B0 to B1

Saulo Silva

Regional and National Air Navigation Performance Framework/Aviation System Block Upgrade (ASBU) Implementation Workshop for the NAM/CAR Regions (Mexico City, Mexico, 22 – 26 August 2016)

Objective

To show Block 1 modules as an operational evolution from Block 0 modules.

- Vision

- ASBUs

- Evolution.

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.

Establish Principles and Priorities

Doc 9750: 2014-2016 Triennium Edition

2013-2028 | Global Air Navigation Plan

GANP Policy Principles

Aviation Safety is the Highest Priority

Cost Benefit and Financial issues

Aviation System Block Upgrades (ASBUs), Modules, Elements and Roadmaps

AIRPORT OPERATIONS

- **APTA** Optimized Airport Accessibility
- **WAKE** Wake Vortex Separation
- **RSEQ** Runway Sequencing
- **SURF** Surface Operations
- **ACDM** Airport Collaborative Decision Making
- **RATS** Remotely Operated Aerodrome Control

GLOBALLY INTEROPERABLE SYSTEMS AND DATA (SWIM)

- **FICE** Flight and Flow Information for a Collaborative Environment
- **DATM** Integration of Digital ATM Information
- **AMET** Integration of Meteorological information
- **SWIM** System Wide Information Management

OPTIMUM CAPACITY AND FLEXIBLE FLIGHTS (GLOBAL COLLABORATIVE ATM)

- **FRTO** Free Routing
- **NOPS** Network Operational Planning
- **ASUR** Initial Capability for Ground Surveillance
- **ASEP** Airborne Separation
- **OPFL** Optimum Flight Levels
- **ACAS** Airborne Collision Avoidance Systems
- **SNET** Safety Nets

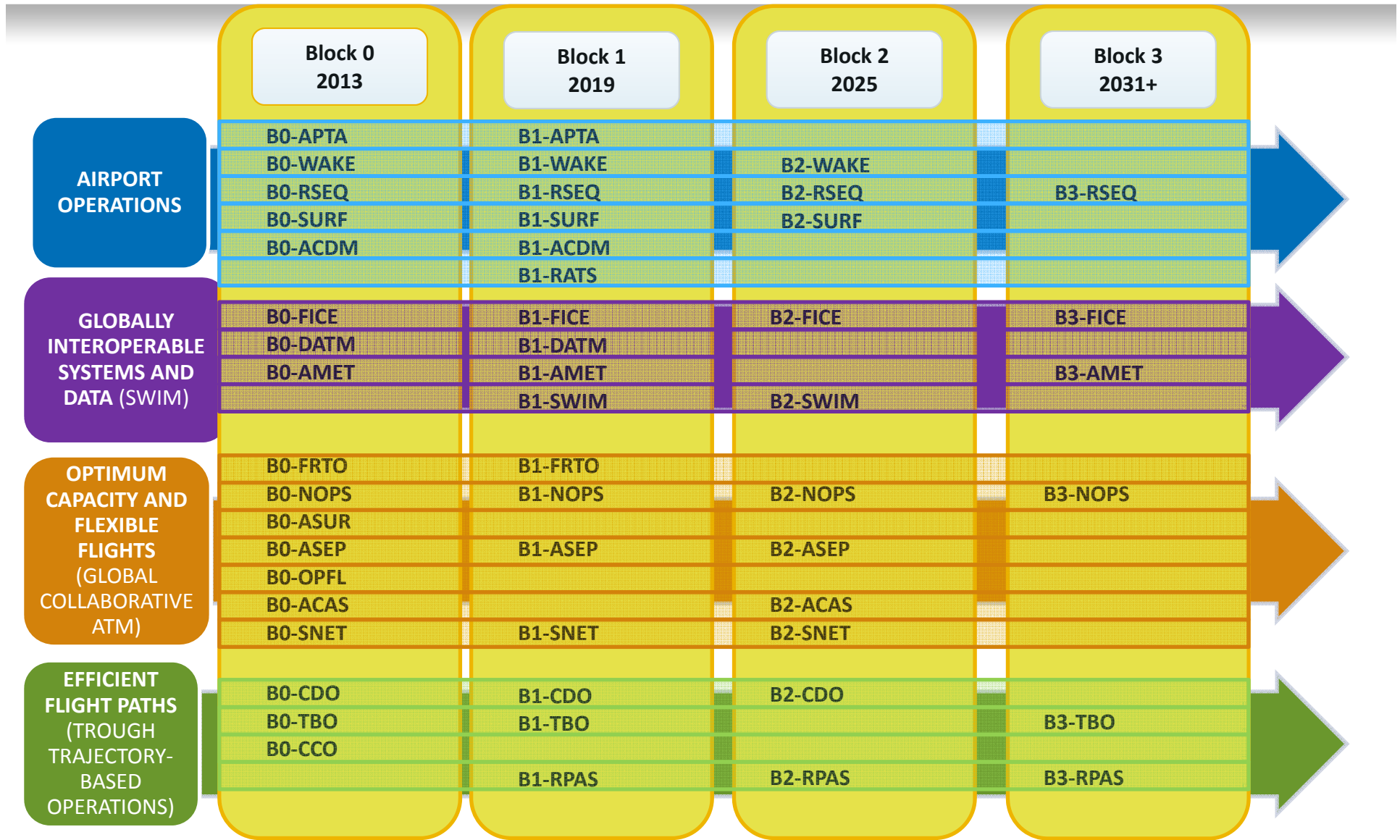## EFFICIENT FLIGHT PATHS (TROUGH TRAJECTORY-BASED OPERATIONS)

