International Civil Aviation Organization

WORKING PAPER

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TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 1: Strategic issues that address the challenge of integration, interoperability and harmonization of systems in support of the concept of "One Sky" for international civil aviation

1.1: Global Air Navigation Plan (GANP) – framework for global planning

ASBU BLOCK "0" MODULES GAP ANALYSIS

(Presented by the International Business Aviation Council)

SUMMARY

This paper presents the results of a Gap Analysis undertaken to identify Block "0" modules that present significant difficulties or considerable uncertainties for business aircraft, both jet and turboprops.

Action: The Conference is invited to note this paper and refer the Appendix hereto for further consideration in the updating and finalization of ASBU Block "0".

1. INTRODUCTION

1.1 The International Business Aviation Council (IBAC) in collaboration with avionics equipment manufacturers and aircraft manufacturers has conducted a Gap Analysis of the aviation system block upgrade (ASBU) Block "0" modules, the results of which are addressed in the appendix to this working paper.

2. BACKGROUND

2.1 The current global business aircraft fleet comprises approximately 18 405 jets and 13 381 turboprops. One forecast projects deliveries of 10 000 jets during the period 2011-2020.

2.2 The purpose of the Gap Analysis was to identify those Block "0" modules that present significant difficulties or considerable uncertainties for business aircraft, both jet and turboprops. The analysis principally addressed the current and anticipated availability of avionics for installation in business aircraft currently in production and those to be built in the period to 2018. It is important to recognize that business aircraft avionics are typically a separate and distinct product line for many avionics equipment manufacturers.

2.3 The analysis did not explore in depth consideration of the size and scope of retrofit issues. Suffice it to say that with the size of the global fleet, the fleet age profile, the maintenance capacity and resources required to support retrofit on an unprecedented scale will pose a major challenge for the business aviation community.

3. CONCLUSION

3.1 Recognizing the importance of Block “0” as the foundation for the evolution of ASBUs, there is Block “0” modules need to accommodate all segments of civil aviation, Reflecting the reality of both avionics equipment availability as well as the time lines for the implementation of the various airborne functionalities will enhance the credibility of the planning.

4. ACTION

4.1 The Conference is invited to note this paper and refer the appendix hereto for further consideration in the updating and finalization of ASBU Block “0”.

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APPENDIX

Performance Improvement Area 1: Greener Airports				
Description	**Impact**	**Gap**	**Comments**	**ASBU Ref docs page #**
B0-65: Optimisation of approach procedures including vertical guidance. The use of performance-based navigation (PBN) and ground-based augmentation system (GBAS) landing system (GLS1) procedures will enhance the reliability and predictability of approaches to runways, thus increasing safety, accessibility and efficiency. This is possible through the application of Basic global navigation satellite system (GNSS), Baro vertical navigation (VNAV), satellite-based augmentation system (SBAS) and GLS. The flexibility inherent in PBN approach design can be exploited to increase runway capacity.	PBN approach procedures can be flown with basic IFR GNSS avionics that support on board performance monitoring and alerting these support lateral navigation (LNAV) minima. Basic IFR GNSS receivers may be integrated with Baro VNAV functionality to support vertical guidance to LNAV/VNAV minima. **Aircraft require avionics to fly GBAS land system (GLS) approaches**.	Lack of a clear understanding in description. **Problem is GBA I**tem 4 in the ref doc has very little reference to GBAS indicates need for aircraft GBAS solution. SAM region has no plans for SBAS and may(?) pursue GBAS. **GBAS aircraft solution not in Block 0 time scale** see FAA AC 91-05	**Recommend move GBAS portion of module to Block I as no equipment available in the Block 0 timeframe.** Medium importance if SBAS satisfactory.	5
B0-75: Safety And Efficiency Of Surface Operations (A-SMGCS LEVEL 1-2) 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).	A-SMGCS is applicable to any aerodrome and all classes of aircraft/vehicles. ADS B APT,when applied is an element of A-SMGCS, is designed to be applied at aerodromes with medium traffic complexity, having up to two active runways at a time and the runway width of minimum 45 m. **Uses existing aircraft ADS-B and/or SSR transponder systems, including correct setting of aircraft identification.**	**Add reference to D0 documents 260A**.	**Business Aviation use DO260A standard for ADS-B out and as per current US and Europe mandates.** **VDL mode 2 is acceptable.** Medium importance if 260A is the ADS-B standard. Some business aircraft manufacturers have advised DO260B equipment will not be available from their suppliers in the Block 0 timeframe	69

