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# Global Air Navigation Planning

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Brussels/October 2017





# Flight Plan

- A vision
- Challenges
- GANP
- Update Performance Improvement Area 2 and ICAO Work Programme



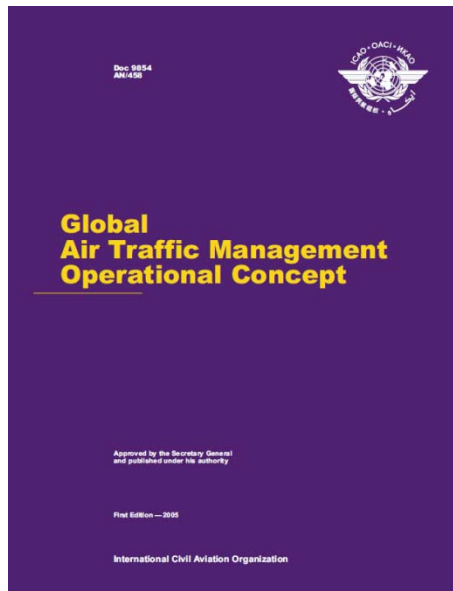
*“Do we know where to go?”*





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# “Yes”



To achieve an **interoperable** global air traffic management system, **for all users during all phases of flight**, that **meets agreed levels of safety**, provides for **optimum economic operations**, is **environmentally sustainable** and **meets national security requirements**



# Guiding principles

- Safety
- Human
- Technology
- Collaboration
- Continuity
- Information

The ATM community will **depend** extensively on the **provision of timely, relevant, accurate, accredited and quality-assured information** to collaborate and make informed decisions. **Sharing information on a system-wide basis** will allow the ATM community to conduct its business and operations in a safe and efficient manner.



# GAP





**DRIVERS  
FOR  
CHANGE**

Aviation is  
undergoing a  
**FUNDAMENTAL**  
change



# DRIVERS FOR CHANGE

- Expectations of the ATM community
  - Expected benefits
    - Airspace users
    - Service providers
    - Regulators
  - Total system performance framework
    - Competing expectations to be balanced





## Concept components

- AOM** — Airspace organization and management
- DCB** — Demand/capacity balancing
- AO** — Aerodrome operations
- TS** — Traffic synchronization
- CM** — Conflict management
- AUO** — Airspace user operations
- ATM SDM** — ATM service delivery management



# Information: Key for evolution

- Global information utilization, management and interchange enabling...  
... the future of the air navigation system





# Information Management

- Functions:
  - Provide accredited, quality-assured timely information
  - Monitor and control quality of shared information
  - Provide information-sharing mechanisms
- Meeting expectations ATM community





# Aeronautical Information

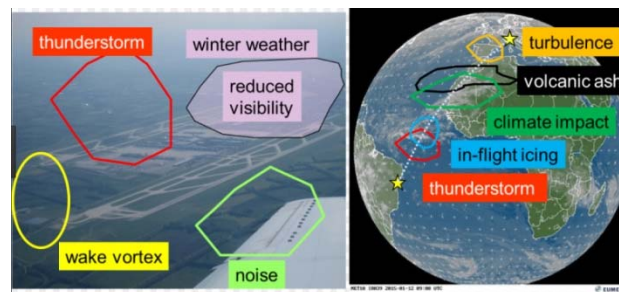
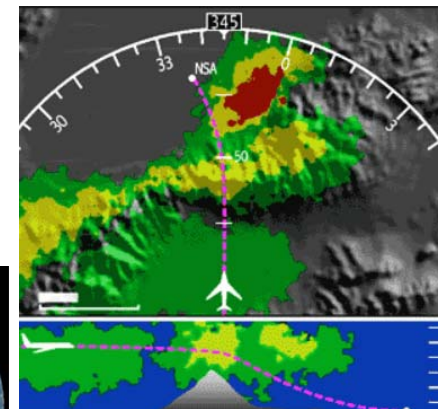
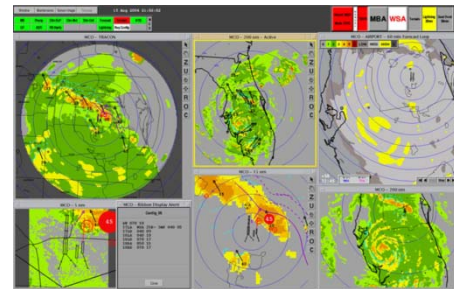
- Temporality and issuance concepts
  - Overload
  - Intelligent IM
- Media
  - Fully electronic
  - Networked environment





# Meteorological information

- Integrated function
- Tailored
  - Meet ATM requirement
- Main benefits
- Performance management
  - Quality Assurance





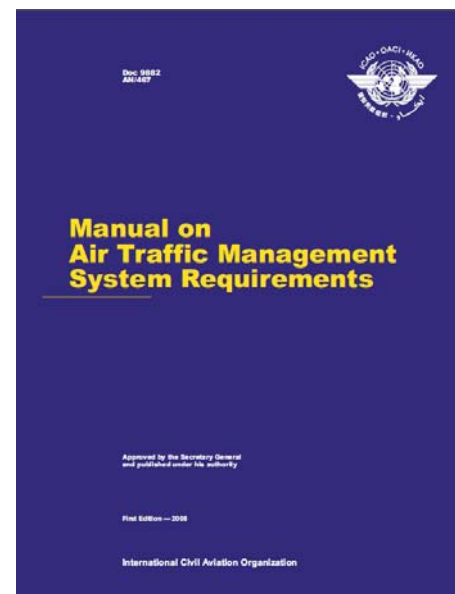
## Other services

- Air Defense
- Search and Rescue
- Aviation accident/incident investigation
- Law enforcement
- Regulatory authorities