- **CDO** Continuous Descent Operations
- **TBO** Trajectory-based Operations
- **CCO** Continuous Climb Operations
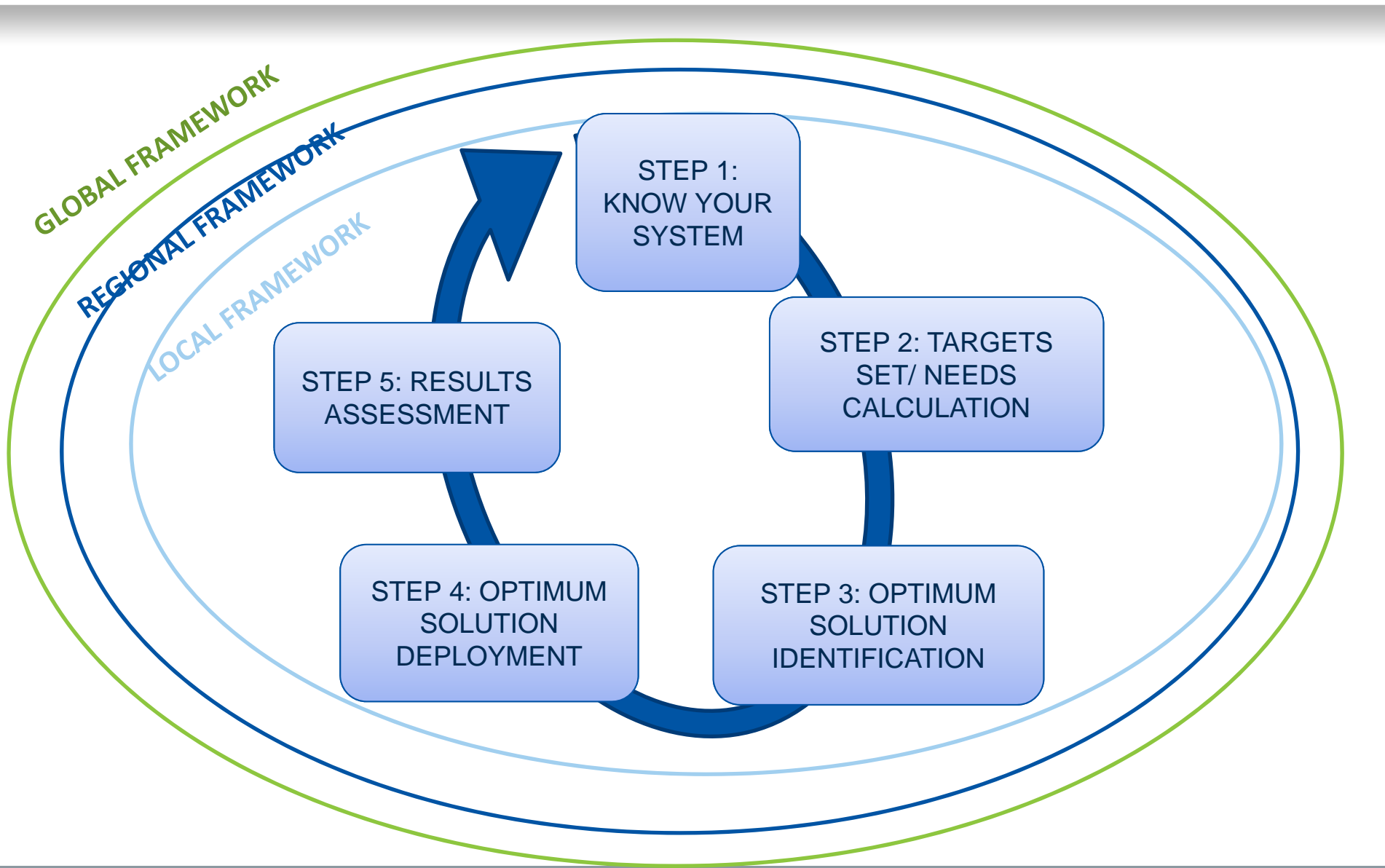- **RPAS** Integration of Remotely Piloted Aircraft