Description	Impact	Gap	Comments	ASBU Ref docs page #
B0-15: Improve Traffic Flow through Runway sequencing (Arrival Management/Departure Management (AMAN/DMAN)) To manage arrivals and departures (including time-based metering) to and from a multi-runway aerodrome or locations with multiple dependent runways at closely proximate aerodromes, to efficiently utilize the inherent runway capacity.	Arriving flights are "metered" by control time of arrival (CTAs) and must arrive at a defined point close to the aerodrome by this time. Metering allows ATM to sequence arriving flights such that terminal and aerodrome resources are utilized effectively and efficiently. Arrival management sequences the aircraft, based on the airspace state, wake turbulence, aircraft capability, and user preference. Departure management sequences the aircraft, based on the airspace state, wake turbulence, aircraft capability, and user preference, to fit into the overhead en-route streams without disrupting the traffic flow.	For approach, time-based metering is mainly achieved through ATC speed clearance to adjust the aircraft sequence in the AMAN. **This operation can be facilitated by requiring the aircraft to meet a CTA at a metering fix, relying on the aircraft required time of arrival function from current flight management system (FMS).** **Business Aviation aircraft FMSs do not have RTA (ie CTA).**	**If no RTA will the aircraft (those not equipped) be denied access to the airspace??** **Although benefits may not be derived by Business Aviation**; if there is no exclusionary airspace, this will be a minor issue.	41

Performance Improvement Area 3: **Optimum Capacity and Flexible Flights – Through Global Collaborative ATM**				
Description	**Impact**	**Gap**	**Comments**	**ASBU Ref docs page #**
B0-10: 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.	This module is aimed at improving the profiles of flights in the en-route phase through the deployment and full application of procedures and functionalities on which solid experience is already available, but which have not been systematically exploited and which are of a nature to make better use of the airspace. This includes CDM applications for en-route airspace to anticipate on the knowledge of the airspace use requests, take into account preferences and inform on constraints; FUA: flexible use of airspace to allow both the use of airspace otherwise segregated, and the reservation of suitable volumes for military usage; this includes the definition of conditional routes. flexible routing (flex tracking): route configurations designed for specific traffic pattern.	**Dynamic re-routing can require aircraft connectivity (ACARS) to its flight operating centre for flight tracking and the up-load of new routes computed by the FOC flight planning system (FPS),** and possibly FANS 1/A capability for the exchange of clearance with ATC. Non Commercial carriers do not have an AOC for providing upload! **Business Aviation operators have no Operational Control services equivalent to those of airlines hence inability to participate in CDM** there has been no consideration of avionics impact of uplink of FPL and re-clearances employing auto-load some airlines have disabled this functionality domestic aircraft do not have such a capability.	**Business Aircraft Avionics not taken into account. Business Aviation issues.** **All pilots don't agree. Manual input and cross check is preferred for some waypoint entry.** **Without equipage benefits may not be derived.** Minor issue	187

