International Civil Aviation Organization

AN-Conf/12-WP/25
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WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

Agenda Item 6: Future direction
6.1: Implementation plans and methodologies

PRIORITIZING THE AVIATION SYSTEM BLOCK UPGRADE MODULES

(Presented by the Secretariat)

EXECUTIVE SUMMARY

The Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP) will be a high level reference document that contains a rolling plan for the next fifteen years of aviation systems improvements in the form of modules within the aviation system block upgrades (ASBUs) that will guide States, industry and international organizations on the basis of operational thresholds and timeframes. However, not all of the modules contained in the ASBUs are intended to be universally implemented.

This paper recommends that a means of prioritizing the ASBU modules be developed to assist States, industry and international organizations in determining which modules to act upon and implement and in what circumstances and timeframes. The paper also proposes an initial prioritization of the modules in Block 1, to assist in identifying those modules to be considered as essential for implementation at a global level. A simplified module naming and numbering system is also proposed.

Action: The Conference is invited to agree to the recommendation in paragraph 4.

Strategic Objectives:	This working paper relates to the Safety and Sustainable Development of Air Transport Strategic Objectives.
Financial implications:	Based on preliminary indications, the benefits of implementing the ASBU modules, where needed, are substantial for global system performance. For high-density airspace, the impact of non-implementation will be a lack of optimum global system performance and a lack of system harmonization. The cost impact for some modules may be substantial. However, when appropriately implemented the benefits are expected to far outweigh the costs.
References:	Doc 9958, *Assembly Resolutions in Force (as of 8 October 2010)* Doc 9750, *Global Air Navigation Plan*

1. INTRODUCTION

1.1 In the international civil aviation system, the facilities and services implemented, along with the equipage and operational procedures adopted, have a direct impact on overall harmonization, interoperability and sustainability. Therefore, the adoption of agreed and harmonized solutions by States for air navigation is critical.

1.2 Article 37 of the *Convention on International Civil Aviation* (Doc 7300), states "Each contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures, and organization in relation to aircraft, personnel, airways and auxiliary

services in all matters in which such uniformity will facilitate and improve air navigation. To this end the International Civil Aviation Organization shall adopt … international standards and recommended practices and procedures dealing with a) communications systems and air navigation aids…".

1.3 The aviation system block upgrade (ASBU) modules are organized into logical and scalable groupings 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.

2. PRIORITIZING IMPLEMENTATION OF THE ASBU'S

2.1 The Fourth Edition of the *Global Air Navigation Plan* (AN-Conf/12-WP/3 refers) introduces ICAO's ASBU methodology and supporting technology roadmaps based on a rolling fifteen-year planning horizon. This framework is intended primarily to ensure that global aviation system performance will be maintained and enhanced, that air traffic management improvement programmes are harmonized, and that barriers to future aviation efficiency and environmental gains may be removed at a reasonable cost. Agreement on such a framework would clarify how the air navigation service provider and the airspace user could plan for future equipage.

2.2 Although the GANP has a global perspective, it is not intended that all ASBU modules are to be applied around the globe. Using a 'think global – act local' planning concept, some of the ASBU modules contained in the GANP are specialized packages that should be applied where specific operational requirements or corresponding benefits exist.

2.3 Although some modules are suitable for entirely stand-alone deployment, an overall integrated deployment of a number of modules could generate additional benefits. The benefits from an integrated implementation of a number of modules may be greater than the benefits from a series of isolated implementations. Similarly, the benefits from the coordinated deployment of one module simultaneously across a wide area (e.g. a number of proximate airports or a number of contiguous airspaces/flight information regions) may exceed the benefits of the implementations conducted on an ad hoc or isolated basis.

2.4 Accordingly, rather than implementing State-by-State, deployments on a global, regional and sub-regional basis should be considered as an integral part of global and regional planning through the planning and implementation regional groups (PIRGs) processes. In this way implementation, including applicability dates, can be agreed and applied by all stakeholders involved.

2.5 An example of a need for global applicability would be performance-based navigation (PBN). Assembly Resolution A37-11 urges all States to implement approach procedures with vertical guidance in accordance with the PBN concept. Therefore, the ASBU modules on PBN approaches should be seen as required for implementation at all airports.

2.6 In the same way, some modules are well suited for regional or sub-regional deployment and the regional planning processes under the PIRG should take this into account when considering which modules to implement regionally and in what circumstances and agreed timeframes.