ASBUs FRAMEWORK

ICAO — UNITING AVIATION

Category	Block 0 2013	Block 1 2019	Block 2 2025	Block 3 2031+
AIRPORT OPERATIONS	B0-APTA	B1-APTA		
	B0-WAKE	B1-WAKE	B2-WAKE	
	B0-RSEQ	B1-RSEQ	B2-RSEQ	B3-RSEQ
	B0-SURF	B1-SURF	B2-SURF	
	B0-ACDM	B1-ACDM		
		B1-RATS		
GLOBALLY INTEROPERABLE SYSTEMS AND DATA (SWIM)	B0-FICE	B1-FICE	B2-FICE	B3-FICE
	B0-DATM	B1-DATM		
	B0-AMET	B1-AMET		B3-AMET
		B1-SWIM	B2-SWIM	
OPTIMUM CAPACITY AND FLEXIBLE FLIGHTS (GLOBAL COLLABORATIVE ATM)	B0-FRTO	B1-FRTO		
	B0-NOPS	B1-NOPS	B2-NOPS	B3-NOPS
	B0-ASUR			
	B0-ASEP	B1-ASEP	B2-ASEP	
	B0-OPFL			
	B0-ACAS		B2-ACAS	
	B0-SNET	B1-SNET	B2-SNET	
EFFICIENT FLIGHT PATHS (TROUGH TRAJECTORY-BASED OPERATIONS)	B0-CDO	B1-CDO	B2-CDO	
	B0-TBO	B1-TBO		B3-TBO
	B0-CCO			
		B1-RPAS	B2-RPAS	B3-RPAS

ASBUs FRAMEWORK

AIRPORT OPERATIONS

AIRPORT OPERATIONS

**Block 0
2013**

B0-APTA
B0-WAKE
B0-RSEQ
B0-SURF
B0-ACDM

**Block 1
2019**

B1-APTA
B1-WAKE
B1-RSEQ
B1-SURF
B1-ACDM
B1-RATS

**Block 2
2025**

B2-WAKE
B2-RSEQ
B2-SURF

**Block 3
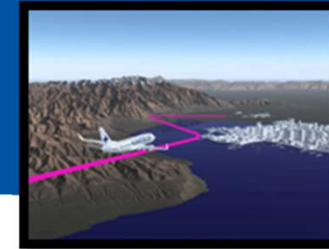2031+**

B3-RSEQ

Block 0 and Block 1

APTA

B0-APTA

Optimization of Approach Procedures including vertical guidance

First step toward universal implementation of GNSS-based approaches.

- GNSS-based PBN approach procedures
  - GNSS + Baro VNAV
  - GNSS + SBAS
  - GNSS + GBAS

B1-APTA

Optimized Airport Accessibility

Next step in the universal implementation of GNSS-based approaches.

- Extension of GNSS-based approaches
  - GNSS + GBAS: CAT I capability to category CAT II/III
  - Potential integration of the PBN STAR directly
- ❖ Limited factor: emergence of multi-frequency/constellation GNSS

Block 0 and Block 1

WAKE

B0-WAKE

Increased Runway Throughput through Optimized Wake Turbulence Separation
Revision of current ICAO wake vortex separation minima and procedures.