# Information Service Requirements

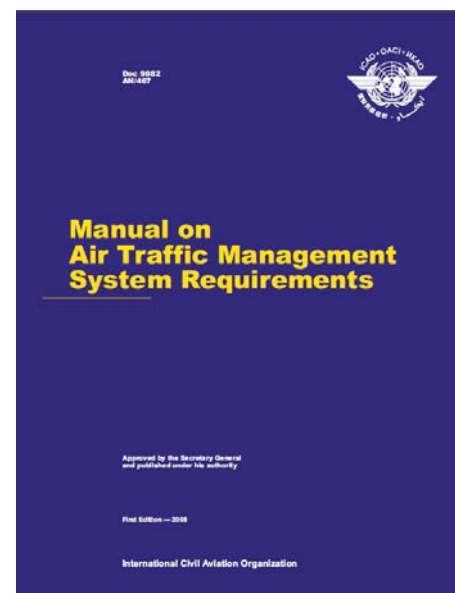
- System-wide information management
- Accredited, quality-assured and timely information
- Nature of information
- Validity period
- Integrated picture
- Aviation data standard and reference system
- Information exchange protocols and procedures
- Collection and integration
- Reduction in transactional friction





# Information Service Requirements

- Relevant operational information available
- Optimize flight operations management
- Optimize 4-D trajectory planning and operation
- Status of ATM system resources
- Flight parameters and aircraft performance characteristics
- Access to MET information
- Standards for meteorological model
- Environmental performance targets









# Global Air Navigation Planning

2002

2007

2013

2016

Doc 9750  
AN/963



**Global Air Navigation Plan  
for CNS/ATM Systems**

Approved by the Secretary General  
and published under his authority.

Second Edition — 2002

International Civil Aviation Organization

Doc 9750  
AN/963



**Global  
Air Navigation  
Plan**

Approved by the Secretary General  
and published under his authority.

Third Edition — 2007

International Civil Aviation Organization



CAPACITY AND EFFICIENCY

2013–2028  
Global Air Navigation Plan



CAPACITY & EFFICIENCY

2016–2030  
Global Air Navigation Plan





# GANP 2013

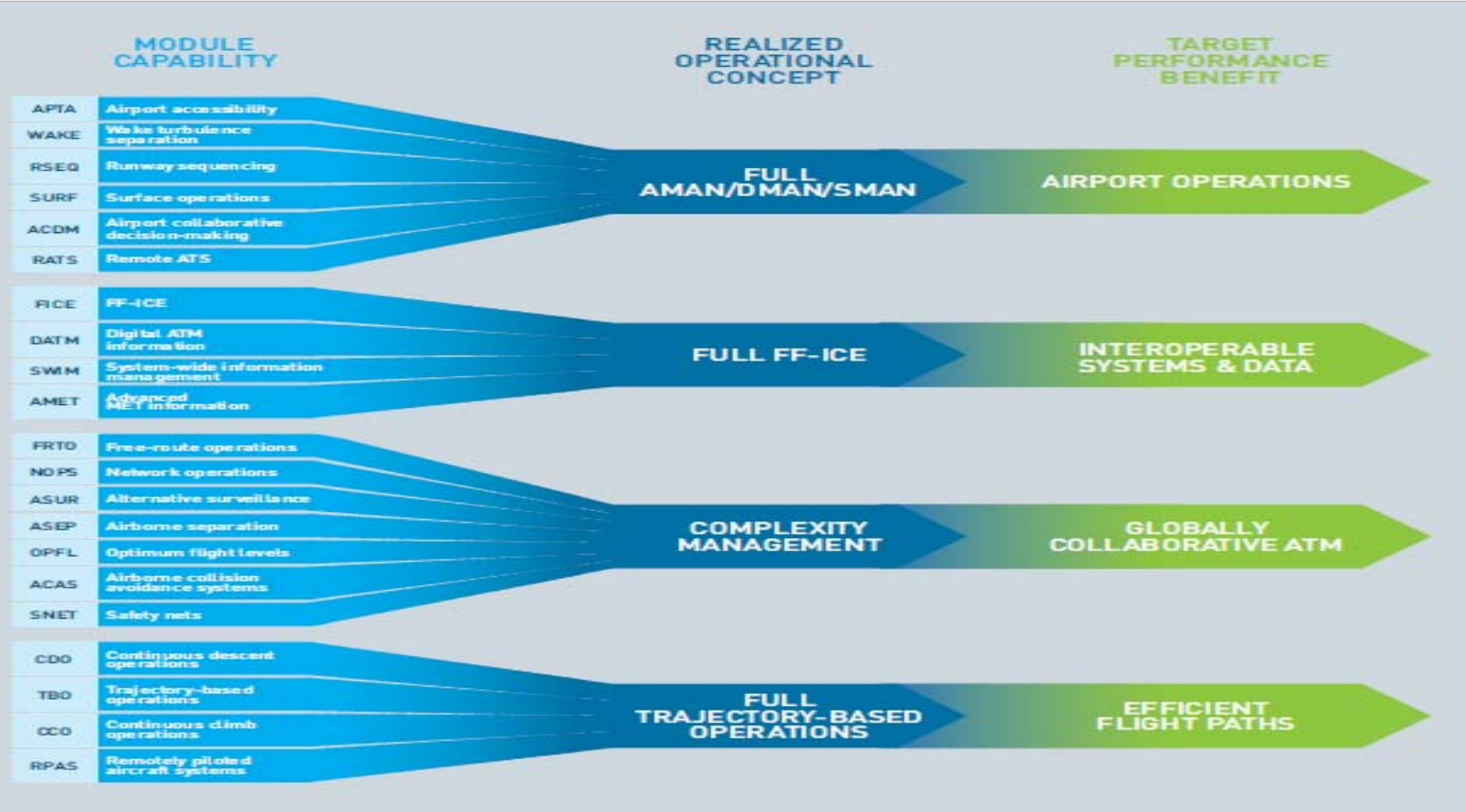
*“Increase the capacity and improve the efficiency of the global civil aviation system”*



- Through the **GANP**, offer a long-term vision to assist all aviation stakeholders, and ensure continuity and harmonization among modernization programmes
- Through the **Aviation System Block Upgrades (ASBU)**, provide a consensus-driven modernization framework for integrated planning based on performance