2.7 Finally, from time to time it is essential to agree on a next generation replacement of existing equipage or services that no longer meet the system requirements of the global system. The most recent example

is the global implementation of the 2012 ICAO flight plan. A future example could be the replacement to the aeronautical fixed telecommunication network, which has been distributing the ICAO flight plan since the 1950s.

2.8 Based on the above paragraphs, it is important to clarify how each ASBU module fits into the framework of the regional and global aviation system. To assist in this regard, a proposal for a module categorization system has been developed with the objective of ranking each module in terms of implementation priority (see Appendix A).

2.9 Rationalizing the block modules into categories of priority would assist with the understanding of how the ASBU modules relate to the global system. It would also assist States and PIRGs in identifying and developing their future system requirements.

2.10 This prioritization and categorization exercise could be done first by individual States and then regionally by the PIRGs in coordination with ICAO during the update of Regional Air Navigation Plans (ANPs) and related implementation plans. Some modules may need to be categorized at a global level in order to ensure global interoperability or to improve safety. This exercise should be completed as soon as possible after the Conference in order to support wide synchronization of agreed global or regional implementation timelines and to achieve operational benefits worldwide.

2.11 It is expected that some ASBU modules will be essential at a global level and therefore may eventually become the subject of ICAO Standards with mandated implementation dates. For other modules, implementation should follow common methodologies defined either as Recommended Practices or Standards in order to leave flexibility in deployment process but ensure global interoperability at a high level. Appendix B identifies possible modules to be considered as essential for implementation at a global level for the purpose of describing the minimum path to interoperability and safety.

3. MODIFYING THE MODULE NAMING AND NUMBERING SYSTEM

3.1 The module numbering system (B0-65, etc.), employed during the ASBU systems engineering development stage was retained to demonstrate continuity from inception to final drafts but will be simplified in future versions.

3.2 The current numbering system indicates a block-year of readiness (B0, 1, 2 or 3), a tracking number (015, 065, etc.) and a block module title. An example is “B0-65 – Optimization of approach procedures including vertical guidance”. It is proposed that this will be modified into a more user and database friendly numbering system of the block year of readiness (0, 1, 2 or 3) and a 3-4 letter identifier replacing the existing tracking number, in conjunction with a short title for each module. A simplified module numbering/naming system using an intuitive approach is reflected in Columns 2 and 4 of the Table in Appendix B. After agreement by the Conference appropriate revisions will be incorporated into the update of the GANP.

4. CONCLUSION

4.1 The ASBUs described in the GANP are designed to achieve harmonization and interoperability leading to improvements in the provision of air navigation services worldwide. Although the ASBU modules provide the basis for a globally interoperable system, not all of the modules are intended to be implemented everywhere nor at the same time. Accordingly, a means of prioritizing the ASBU modules is necessary to assist in determining which modules to implement and in what circumstances and timeframes. To this end, the Conference is invited to agree to the following recommendation:

Recommendation 6/x - Prioritizing the aviation system block upgrade modules

That the Conference:

a) endorse in principle a rationalization of the aviation system block upgrade modules into categories for implementation priority on the basis of the material contained in Appendix A;

b) agree on principles for the naming/numbering of modules and designation of modules as part of the minimum path to global interoperability and safety;

c) request ICAO to modify the module naming and numbering system using, as a basis, the intuitive samples contained in Columns 2 and 4 of the table in Appendix B;

d) identify modules in Block 1 considered to be essential for implementation at a global level in terms of the minimum path to global interoperability and safety;

e) note that the categorization of modules in Blocks 2 and 3 will be undertaken at a future date based on the experience gained with prioritization of the modules in Block 1; and

f) request States and planning and implementation regional groups, in coordination with ICAO, to prioritize implementation of the aviation system block upgrade modules in accordance with the categorization system agreed by the Conference.

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APPENDIX A

PROPOSED CATEGORIZATION SYSTEM

To assist in the rationalization and prioritization of the aviation system block upgrade modules (ASBUs), a set of categories is proposed for consideration by States within their planning and implementation regional groups (PIRGs).

The proposed categories are:

a) Essential (E): These are the ASBU modules that provide substantial contribution towards global interoperability, safety or regularity of flight and in many cases form a prerequisite step towards the aviation system performance objectives of the GANP.

b) Desirable (D): These are the ASBU modules that, because of their strong business and/or safety case, are recommended for implementation almost everywhere.

c) Specific (S): These are the ASBU modules that are recommended for implementation to address a particular operational environment or mitigate identified risks.

d) Optional (O): These are the ASBU modules that address particular operational requirements and provide additional benefits that may not be common everywhere.

