ICAO CAPACITY & EFFICIENCY

GLOBAL AIR NAVIGATION CONSIDERATION (GANP Overview) AND ASBU IMPLEMENTATION

MAYDA ÁVILA
REGIONAL OFFICER
COMMUNICATION, NAVIGATION AND SURVEILLANCE

State National Air Navigation Plan (ANP) Development Workshop & First NAM/CAR Air Navigation Implementation Working Group (ANI/WG) Aviation System Block Upgrades (ASBU) Task Force (TF) Meeting (ASBU/TF/1)
Mexico City, Mexico, March 12-15, 2018)

AGENDA

ICAO Strategy

ASBU Implementation – Block 0

SWIM, AIM IMPLEMENTATION (Considerations)

NACC REGIONAL OFFICE (RPBANIP)

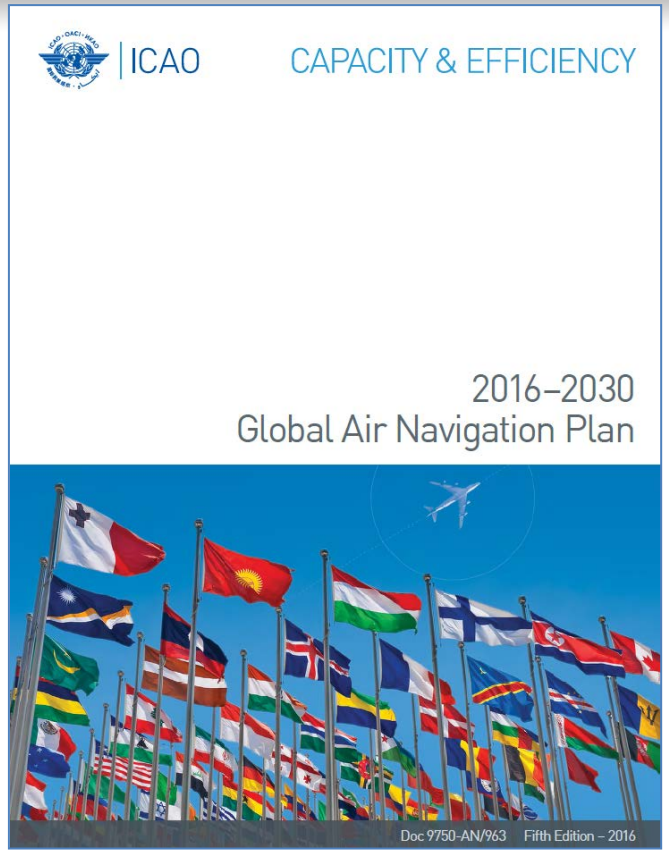
Conclutions

ICAO Strategy

Global Air Navigation Plan

- ICAO's Vision
- Our Mission
- 2017–2019 Strategic Objectives

Aviation System Block Upgrades (ASBUs), Modules and Roadmaps



ICAO STRATEGIC OBJECTIVES

2017–2019 Strategic Objectives

A. **Safety**
Enhance global civil aviation safety.

B. **Air Navigation Capacity and Efficiency**
Increase capacity and improve efficiency of the global civil aviation system.

C. **Security and Facilitation**
Enhance global civil aviation security and facilitation.

D. **Economic Development of Air Transport**
Foster the development of a sound and economically-viable civil aviation system.

E. **Environmental Protection**
Minimize the adverse environmental effects of civil aviation activities.

ICAO's 10 Key Air Navigation Policy Principles

1. Commitment to the implementation of ICAO's Strategic Objectives and Key Performance Areas.
2. Aviation safety is the highest priority.
3. Tiered approach to air navigation planning.
4. Global Air Traffic Management Operational Concept (GATMOC)
5. Global air navigation priorities
6. Regional and State air navigation priorities
7. Aviation System Block Upgrades (ASBUs), Modules and Roadmaps
8. Use of ASBU Blocks and Modules
9. Cost-benefit and financial issues
10. Review and evaluation of air navigation planning.

ICAO companion publications supporting the GANP

Global Air Traffic Management Operational Concept (Doc 9854)

The Global ATM Operational Concept (GATMOC) was published in 2005. It set out the parameters for an integrated, harmonized and globally interoperable ATM system planned up to 2025 and beyond. Doc 9854 can serve to guide the implementation of CNS/ATM technology by providing a description of how the emerging and future ATM system should operate. The GATMOC also introduced some new concepts:

a. **planning based on ATM system performance;**
b. **safety management through the system safety approach; and**
c. **a set of common performance expectations of the ATM community.**

ICAO companion publications supporting the GANP

Manual on Air Traffic Management System Requirements (Doc 9882)

Doc 9882, published in 2008, is used by PIRGs as well as by States as they develop transition strategies and plans. It defines the high-level requirements (i.e. ATM system requirements) to be applied when developing Standards and Recommended Practices (SARPs) to support the GATMOC. This document provides high-level system requirements related to:

a. **system performance-based on ATM community expectations;**
b. **information management and services;**
c. **system design and engineering; and**
d. **ATM concept elements (from the GATMOC).**

Block Upgrade Technology Roadmaps

- Technology Roadmaps complement the ASBU Modules by providing timelines for the technology that will support the communications, navigation and surveillance (CNS), information management (IM) and avionics requirements of the global air navigation system. These Roadmaps provide guidance for infrastructure planning (and status) by indicating on a per-technology basis, the need for and readiness of:

- existing infrastructure
- ICAO Standards and guidance material
- Demonstrations and validations
- Initial operational capability (IOC) of emerging technologies
- global implementation.

