International Civil Aviation Organization

Performance Based Navigation/Global Navigation Satellite System Task Force (PBN/GNSS TF)

Fifth Meeting
(Cairo, Egypt, 15 - 17 April 2013)

Agenda Item 3: Development in PBN and GNSS

TWELFTH AIR NAVIGATION CONFERENCE RECOMMENDATIONS RELEVANT TO PBN AND GNSS

(Presented by the Secretariat)

SUMMARY

This paper presents the Twelfth Air Navigation Conference (AN-Conf/12) Recommendations relevant to PBN and GNSS

Action by the meeting is at paragraph 3.

REFERENCES

- AN-Conf/12 Draft Report

1. INTRODUCTION

1.1 The Twelfth Air Navigation Conference (AN-Conf/12) was held in Montreal, Canada, from 19 to 30 November 2012. The Conference adopted 56 Recommendations, listed at **Appendix A** to this working paper, from which 15 considered relevant to the work of the PBN/GNSS TF.

2. DISCUSSION

PERFORMANCE BASED NAVIGATION (PBN)

2.1 The AN-Conf/12 acknowledged the notable work that had already been completed by ICAO and its partners to support the global implementation of Performance-Based Navigation (PBN) but also recognized that there is a shortfall in meeting Assembly Resolution A37/11 regarding production of State PBN implementation plans and instrument approach procedures with vertical guidance. Consequently, the Committee recognized that States still required assistance with PBN implementation especially in the areas of operational approvals and training of personnel. However, it was highlighted that the resources to support PBN were extremely limited and must be managed effectively. The Committee agreed that ICAO should continue to provide support, with assistance from States, International Organizations and Industry, in order to facilitate the timely implementation of PBN.

2.2 The Committee acknowledged the need for additional ICAO provisions to support specific PBN applications for specific situations including PBN standard terminal arrival routes (STARS) for simultaneous parallel runway operations.

2.3 The Committee agreed to the development of separation standards to support all PBN specifications and which will also allow for operations where mixed navigation performance requirements are in effect.

2.4 The Committee discussed the application of Ground-Based Augmentation Systems (GBAS) for standard instrument arrivals and departures and agreed that further analysis of the requirement was necessary.

2.5 The Committee also recognized that airport authorities are a key stakeholder and need to be involved early in the PBN planning process in order to address/mitigate potential impacts such as community noise exposure and airport infrastructure requirements

2.6 Furthermore, the Committee supported the sharing of Required Navigation Performance Authorization Required (RNP AR) implementation and Flight Operational Safety Assessment (FOSA) documentation as a means to inform States with examples of the safe implementation of RNP AR procedures.

Global Navigation Satellite System

2.7 On the other hand, the committee noted information on the implementation status of Global Navigation Satellite System (GNSS) constellations and augmentations systems, and considered a number of related implementation issues.

2.7.1 *Status of Core GNSS Constellations*

2.7.1.1 The Committee was informed that the United States is currently deploying modernized Global Positioning System (GPS) satellites with L1C/A and L5 signals and improved military encrypted signals that will enable civil and authorized State aircraft with modernized equipment to remove ionosphere induced errors and take advantage of increased performance and robustness.

2.7.1.2 The Committee was informed that the Russian Global Navigation Satellite System (GLONASS) was operating with a stable constellation of twenty-four GLONASS-M satellites, with additional back-up satellites. In addition, the Russian Federation is continuing its work to develop a new generation of GLONASS-K satellites. In-orbit tests are currently being conducted on an experimental GLONASS-K satellite. The ground control system is also being improved.

2.7.1.3 The Committee noted that Galileo is a GNSS constellation that is being developed by the European Union in cooperation with the European Space Agency. The first four satellites have already been successfully launched, and it is expected that 18 satellites will be operational by 2015, enabling the provision of initial services in combination with GPS and other constellations. It is planned that the Galileo constellation will be fully deployed by 2020.

2.7.1.4 The Committee also noted information on the BeiDou system, a GNSS constellation developed and operated by China. The deployment of the system is progressing as scheduled. The second phase of development has just been completed, supporting a position, navigation and timing (PNT) service for China and the surrounding areas. According to the schedule, full global deployment of the constellation will be completed by 2020.

2.7.2 *Satellite-based augmentation system (SBAS)*

2.7.2.1 The Committee was provided information on the implementation status of several Satellite-Based Augmentation Systems (SBAS). In particular, it was noted that the critical (Safety-of-Life) service of the European Geostationary Navigation Overlay Service (EGNOS) system was declared operational for aviation in 2011, and offered to ICAO for use by the Civil Aviation Community. Furthermore, the committee noted the progress made in the deployment of the GPS Aided Geo Augmented Navigation (GAGAN) system developed by India, with the completion of the final system acceptance test and the inception of the certification process.