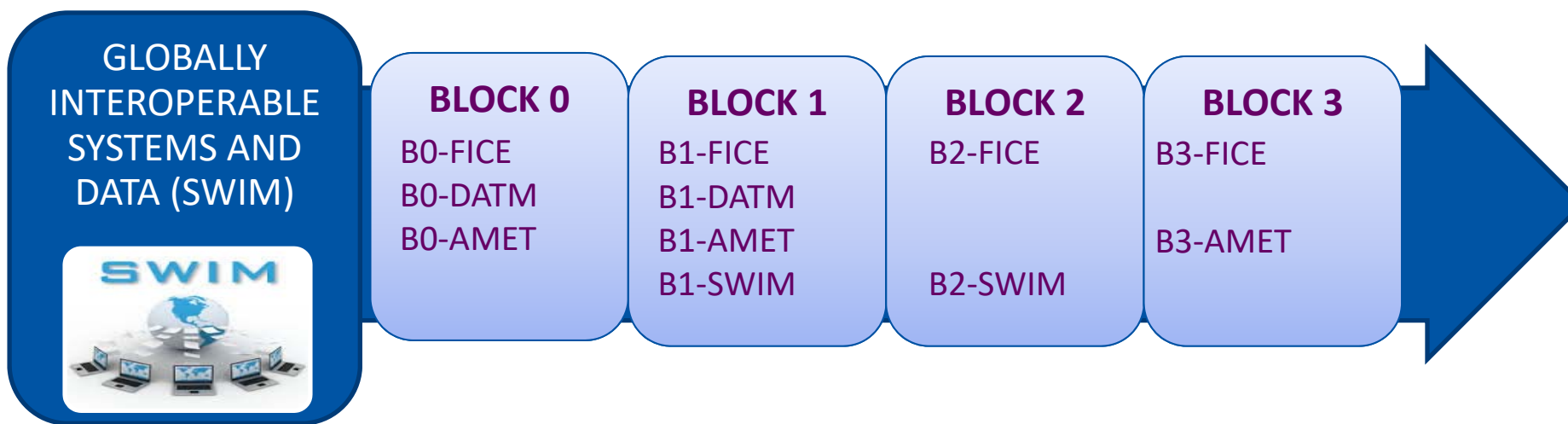


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# GLOBALLY INTEROPERABLE SYSTEMS AND DATA (SWIM)





# FICE Block 0 and Block 1

## B0-FICE

### Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration

Supports the coordination of ground-ground data communication between

ATSUs, based on ATS Inter-facility Data Communication (AIDC).

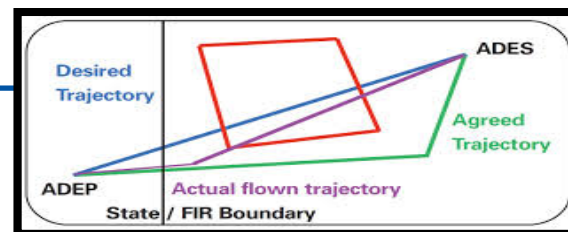
## B1-FICE

### Increased Interoperability, Efficiency and Capacity through FF-ICE, Step 1 application before Departure

Introduction of FF-ICE step 1, to implement

ground-ground exchanges before departure using common flight information reference model, FIXM, XML and the flight object used.

- New Flight Information Mechanism





# DATM Block 0 and Block 1



## **B0-DATM**

### **Service Improvement through Digital Aeronautical Information Management**

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.

## **B1-DATM**

### **Service Improvement through Integration of all Digital ATM Information**

Increase in information integration and support on a new concept of ATM information exchange fostering access via

internet-protocol-based tools Exchange models such as AIXM, FIXM, WXXM and others relate their concepts to the AIRM fostering convergence, re-use, and collaborative alignment.



# AMET Block 0 and Block 1

## **B0-AMET**

### **Meteorological information supporting enhanced operational efficiency and safety**

Meteorological information provided in support of flexible airspace management.

- Element 1: WAFS
- Element 2: IAVW
- Element 3: Tropical cyclone watch
- Element 4: Aerodrome warnings
- Element 5: Wind shear warnings and alerts
- Element 6: SIGMET and other operational meteorological (OPMET) information

## **B1-AMET**

### **Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service)**

Meteorological information supporting automated decision process or aids, involving.

- Element 1: Meteorological information
- Element 2: Meteorological information translation
- Element 3: ATM impact conversion
- Element 4: Meteorological information integrated decision support





# SWIM Block 1



## **B1-SWIM**

### **Performance Improvement through the application of System-Wide Information Management (SWIM)**

Implementation of SWIM services (applications and infrastructure) creating the aviation intranet based on standard data

models, and internet-based protocols to maximize interoperability.

- Applications of SWIM on the ground
- Air ground data exchanges will remain based on point-to-point communication



# GANP 2016

- **Objectives**

- **International and overarching framework** of a global investment plan: make it more usable towards implementation
- Keep it **stable** while making the necessary updates/additions
- Adjust the **periodicity** to the Assembly and ICAO editing cycles

- **A Planning Document for Implementation**

- GANP should serve as a comprehensive planning tool to **support the development and implementation** of a harmonized global air navigation system