ASBU IMPLEMENTATION

BLOCK 0

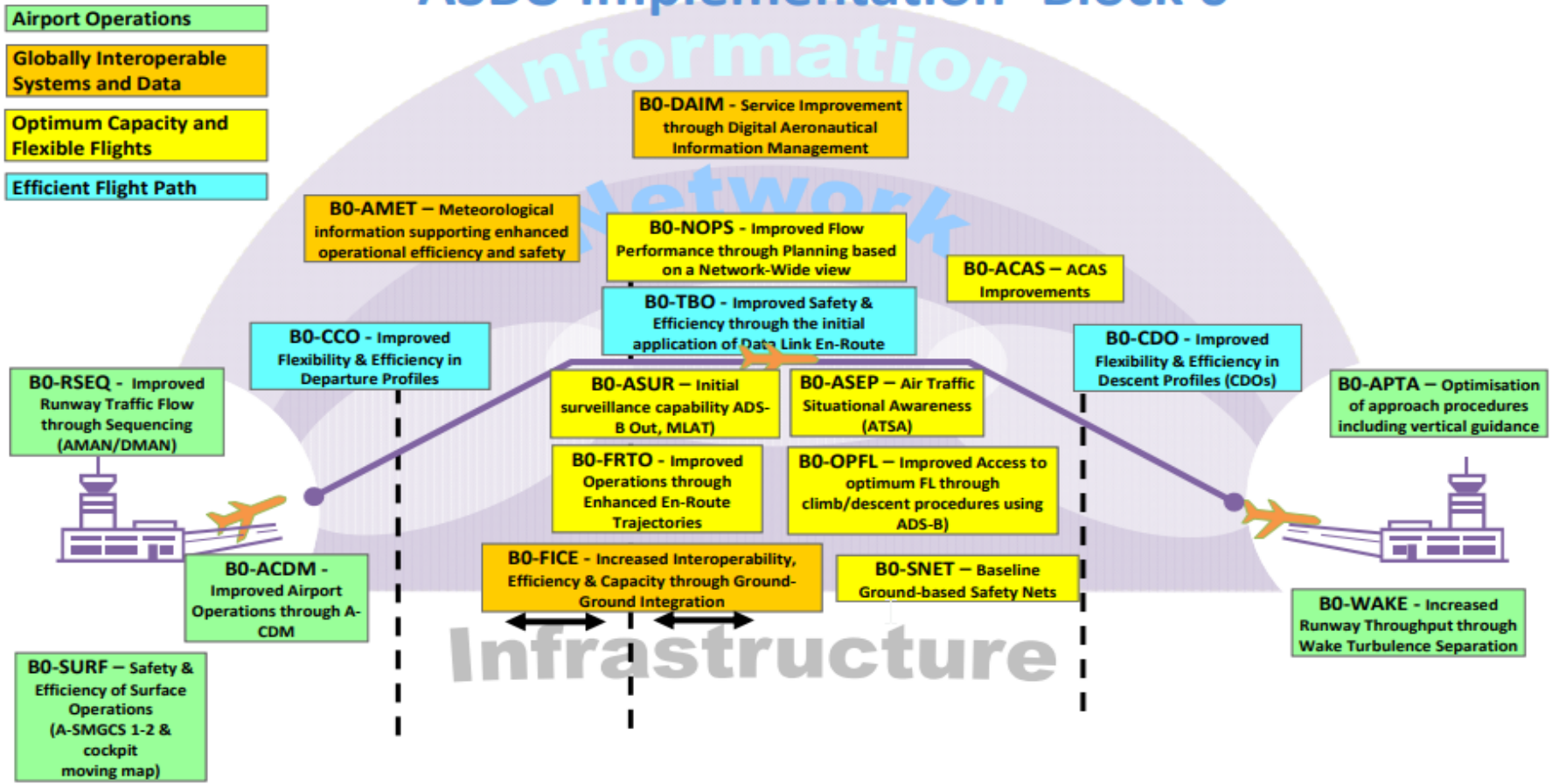
BLOCK 0

Block 0 is composed of Modules containing technologies and capabilities which have already been developed and can be implemented today. Based on the milestone framework established under the overall Block Upgrade strategy, ICAO Member States are encouraged to implement those Block 0 Modules applicable to their specific operational needs.