2.7.3 *Multi-constellation/multi-frequency GNSS*

2.7.3.1 Noting the information on implementation status of new and enhanced constellation and augmentation systems, the committee acknowledged that GNSS is currently undergoing a significant evolution. As new constellations are deployed, and existing constellations are enhanced, signals from multiple constellations broadcasting in multiple frequency bands are becoming available. These developments lead to technical performance improvements, which create the potential for achieving significant operational benefits.

2.7.3.2 At the same time, it was noted that the introduction of multi-constellation, multi-frequency GNSS entailed a number of new technical and regulatory challenges beyond those already associated with current GNSS implementation.

2.7.3.3 With regard to regulatory challenges, the committee discussed the issues associated with mandating the use of specific GNSS elements. While in some cases mandates might expedite the fruition of the benefits deriving from the use of a specific system or technology, the meeting recognized that a performance-based approach is in principle preferable in the GNSS case.

2.7.3.4 The meeting acknowledged that some States may mandate equipage of aircraft with a specific GNSS constellation for various reasons not necessarily associated with navigation performance only. In such cases, the consensus of the meeting was that any State intending to introduce such mandates should limit them to aircraft operators for which it is the State of the operator.

2.7.3.5 The meeting's attention was also drawn to the additional difficulties that would necessarily arise if different mandates for specific GNSS elements were introduced in different States or regions. In particular, it was noted that such a situation could result in significant costs for users in terms of additional cockpit controls and procedures; crew training and maintenance support, and possibly raise human factors concerns. In order to limit such consequences, content and timelines for the implementation of potential mandates would need to be coordinated at the regional and inter-regional level in order to reduce the implementation burden on airspace users.

2.7.3.6 The Committee concluded that the potential benefits of the on-going evolution of GNSS towards a multi-constellation, multi-frequency scenario could only be fully secured if ICAO, States and aircraft operators take action to overcome the associated challenges.

Aviation System Block Upgrades (ASBU)

2.8 With a focus on harmonization and interoperability leading to a global air traffic management (ATM) system, the Committee noted that the revised Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP) version provides a global planning framework which, among other things, provides a timeline for which future improvements can be implemented by States in accordance with their needs. In addition, it identifies the need for the development of standards and recommended practices, regulatory requirements, procedures and technology associated with the

aviation system block upgrades (ASBU). The ASBUs are supplemented by Ccommunications, Navigation, Surveillance (CNS), avionics and information management roadmaps. High-level impediments to implementation such as cyber security were identified and considered during the discussions. Arrangements to ensure the periodic update of the ASBUs and roadmaps on a rolling fifteen-year planning horizon were discussed.

2.9 The Committee agreed that the ASBUs and associated technology roadmaps were an integral part of the GANP and a valuable implementation tool kit, and they will continue to evolve as more work is done on refining and updating their content and in subsequent development of related provisions, support material and training.

2.10 Although the GANP has a global perspective, it is not intended that all ASBU modules are to be applied around the globe. When the ASBU blocks and modules are adopted by regions, subregions or States they should be followed in close accordance with the specific ASBU requirements to ensure global interoperability and harmonization of air traffic management. It is expected that some ASBU modules will be essential at the global level and therefore may eventually be the subject of ICAO mandated implementation dates.

2.11 The implementation of air navigation measures, including those identified in the ASBUs can require significant investment of finite resources by ICAO Regions, Subregions, States and the Aviation Community. When considering the adoption of different blocks and modules, ICAO regions, subregions and States should undertake cost benefit analyses to determine the business case for implementation in their particular region or State.

2.12 ICAO should complete the development of guidance material on cost-benefit analysis for the purposes of advising the States and implementing the GANP. ICAO should review the GANP every three years and if necessary, all relevant air navigation planning documents through the established and transparent process.

2.13 The appendices to the GANP should be analysed annually by the Air Navigation Commission to ensure they remain accurate and up-to-date.

2.14 The progress and effectiveness of ICAO Regions and States against the priorities set out in their respective regional and State air navigation plans should be annually reported, using a consistent reporting format, to ICAO. This will assist Regions and States adjust their priorities to reflect actual performance and address any emerging air navigation issues.

2.15 The meeting may wish to recall that, the MIDANPIRG/13 Meeting, endorsed an initial set of operational improvements of the Aviation System Block Upgrades (ASBU) modules relevant to the MID Region, and agreed that MIDANPIRG subsidiary bodies further review these improvements based on the outcome of the ICAO Twelfth Air Navigation Conference (AN-Conf/12).

