INTERNATIONAL CIVIL AVIATION ORGANIZATION

AFI PLANNING AND IMPLEMENTATION REGIONAL GROUP
EIGHTEENTH MEETING (APIRG/18)
Kampala, Uganda (27 – 30 March 2012)

Agenda Item 3.4: Communication Navigation and Surveillance (CNS)

ATM System Block Upgrade (ASBU)

(Presented by IATA)

SUMMARY
Block upgrades describe a way to apply the concepts defined in the ICAO *Global Air Navigation Plan* (Doc 9750) with the goal of implementing regional performance improvements. It includes the development of technology roadmaps, to ensure that standards are mature and to facilitate the synchronization between air and ground systems, as well as between regions. The ultimate goal is to achieve global interoperability. Safety demands this level of interoperability and harmonization. Safety must be achieved at a reasonable cost with commensurate benefits. Aviation System Block Upgrades comprise a suite of capabilities, called modules, each having the essential qualities of: • A clearly-defined measurable operational improvement and success metric; • Necessary equipment and/or systems in aircraft and on ground along with an operational approval or certification plan; • Standards and procedures for both airborne and ground systems; and • A positive business case over a clearly defined period of time. Block upgrades are separated by a period of five years, with initial operating capability (IOC) for Block 0 currently available; for Block 1 from 2018; for Block 2 from 2023; and for Block 3 from 2028 and beyond. Block 0 modules that which are available NOW! In implementing Block upgrades, it is recognized that all module solutions are not required in all airspaces.
REFRENCE(S): **ICAO Doc 9750 Global Air Navigation Plan;** **ICAO Doc 9854 Global Air Traffic Management Operational Concept**
Related ICAO Strategic Objective(s): A & C

1. INTRODUCTION

1.1. ICAO launched the Aviation System Block Upgrades initiative to progress outcomes of its 37th General Assembly in terms of facilitating interoperability, harmonization, and modernization of air transportation worldwide.

1.2. To that end, ICAO established a programmatic, collaborative approach to develop a set of air traffic management (ATM) solutions to meet the global needs for an interoperable airspace that takes advantage of current equipage, establishes a transition plan that provides key performance improvements, and enables global interoperability.

1.3. The concept of the block upgrades originates from existing near-term implementation plans based largely on operational concepts extracted from the United States' NextGen, Europe's SESAR and Japan's CARATS programmes and is aligned with the ICAO Global Air Traffic Management Operational Concept (Doc 9854).

1.4. The intent is to apply key capabilities and performance improvements, drawn from these programmes, across regional and local environments with the same level of performance and associated benefits on a global scale.

1.5. Block upgrades are organized in five-year time increments starting 2013 as follows:

a) Block 0: available now
b) Block 1: available to be deployed globally from 2018
c) Block 2: available to be deployed globally from 2023
d) Block 3: available to be deployed globally from 2028

1.6. The block upgrades initiative should constitute the basis for future plans for ATM modernization. Where plans are in existence, they should be revised in line with objectives defined in the block upgrades.

a) For the Industry, this constitutes a basis for planning future development and delivering products on the market at the proper target time.
b) For service providers or operators, block upgrades should serve as a planning tool for resource management, capital investment, training as well as potential reorganization

1.7. A key element of a block upgrade is to ensure that all of its capabilities and performance modules reflect proven operational applications and technologies, along with validation (and data) of the cost/benefits of implementation. This process should embrace ICAO approach of Collaborative Decision Making process.

2. DISCUSSION

2.1. Implementation of any Block 0 module **(Appendix A)** must leverage on existing on-board avionics.

2.2. Airlines have invested in Area Navigation (RNAV) Systems as the primary enabler for the implementation of Performance Based Navigation (PBN);

2.3. In this regard, IATA sees PBN as the main enabler for Block 0 operational

improvements. PBN, complemented by Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO), will contribute to several ICAO strategic objectives:

a) Safety
   Main enabler to address CFIT and un-stabilized approaches
b) Access
   Due to flexibility and application of modern on-board avionics to its full extent, more runways are accessible (previously not accessible, or by less safe circling, offset or steep angle approaches)
c) Efficiency
   Through application of modern on-board avionics to its full extent, positioning of routes, SIDs and Stars is not constraint anymore by location of navaids, but can be put virtually anywhere (airspace optimization, less fuel burn, less delays, workload decrease).
d) Environment
   CDO and CCO reduce fuel burn (less CO2 emissions) and noise.