2016–2030  
Global Air Navigation Plan

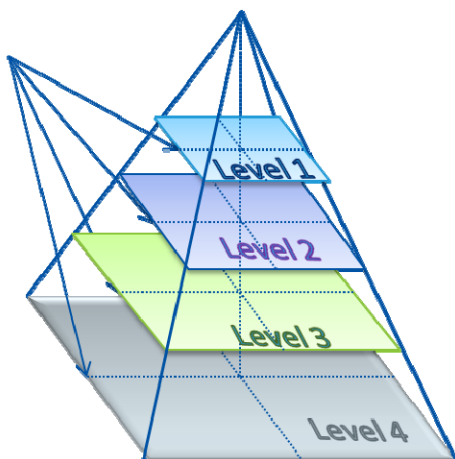




# 2019 Update of the GANP

## Multilayer Structure

LAYERS



COMPONENTS

GLOBAL  
MANAGERIAL



GLOBAL  
TECHNICAL



REGIONAL



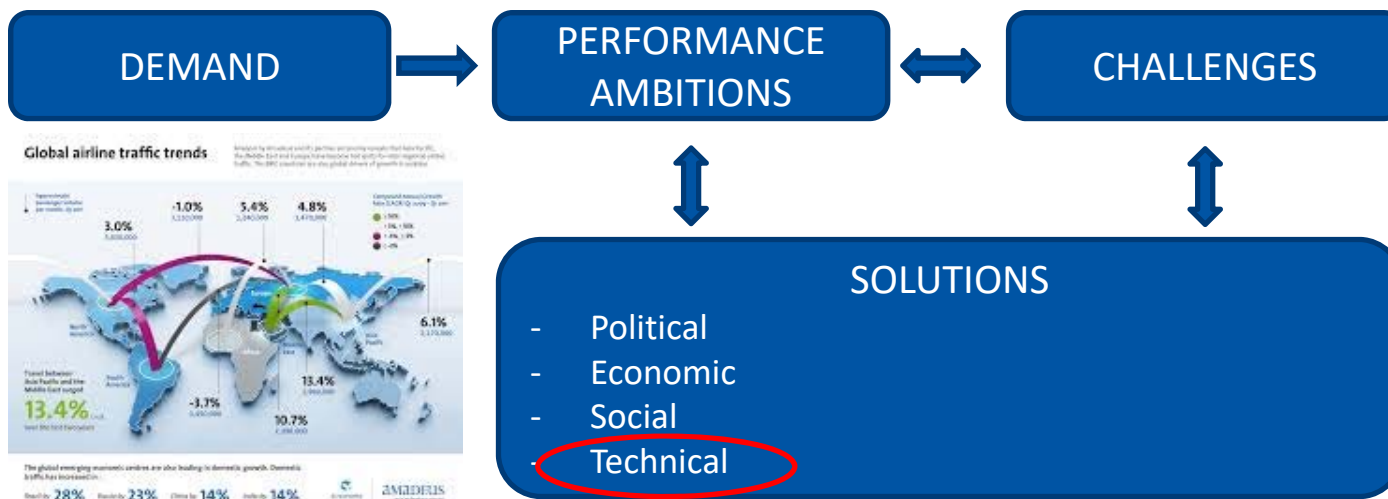
NATIONAL





# GANP STRUCTURE

## STRATEGIC APPROACH



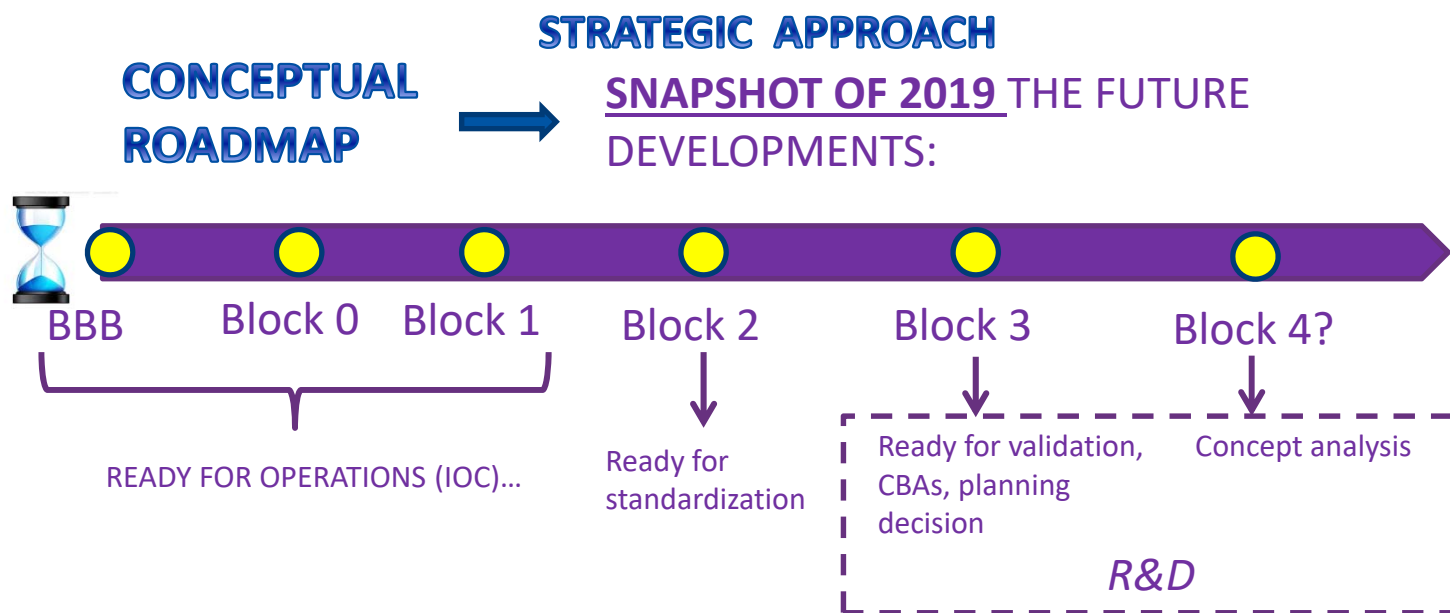


# GANP STRUCTURE





# GANP STRUCTURE





# GANP STRUCTURE

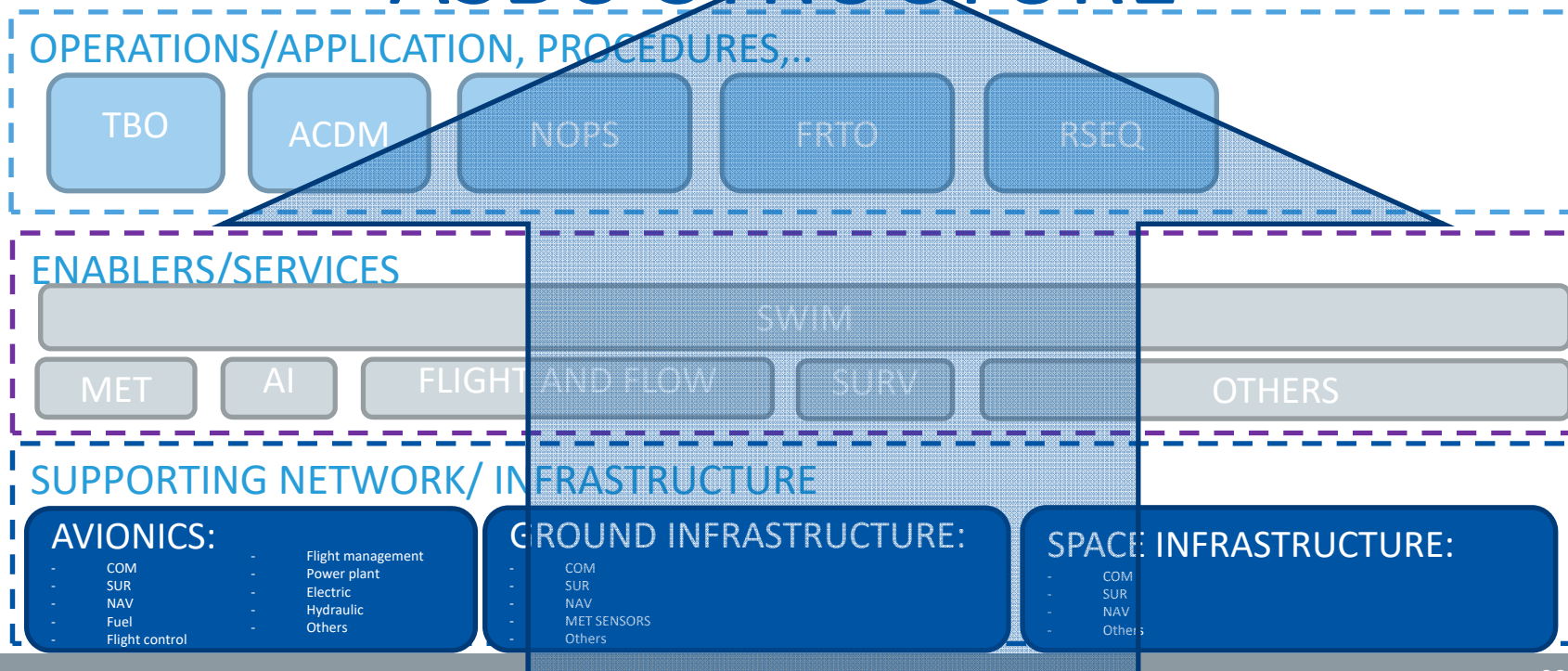
## STRATEGIC APPROACH CONCEPTUAL ROADMAP

For each block:

	ACDM	RSEQ	SURF	FRTO	OPFL	TBO	...
AOM		★		★	★		
DCB	★						
AO	★		★				
TS		★					
CM					★		
AUO							



# ASBU STRUCTURE

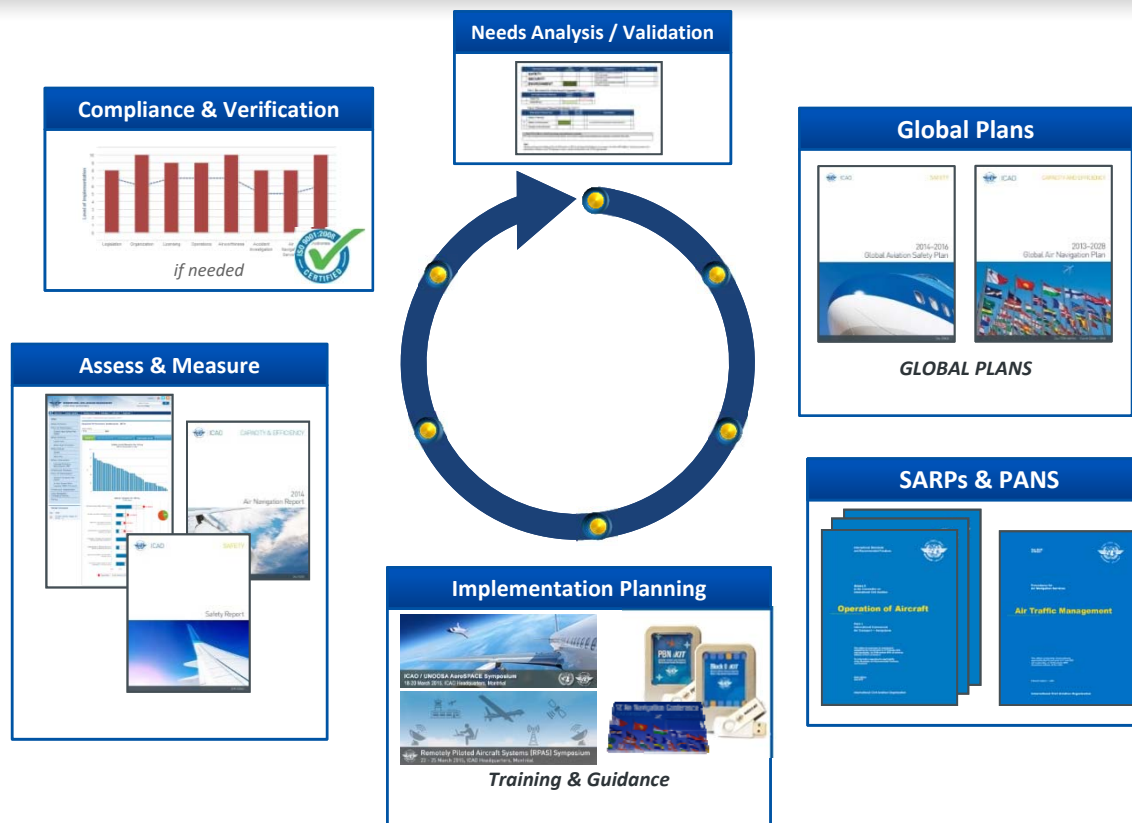






# Key concepts

- **ASBU Block:** a six year timeframe whose starting date defines a deadline for an element to be available for implementation.
- **ASBU Thread:** key feature area of the air navigation system that needs improvement in order to achieve the vision outlined in the Global ATM Operational Concept.
- **ASBU Module:** a group of elements from a thread that, according to the enablers' roadmap, will be available for implementation within the defined deadline established by the ASBU Block.
- **ASBU Element:** a specific change in operations designed to improve the performance of the air navigation system under specified operational conditions.
- **ASBU Enabler:** component (standards, procedures, training, technology, etc) required to implement an element.