2.16 Based on the above, the ICAO MID Regional Office circulated a Survey on Aviation System Block Upgrades ASBU Block Zero Modules, attached to the State Letter Ref AN 7/26.1–13/056 dated 18 February 2013, in order to priorities the appropriate ASBU modules relevant to the MID Region. The Survey is at **Appendix B** to this working paper.

2.17 Accordingly, the ICAO MID Regional Office received replies on the State Letter mentioned above from the following States: Jordan and Qatar, their replies are at **Appendix C** to this working paper.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the list of AN-Conf/12 recommendation at **Appendix A** to this working paper and also provide any suggestions;

b) note the Survey on Aviation System Block Upgrades ASBU Block Zero Modules at **Appendix B** to this working paper and also provide any update; and

c) note the Surveys on Aviation System Block Upgrades ASBU Block Zero Modules at **Appendix C** to this working paper received from some States.

APPENDIX A

RECOMMENDATIONS ADOPTED BY AN-CONF/12	SUGGESTED FOLLOW-UP ACTION	
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)
Recommendation 1/1 – The draft Fourth Edition of the Global Air Navigation Plan (Doc 9750, GANP) That States:		
a) agree in-principle, with the replacement of the introduction by the high level policy principles as shown in the appendix and inclusion of other proposed improvements made at this Conference, into the updated draft Fourth Edition of the GANP;	a): Note.	a) and c): Develop and review the new draft version of the GANP taking into account AN-Conf/12 recommendations.
b) should have the opportunity to provide any final comments on the updated draft GANP to ICAO before it is considered by the ICAO Assembly in 2013; That ICAO:	b): Approve validation process of the new draft version of the GANP as proposed by the ANC.	b): Note.
c) include the key air navigation policy principles presented in the appendix under "Global Air Navigation Plan" into the Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	c): Approve as part of the GANP approval.	
d) develop financial policies which support efficient acquisition and implementation of global air navigation services infrastructure and aircraft equipage;	d): Request Secretary General to take appropriate action.	d): Contribute to the definition of financial policies.
e) taking a total systems and performance-based approach, create a Standards and Recommended Practices development plan for the aviation system block upgrades including the establishment of agreed global priorities between the different blocks and modules;	e) to g): Note.	e) to g): Approve and include in the Air Navigation work programme.
f) define a stable and efficient process for endorsement by the 38th Session of the ICAO Assembly, for updating the GANP that ensures stability in module timelines for any future updates; and		

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g) ensure that the nature and status of the planning information in the various documents pertaining to the GANP are consistent and complete and allow due account to be taken of the inputs from ATM research, development and deployment programmes.		
Recommendation 1/2 – Implementation That ICAO: a) through its regional offices, provide guidance and practical assistance to States and regions and subregions when they decide to implement individual blocks or modules of the aviation system block upgrades; b) establish a group and improved mechanism for interregional cooperation to ensure harmonization of air traffic management; and c) assist States and regions in training and capacity-building towards implementation of the relevant modules of the aviation system block upgrades.	a) to c): Note.	a) to c): Consider including into the Air Navigation work programme and request the Secretary General to take appropriate action.
Recommendation 1/3 – Guidance on business cases That ICAO complete the development of guidance material on business case analysis, adopting such appropriate guidance material that may be already available or under development.	Approve and request the Secretary General to take appropriate action.	Contribute to the definition of business cases and related guidance.
Recommendation 1/4 – Architecture That ICAO: a) develop, for inclusion in the first update of the GANP after the 38th Session of the ICAO Assembly, a global ATM logical architecture representation in support of the GANP and planning work by States and regions; and b) develop a breakdown of the logical architecture of the ground system to the level needed to best address the global interoperability issues.	a) and b): Note.	a) and b): Approve and include in the Air Navigation work programme.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	SUGGESTED FOLLOW-UP ACTION	
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Recommendation 1/5 – Time reference accuracy That ICAO define the accuracy requirements for the future use of a time reference and to prepare the necessary amendments to Standards and Recommended Practices.	Note.	Approve and include in the Air Navigation work programme
Recommendation 1/6 – Data communications issues That ICAO: a) organize a multidisciplinary review of air traffic control communication requirements and issues; and b) review the operation, management and modernization of a regional digital network technical cooperation project and other similar regional experiences with the aim that this efficient practice can be adapted for use in other ICAO regions; That States: c) explore multi-modal solutions when appropriate to overcome transition issues; and d) anticipate and accelerate the migration of air traffic management communication systems towards more efficient technologies to timely service the aviation system block upgrade modules.	a) and b): Note. c) and d): Note.	a) and b): Approve and include in the Air Navigation work programme. c) and d): Approve and request the Secretary General to bring to the attention of States.
Recommendation 1/7 – Automatic dependent surveillance — broadcast That States: a) recognize the effective use of automatic dependent surveillance — broadcast (ADS-B) and associated communication technologies in bridging surveillance gaps and its role in supporting future trajectory-based air traffic management operating concepts, noting that the full potential of ADS-B has yet to be fully realized; and	a) to c): Note.	a) to c): Note and request the Secretary General to bring to the attention of States.