2.4. Before committing to any investment on equipage for Block1/2/3 (Appendix A) a sound and realistic business case must be developed for all proposed operational improvements. Operational business case is essential. Business case justification for future equipage will be strengthened by demonstrating benefits from the use of current equipage.

3. ACTION BY THE MEETING

3.1. The meeting is invited to:

a) Embrace the Aviation System Block Upgrade framework as the unified planning mechanism to ensure harmonization and interoperability, driving regional planning;

b) Work closely with all aviation stakeholders in the region, whose investment decisions are interdependent.

c) Prioritize implementation of PBN, CDO and CCO as the main enablers for Block 0 operational improvements.

d) Ensure the development of sound and realistic business cases before asking for committing to any investment on equipage for Block1/2/3.

-END-

Appendix A: Summary Table of Aviation System Block Upgrades Mapped to Performance Improvement Areas

Performance Improvement Area 1: Greener Airports

Block 0	Block 1	Block 2	Block 3
B0-65 **Optimisation of Approach Procedures Including Vertical Guidance (GBAS I)** • Technology • Airspace user operations • CNS	**B1-65** **Optimisation of Approach Procedures Including Vertical Guidance (GBAS II/III)** • Technology • Airspace user operations • CNS		
B0-70 **Wake Vortex Separation, Refined** Revision of current ICAO separation standards and procedures to address improved departure and arrival runway throughput • No technology • Safety, capacity • Conflict management	**B1-70** **Wake Vortex Separation (Time-based)** Separation standards and procedures on parallel and closely spaced parallel runways with mitigations for cross winds • No technology • Safety, capacity • Conflict management	**B2-70** **Advanced Wake Vortex Separation (Time-based)** • Safety, capacity • Conflict management	
B0-75 **Runway Safety** Airport surface surveillance for ANSP • Technology • Safety, efficiency • Conflict management	**B1-75** **Enhanced Surface Situational Awareness** Airport surface surveillance for ANSP with safety logic, cockpit moving map displays and visual systems for taxi operations • Technology • Safety, efficiency • Conflict management	**B2-75** **A-SMGCS Level 3-4 and SVS** Taxi routing and guidance evolving to trajectory based with ground / cockpit monitoring and data link delivery of clearances and information. Cockpit synthetic visualisation systems • Technology • Safety, efficiency • Conflict management	
B0-80 **A-CDM & Airport Planning Phase 1** Airport queue management at gate regulating the flow of aircraft to / from the runway • Technology • Safety, capacity, efficiency • Traffic synchronisation	**B1-80** **A-CDM & Airport Planning Phase 2** Airport queue management at gate regulating the flow of aircraft to / from the runway • Technology • Safety, capacity, efficiency • Traffic synchronisation		

B2-80
Remote Tower
Aerodrome Tower ATS contingency and remote provision of ATS to aerodromes through visualisation systems and tools

- Technology
- Safety, efficiency
- Conflict management

B1-15
AMAN/DMAN Metroplex
Integrated surface management and departure sequencing, bring robustness to departure management and improvement on arrival management through CTA allocation and application of performance-based navigation

- Technology
- Efficiency, capacity, safety, predictability, cost efficiency
- Traffic synchronisation

B0-15
Runway Sequencing
Time-based metering through the controlled time of arrival and dynamic departure management

- Technology
- Efficiency, capacity, flexibility, predictability
- Traffic synchronisation

B2-15
Linked AMAN/DMAN
Synchronised AMAN/DMAN will promote more agile and efficient en-route and terminal operations

- Technology
- Efficiency, capacity, safety, predictability, interoperability
- Traffic synchronisation

B3-15
Integrated AMAN/DMAN/SMAN

- Technology
- Efficiency, capacity, safety, predictability, interoperability
- Traffic synchronisation

Performance Improvement Area 2:
Globally Interoperable Systems and Data – Through Globally Interoperable System Wide Information Management