Rationalizing all the block modules into categories of priority will assist all stakeholders to understand how the ASBU modules contained in the GANP relate to the global system. It will also assist States and PIRGs in identifying and developing their own future system requirements.

Some modules will need to be categorized at a global level in order to ensure global interoperability or to improve safety. It is also expected that modules other than those agreed for categorization as Essential at a global level may be categorized differently between regions. Indeed, the category of a specific module may evolve depending on the maturing operational situation of a given region.

It is proposed that PIRGs should complete, in coordination with ICAO, a regular review of module categorizations in conjunction with the regional ANP update cycle with the objective of supporting wide synchronization of agreed global or regional deployment timelines and achievement of predictable operational benefits worldwide.

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APPENDIX B

PROPOSAL FOR GLOBAL CATEGORIZATION

In the lead up to the AN-Conf/12, early feedback from States and international organizations has been supportive of the longer term planning horizons embedded in the aviation system block upgrades (ASBUs) methodology. However, the need for greater overall clarity has been stressed, particularly in terms of technical and human resources planning and investment. On behalf of each stakeholder in the aviation system, this is perhaps best expressed in plain and simple language - *What must I do, and when must I do it?*

Minimum path to global interoperability

Conceptually, it is appropriate to consider this challenge in the context of a minimum path to the global interoperability of technical systems. Interoperability is built in to the ASBU methodology, contingent upon the necessary technical requirements being documented within each of the modules and their supporting technology roadmaps. Such an approach is expected to increase global convergence over time, whereby any future implementation takes place in accordance with the technical specifications of the relevant modules. If the same module specification is always implemented no matter the geographical location or the implementation date, global interoperability will ultimately be enhanced. Hence, the question *What must I do* can be partially answered by: *Do what is specified in the module*.

Equally important, given the large number of modules presented via the ASBU methodology, is the identification by stakeholders of which modules to implement first and their target implementation timeframes – essentially the other half of the *What must I do* question in conjunction with the *When must I do it*. This has already proven to be a challenging debate in many forums but has resulted in a consistent recognition that, whilst all modules are considered important:

- some modules must be implemented globally, and therefore must be designated as forming an Essential part of the minimum path to global interoperability;

- deployment of such modules in the earliest available timeframe will result in maximum aviation system benefits; and

- implementations of any such module should take place within the same approximate time periods.

It is anticipated that the development of suitable high level principles or guidelines to enable the objective identification of modules considered to be essential at a global level will be necessary. In serving the primary targets of safety and interoperability, such principles could, for example, include a focus on those modules providing:

- direct and tangible safety improvements;

- interoperability of ground-to-ground systems, recognizing the desirability of automation systems (including flight planning, AIM, MET, ATM and eventually SWIM systems) to be able to effectively communicate globally; or

- interoperability of air-to-air systems, recognizing the need for airborne applications such as airborne collision avoidance system (ACAS) and the airborne separation assurance system (ASAS) airborne tools to be able to interact without restriction.

In the case of interoperability of ground-to-ground systems, an example is that of the importance of the aircraft flight plan as an integral part of the system. Flight plan details are widely relayed over ground-ground networks and interoperability of these communication formats and systems is critical to the operation of the aviation system. In this context module B1-25 *Increased Interoperability, Efficiency and Capacity through flight and flow – information for a collaborative environment (FF-ICE), Step 1* is essential at a global level and is therefore candidate for the global minimum path to interoperability. Similarly, module B1-30 *Service Improvement through integration of all digital ATM information* is in this category.

The need for interoperability of air-to-air systems is well demonstrated in the case of ACAS, whereby collision avoidance algorithms rely on the information provided by the equipment in each affected aircraft to derive a separation solution. ACAS deployment is already subject to Annex 6 — *Operation of Aircraft* global provisions and should improve according to module B2-101 *New Collision Avoidance System* in order to adapt to future trajectory-based environment. The initiatives in module B1-85 *Increased Capacity and Efficiency through Interval Management* build on the air traffic situational awareness deployed via B0-85 in the same ASBU thread are also to be considered for global interoperability level focussed on ADS-B In and Out technology. This approach relies on a high level of interoperability and harmonisation in operational procedures and avionics requirements, indicating that this module should be designated as globally essential in terms of the minimum path.