# AMET: MET INFORMATION

- **Enabler**
  - For operational threads and also the Network/Infrastructure threads
- **Challenge**
  - To ensure that all the ASBU threads and related elements are able to fully articulate the MET information requirements in the future
- **MET information vs. existing products**
  - Information = phenomenon/parameter and data characteristics such as severity, accumulation, intensity, probability of occurrence, confidence/uncertainty of forecasts and reliability, etc.



# AMET: Evolution & ICAO provisions

- Evolution driven by the **transition to the SWIM environment** and by the need for more **interoperability allowing integration of MET information** in ATM systems
- Basic Building Block (BBB): baseline
- Block 0: 2013
  - Existing information products
  - Annex 3 (Amdt 77 incl.) + Amdt 78
- Block 1: 2019
  - Transition towards an information-centric environment »»» MET information
  - Amdts 79+ and PANS-MET



# DATM: Aeronautical Information

- **Enabler**
  - For operational threads and also the Network/Infrastructure threads
- **Challenge**
  - To ensure that all the ASBU threads and related elements are able to fully articulate the AI requirements in the future
- **Digital vs. Paper documentation & telex-based text messages . Quality management**
  - Through aeronautical information service (AIS) to aeronautical information management (AIM) implementation, use of aeronautical information exchange model (AIXM), migration to electronic aeronautical information publication (eAIP) and better quality and availability of aeronautical data.
- **Cross-domain information exchange**
- **Access via internet-protocol-based tools**



# DATM: Evolution & ICAO provisions

- Evolution driven by the **transition to the SWIM environment** and by the need for **system interoperability** allowing for the **integration of aeronautical information** into ATM systems
- Basic Building Block (BBB): baseline
- Block 0: 2013
  - Existing information products
- Block 1: 2019
  - Information data sets
  - Amdt 40 to Annex 15 and new! PANS-AIM



# FICE: FLIGHT & FLOW INFORMATION

- Enabler
  - For operational threads and also the Network/Infrastructure threads
- Challenge
  - To clarify the evolution of flight information exchange, the new capabilities as well as to ensure that all the ASBU threads and related elements articulate the F&F information requirements in the future
- Manual vs. digital transfer of flight data. TBO foundation.
  - Implement pre-flight collaborative coordination and maintenance of advanced flight information: improved response to operators flight preferences.



# FICE: Evolution & ICAO provisions

- Evolution driven by the need to establish the **foundation for TBO and co-dependent on the transition to SWIM environment**
- Basic Building Block (BBB): baseline
- Block 0: 2013
  - Digital transfer of flight information
  - Annex 10 Volume II
  - Doc 4444 PANS ATM
  - Doc 9694 Manual on Air Traffic Services Data Link Applications
- Block 1: 2019
  - Advanced exchange of flight information
  - FF-ICE/1 SARPs and PANS
  - Updated Doc 9965 Manual on Flight and Flow- Information for a Collaborative Environment (FF-ICAE)





# SWIM: INFORMATION MANGEMENT

- Enabler
  - For operational threads and also the Network/Infrastructure threads
- Challenge
  - To ensure that all the ASBU threads and related elements are able to fully articulate the SWIM requirements in the future and reflect the envisaged system requirements
- ATS messages vs. SWIM.
  - Enabler for all envisioned ATM information exchange in support of ATM operations



# SWIM: Evolution & ICAO provisions

- Evolution driven by the need to provide a **flexible platform for information services to meet operational needs**
- Basic Building Block (BBB)
  - Point-to-point connectivity and protocols using pre-defined messages
- Block 0: 2013
- Block 1: 2019
  - Advanced exchange of ATM information via a secure aviation intranet
  - Initial SWIM SARPs and PANS
  - Updated Doc 10039 SWIM Manual, Vol. 1 and 2
    - Including operational scenarios and use cases
  - Air Traffic Management Information Reference Model (AIRM).
    - Including guidance material



# iAID

The screenshot displays the iAID web application interface. At the top left is the ICAO logo and the text 'ICAO AID'. To the right are social media icons for Facebook, Twitter, LinkedIn, YouTube, and Instagram, and a search bar labeled 'Search ICAO'. Below the header is a navigation menu with 'ELEMENT OVERVIEW', 'THREAD OVERVIEW', and 'ENABLERS'. The main content area is titled 'ELEMENT OVERVIEW' and features a filter bar with 'Functional Description' (checked), 'Enablers', 'Deployment Applicability', and 'Performance Impact Assessment', along with an 'Add Element' button. A list of elements is shown below, each with a unique ID and a description, and edit/delete icons.

ID	Description	Actions
WAKE-B0/1	Wake turbulence separation minima based on six aircraft categories	Edit, Delete
APTA-B0/1	PBN Approaches (with basic capabilities)	Edit, Delete
APTA-B0/2	PBN SID and STAR procedures (with basic capabilities)	Edit, Delete
APTA-B0/3	Cat I Precision Approach Procedures	Edit, Delete
APTA-B0/4	PBN transitions to/from xLS (with basic capabilities)	Edit, Delete