- RECAT
- Parallel operations
- WIDAO/WTMD
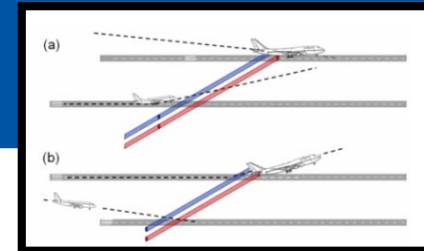
B1-WAKE

Increased Runway Throughput through Dynamic Wake Turbulence Separation
Dynamic management of wake turbulence separation minima based on the real-time identification of wake turbulence hazards.

- Leader/follower pair-wise static matrix of aircraft type wake separation pairings
- Use of airport wind information (predicted and monitored)
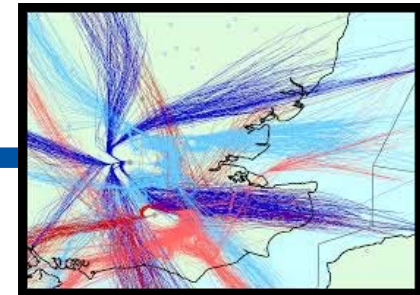- Wind prediction/monitoring

Block 0 and Block 1

RSEQ

B0-RSEQ
Improved Traffic Flow through Runway Sequencing (AMAN/DMAN)
Time-based metering to sequence departing and arriving flights.

- AMAN and time-based metering
- DMAN
- Point Merge

B1-RSEQ
Improved Airport Operations through Departure, Surface and Arrival Management
Extension of arrival metering and, integration of surface management with departure sequencing.

- Surface Management
- Departure and surface integration
- Extended arrival metering
- Utilization of RNAV/RNP routes

Block 0 and Block 1

SURF

Figure 2: A-SMGCS traffic display at London-Luton Airport (EGGW, LTN)
Movement area of an airport = manoeuvring area + apron(s)

B0-SURF

Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2) and Enhanced Vision System (EVS)
Airport surface surveillance for ANSP.

- Element 1 – A-SMGCS Level 1-2 (Surveillance & alerting)
- Element 2- Enhanced vision systems for taxi operations (e.g. infrared cameras, millimeter wave radar,...)
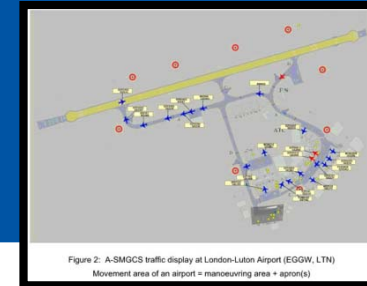
B1-SURF

Enhanced Safety and Efficiency of Surface Operations- SURF
Airport surface surveillance for ANSP and flight crews, cockpit moving map displays and visual systems for taxi operations.

- Element 1: Basic surface situational awareness (SURF)
- ADS-B In or TIS-B
- Cockpit electronic maps

Block 0 and Block 1

A-CDM

B0-ACDM
Improved Airport Operations through Airport-CDM

Airport operational improvements through the way operational partners at airports work together.

B1-ACDM Optimized Airport Operations through A-CDM Total Airport Management

Airport and ATM operational improvements through the way operational partners at airports work together.

- Airport Operations Planning (AOP)
- Airport Operations Centre (APOC)

Block 1

RATS

B1-RATS

Remotely Operated Aerodrome Control

Remote provision of ATS to aerodromes or remotely operated aerodrome control tower contingency and through visualization systems and tools.

- Element 1: Remote provision of ATS for single aerodromes
- Element 2: Remote provision of ATS for multiple aerodromes
- Element 3: Remote provision of ATS for contingency situations

GLOBALLY INTEROPERABLE SYSTEMS AND DATA (SWIM)

GLOBALLY INTEROPERABLE SYSTEMS AND DATA (SWIM)

