International Civil Aviation Organization

SIXTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND METEOROLOGY SUB-GROUP (CNS/MET SG/16) OF APANPIRG

Bangkok, Thailand, 23 – 27 July 2012

Agenda Item 2: **Review**

4) SIP Workshop 12th Air Navigation Conference and Aviation System Block Upgrades (ASBUs)

SYSTEM CAPABILITY FOR ASBU B0 MODULES

(Presented by the Secretariat)

SUMMARY

Aviation Systems Block Upgrades (ASBU) is a new concept developed by ICAO for the harmonious development of global civil aviation which will be presented to the 12th Air Navigation Conference for its consent. This paper lists the system capabilities required for implementing individual modules of Block 0 and urges the States to inform about their adoption of modules and provide information on the status of system capabilities to support planning implementation of Block 0 level of ASBU in the region.

This paper relates to – **Strategic Objectives:**

A: Safety - *Enhance global civil aviation safety*
C: Environmental Protection and Sustainable Development of Air Transport - *Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment*

Global Plan Initiatives: All

1. Introduction

1.1 ICAO estimates that US$120 billion will be spent on the transformation of air transportation systems in the next ten years. A number of initiatives including US NextGen, European SESAR etc. have been planned around the world to upgrade the existing air navigation services. It therefore becomes necessary to support the investors in planning their investment. Based on industry input, the concept of Aviation Systems Block Upgrade (ASBU) with the following framework has been developed:

- Develops a set of air traffic management (ATM) solutions or upgrades
- Takes advantage of current equipage
- Establishes a transition plan, and
- Enables global interoperability

1.2 This new concept of ASBU is proposed to be presented to the 12th Air Navigation Conference scheduled to be held in Montreal from 19 to 30 November, 2012. The concept of ASBU has been developed based on the inputs received from all the stake holders including the Air Navigation Service Provider, the Aerodrome Operator, the Regulating Agencies, the Airline Operators etc. and proposes up-gradation of services in a four phases starting from the existing capabilities. Offering a structure based on expected operational benefits, it should support investment and implementation processes, making a clear relation between the needed technology and operational improvement. It may also be noted that many of the modules developed in the Block 0 will not be necessary to manage the complexity of air traffic management in many parts of the world and hence all the modules may not be required to be implemented in all States and regions. This paper discusses ASBU concept in very brief and proposes to establish a Task Force to assess the required capabilities and include them into the regional work programme for the implementation of Block 0.

1.3 Recommendations in this paper have been developed on the basis of information provided in the Workshop on preparations for AN-Conf/12 and ASBU Methodology held from 14 to 18 May 2012.

2. Discussion

2.1 This new concept of Aviation Systems Block Upgrade (ASBU) is expected to provide better interaction between several stakeholders including the air navigation service providers, regulators, airspace users and manufacturers. By definition an Aviation System Block Upgrade designates a set of improvements that can be implemented globally from a defined point in time to enhance the performance of the ATM system. There are four components of a Block Upgrade:

i) **Module:** A module is a deployable package (performance) or capability. It will offer an understandable performance benefit, related to a change in operations, supported by procedures, technology, regulations/standards as necessary and a business case.

ii) **Thread:** A series of dependent modules across the block upgrades represent a coherent transition thread in time from basic to more advanced capability and associated performance. A thread describes the evolution of a given capability through the successive block upgrades, from basic to more advanced capability and associated performance, while representing key aspects of the global ATM concept.

iii) **Block:** A block is made up of modules that when combined enable significant improvements and provide access to benefits for a defined period.

iv) **Performance Improvement Area (PIA):** sets of modules in each block are grouped to provide operational and performance objectives in relation to the environment to which they apply.

Four Performance Improvement Areas have been identified as follows:

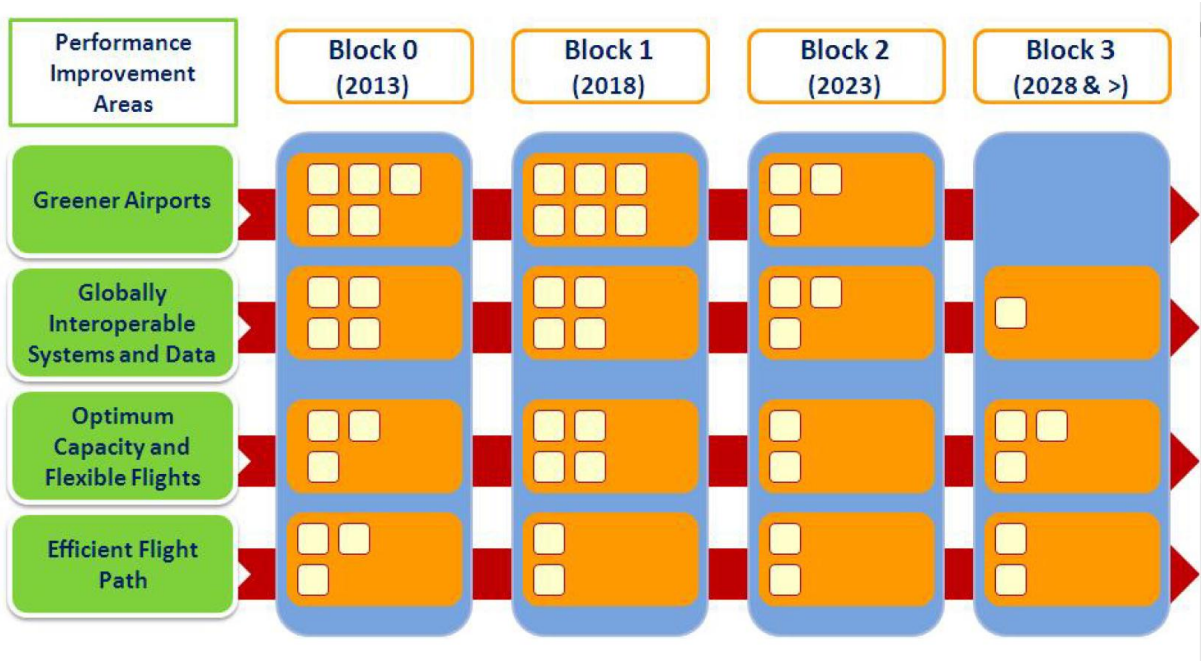
i) Airports

ii) Globally Interoperable Systems and Data – through globally interoperable System Wide Information Management

iii) Optimum Capacity and Flexible Flights – through global collaborative ATM

iv) Efficient Flight Path – through trajectory based operations

The concepts explained above can be pictorially represented as below:



2.2 ASBU comprises of a suite of modules, organized into flexible and scalable building blocks that can be introduced and implemented in a State or a region depending on the need and level of readiness, while recognizing that all the modules are not required in all airspaces. The upgrades have been organized in five year time increments starting from 2013. The arrangements envisaged here will be formalized at the Twelfth Air Navigation Conference scheduled to be held from 19 to 30 November, 2012.

2.3 ASBUs mapped into Performance Improvements Areas for Block – 0 are as given in the following table

Performance Improvement Area (PIA)	Module	Module Title	Module brief description
Airports	B0-65	Optimization of approach procedures including vertical guidance	This is the first step towards universal implementation of GNSS-based approaches
	B0-70	Increased Runway Throughput through Wake Turbulence Separation	Improved throughput on departure and arrival runways through the revision of current ICAO wake vortex separation minima and procedures
	B0-75	Improved Runway Safety (A-SMGCS Level 1-2 and Cockpit Moving Map)	Airport surface surveillance for ANSP
	B0-80	Improved Airport Operations through Airport-CDM	Airport operational improvements through the way operational parameters at airports work together
	B0-15	Improved Runway Traffic Flow through Sequencing (AMAN/DMAN)	Time based metering to sequence departing and arriving flights
Globally Interoperable Systems and Data – Through Globally Interoperable System Wide Information Management	B0-25	Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration	Supports the coordination of ground-ground data communication between ATSU based on ATS Inter-facility Data Communication (AIDC) defined by ICAO Document 9694
	B0-30	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
	B0-105	Meteorological Forecasts, Warnings and Alerts	Global, regional and local meteorological information • Aerodrome warnings to give concise information of meteorological conditions that could adversely affect all aircraft at an aerodrome including wind shear

			• Forecasts provided by world area forecast centres (WAFC) and tropical cyclone advisory centres (TCAC) This information will support flexible airspace management, improved situational awareness and collaborative decision making, and dynamically-optimized flight trajectory planning
Optimum Capacity and Flexible Flights – Through Global Collaborative ATM	B0-10	Improved Operations through Enhanced En-route trajectories	Implementation of performance-based navigation (PBN concept) and flex tracking to avoid significant weather and to offer greater fuel efficiency, flexible use of airspace (FUA) through special activity airspace allocation, and collaborative decision-making (CDM) for en-route airspace with increased information exchange among ATM stakeholders
	B0-35	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 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
	B0-84	Initial Capability for Ground-based Cooperative Surveillance	Ground surveillance supported by ADS-B and/or wide area multilateration systems will improve safety, especially search and rescue and capacity through separation instructions. This capability will be expressed in various ATM services, e.g. traffic information, search and rescue and separation provision
	B0-85	Air Traffic Situational Awareness (ATSA)	This module comprises two ATSA (Air Traffic Situational Awareness) applications which will enhance safety and efficiency by providing pilots with the means to achieve quicker visual acquisition of targets:

			• AIRB (Enhanced Traffic Situational Awareness during Flight Operations) • VSA (Enhanced Visual Separation on Approach)
	B0-86	Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B	The aim of this module is to prevent flights to be trapped at an unsatisfactory altitude for a prolonged period of time. The In Trail Procedure (ITP) uses ADS-B based separation minima to enable an aircraft to climb or descend through the altitude of other aircraft when the requirement for procedural separation cannot be met
	B0-101	ACAS Improvements	Implementation of ACAS with enhanced optional features such as altitude capture laws reducing nuisance alerts, linking to the autopilot for automatic following of resolution advisories
	B0-102	Increased Effectiveness of Ground-based Safety Nets	This module 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)
Efficient Flight Path – Through Trajectory-based Operations	B0-05	Improved Flexibility and Efficiency in Descent Profiles (CDOs)	Deployment of performance-based airspace and arrival procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous descent operations (CDOs)
	B0-40	Improved Safety and Efficiency through the initial application of Data Link En-Route	Implementation of an initial set of data link applications for surveillance and communications in ATC

	B0-20	Improved Flexibility and Efficiency in Departure Profiles	Deployment of departure procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous climb operations (CCOs)

2.4 In this paper, an effort has been made to list out the System Capabilities for each module which will be required to be in place for implementing Block 0. The Systems Requirements, both on the ground and in the air for each module corresponding to the Block 0 are provided in the table placed at Attachment A. It is proposed to carry out a survey using this table to assess the level of existing system capabilities in the region for the implementation of Block 0after concept of ASBU is adopted in the 12th Air Navigation Conference with or without any change.

2.5 In addition, a number of new technologies (in addition to the existing ones) have been included in Block 0, like ADS-B IN, up-gradation of ATC automation systems etc. The meeting may consider to establish a Task Force to identify all these technologies and arrange to include them in the regional work-plan. Meeting may consider adopting following Decision in this regard.
work-plan. Meeting may consider to adopt following Decision in this regard

Decision 16/xx - Adoption of Block 0 technologies in the work-plan

That, a Task Force be established to review readiness of required technologies for the implementation of Block 0 in the region and to arrange inclusion of these in the regional Work Plan.

3. Action by the Meeting

3.1 Meeting is invited to:

a) note the system requirements for Block 0 modules; and

b) consider to adopt Decision 16/xx in para 2.5

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Module No.	Module Name	Adoption	Technical Requirements	Remarks
Greener Airports (PIA 1)				
B0-15	Improved Runway Traffic Flow through Sequencing (AMAN/DMAN)		Avionics FMS capabilities	
			Ground Systems Automation support for synchronization of arrival sequencing, departure sequencing an surface information	
			For AMAN/DMAN application may require site adaptation and maintenance	
B0-65	Optimization of Approach Procedures including Vertical Guidance		Avionics Basic IFR Avionics (TSO C129 with RAIM)	
			Basic IFR GNSS receivers with Baro VNAV	
			SBAS avionics (TSO C145/146)	
			GBAS receivers (TSO C161/162)	
			Ground Systems SBAS elements (Reference station etc.), ionospheric information	
			GBAS System	
B0-70	Increased Runway Throughput through Wake Turbulence Separation		Ground Systems Decision support tool to aid application of new set of 6 category ICAO wake separation	
			For Wake Turbulence Mitigation for Departures (WTMD), prediction of crosswind strength and direction display on controller position	
B0-75	Improved Runway Safety (A-SMGCS)		Avionics ADS-B and/or SSR Transponder	
			Vehicles A-SMGCS compatible vehicle systems	