ASBU Implementation- Block 0

Performance Improvement Areas

- Airport Operations
- Globally Interoperable Systems and Data
- Optimum Capacity and Flexible Flights
- Efficient Flight Path



ASBU Implementation Overview

ASBU Modules	ASBU Modules Identifiers
APTA	Airport Accessibility
WAKE	Wake Turbulence Separation
RSEQ	Runway Sequencing
SURF	Surface Operations
ACDM	Airport Collaborative Decision Making
FICE	FF/ICE
DATM	Digital Aeronautical Management
AMET	Advanced Meteorological Information
FRTO	Free Route Operations
NOPS	Network Operations
ASUR	Alternative Surveillance
ASEP	Airborne Separation
OPFL	Optimum Flight Levels
ACAS	Airborne Collision Avoidance Systems
SNET	Ground-Based Safety Nets
CDO	Continuous Descent Operations
TBO	Trajectory-Based Operations
CCO	Continuous Climb Operations

Bloque 0

ADS-B as key enabler of the ASBU implementation

B0

B0- ASURF
Initial surveillance capability ADS-B Out, MLAT

Ground surveillance supported by ADS-B OUT and/or wide area Multilateration systems will improve safety, especially search and rescue and capacity through separation reductions.

Operating environment/ Phases of flight: All airborne flight phases in continental or subsets of oceanic airspace and on aerodrome surfaces.

B0- SURF
Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2)

Airport surface surveillance for ANSP.

Basic A-SMGCS provides surveillance and alerting of movements of both aircraft and vehicles on the aerodrome thus improving runway/ aerodrome safety. ADS-B information is used when available (ADS-B APT) and enhanced vision systems (EVS) is used for low visibility operations.

Linkage B0-*SURF* / B0-*ACDM/ B0-RSEQ*

B0-ASUR: Initial capability for ground surveillance

- To provide initial capability for lower cost ground surveillance supported by new technologies such as ADS-B OUT and wide area multilateration (MLAT) systems

- This capability is characterized by being dependent/cooperative (ADS-B OUT) and independent/cooperative (MLAT). The overall performance of ADS-B is affected by avionics performance and compliant equipage rate.

Benefits

Capacity:
Improved coverage, capacity, velocity vector performance and accuracy can improve ATC performance in both radar and non-radar environments.

Efficiency:
Availability of optimum flight levels and priority to the equipped aircraft and operators.

Safety: Reduction of the number of major incidents. Support to search and rescue.

ADS-B as key enabler of the ASBU implementation

B0

B0: OPFL
Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B

Enables an aircraft to reach a more satisfactory flight level for flight efficiency or to avoid turbulence for safety. The use of In Trail Procedure (ITP) facilitates en-route climb or descent to enable better use of optimal flight levels in environments where a lack of ATC surveillance and/or the large separation minima currently implemented is a limiting factor. The main benefit of ITP is fuel/emissions savings and the uplift of greater payloads.

This can be applied to routes in procedural airspaces.

B0– SNET
Increased Effectiveness of Ground-based Safety Nets

Provides improvements to the effectiveness of the ground-based safety nets assisting the Air Traffic Controller and generating, in a timely manner, alerts of an increased risk to flight safety (such as short terms conflict alert, area proximity warning and minimum safe altitude warning).

Monitors flights to provide timely alerts to air traffic controllers of potential risks to flight safety. Alerts from short-term conflict alert (STCA), area proximity warnings (APW) and minimum safe altitude warnings (MSAW) are proposed. Ground-based safety nets make an essential contribution to safety and remain required as long as the operational concept remains human centred.

B0-OPFL : Improved access to optimum flight levels through climb/descent procedures using ADS-B

To enable aircraft to reach a more satisfactory flight level for flight efficiency or to avoid turbulence for safety. The main benefit of in-trail procedure (ITP) is fuel/emissions savings and the uplift of greater payloads.

This can be applied to routes in procedural airspaces.

Benefits

Capacity:
Improvement in capacity on a given air route.

Efficiency:
Increased efficiency on oceanic and potentially continental en-route.

Safety:
A reduction of possible injuries for cabin crew and passengers by providing a tool to manage contingency scenarios.

Environment:
Reduced emissions.

Surveillance related ASBU

B0

B0- TBO
Improved Safety and Efficiency through the initial application of En-Route Data Link

To implement an initial set of data link applications for surveillance and communications in ATC, supporting flexible routing, reduced separation and improved safety.

Linkage with B0/FICE

Requires good synchronization of airborne and ground deployment to generate significant benefits, in particular to those equipped. Benefits increase with the proportion of equipped aircraft.

For ground systems, the necessary technology includes the ability to manage ADS-C contract, process and display the ADS-C position messages. CPDLC messages need to be processed and displayed to the relevant ATC unit. Enhanced surveillance through multi-sensor data fusion facilitates transition to/from radar environment.

B0-DATM Service improvement through digital aeronautical information management

The initial introduction of digital processing and management of information from origination to publication through, aeronautical information service (AIS)/aeronautical information management (AIM) implementation, use of aeronautical exchange model (AIXM), migration to electronic aeronautical information publication (AIP) and better quality and availability of data.

Applicability

Applicable at State level with increased benefits as more States participate. States should be able to apply the most optimal exchange formats for the exchange of data as at the global level a standardized format is far more important to ensure global interoperability.