Block 0
2013

B0-FICE
B0-DATM
B0-AMET

Block 1
2019

B1-FICE
B1-DATM
B1-AMET
B1-SWIM

Block 2
2025

B2-FICE

B2-SWIM

Block 3
2031+
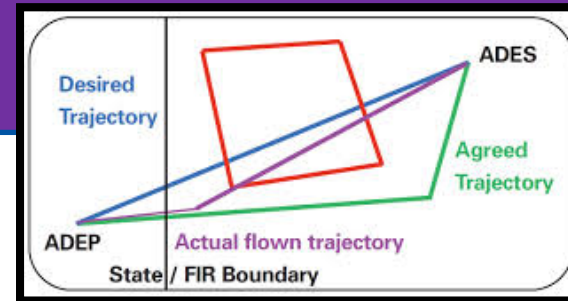
B3-FICE

B3-AMET

Block 0 and Block 1

FICE

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 though 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

Block 0 and Block 1

DATM

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.

Block 0 and Block 1

AMET

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

Block 1

SWIM

B1-SWIM

Performance Improvement through the application of System-Wide Information Management (SWIM)
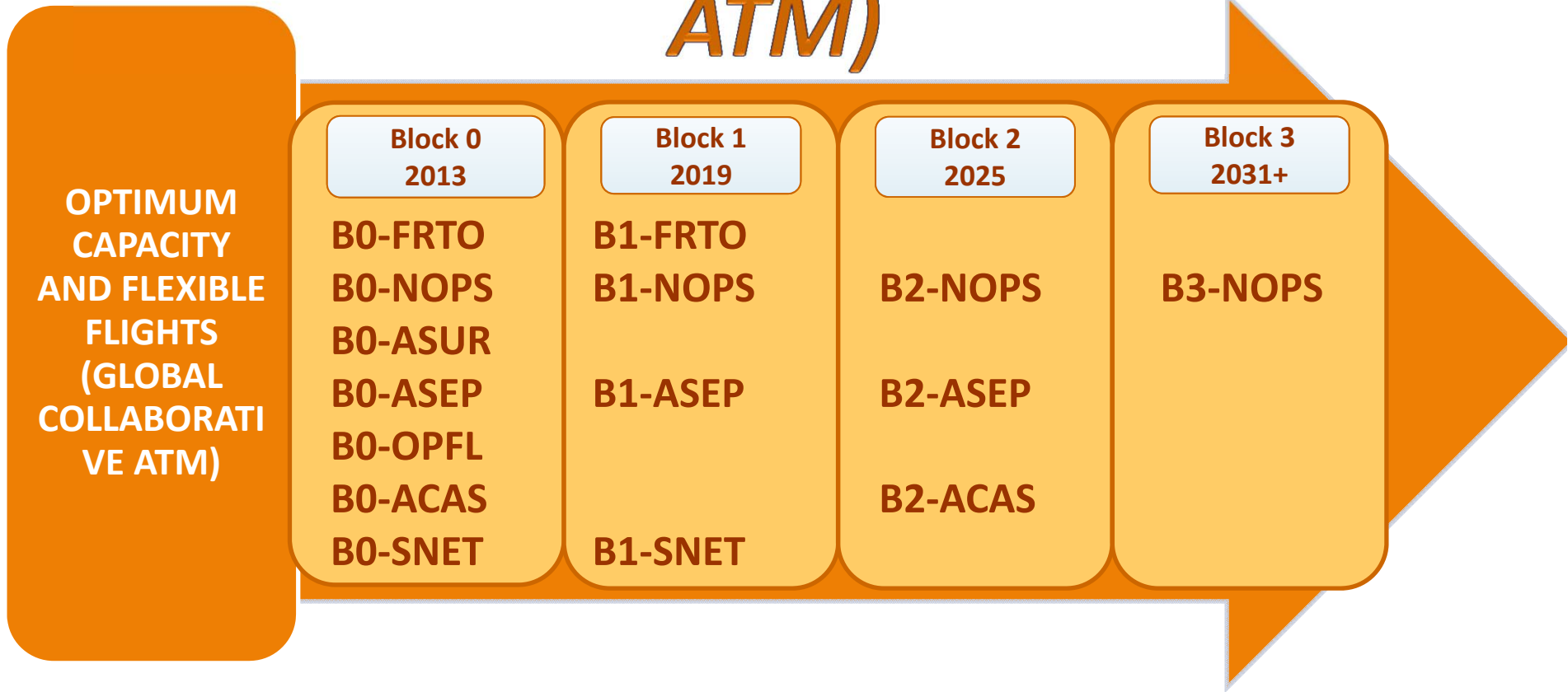
Implementation of SWIM services (applications and infrastructure) creating the aviation intranet based on standard data models, and internet-based protocols to maximize interoperability.