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(WACAF) Office  
Dakar

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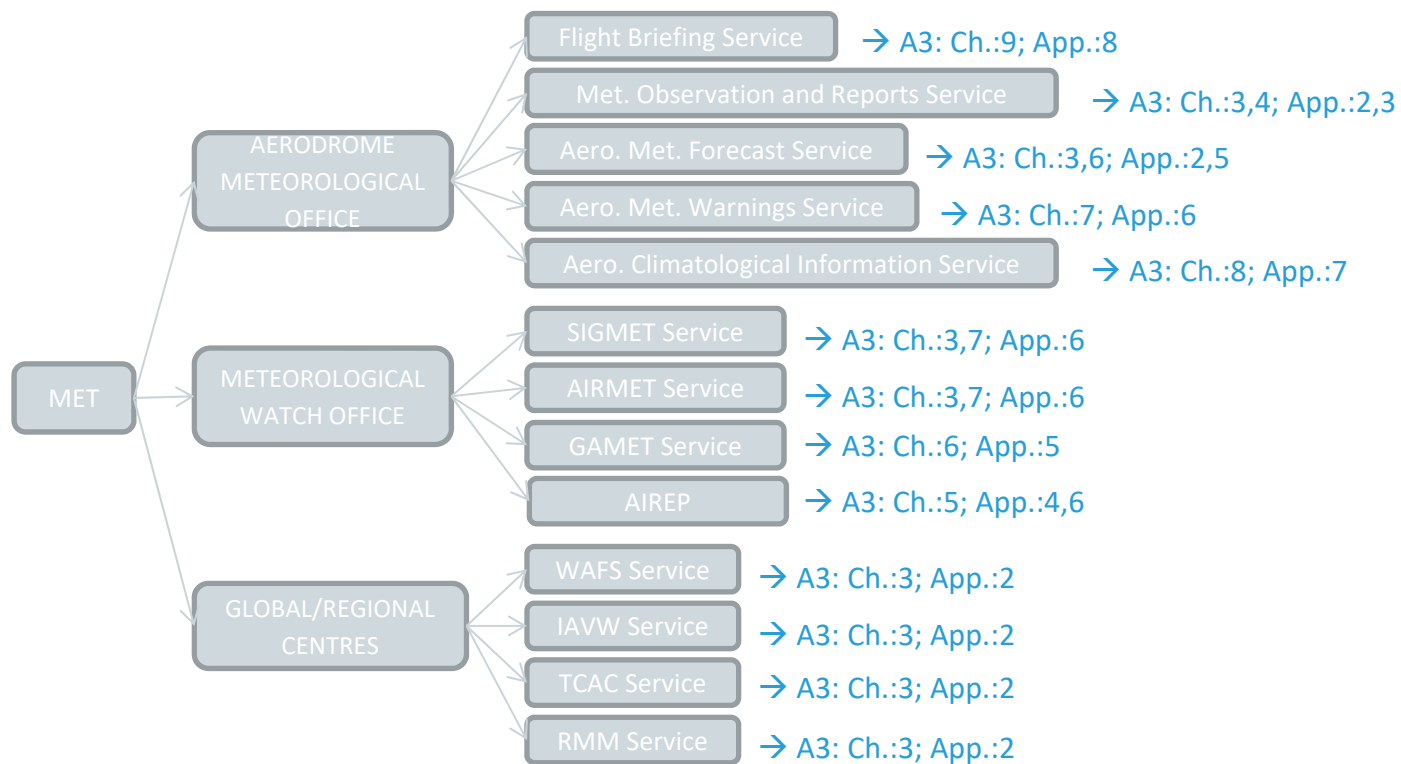
Eastern and  
Southern African  
(ESAF) Office  
Nairobi

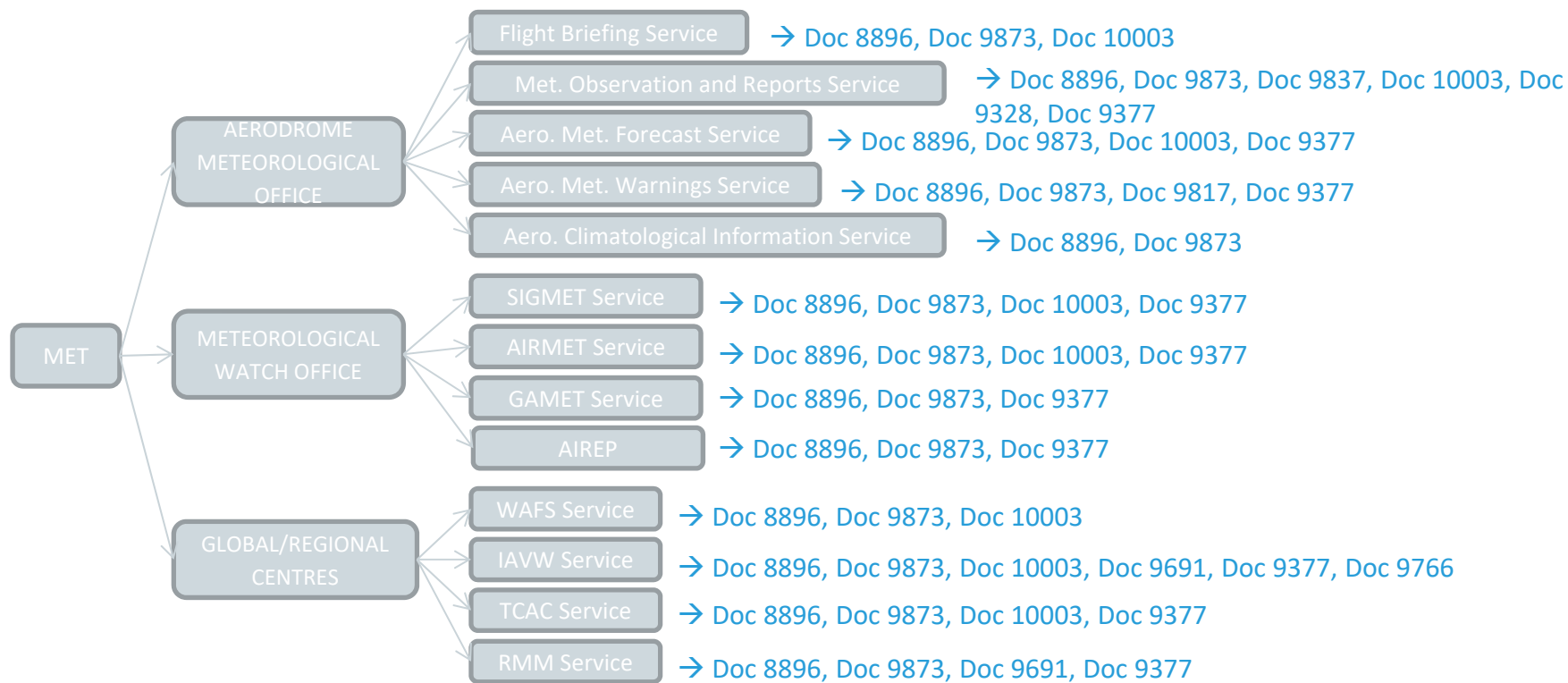
Asia and Pacific  
(APAC) Sub-office  
Beijing

