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WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 2: Aerodrome operations – improving airport performance
2.1: Airport capacity

AVIATION SYSTEM BLOCK UPGRADE MODULES RELATING TO AIRPORT CAPACITY

(Presented by the Secretariat)

EXECUTIVE SUMMARY

The 37th Session of the ICAO Assembly directed ICAO to increase its efforts to meet global needs for airspace interoperability while maintaining its focus on safety. To this end, a planning framework for global harmonization and interoperability named the aviation system block upgrades (ASBUs) is proposed to the Conference for incorporation into the Fourth Edition of the *Global Air Navigation Plan.*

This paper presents the ASBU modules related to airport capacity, which comprise:

a) B0-15, B1-15, B2-15 and B3-15 – integration of arrival/departure/surface management;
b) B0-65 and B1-65 – increasing use of GNSS-based instrument procedures;
c) B0-70, B1-70 and B2-70 – optimized management of wake turbulence separation;
d) B0-75, B1-75 and B2-75 – enhanced surface surveillance;
e) B0-80 and B1-80 – airport collaborative decision-making; and
f) B1-81 – remotely operated control towers.

Action: The Conference is invited to agree to the recommendation in paragraph 3.

Strategic Objectives:	This working paper relates to the Safety Strategic Objective.
Financial implications:	The cost impact for some modules is expected to be substantial, and the airports and air navigation service providers (ANSPs) concerned may need to undertake considerable investment. However, based on preliminary indications, the benefits of implementing these modules could be substantial for individual airport and global system performance, and when implemented, the benefits are expected to far outweigh the costs.
References:	Doc 9958, *Assembly Resolutions in Force (as of 8 October 2010)* Doc 9854, *Global Air Traffic Management Operational Concept* Doc 9750, *Global Air Navigation Plan* AN-Conf/12-WP/3

1. INTRODUCTION

1.1 The next edition of the *Global Air Navigation Plan* (Doc 9750, GANP), will be presented to the ICAO Assembly in 2013 for approval. The draft GANP, and the aviation system block upgrade (ASBU) strategy it establishes, proposes that future air navigation technology and procedure improvements are organized and based on a consultative strategic approach that coordinates specific global performance capabilities and the flexible upgrade timelines associated with each component.

1.2 The ASBU modules are organized into flexible and scalable building blocks that can be implemented depending on the operational need, while recognizing that implementation of a particular module is not mandatory in all areas or circumstances. The approach adopted is not limiting and recognizes that deployment in addition to the material described in the ASBUs may also take place or be necessary. The broad timescales associated with the ASBU framework (Block 0 = 2013, Block 1 = 2018, Block 2 = 2023, Block 3 = 2028) are intended only to depict the initial readiness of all components, including ICAO Standards and Recommended Practices (SARPs), needed for deployment and do not imply a mandated State or regional implementation timeframe. The ASBU framework with supporting technology roadmaps ensures that State and regional implementation planning and deployment activities can be undertaken with the confidence that all components necessary for a particular deployment will be available within the ASBU dates mentioned.

1.3 In relation to airport operations, carefully considered medium- and long-term airport planning to improve the efficacy of runway and taxiway infrastructure by optimizing surface movement, and the implementation of safety management to control safety risks and mitigate hazards such as those that contribute to runway excursions and incursions, remain essential. At the same time, taking advantage of technical developments in air navigation and aircraft systems may also assist in improving airport capacity and efficiency. In order to contribute to an overall strategy enhancing airport capacity, five significant planning threads, as described in the appendices to this paper and illustrated in the attached Figure 1, are proposed for inclusion in the ASBU framework:

a) integration of arrival/departure/surface management;

b) increasing use of GNSS-based instrument procedures;

c) optimized management of wake turbulence separation;

d) enhanced surface surveillance, and

e) airport collaborative decision-making.

1.4 A module on remotely operated control towers has also been proposed to ensure the timely availability of provisions to support this fast evolving technology. Aspects relating to punctuality and predictability in transiting airport security control points will be discussed following the High-Level Conference on Aviation Security (HLCAS) to be held in Montréal from 12 to 14 September 2012.

2. ASBU MODULES - AIRPORT CAPACITY

Overall Strategy

2.1 By working on some of today’s capacity constraints using the planning threads shown above, worthwhile gains in airport capacity have been demonstrated by deployment of one or more of the

Block 0 modules. Transitioning over time towards the Block 3 outcomes should see the operational use of aircraft capabilities and the synchronization of collective traffic flows to optimize the use of runways and the airport surface. Increasing use of traffic planning tools, advanced instrument procedures and all-weather operations should realize greater predictability of operations without undue reliance on ground based navigation infrastructure.

2.2 Depending upon airport- or aircraft-specific circumstances:

a) 3D trajectories bring greater efficiency and environmental benefits;

b) the application of 4D trajectories should increase predictability and reduce uncertainty between the planned and actual aircraft arrival or departure sequences;

c) managed reductions in the wake vortex spacing required between aircraft should increase runway movement rates; and

d) traffic synchronization through progressive integration of surface, arrival and departure management tools should further optimize airspace and airport traffic flows.

2.3 Conflict management, demand and capacity balance and overall traffic synchronization should be fully integrated as an end state objective, and should be supported by overall airport collaborative decision-making (CDM).

Incremental development

2.4 The ASBU concept facilitates the step by step deployment of operational improvements within the boundaries of an overall planning framework. Looking towards the end state, following the deployment of the airport capacity elements of Block 3 each aircraft should be capable of exchanging information regarding its 4D trajectory profile and be able to adhere fully to an agreed 4D trajectory. The air traffic and airport management systems should support time-based interval management, integrated sequencing and augmented surveillance capabilities.