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

OPTIMUM CAPACITY AND FLEXIBLE FLIGHTS (GLOBAL COLLABORATIVE ATM)

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Block 0 2013	Block 1 2019	Block 2 2025	Block 3 2031+
B0-FRTO	B1-FRTO		
B0-NOPS	B1-NOPS	B2-NOPS	B3-NOPS
B0-ASUR			
B0-ASEP	B1-ASEP	B2-ASEP	
B0-OPFL			
B0-ACAS		B2-ACAS	
B0-SNET	B1-SNET		

Block 0 and Block 1

OPFL, ACAS, ASUR

B0-OPFL
Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B
This module enables an aircraft to reach a more satisfactory flight level for flight efficiency or to avoid turbulence for safety.

- In-trail procedure (ITP)

B0-ASUR
Initial Capability for Ground Surveillance
Ground surveillance supported by ADS-B OUT and/or wide area multilateration systems. This capability will be expressed in various ATM services, e.g., traffic information, search and rescue and separation provision.

- Element 1: ADS-B
- Element 2: Multilateration (MLAT)

B0-ACAS
ACAS Improvements
To provide short term improvements to existing airborne collision avoidance systems (ACAS) to reduce nuisance alerts while maintaining existing levels of safety.

Block 0 and Block 1

FRTO

B0-FRTO

Improved Operations through Enhanced En-Route Trajectories

To allow the use of airspace which would otherwise be segregated (i.e., special use airspace) along with flexible routing adjusted for specific traffic patterns.

- Element 1: Airspace planning
- Element 2: Flexible use of airspace (FUA)
- Element 3: Flexible routing
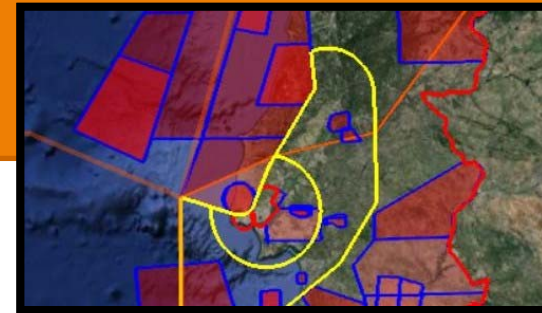
B1-FRTO

Improved Operations through Optimized ATS Routing

Introduction of free routing in defined airspace, where the flight plan is not defined as segments of a published route network or track system to facilitate adherence to the user-preferred profile.

- Element 1: Free routing
- Element 2: Reduced route spacing
- Element 3: Dynamic sectorization

Block 0 and Block 1

NOPS

B0-NOPS

Improved Flow Performance through Planning based on a Network-Wide view

Collaborative ATFM measure to regulate peak flows involving departure slots, managed rate of entry into a given piece of airspace for traffic along a certain axis, requested time at a way-point or and FIR/sector boundary along the flight, use of miles-in-trail to smooth flows along a certain traffic axis and re-routing of traffic to avoid saturated areas.

B1-NOPS

Enhanced Flow Performance through Network Operational Planning

ATFM techniques that integrate the management of airspace, traffic flows including initial user driven prioritization processes for collaboratively defining

ATFM solutions based on commercial/operational priorities.

- Element 1: Improved ATFM and ATFM-AOM integration
- Element 2: Synchronization
- Element 3: Initial user driven prioritization process (UDPP or fleet prioritization)
- Element 4: Full flexible use of airspace (FUA)
- Element 5: Complexity management

Block 0 and Block 1

ASEP

B0-ASEP

Air Traffic Situational Awareness (ATSA)

Two ATSA applications which will enhance safety and efficiency by providing pilots with the means to enhance traffic situational awareness and achieve quicker visual acquisition of targets.

- Element 1: ATSA-AIRB
- Element 2: ATSA-VSA

B1-ASEP

Increased Capacity and Efficiency through Interval Management

Interval Management (IM) improves the management of traffic flows and aircraft spacing. Precise management of intervals between aircraft with common or merging trajectories maximizes airspace throughput while reducing ATC workload along with more efficient aircraft fuel burn.