Block 0 Modules

Block 0 modules have been specified with a readiness date of 2013, signifying that all components necessary for a particular deployment will be available from that time. In the case of Block 0 modules, the ASBU methodology serves to aggregate these existing initiatives into one place and correlate them with the future initiatives proposed via Blocks 1 through 3. In general terms, the Block 0 initiatives are considered mature for implementation as a result of the long standing development efforts arising from demands that comprehensively precede the ASBUs methodology. Minimum path considerations for Block 0 modules should take into account that as a result of this pre-existing development, in many cases ICAO SARPS and PANS provisions are already available, along with guidance material. The previous version of the GANP and its Global Plan Initiatives (GPIs) which relate to Block 0 have also served as the basis for the current implementation programmes.

Accordingly, in terms of the minimum path to global interoperability and recognizing that the Block 0 modules in many cases provide the foundation for future development, all Block 0 modules should be considered for early implementation by States, according to their operational needs.

Specifically, the Block 1 modules described in the next section below as being essential globally are reliant on the foundation provided by the preceding Block 0 module in the same ASBU thread. Therefore modules B0-25 *Increased Interoperability, Efficiency and Capacity through Ground-Ground integration,* B0-30 *Service Improvement through Digital Aeronautical Information Management,* B0-84 *Initial Capability for Ground-Based Cooperative Surveillance,* B0-85 *Air Traffic Situational Awareness,* and B0-101 *ACAS Improvements* are considered as essential for global implementation and therefore part of the minimum path.

Block 1 Modules

Block 1 modules have been specified with a readiness date of 2018. It is anticipated that States and PIRGs will develop implementation planning to support local, sub-regional and regional deployment of the Block 1 modules. The recent implementation of the 2012 ICAO flight plan has demonstrated the need that some modules be considered for worldwide applicability with the same or proximate timeframes to ensure the success of the global plan.

The Table below contains initial proposals for the categorization of some Block 1 modules as Essential at a global level. These proposals give due consideration to the fact that some Block 1 modules constitute a prerequisite for the realization of Block 2 and Block 3 objectives and take into account the preceding Block 0 modules that provide the foundation of the ASBU thread. The criteria used to categorize modules as "Essential" at a global level are related to interoperability as well as safety, in accordance with the categories proposed in Appendix A.

The minimum path for interoperability is also related to the harmonized implementation of the technology and procedures necessary to support the functional implementation of the modules.

Block 2 and Block 3 Modules

The readiness date for Block 2 modules has been specified as 2023, with Block 3 readiness from 2028. In light of these more distant timeframes it has not been considered necessary to identify minimum path modules from either of these Blocks at this stage. However, it should be recognized that the Block 2 and Block 3 modules in many cases constitute the targeted goal for future development towards 4D trajectory-based system.

Therefore Modules B2-25 *Coordination through multi-centre Ground-Ground Integration,* B2-31 *Enabling Airborne Participation in collaborative ATM through SWIM* and B2-101 *New Collision Avoidance System* could become eligible for Essential category at a global level and be part of the minimum path to global interoperability in the future aviation system.

Table.– Proposal for categorization of Block 1 modules as Essential at a global level

Column 1	Column 2	Column 3	Column 4	Column 5
Current ASBU Identifier	**Proposed ASBU Identifier**	**Proposed Global Level Categorization**	**Proposed Short Title**	**Rationale for Global Categorization Proposal**
B1-65	***1-PAPP*** (**P**erformance-based **APP**roach)	*Desirable*	Optimized airport accessibility	This module is not considered as Essential at a global level although it contributes to the improvement of the efficiency of the aviation system.
B1-70	***1-WAKE*** (**WAKE** turbulence separation)	*Optional*	Increased runway throughput through dynamic wake turbulence separation	This module is not considered as Essential although it contributes to the improvement of efficiency of flights on some constrained airports.