Module No.	Module Name	Adoption	Technical Requirements	Remarks
			Ground System A-SMGCS	
			ADS-B airport application	
B0-80	Improved Airport Operations through ACDM		Ground System Interconnect ground systems	
			Where available, shared surveillance Information	
Globally Interoperable Systems and Data (PIA 2)				
B0-25	Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration		Ground System AIDC messages in FDPS using AFTN-AMHS	
			Oceanic ATSUs supporting communication via data-link	
B0-30	Service Improvement through Digital Aeronautical Management		Ground Systems Communication access for AIS	
			Access can be using IPS	
			Automation of national aeronautical data, NOTAM and MET. Tasks including data collection, verification and distribution	
			Linked to B0-40	
B0-105	Meteorological information supporting enhanced operational efficiency and safety		Ground Systems Airport operators and airspace users may implement display in plain text.	
			Airspace users may use AOC data-link to send information to aircraft	
Optimum Capacity and Flexible Flights (PIA 3)				
B0-10	Improved Operations through Enhanced En-Route Trajectories		Avionics Enhanced Flight Planning System	
			Flight following/monitoring to update crews about any changes in flight planning assumptions	
			Ground Systems Provision to support CDM through internet portal (SWIM subsequently)	
			Accommodation of Flex Route operations in FDPS	
			Capability of communication with adjacent controllers	

Module No.	Module Name	Adoption	Technical Requirements	Remarks
			Assess • Conflict detection algorithm if it detects conflict between fixed/flexible route structures • Automatic exchange of flight data, co-ordination and transfer of control • FDPS capable of recognizing fixes not part of fixed structure such as lat/long, bearing/distance • FDPS capability to recognize/process direct route • Possibility of transfer of control at other than published fixes • Elements of the plan needed to be extracted by FDPS to support implementation of Flex routes • Flt. Progress Strip capable of extrapolating Flex Route information and support Flex Route opns. • FDPS capable of facilitating re-routing within Flex Route airspace • Some ANSPs may consider having different symbols to indicate flight operating on Flex route	
B0-35	Improved Flow Performance through Planning based on a Network-wide View		<u>Ground System</u> ATFM implementation	
			Regional ATFM	
B0-84	Initial Capability for Ground-based Cooperative Surveillance		<u>Avionics</u> Aircraft equipped with ADS-B OUT	
			For Multilateration aircraft to be equipped with Mode S radar transponder	
			<u>Ground Systems</u> Ground based surveillance data processing system and flight data processing system (FDPS)	
			Depending upon capabilities and ATC procedures and full/partial avionics equipage ADS-B may be provided	
			ATS systems designed to enable ADS-B to ADS-B and ADS-B to radar separation and fused targets	

Module No.	Module Name	Adoption	Technical Requirements	Remarks
B0-85	Air Traffic Situational Awareness		Avionics ADS-B OUT compliant with AMC2024/DO-260A/DO-260B/ED102A. Certification of ADS-B OUT data	
			ADS-B IN compliant with DO-314/ED160 or DO-317A/ED194 (for Visual Separation on Approach or VSA)	
			ADS-B IN compliant with DO-319/ED164 or DO-317A/ED194 (for situation awareness during flight operations)	
			Ground Systems Implementation of ADS-B and integration with ATC automation	
B0-86	Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B		Avionics ADS-B IN capability compliant with DO-312/ED-159 or DO-317A/ED-194	
			ADS-B OUT compliant with AMC 20-24/DO-260A/DO-260B/ED-102A, or DO-317A/ED-194	
			CPDLC compliant with DO-306 chg 1/ED-122 Chg 1	
			Ground System Implementation of conflict probe logic	
			Compliant ADS-B ground system	
B0-101	ACAS Improvements		Avionics RTCA DO185B/EUROCAE DO143 MOPS	
			RTCA DO325 Annex C	
B0-102	Increased Effectiveness of Ground-Based Safety Nets		Avionics Aircraft support cooperative surveillance using Mode C/S transponder or ADS-B OUT	

Module No.	Module Name	Adoption	Technical Requirements	Remarks
			Ground Systems Surveillance systems must be equipped with ground-based safety nets appropriate and optimized for the environment	
			Short Term Conflict Alert, Area Proximity Warnings and Minimum Safe Altitude Warning	
Efficient Flight Path-Through Trajectory based operations (PIA-4)				
B0-05	Improved Flexibility and Efficiency in Descent Profiles (CDOs)		Avionics Computer generated vertical flight path (i.e. vertical navigation (VNAV)(FMS) with or without fixed lateral path.	
			Ground Systems PBN requirements supported by CNS/ATM environment (Navaid infrastructure)	
			Redundancy in the form of non-RNAV means of navigation	
			RNP AR approaches after cost/benefit study	
B0-40	Improved Safety and Efficiency through the initial application of Data Link En-Route		Avionics Data-link implementation (FANS 1/A and others)	
			Ground Systems Ability to process and display ADS-C position messages	
			Ability to process and display CPDLC messages	
			Enhanced Surveillance through multi-sensor data fusion facilities	
B0-20	Improved Flexibility and Efficiency in Departure Profiles		Ground Systems Automation support to display aircraft capabilities in order to know which aircraft can do what	