Benefits

Interoperability	Essential contribution to interoperability.
Safety	Reduction in the number of possible inconsistencies. Module allows for better data quality, safe guarding and validation of the data throughout the process, and harmonization/ synchronization with adjacent States, as necessary.

Cost

Reduced costs in terms of data inputs and checks, paper and post, especially when considering the overall data chain, from originators, through AIS to the end users. The business case for the aeronautical information conceptual model (AIXM) has been conducted in Europe and in the United States and has shown to be positive. The initial investment necessary for the provision of digital AIS data may be reduced through regional cooperation and remains low compared with the cost of other ATM systems. The transition from paper products to digital data is a critical pre-requisite for the implementation of any current or future ATM or Air Navigation concept that relies on the accuracy, integrity and timeliness of data.

CAPACITY & EFFICIENCY

B0-FICE	Increased interoperability, efficiency and capacity through ground-ground integration

To improve coordination between air traffic service units (ATSUs) by using ATS interfacility data communication (AIDC) defined by ICAO's *Manual of Air Traffic Services Data Link Applications* (Doc 9694). An additional benefit is the improved efficiency of the transfer of communication in a data link environment.

Applicability

Applicable to at least two area control centres (ACCs) dealing with en-route and/or terminal control area (TMA) airspace. A greater number of consecutive participating ACCs will increase the benefits.

Benefits

Capacity	Reduced controller workload and increased data integrity supporting reduced separations translating directly to cross sector or boundary capacity flow increases.
Efficiency	The reduced separation can also be used to more frequently offer aircraft flight levels closer to the flight optimum; in certain cases, this also translates into reduced en-route holding.
Interoperability	Seamlessness: the use of standardized interfaces reduces the cost of development, allows air traffic controllers to apply the same procedures at the boundaries of all participating centres and border crossing becomes more transparent to flights.
Safety	Better knowledge of more accurate flight plan information for receiving ATS units and reduced risk of coordination errors.

Cost

Increase of throughput at ATS unit boundary and reduced ATC workload will outweigh the cost of ground system software changes. The business case remains dependent on the environment.

SWIM, AIM IMPLEMENTATION

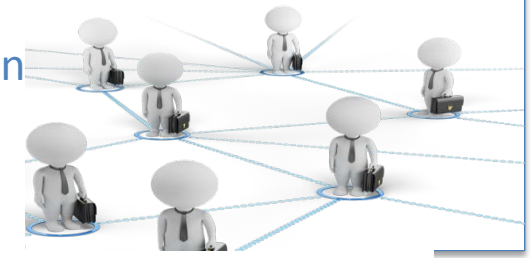
SOME CONSIDERATION

Common implementation challenges

- Institutional challenges:
  - Lack of effective regulatory frameworks to support AIM transition
  - Lack of clear requirements for stakeholders involved, quality of services is impacted
  - Lack of understanding that multiple and uncoordinated rules can be costly
  - Lack of competent staff/training

Common implementation challenges

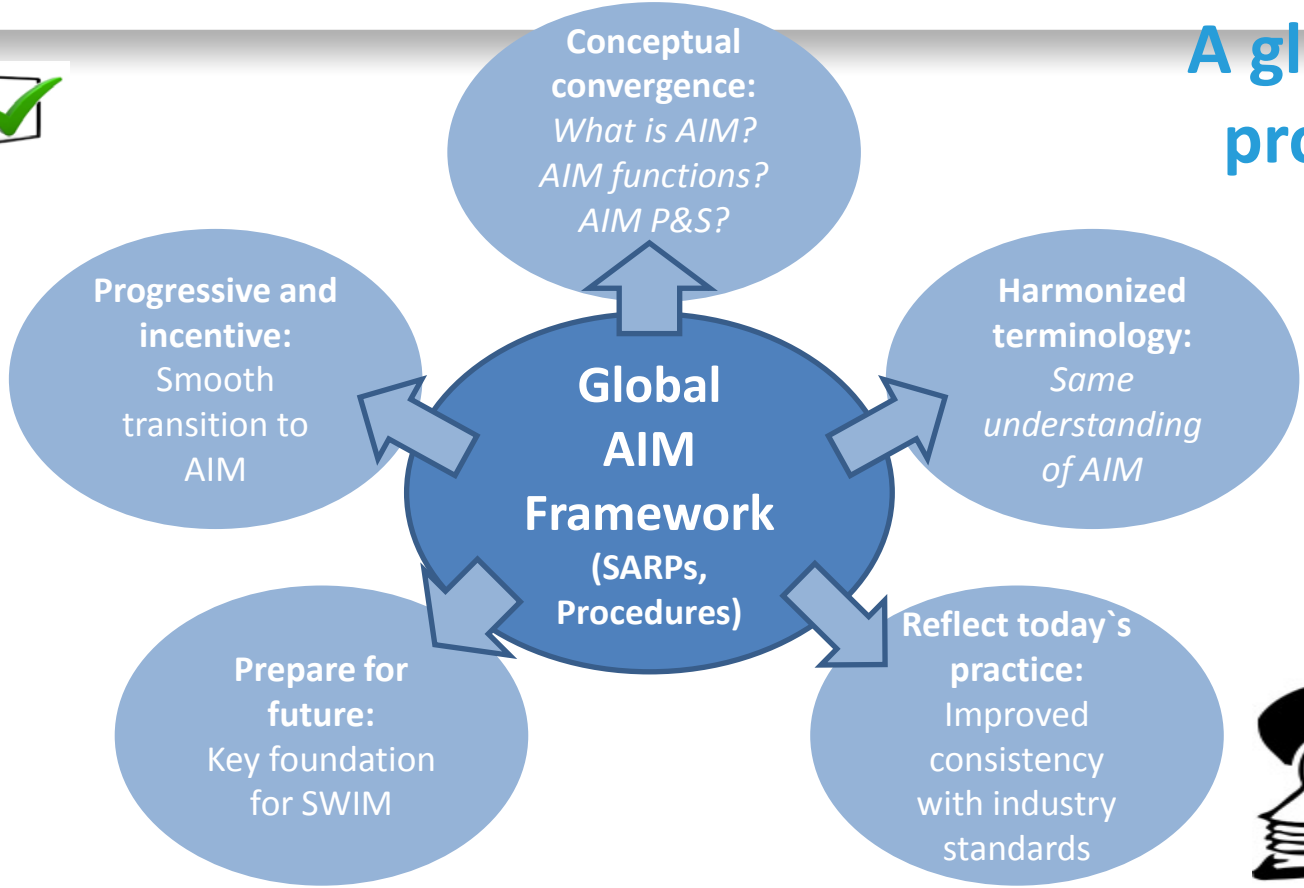
- Service provision challenges:
  - Quality issues in the aeronautical information products
  - Not easy relationship with data originators
  - Lack of competent resources, need for training
  - Digital datasets are still considered immature for implemen
    exchange of data between stakeholders is still a challenge