Block 0	Block 1	Block 2	Block 3
B0-25 **Ground-Ground Integration Through ATS Inter-facility Data Communication (AIDC)** Supports the coordination ground-ground data communication between ATSU based on ICAO Document 9694 and as described by letters of agreement (LoA). Exception and non-compliant to LoA transfers are treated by direct speech communication • Technology • Capacity, efficiency and interoperability • Information management	**B1-25** **Ground-Ground Integration Through Advanced ATS AIDC and FF-ICE/1 Before Departure** AIDC supporting exception and non-compliant coordination with FF-ICE step 1 implemented for ground-ground exchanges using common flight information reference model, FIXM, XML and the flight object (used before departure) • Technology • Capacity, efficiency, interoperability, participation • Information management	**B2-25** **Ground-Ground Integration: (FF-ICE/1 and Flight Object, SWIM)** FF-ICE supporting trajectory-based operations through exchange and distribution of information for multicentre operations using flight object implementation and IOP standards • Technology • Capacity, efficiency, interoperability, participation, safety, flexibility • Information management	
B0-30 **Information Management Based on AIXM** 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 • Technology • Cost, safety, environment • Information management	**B1-30** **Improved Information Management** Implementation of the aeronautical 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 • Technology • Cost, safety, environment, access • Information management		**B3-25** **Full FF-ICE** All data for all relevant flights systematically shared between air and ground systems using SWIM in support of collaborative ATM and trajectory-based operations • Technology • Capacity, efficiency, interoperability, participation, safety, flexibility • Information management
	B1-31 **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 • Technology • Cost, safety, environment, access • Information management	**B2-31** **Airborne Access to SWIM** Full connection of the aircraft an information node in SWIM enabling full participation in collaborative ATM processes with access to rich voluminous dynamic data including meteorology • Technology • Efficiency, safety, predictability, access, environment • Information management	

B1-50
WIMAX (Aeromacs)
Air ground mobile data link for airport surface operations providing ATS and AOC services based on Mobile WiMAX System Standard

- Technology
- Efficiency
- CNS

B2-55
Next Generation Data Link
Introduction of L band terrestrial component (LDACS) and new satellite component (New SATCOM) based on ATM/OSI and ATN/IPS protocol enabling future quality of service requirements and increased throughput capacity

- Technology
- Capacity, flight efficiency, interoperability
- CNS

B0-60
Common Time Reference

- Technology
- CNS

B0-95
Ground Communications Using Internet Protocols (IPV6)
Implementation of IPV6 in support of AIDC (global data communication standard - ICAO standards for its implementation already exist and guidance material on implementation and operation are in preparation)

- Interoperability, efficiency, access
- Technology
- CNS

Performance Improvement Area 3:
Optimum Capacity and Flexible Flights – Through Global Collaborative ATM

Block 0	Block 1	Block 2	Block 3
B0-10 **Improved En-route Profiles** Implementation of performance-based navigation (PBN) through RNAV-based routing systems, flex tracking to avoid significant weather and to offer greater fuel efficiency, flexible use of airspace (FUA) through special activity airspace allocation, airspace planning and time-based metering, and collaborative decision-making (CDM) for en-route airspace with increased information exchange among ATM stakeholders • No technology • Capacity, flexibility, environment, efficiency • Airspace user operations • Conflict management	**B1-10** **Dynamic ATS Routes** 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 • Technology • Efficiency, capacity, environment • Airspace user operations • Conflict management		**B3-10** **Traffic Complexity Management** Introduction of complexity management to address events and phenomena that affect traffic flows due to physical limitations, economic reasons or particular events and conditions by exploiting the more accurate and rich information environment of a SWIM-based ATM • Technology • Capacity, predictability, efficiency, access, equity, environment • Demand and capacity balancing
B0-35 **Air Traffic Flow and Capacity Management with a Network Operations Plan and CDM** 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 an 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 • No technology Capacity, predictability, flight efficiency, environment, access, equity • Demand and capacity balancing • Traffic synchronisation	**B1-35** **Enhanced Network Operational Planning** ATFM techniques that integrate the management of airspace, traffic flows and user expectations including initial user driven prioritisation processes for collaboratively defining ATFM solutions based on commercial/operational priorities unknown to ATM, managing free routing, traffic synchronisation at airspace choke points and the full deployment of FUA that operates airspace as a continuum used in an optimal manner by civil and military users • Technology • Capacity, flight efficiency, predictability, participation • Airport operation management • Demand and capacity balancing	**B2-35** **Integrated User Driven Prioritisation Process** Introduction of CDM applications supported by SWIM that permit airspace users manage competition and prioritisation of complex ATFM solutions when the network or its nodes (airports, sector) no longer provide capacity commensurate with user demands • Technology • Efficiency, capacity, predictability • Demand and capacity balancing • Traffic synchronisation	

B1-105
Enhanced Weather Decision-making Capability (Strategic >40 Minutes)
Weather information supporting automated decision process or aids involving: weather information, weather translation, ATM impact conversion and ATM decision support

- Technology
- Efficiency, capacity, safety, predictability
- Airspace users operations
- Demand and capability balancing

B3-105
Advanced Weather Decision-making Capability (Tactical <40 Minutes)
Weather information supporting both air and ground automated decision support aids for implementing weather mitigation strategies.