Description	Impact	Gap	Comments	ASBU Ref docs page #
B0-84: Initial capability for ground surveillance This module provides initial capability for lower cost ground surveillance supported by new technologies such as ADS-B OUT and wide area multilateration systems. This capability will be expressed in various ATM services, e.g. traffic information, search and rescue and separation provision.	This module introduces the opportunity to expand ATC radar equivalent service with two new surveillance techniques that can be used, separately or jointly: automatic dependent surveillance — broadcast (ADS-B) and multilateration(MLAT). These techniques provide alternatives to classic radar technology at a lower implementation and maintenance cost, thereby allowing to provide surveillance services in areas where they are currently not available for geographical or cost reasons. These techniques also allow, in certain conditions, a reduction of separation minima thereby potentially increasing the ability to accommodate larger volumes of traffic. **For ADS-B surveillance services, aircraft must be equipped with ADS-B OUT.** Accuracy and integrity are reported from the avionics. Users of the data decide on the required accuracy and integrity for the application. **For multilateration, aircraft need to be equipped with Mode S radar transponders.**	**DO260A or DO260B is left open for individual state decisions and possibly two standards or dual requirements!**	**Business Aviation use DO260A standard for ADS-B out and as per current US and Europe mandates**. If DO260B is the standard in the short term (Block O) this will be an issue of **medium importance**. Some business aircraft manufacturers have advised DO260B equipment will not be available from their suppliers in the Block 0 timeframe.	233

Description	Impact	Gap	Comments	ASBU Ref docs page #
B0-85 ; Air Traffic Situational Awareness (ATSA) Two *ATSA (Air Traffic Situational Awareness)* 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: • AIRB (basic airborne situational awareness during flight operations); and • VSA (visual separation on approach).	**These are cockpit-based applications** which do not require any support from the ground hence they can be used by any suitably equipped aircraft. This is **dependent upon aircraft being equipped with ADS-B OUT**. ADS-B OUT compliant with AMC2024 / DO-260A/DO-260B /ED102 A is needed on the majority of the aircraft population. There is a potential need to certify ADS-B OUT data. ADS-B IN compliant with DO-314/ED160 or DO-317A/ED194 is required to support VSA. ADS-B IN compliant with DO-319/ED164 or DO-317A/ED194 is required to support AIRB.	**AIRB and VSA requires ADS-B IN and is predicted/reliant on most other aircraft having ADS-B OUT at least one aircraft OEM has no supplier.** **Avionics availability at low enough costs for GA is not yet available**	**Is this relevant in Block O with the TCASII Vers 7 capabilities??** Is ACAS II inadequate for performance reasons? Block 1 for Business Aviation Minor Issue.	241
B0-86: 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. The main benefit of ITP is significant fuel savings and the uplift of greater payloads.	**The aircraft performing the in-trail procedure (ITP) will require an ADS-B IN capability** compliant with DO-312/ED-159or DO-317A/ED-194 . **The other aircraft involved in the procedure will require an ADS-B OUT** capability 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 is required.	**Similar issues as for B0-85**. **Maneuvering aircraft requires ADS-B in.** With ITP the unstated caveat is between suitably equipped aircraft pairs.	Minor issue	267
B0-101: ACAS Improvements To provide short-term improvements to existing airborne collision avoidance systems (ACAS) to reduce nuisance alerts while maintaining existing levels of safety. This will reduce trajectory deviations and increase safety in cases where there is a breakdown of separation.	ACAS is subject to **global mandatory carriage for aeroplanes with a MTCM greater than 5.7 tons.** The current version of ACAS II is 7.0. RTCA DO185B / EUROCAE DO143 MOPS are available for TCAS implementation. RTCA DO325 Annex C is being modified to accommodate the 2 functions (APFD and TCAP). It should be ready by Q1 2013.	**Not required for some Business Aviation aircraft.**	**Business Aviation in some locations do not carry TCAS??** Awareness issue? Minor issue for Business Aviation in Block 0.	273