Asia and Pacific  
(APAC) Office  
Bangkok



THANK YOU







# AMET Block 0

- **Concept of operations**
  - *Global, regional and local meteorological information to support flexible airspace management, improved situational awareness, collaborative decision-making and dynamically optimized flight trajectory planning.*
- **Elements**
  - AMET-B0/1 Meteorological observation products
  - AMET-B0/2 Meteorological forecast products
  - AMET-B0/3 Meteorological advisory and warning products
  - AMET-B0/4 Climatological and historical meteorological products
  - AMET-B0/5 Dissemination of meteorological products



# AMET Block 0

- **New capabilities**
  - Provision of additional observations. More automated.
  - Higher temporal and spatial resolution for lightning, radar and satellite information
  - Greater resolution (spatial and temporal) of gridded WAFS information. ICE, TURB, CB WAFS
  - Improved visualization of meteorological forecast products and advisory and warning products
  - VAA extended period forecasts. Increased VAAC domain
  - Commencement of the exchange of meteorological information using the ICAO Meteorological Information Exchange Model (IWXXM), being the conversion of Traditional Alphanumeric Code (TAC), using an IWXXM schema, into XML/GML.





# AMET Block 1

- **Concept of operations**

- *Meteorological information supporting automated decision process or aids, involving meteorological information, meteorological information translation, ATM impact conversion and ATM decision support.*

- **Elements**

- AMET-B1/1 Meteorological observation information

- AMET-B1/2 Meteorological forecast information

- AMET-B1/3 Climatological and historical meteorological information

- AMET-B1/4 Meteorological information in SWIM



# AMET Block 1

- New capabilities
  - Commencement of change from product-centric to data-centric information (parameters and phenomena, and their associated characteristics).
  - Space weather information. Sulphur dioxide (SO<sub>2</sub>) services. Enhanced hazardous weather services.
  - Climatological data. Climate change information.
  - Meteorological information in ICAO Meteorological Information Exchange Model (IWXXM) form starts to replace traditional alphanumeric code (TAC) products. Human-readable products will start to be derived from the IWXXM information (rather than the other way around). The introduction of web services allows for progressive replacement of fixed line dissemination systems.



# DATM Block 0

- **Concept of operations**
  - *Aeronautical information which encompass improved data quality (accuracy, resolution, integrity, timeliness, traceability, completeness, format), timely distribution of information, digital exchange and processing of information, and more efficient management of aeronautical information to avoid reliance on manual processing and manipulation. Quality-assured aeronautical information is essential.*
- **Elements**
  - DATM-B0/1 Provision of quality-assured aeronautical data and information
  - DATM-B0/2 Provision of digital AIP data sets
  - DATM-B0/3 Provision of digital terrain data sets
  - DATM-B0/4 Provision of digital obstacle data sets
  - DATM-B0/5 Provision of digital instrument flight procedure data sets
  - DATM-B0/6 Provision of digital aerodrome mapping data sets
  - DATM-B0/7 NOTAMs improvement



# DATM Block 0

- **New capabilities**
  - Ensure that aeronautical data and information comply with the required standards.
  - Use of common reference systems
  - Automated data-centric environment
  - High quality
  - Provision of digital data sets:
    - AIP
    - Terrain data
    - Obstacle data
    - Aerodrome mapping data
    - Instrument flight procedure data
  - **NOTAM digital version**



# DATM Block 1

- **Concept of operations**
  - *This module addresses the need for increased aeronautical information integration and will support a new concept of ATM information exchange fostering access via internet-protocol-based tools based on service orientation in accordance with the SWIM concept. Additional aeronautical information may be required.*
- **Elements**
  - DATM-B1/1    AIM requirements to support NOPS-B1/5
- **New capabilities**
  - Airspace usage plan (AUP) and User usage plan (UUP) are exchanged using SWIM.



# FICE Block 1

- **Concept of operations**

- *Establish foundation for TBO by enabling exchange of advanced flight information between operators and ATM and unique identification of the flight. Implement pre-flight collaborative coordination and maintenance of advanced flight information: improved response to operators flight preferences. Capacity and demand balancing improvement (better capacity utilization) due to timely and accurate flight information.*

- **Elements**

- FICE-B1/1 Flight Information Exchange Model (FIXM)
- FICE-B1/2 eFPL processing
- FICE-B1/3 Planning Service
- FICE-B1/4 Flight Plan Information Requests



# FICE Block 0

- **Concept of operations**
  - *To improve coordination between air traffic service units (ATSUs) by using ATS basic interfacility flight data communication. The benefit is the improved efficiency through digital transfer of flight data.*
- **Elements**
  - FICE-B0/1 Automated basic Inter facility data exchange
- **New capabilities**
  - Replacement of coordination via voice by automatic message exchange



# FICE Block 1

- **New capabilities**
  - Globally Unique Flight Identifier (GUFI). ATS messages. New content envisioned. I.e. 4D Trajectories
  - Messaging, such as addresses, versioning, message numbers which supports FIXM in the FFICE and SWIM environment
  - Acceptance of any valid Filed Flight Plan by any ATM Service Provider (ASP) implementing FF-ICE
  - Determine relevant constraints applicable to a flight and feed them back to the operator. Support Preliminary Flight Plans.
  - Support flight plan information requests that replicate the function of the RQP and RQS messages. Allow to request and FF-ICE flight plan





# SWIM Block 1

- Concept of operations
  - *System Wide Information Management replaces the current point-to-point technologies by a secure aviation intranet relying on internet technologies for providing information (exchange) services to the entire ATM community. In order to facilitate information exchange through standardised SWIM information services via, for example, request/reply or publish/subscribe exchange patterns, common data models and service descriptions are defined and appropriate governance rules are established. This thread is not in itself an operational improvement but rather a fundamental enabler to support all ATM improvements that require information to be made available.*



# SWIM Block 1

- **Elements**

- SWIM-B1/1      SWIM information service provider
- SWIM-B1/2      SWIM information service consumer
- SWIM-B1/3      SWIM registry

- **New Capability**

- Exposure of services
- Discovery of services
- User access control