B1-15	***1-RSEQ*** (**R**unway **SEQ**uencing)	*Optional*	Improved airport operations through departure, surface and arrival management	This module is not considered as Essential although it contributes to the improvement of efficiency of the aviation system.
B1-75	***1-SMGC*** (**S**urface **M**ovement **G**uidance and **C**ontrol)	*Optional*	Enhanced safety and efficiency of surface operations (A-SMGCS/SURFIA) and EVS	This module is not considered as Essential although it contributes to the improvement of efficiency of the aviation system. It may be needed to improve safety in some specific operational environments.
B1-80	***1-ACDM*** (**A**irport **C**ollaborative **D**ecision-**M**aking)	*Desirable*	Optimized airport operations through airport-CDM	This module could have been considered as Essential because it is a fundamental one to solve any type of issue on an airport and may generate big benefits in safety and efficiency without big investments. However it was considered as Desirable because it was not contributing globally to interoperability.
B1-81	***1-RTWR*** (**R**emote **T**o**W**e**R**)	*Optional*	Remote operated aerodrome control tower	This module is not considered as Essential since it is basically related to some particular operational environments.
B1-25	***1-FICE*** (**F**light/flow **I**nformation for a **C**ollaborative **E**nvironment)	***Essential***	Increased interoperability, efficiency and capacity through FF-ICE/1 application before departure	This module is proposed to be **Essential** because it is one of the key elements of the future aviation system in order to solve actual restrictions on the flight plan format and permit the proper level of exchange of information to support efficient operations. It is a prerequisite for a lot of operational improvements considered by other modules in Blocks 1, 2 and 3.
B1-30	***1-DATM*** (**D**igital **A**ir **T**raffic **M**anagement information)	***Essential***	Service improvement through integration of all digital ATM information	This module is proposed to be **Essential** because it is one of the key elements of the future aviation system in order to exchange aeronautical, ATM and meteorological information with the proper content and the proper level of integrity. It is a prerequisite for a lot of operational improvements considered by other modules in Blocks 1, 2 and 3.

B1-31	***1-SWIM*** (**S**ystem-**W**ide **I**nformation **M**anagement)	***Essential***	Performance improvement through the application of system-wide information management (SWIM)	Implementation of SWIM services (applications and infrastructure) could be considered only Desirable at the level of Block 1. However This module is proposed to be **Essential** because it should constitute part of the skeleton of the future aviation system. It is a prerequisite for a lot of operational improvements considered by other ASBU modules in Block 1, 2 and 3.
B1-105	***1-DMET*** (**D**igital **MET**eorological information)	*Desirable*	Better operational decisions through integrated weather information (Strategic>40 Minutes)	This module is not considered as Essential although it contributes to the improvement of efficiency of the aviation system. In some regions of the world, it may be classified as Essential for safety reason because of major meteorological hazards. The need for real time meteorological information in the future may generate a change to the category Essential at a global level.
B1-10	***1-EERT*** (**E**nhanced **E**n **R**oute **T**rajectories)	*Optional*	Operations through free routing	This module is not considered as Essential although it contributes to the improvement of efficiency of the aviation system.
B1-35	***1-NOPM*** (**N**etwork **O**perations **P**lanning and **M**anagement)	*Desirable*	Enhanced flow performance through network operational planning	This module is not considered as Essential although it contributes to the improvement of efficiency of the aviation system. It is Essential at a regional level in order to ensure smooth and efficient management of traffic.
B1-85	***1-ASAS*** (**A**irborne **S**eparation **A**ssurance **S**ystems)	***Essential***	Increased capacity and flexibility through interval management	Although this module would naturally appear as a Desirable one since it is supporting capacity improvement which is not needed everywhere, it will imply a high level of harmonization in operational procedures and avionics systems. This module is also candidate to assist in creating some efficient solutions in areas where ground equipment is difficult to implement. Therefore it was categorized as **Essential** at a global level.

B1-102	***1-SNET*** (**S**afety **NET**s)	*Desirable*	Ground-based safety nets on approach	This module is not considered as Essential although it contributes to the improvement of safety and efficiency of the aviation system. In some regions of the world, it may be classified as Essential for safety reason.
B1-05	***1-CDO*** (**C**ontinuous **D**escent **O**perations)	*Desirable*	Improved flexibility and efficiency in descent profiles	This module is not considered as Essential at a global level although it contributes to the improvement of the efficiency of the aviation system.
B1-40	***1-TBO*** (**T**rajectory-**B**ased **O**perations)	*Desirable*	Improved traffic synchronization and initial trajectory-based operation	Although this module is the beginning of trajectory-based operations that will constitute the corner stone of the future aviation system, it is not considered as Essential at the stage of Block 1. For some high-density area in the world and considering the need for harmonized operational procedures and avionics systems, it should be classified as Essential.
B1-90	***1-RPAS*** (**R**emotely **P**iloted **A**ircraft **S**ystems)	*Specific*	Initial integration of remotely piloted aircraft (RPA) systems into non-segregated airspace	This module is not considered as Essential at a global level since it is corresponding to very specific type of operations.

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