- Technology
- Efficiency, capacity, safety, predictability, flexibility
- Conflict management

B0-85
Early Airborne Separation Assistance Systems (ASAS) Applications (ITP)
ASAS application in-trail procedure using either ADS-C or ADS-B to enable an aircraft to climb or descend through the altitude of other aircraft when the requirements for procedural separation cannot be met to prevent flights from being constrained at inefficient levels

- Technology
- Cost effectiveness
- Capacity
- Environment
- Conflict management

B1-85
Air Traffic Situational Awareness (ATSA) and Airborne Spacing (ASPA)
ATSA provides a cockpit display of a graphical depiction of traffic to assist the pilot in out-the-window visual acquisition of traffic:
AIRB en-route phase;
VSA approach phase (supporting the flight crew to acquire and maintain own separation from the preceding aircraft when performing a visual approach procedure);
SURF surface (including surrounding surface traffic position and identity and own-ship position overlaid on a map of the airport).
ASPA IM interval management supports the pilot to achieve and maintain an interval or spacing from a target aircraft such as mile-in-trail en-route or for final approach spacing

- Technology
- Cost effectiveness, capacity, safety
- Conflict management

B3-85
Airborne Separation (ASEP)

- Technology
- Conflict management

B2-100
New Collision Avoidance System
Implementation of Airborne Collision Avoidance System (ACAS) to take account of the trajectory-based operations procedures

- Technology
- Safety
- Conflict management

Performance Improvement Area 4:
Efficient Flight Path – Through Trajectory-based Operations

Block 0	Block 1	Block 2	Block 3
B0-5 **Improved Flight Descent Profiles** Deployment of performance-based airspace and arrival procedures that optimize the aircraft profile taking account of airspace and traffic complexity with continuous descent operations (CDOs) • Technology • Capacity, efficiency, flexibility, safety • Airspace user operations • Airport operations		**B2-5** **Optimized Arrivals in Dense Airspace** Deployment of performance-based airspace and arrival procedures that optimize the aircraft profile taking account of airspace and traffic complexity including optimized profile descents (OPDs), supported by trajectory-based operations and self-separation • Technology • Capacity, efficiency, flexibility, safety • Airspace user operations • Airport operations	**B3-5** **Full 4D Trajectory-based Operations** Trajectory-based operations deploys an accurate four-dimensional trajectory that is shared among all of the aviation system users at the cores of the system. This provides consistent and up-to-date information system-wide which is integrated into decision support tools facilitating global ATM decision-making • Technology • Flight efficiency, capacity, safety, flexibility • Airspace user operations • Airspace organization and management
B0-40 **Initial Data Link En-Route** Implementation of an initial set of data link applications which provides dependent surveillance over oceanic and remote areas and introduces a number of air ground communication applications covering ADS-C, CPDLC and other FANS1/A and LINK applications for ATC • Technology • Safety, capacity, efficiency • Conflict management	**B1-40** **Initial 4D and Airport** Initial use of the aircraft RTA capability in trajectory-based operations to improve the synchronisation of traffic flows at en-route merging points and to optimize the approach sequence through air ground exchange of aircraft derived data and specifically related to a single controlled time of arrival (CTA) • Technology • Efficiency, predictability, capacity, environment • Traffic synchronisation		
B0-20 **Improved Flight Departure Profiles** Airspace design and procedures are deployed that implement required navigation performance to support initial continuous climb operations (CCO) • No Technology • Flight efficiency, environment • Airspace user operations • Airspace organization and management			

B1-90
Remotely Piloted Aircraft (RPA) Systems
Implementation of basic procedures for operating RPAs in non-segregated airspace including detect and avoid

- Technology
- Safety, predictability
- Airspace organization and management

B2-90
RPA Integration in Traffic
Implements refined operational procedures that cover lost link (including a unique squawk code for lost link) as well as enhanced detect and avoid technology

- Technology
- Safety, predictability
- Airspace organization and management

B3-90
RPA Transparent Management
RPA operate on the aerodrome surface and in non-segregated airspace just like any other aircraft

- Technology
- Safety, predictability
- Airspace organization and management