Block 0 and Block 1

SNET

B0-SNET

Increased Effectiveness of Ground-based Safety Nets

This module monitors flights while airborne to provide timely alerts to air traffic controllers of potential risks to flight safety.

- Element 1: Short-term conflict alert (STCA)
- Element 2: Area proximity warning (APW)
- Element 3: Minimum safe altitude warning (MSAW)
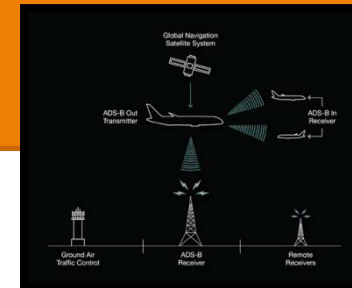
B1-SNET

Ground-based Safety Nets on Approach

To enhance safety by reducing the risk of controlled flight into terrain accidents on final approach through the use of approach path Monitor (APM). APM warns the controller of increased risk of controlled flight into terrain during final approach.
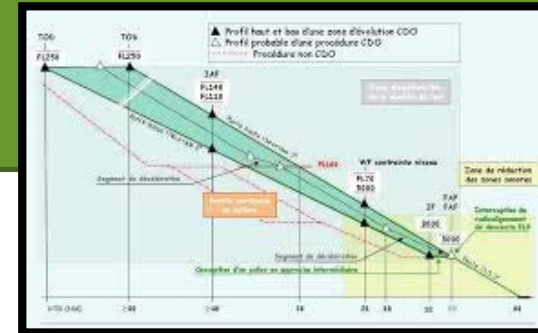
Block 0 and Block 1

CDO

B0-CDO

Improved Flexibility and Efficiency in Descent Profiles (CDO)

Deployment of performance-based airspace and arrival procedures that allow an aircraft to fly its optimum aircraft profile taking account of airspace and traffic complexity with continuous descent operations (CDOs)

- Element 1: Continuous descent operations
- Element 2: Performance-based navigation

B1-CDO

Improved Flexibility and Efficiency in Descent Profiles (CDOs) using VNAV

To enhance vertical flight path precision during descent, arrival, and enables aircraft to fly an arrival procedure not reliant on ground based equipment for vertical guidance.
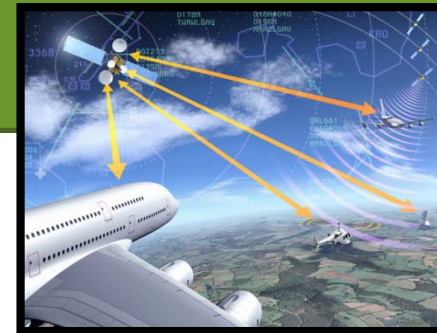
Block 0 and Block 1

TBO

B0-TBO

Improved Safety and Efficiency through the initial application of data link and SATVOICE En-Route

Implementation of an initial set of data link applications for supporting surveillance and communications in air traffic services.

- Element 1: ADS-C over Oceanic and remote areas
- Element 2: CPDLC

B1-TBO

Improved Traffic Synchronization and Initial Trajectory-Based Operation.

Improve traffic flows synchronization at en-route merging points and optimize approach sequence through the use of 4DTRAD capability and airport applications (RTA).

- Element 1: Initial 4D operations (4D TRAD)
- Element 2: Data link operational terminal information service (D-OTIS)
- Element 3: Departure clearance (DCL)
- Element 4: Data link TAXI (DTAXI)

Block 0 and Block 1

CCO

B0-CCO

Improved Flexibility and Efficiency in Departure Profiles - Continuous Climb Operations (CCO)

Deployment of departure procedures that allow an aircraft to fly its optimum aircraft profile taking account of airspace and traffic complexity with continuous climb operations (CCOs).

Block 0 and Block 1

RPAS

B1-RPAS

Initial Integration of Remotely Piloted Aircraft (RPA) into non-segregated airspace

Implementation of basic procedures for operating RPA in non-segregated airspace.

- Streamline process to access non-segregated airspace
- Defining airworthiness certification for RPA
- Define operator certification
- Define remote pilot licensing requirements
- Define detect and avoid technology performance requirements

- Vision

- ASBUs

- Evolution.

Objective

To show Block 1 modules as an operational evolution from Block 0 modules.