Common implementation challenges

- Technological challenges:
  - AIXM poses challenges in terms of data exchanges;
  - AIXM is very permissive. Major bilateral coordination is required;
  - Lack of global business rules to facilitate the exchange of information;
  - Need for mapping rules to convert AIXM to ARINC;
  - No incremental AIXM updates (UUIDs issues)

A global set of provisions…



How the global AIM framework helps…

- Important reference for National AIM Regulatory Framework
- Better identifies responsibilities and functions of stakeholders involved, including data originators
- Clear set of requirements of data to be collected and maintained by the AIS
- Focuses stakeholders attention on the right things: quality first
- Start addressing well-known issues (e.g. what infor
- Modern concepts: split data collection from data p

New practical tools

- PANS-AIM: instructions and practical procedures for AIM offices

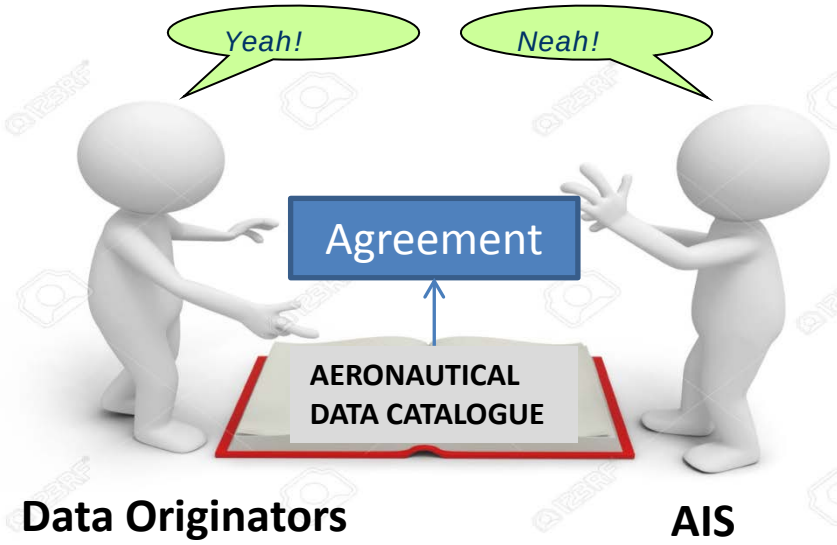
Example:

e.g. PROCESSING

1. Verification:
   - Comparison processes
   - Feedback processes
   - Processing through independent systems
   - Data and information compared with originator`s request
2. Validation:
   - Data and information compared to an expected range, value or business rules
   - Data and information compared between two different outputs