Performance Improvement Area 4: **Efficient Flight Path – Through Trajectory-based Operations**				
Description	**Impact**	**Gap**	**Comments**	**ASBU Ref docs page #**
B0-40: Improved Safety and Efficiency through the initial application of Data Link En-Route To implement an initial set of data link applications for surveillance and communications in ATC, supporting flexible routing, reduced separation and improved safety.	FANS 1/A and ATN B1, both exist. FANS1/A is deployed in oceanic and remote regions whilst ATN B1 is being implemented in Europe according to European Commission legislation (EC Reg. No. 29/2009) – the data link services implementing rule. These two packages are different from the operational, safety and performance standpoint and do not share the same technology but there are many similarities and can be accommodated together, thanks to the resolution of the operational and technical issues through workaround solutions, such as accommodation of FANS 1/A aircraft implementations by ATN B1 ground systems and dual stack (FANS 1/A and ATN B1) implementations in the aircraft.	An important goal of the global ATM concept within the area of data link is to harmonize the regional implementations and to agree on a common technical and operational definition, applicable to all flight regions in the world. This is planned to be achieved through Block 1 changes. Data link implementations today are based on different standards, technology and operational procedures although there are many similarities However, **not readily available for retrofit**. **Not certified for most Business Aviation aircraft**. Some Gulfstream aircraft only.	Business Aviation is coming online with availability of equipment. **The implementation of a first package of data link applications, covering ADS-C, CPDLC and other applications for ATC with Business Aviation aircraft operating globally is a significant and costly burden for Business Aviation aircraft!** 2017 for a lot of the block 0 items. Move to Block 1 for mandates. Major issue	325

Description	Impact	Gap	Comments	ASBU Ref docs page #
B0-05: Improved flexibility and efficiency in descent profiles (CDOS) To use performance-based airspace and arrival procedures allowing aircraft to fly their optimum profile using continuous descent operations (CDOs). This will optimize throughput, allow fuel efficient descent profiles and increase capacity in terminal areas.	This module integrates with other airspace and procedures (CDO, PBN and airspace management) to increase efficiency, safety, access and predictability. CDO is an aircraft operating technique aided by appropriate airspace and procedure design and appropriate ATC clearances enabling the execution of a flight profile optimized to the operating capability of the aircraft, with low engine thrust settings and, where possible, a low drag configuration, thereby reducing fuel burn and emissions during descent. A CDO can be flown with or without the support of a computer-generated vertical flight path (i.e. the vertical navigation (VNAV) function of the flight management system (FMS)) and with or without a fixed lateral path. However, the maximum benefit for an individual flight is achieved by keeping the aircraft as high as possible until it reaches the optimum descent point. This is most readily determined by the on board FMS.	**Expand on CDO definition**. Not clear how/why CDO relates to en-route phase of flight. Intent unclear from an operators/pilot perspective? **Why would RNAV/RNP be needed?** What needs to be done to improve FMS functionality to achieve max benefits to operator?	AC20-138b should be referenced Why the notes on RNAV, RNP?? **Depends on FMS capability. Current Business Aircraft FMS not capable.** (One aircraft OEM suggests they could offer such functionality circa 2018.) Benefits may not be derived by Business Aviation but a Minor issue for Block 0.	297

Description	Impact	Gap	Comments	ASBU Ref docs page #
B0-20: Improved Flexibility and Efficiency Departure Profiles - Continuous Climb Operations (CCO) To implement continuous climb operations in conjunction with performance-based navigation (PBN) to provide opportunities to optimize throughput, improve flexibility, enable fuel-efficient climb profiles and increase capacity at congested terminal areas.	The optimum vertical profile takes the form of a continuously climbing path with a minimum of level flight segments only as needed to accelerate and configure the aircraft. A CCO can be flown with or without the support of a computer-generated vertical flight path (i.e. the vertical navigation (VNAV) function of the flight management system (FMS)) and with or without a fixed lateral path.	"The **baseline** for this module **may vary from one State, region or location to the next."** "The **lack of ICAO PBN operational approval guidance material and subsequently the emergence of States or regional approval material, which may differ** or be even more demanding than intended, is slowing down implementation and is perceived as one of the main roadblocks for harmonization." "There is still some **work to be done to harmonize PBN nomenclature,** especially in charts and States/regional regulations."	**Three disturbing statements**. An apparently ominous degree of flexibility!!?? No other issue. Medium concern but a minor issue in Block 0.	343

Note.– Aviation system block upgrades comprise a suite of modules, each having the following essential qualities:

a) a clearly-defined measurable operational improvement and success metric;
b) necessary equipment and/or systems in aircraft and on ground along, with an operational approval or certification plan;
c) standards and procedures for both airborne and ground systems; and
d) a positive business case over a clearly defined period of time.

— END —