2.5 The initial steps on this path (Block 0) implement a combination of wake turbulence re-categorization, approach procedures making optimal usage of GNSS-based performance-based navigation (PBN) approaches and traffic flow improvements through the management of arrival and departure runway sequencing. New technology is available to enhance the surveillance of aircraft surface movement, and may also provide information on suitably equipped vehicles. Improved processes are offered to support CDM involving all stakeholders on the airport.

2.6 Block 1 continues the evolution of the Block 0 planning threads to, where possible, reduce approach minima, potentially to CAT II/III capability by using GNSS. Developments in managing wake vortex separation build on a new, more detailed, wake turbulence categorization to create static leader/follower pair matrices of aircraft type wake separation pairings for application on a pair-by-pair basis, with the aim to increase arrivals on closely spaced parallel runways. Airport capacity may also be increased by extended arrival metering and departure/surface integration to facilitate efficient and flexible departure all-weather operations. Procedures and technology, such as enhanced visualization systems, are provided to enhance safety and efficiency of surface operations. Associated with these improvements, airport CDM is brought to another level by establishing a collaborative airport operations plan and performance framework, enabling airport stakeholders to communicate and coordinate through interconnected systems. This sharing of the available resources and information should increase real-time

capability. At this level of maturity, it should also be possible to provide remotely operated control tower services at suitable aerodromes.

2.7 With Block 2, aircraft equipage and the interconnection of systems become increasingly important. The leader/follower pair matrices of aircraft wake separation become dynamic, using real-time weather observations to allow the ANSP to minimize the wake turbulence distance between aircraft. At the same time, the synchronization of departures, arrivals and surface movements, adjusted dynamically to accommodate any change in the arrival/departure flow patterns, allow optimization of airspace and airport resources. Enhancement of airport surface surveillance, with implementation of safety nets, and the extended use of enhanced vision systems for taxi operations may also contribute to increased capacity.

Technology requirements

2.8 The technology improvements that would support the operational improvements include those that support the expansion and development of PBN, and specifically those supporting reducing operational minima, such as for GNSS based CAT II/III procedures. Multi-sensor navigation and improved flight management systems also support PBN operations. Enhanced surveillance capabilities of the airport surface in the tower and on board the aircraft are also key elements. Surveillance and wake turbulence separation may be reliant on version 2 of ADS-B. Progressive implementation of controller-pilot data link communications (CPDLC) initially for departure and taxi clearance, thereafter for enhanced ATM coordination, may play an integral part in delivering the full efficiency of arrival/departure and surface movement management. The progressive implementation of AEROMACS will serve the need of extensive exchange between all operational actors.

2.9 At the level of Blocks 2 and 3, where all improvements rely on close coordination between operational parties, synchronized operations and full use of 4D trajectories, the implementation of system-wide information management (SWIM) plays a key role. Full implementation of ATS interfacility data communications (AIDC) as the normal means of automated ground-ground communication between ATS units is a pre-requisite. Technology requirements and the linkages between the various blocks and modules of the ASBU framework are detailed in the technology roadmaps that constitute part of the draft Fourth Edition of the GANP (refer to AN-Conf/12-WP/3).

Deployment considerations

2.10 The continued deployment of PBN and the development of ICAO provisions on wake turbulence categorization and separations are necessary to improve airport capacity. Procedures for airport CDM and the integration of arrival, departure and surface management will also be necessary, along with real-time decision making. Mixed aircraft equipage operations could be complex and therefore increasing homogeneity in aircraft capabilities would be desirable. Demonstrated benefits from operational trials will be important in providing suitable cost/benefit logic to encourage greater airborne equipage of new technology.

2.11 Many of the operational improvements relating to airport capacity are local by essence and may only result in benefits at individual airports. Accordingly, improvements in airport capacity should be made on the basis of local decisions that take into account current and future aircraft operations and the level and type of equipage on board the aircraft. However, in cases where interdependencies in terms of traffic flows, airspace management and so forth exist between airport pairs, the full benefit of arrival/departure/surface management may only be achieved on a harmonized subregional or regional basis. Aircraft equipage is a significant contributor in all scenarios, with requirements from Block 2 onwards needing increased and harmonized airborne performance capabilities.

2.12 States are urged to give due careful consideration to the potential added benefits which could result from an overall integration of a number of modules across a number of threads. For example, the integration and implementation of several supporting systems (e.g. A-SMGCS, A-CDM, AMAN/DMAN, etc.) at an early stage may generate additional benefits downstream (i.e. in Blocks 2 and/or 3). Benefit from an integrated implementation of all modules is expected to be greater than the sum of all benefits attributable to individual modules.

3. CONCLUSION

3.1 The ASBUs describe ways to apply the concepts defined in the *Global Air Traffic Management Operational Concept* (Doc 9854) to achieve local and regional performance improvements. The ultimate goal is global interoperability. Safety and efficiency demands this level of interoperability and harmonization, which must be achieved at a reasonable cost with commensurate benefits. The Conference is invited to agree to the following recommendation:

Recommendation 2/x - ICAO aviation system block upgrades (ASBUs) relating to airport capacity

That the Conference:

a) urge States, according to their operational needs, to implement the aviation system block upgrade modules relating to airport capacity included in Block 0, as presented in Appendices A through E;

b) endorse the aviation system block upgrade modules relating to airport capacity included in Block 1, as presented in Appendices F through K, and recommend that ICAO use them as the basis of its work programme on the subject;

c) endorse the aviation system block upgrade modules relating to airport capacity included in Blocks 2 and 3, as presented in Appendices L through O, as the strategic direction for this subject; and

d) request ICAO to include, following further development and editorial review, the aviation system block upgrade modules relating to airport capacity in the draft Fourth Edition of the *Global Air Navigation Plan*.

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Figure 1 – Block Upgrade Modules Covered in this Working Paper