New practical tools

- Aeronautical Data Catalogue: description of AIM data scope



Subject	Property	Sub-Property	Type	Description	Note	Accuracy	Integrity	Orig Type	Pub. Res.	Ch
Aerodrome / Heliport				A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.						
	Certification date		Date	The date when the airport certification has been issued by the supervising authority.						
	Certification expiration date		Date	The date when the airport certification will become invalid.						
	Field elevation									
		Elevation	Elevation	The vertical distance above Mean Sea Level (MSL) of the highest point of the landing area.		0.5 m	essential	surveyed	1m or 1 ft	1 m
		Geoid undulation	Height	Geoid undulation at the aerodrome/ heliport elevation position	where appropriate	0.5 m	essential	surveyed	1 m or 1 ft	1 m
	Reference temperature		Value	The monthly mean of the daily maximum temperatures for the hottest month of the year at an aerodrome. This temperature should be averaged over a period of years. (ICAO recommendation)						
	Mean low temperature		Value	The mean lowest temperature of the coldest month of the year, for the last five years of data at the aerodrome elevation.		5 degrees				
	Magnetic variation			The angular difference between True North and Magnetic North.						
		Angle	Angle	The magnetic variation angle value		1 degree	essential	surveyed	1 degree	1 d
		Date	Date	The date on which the magnetic variation had the corresponding value.						
		Annual change	Value	The annual rate of change of the magnetic variation.						
	Reference point			The designated geographical location of an aerodrome.						

- One single source of data quality requirements
- Common language about data
- Basis for agreements with originators

NACC REGIONAL OFFICE

RPBANIP

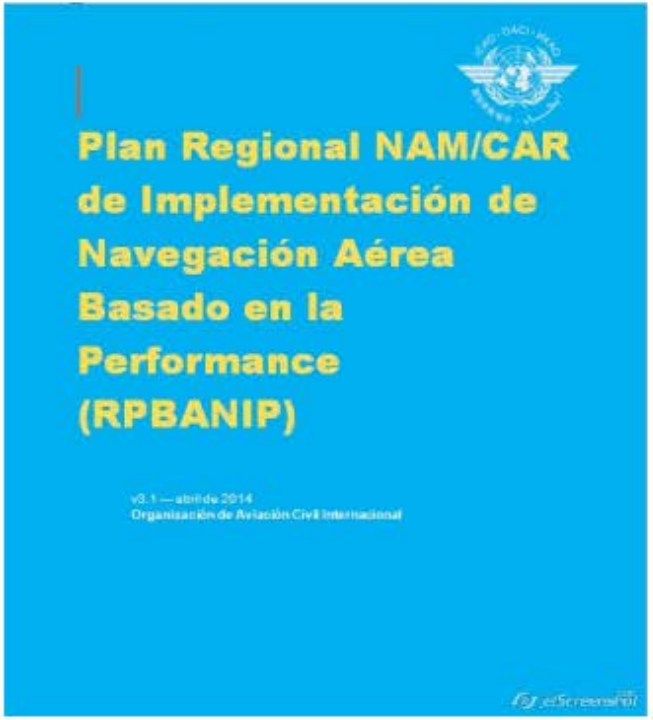
NAM/CAR REGIONAL PERFORMANCE-BASED AIR NAVIGATION IMPLEMENTATION PLAN (RPBANIP)

Harmonized implementation of Air Navigation Services and Systems under a Performance Based Approach.

The States, Air Navigation Implementation Working Group (ANI/WG) and other regional implementation groups follow-up this Plan, and formulate detailed Action Plans

Automation applications are included in most of the RPOs, particularly under RPO No. 4 Situational Awareness, RPO No. 6 Optimization and Modernization of Communication Infrastructure and RPO No. 7 Implementation of AIM respectively.

Version 3.1 of the RPBANIP is ASBU compliant and includes new ICAO ANRFs for monitoring and reporting



http://www.icao.int/NACC/Pages/namcar-RPBANIP.aspx

ASBU Implementation - Definition

Each Module is defined as follows:

