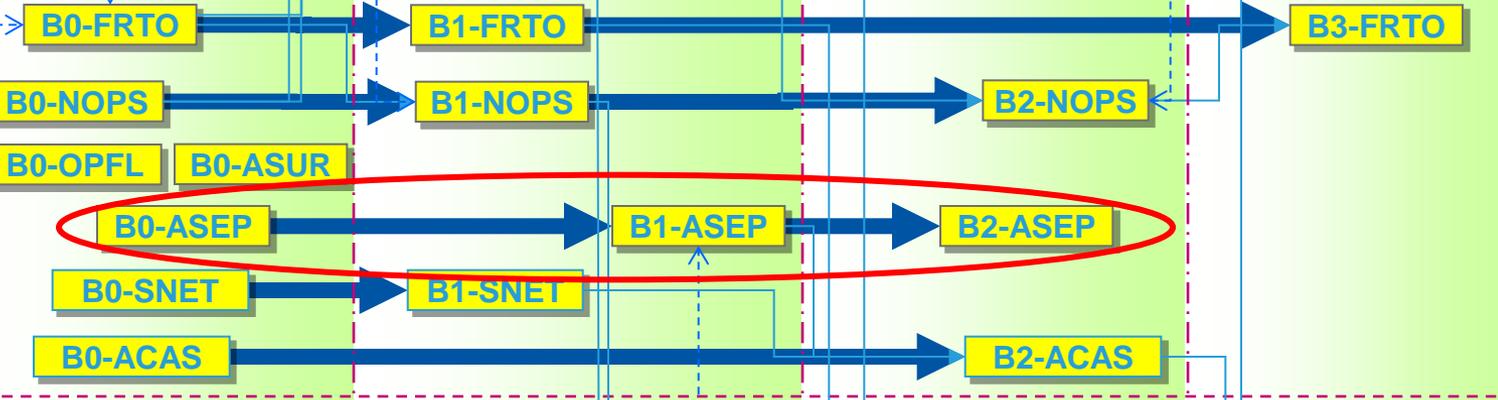
**Greener Airports**



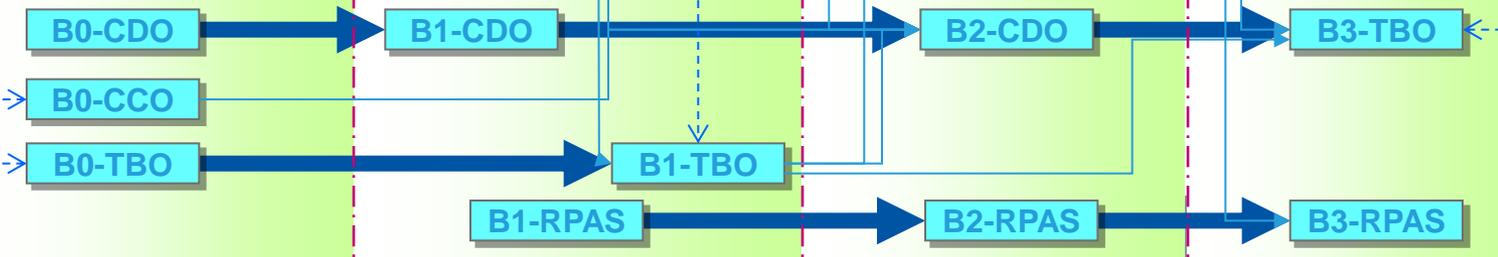
**Globally Interoperable Systems and Data**



**Optimum Capacity and Flexible Flights**



**Efficient Flight Path**





# 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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Southern African  
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THANK YOU