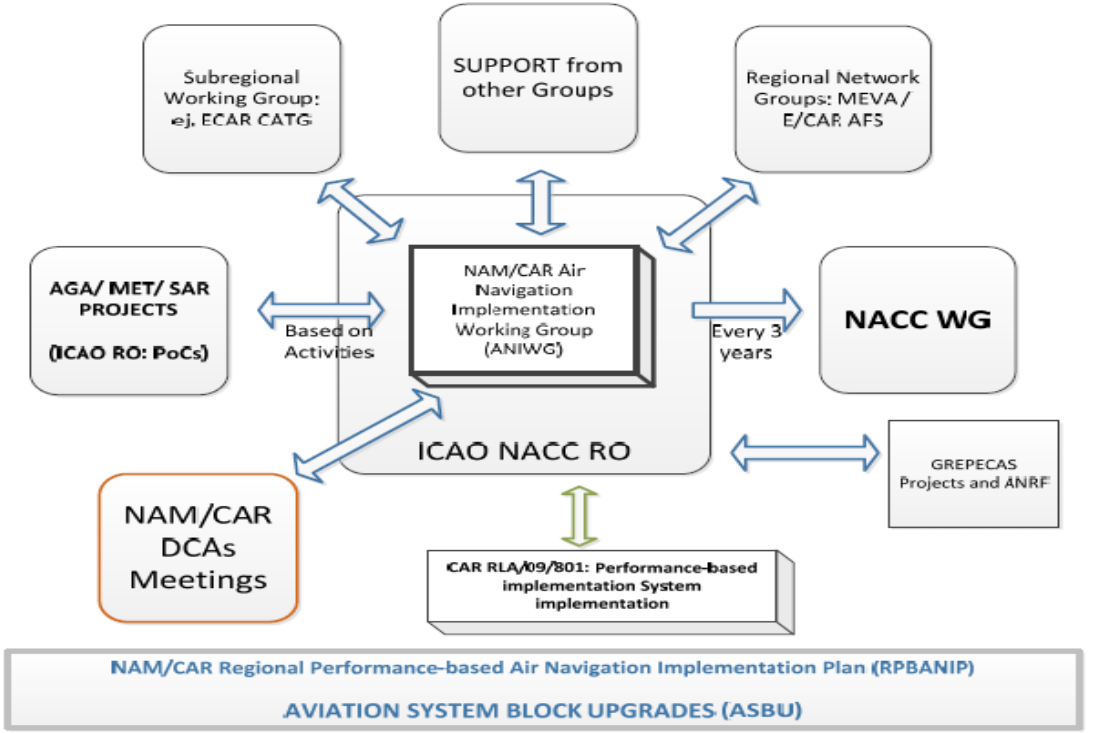
- Intended *Operational Improvement*/*Metric* to determine success
- Necessary *Procedures*/Air and Ground
- Necessary *Technology*/Air and Ground
- Positive *Business Case* per Upgrade
- *Regulatory Approval* Plan/Air and Ground
- *Well understood* by a Global Demonstration Trial
  - All synchronized to allow initial implementation
  - Won't matter ***when or where*** implemented

- Each Module is evaluated for its readiness
- If any component is not found to be ready it moves to a future Block for implementation
- Those Modules that are not specifically ready at a Block release are noted as "dates of readiness"
- States choose the modules that are applicable to their national needs and regional priorities

ASBU adopted modules

NAM/CAR SUPPORT AND IMPLEMENTATION WORKING GROUP

http://www.icao.int/NACC/Pages/nacc-regionalgroups-aniwg.aspx



Follow-up to operational improvements

TABLE GEN III-1 a) CAR IMPLEMENTATION INDICATOR(S) FOR EACH ASBU BLOCK 0 MODULE

Explanation of the Table

1 Block 0 Module Code
2 Block 0 Module Title
3 High level Implementation Indicator/ Module elements
4 Remarks (include any specific selection or applicable ATS units, aerodromes, etc.)

Module Code	Module Title	Implementation Indicator	Remarks
1	2	3	4
B0-APTA	Optimization of Approach Procedures including vertical guidance	% of international aerodromes having at least one runway end provided with APV Baro-VNAV or LPV procedures	

Appendix B - Main Planning Table Template

	Objectives					Priorities and targets			Reference
Block	ASBU modules and elements Enablers	Performance Improvement Area	Applicable or not in [Region] (Yes/No)	Regional planning elements	Enablers	Priority allocated in [Region]	Target(s) in [Region]	Indicator(s) / Metric(s)	Supporting Planning Document (ANRF, other)

ASBU B0-30/DAIM: Planning Targets and Implementation Progress	
Elements	Targets and Implementation Progress (Ground and Air)
1. QMS - AIM	100 % of States QMS Certified by Dec.2016
1. e.TOD Implementation	10 % of States e-TOD Implemented by Dec.2018
1. AIXM 5.1 Implementation	40 % of States with AIXM 5.1 implemented by Dec.2018
1. e-AIP Implementation	45 % of States with e-AIP implemented by Dec.2018
1. Digital NOTAM	35 % of States with Digital NOTAM implemented by Dec. 2018

ASBU Implementation

Performance-based Regional Plan (RPBANIP)

New eANP – Volume III

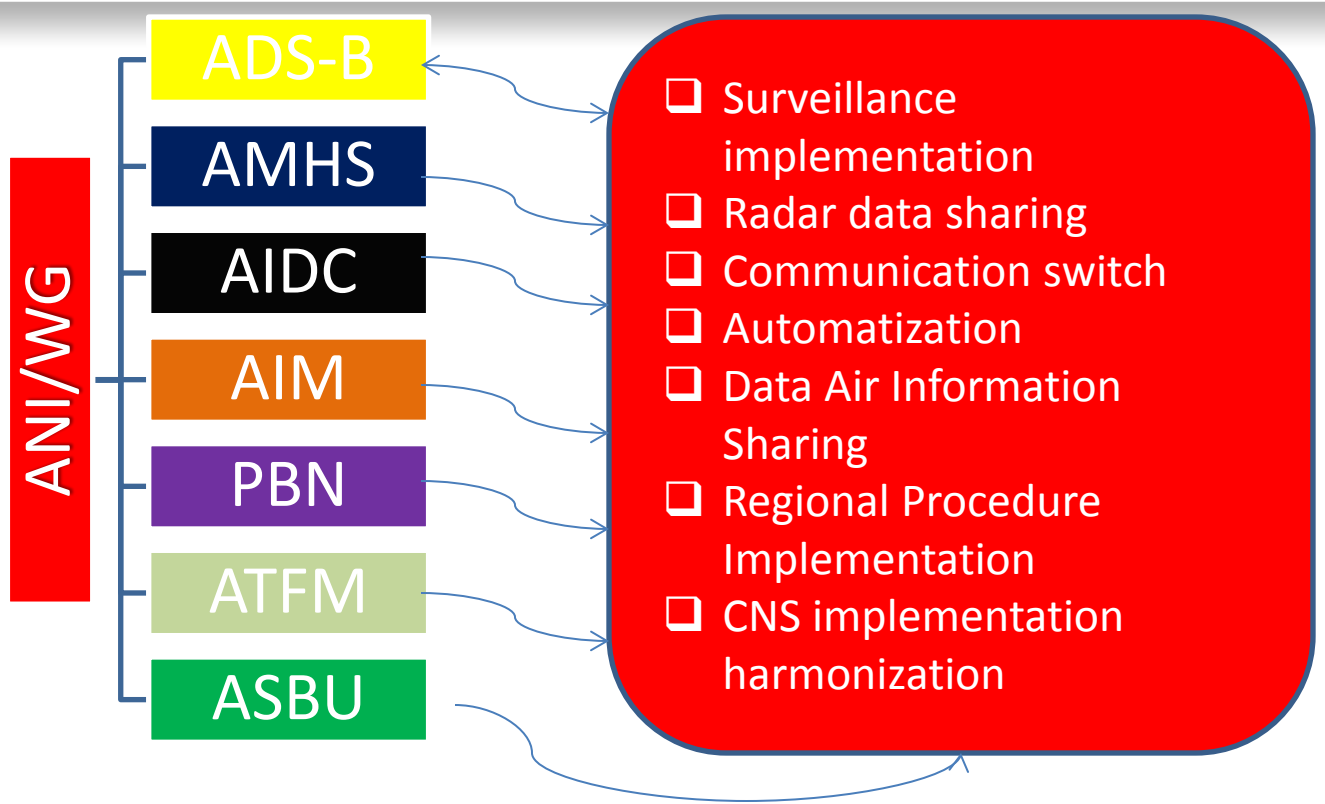
Volume III contains dynamic/flexible plan elements related to the implementation of the air navigation system and its modernization in line with the ICAO Aviation System Block Upgrades (ASBUs) and associated technology roadmaps described in the Global Air Navigation Plan (GANP).

Appendix B - Main Planning Table Template

	Objectives					Priorities and targets			Reference
Block	ASBU modules and elements Enablers	Performance Improvement Area	Applicable or not in [Region] (Yes/No)	Regional planning elements	Enablers	Priority allocated in [Region]	Target(s) in [Region]	Indicator(s) / Metric(s)	Supporting Planning Document (ANRF, other)

- ICAO supports the States in the advice and management necessary to carry out a correct and successful implementation.

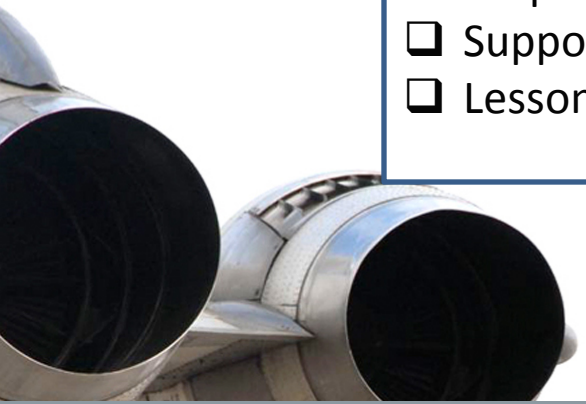
LOCAL	REGIONAL	GLOBAL
AIR NAVIGATION NATIONAL PLAN	SAME OBJETIVES COMMON IMPLEMENTATION	STANDARIZATION HARMONIZATION



https://www.icao.int/NACC/Pages/nacc-regionalgroups-aniwg.aspx

AIDC IMPLEMENTATION

- ❑ National plan implementation
- ❑ Regional plan implementation
- ❑ Development Studies
- ❑ Propose solution for common concerns
- ❑ Support States from knowledge
- ❑ Lesson learned



- https://www.icao.int/NACC/Pages/regional-group-AIDC.aspx

Conclusions

Work in an integrated way

- Update Information
- Improve technical requirement
- Update national and regional necessities
- Support and solve regional deficiencies
- Improve standardization and harmonization

State of the Art

- It does not means the best implementation
- Could be more expensive
- Could take more time to implement it capacities
- Take more time to harmonize


IT STARTS WITH
ONE

ICAO


North American Central American and Caribbean (NACC) Office Mexico City
South American (SAM) Office Lima
ICAO Headquarters Montréal
Western and Central African (WACAF) Office Dakar
European and North Atlantic (EUR/NAT) Office Paris
Middle East (MID) Office Cairo
Eastern and Southern African (ESAF) Office Nairobi
Asia and Pacific (APAC) Sub-office Beijing
Asia and Pacific (APAC) Office Bangkok
THANK YOU