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b) recognize that cooperation between States is key towards improving flight efficiency and enhancing safety involving the use of automatic dependent surveillance — broadcast technology; That ICAO: c) urge States to share automatic dependent surveillance — broadcast (ADS-B) data to enhance safety, increase efficiency and achieve seamless surveillance and to work closely together to harmonize their ADS-B plans to optimize benefits.		
Recommendation 1/8 – Rationalization of radio systems That ICAO and other stakeholders to explore strategies for the decommissioning of some navigation aids and ground stations, and the rationalization of the on-board communications, navigation and surveillance systems while maintaining safety and coordinating the need for sufficient system redundancy.	Note.	Approve and include in the Air Navigation work programme.
Recommendation 1/9 – Space-based automatic dependent surveillance — broadcast That ICAO: a) support the inclusion in the Global Air Navigation Plan, development and adoption of space-based automatic dependent surveillance — broadcast surveillance as a surveillance enabler; b) develop Standards and Recommended Practices and guidance material to support space-based automatic dependent surveillance — broadcast as appropriate; and c) facilitate needed interactions among stakeholders, if necessary, to support this technology.	a) to c): Note.	a) to c): Approve and include in the Air Navigation work programme.

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Recommendation 1/10 – Automatic dependent surveillance — self-organizing wireless data networks That ICAO consider the use of self-organizing wireless data networks based on VDL Mode-4 technology taking into account: a) possible technical advantages; b) whether it satisfies any unmet operational need; and c) its impact of forward and retro-fit on the global air transport fleet.	a) to c): Note.	a) to c): Approve and include in the Air Navigation work programme.
Recommendation 1/11 – Automation roadmap That ICAO: a) develop a global roadmap for the evolution of ground air traffic management automation systems in line with aviation system block upgrade implementation; and b) develop performance-based system requirements for air traffic management automation systems so that: 1) where necessary these systems are interoperable across States and regions; and 2) the function and operation of these systems will result in consistent and predictable air traffic management system performance across States and regions.	a) and b): Note.	a) and b): Approve and include in the Air Navigation work programme.
Recommendation 1/12 – Development of the aeronautical frequency spectrum resource That States and stakeholders: a) recognize that a prerequisite for the deployment of systems and technologies is the availability of adequate and appropriate radio	a) to d): Note.	a) to d): Note and request the Secretary General to bring to the

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spectrum to support aeronautical safety services; b) work together to deliver efficient aeronautical frequency management and "best practices" to demonstrate the effectiveness and relevance of the industry in spectrum management; c) support ICAO activities relating to the aviation spectrum strategy and policy through relevant expert group meetings and regional planning groups; and d) support Assembly Resolution A36-25 and the requirement for sufficient State representation of aviation interests at World Radiocommunication Conferences (WRCs) and relevant International Telecommunication Union WRC preparatory meetings; That ICAO: e) develop and implement a comprehensive aviation frequency spectrum strategy to be referenced to the Global Air Navigation Plan (GANP), which includes the following objectives: 1) timely availability and appropriate protection of adequate spectrum to create a sustainable environment for growth and technology development to support safety and operational effectiveness for current and future operational systems and allow for the transition between present and next generation technologies; 2) demonstrate efficient use of the spectrum allocated through efficient frequency management and use of best practises; and 3) clearly state in the strategy the need for aeronautical systems to operate in spectrum allocated to an appropriate aeronautical safety service; f) establish timelines and methodologies to complement the GANP	e) to i): Note.	attention of States and Stakeholders. e) to i): Approve and include in the Air Navigation work programme.

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planning objectives with a frequency spectrum strategy; g) continue to allocate adequate resources with a far-sighted approach to its work programmes regarding aviation spectrum challenges; h) consider a methodology to enable ATM stakeholders to effectively share ICAO material on aviation frequency spectrum as a common guidance for securing the aviation position at World Radiocommunication Conferences; and i) consider structuring the *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation including Statement of Approved ICAO Policies* (Doc 9718) by using a web-based platform as appropriate, to further support States in their implementation of the spectrum strategy.		
Recommendation 1/13 – Potential use of fixed satellite service spectrum allocations to support the safe operation of remotely piloted aircraft systems That ICAO support studies in the International Telecommunication Union Radio Communication Sector (ITU-R) to determine what ITU regulatory actions are required to enable use of frequency bands allocated to the fixed satellite service for remotely piloted aircraft system command and control (C2) links to ensure consistency with ICAO technical and regulatory requirements for a safety service.	Note.	Approve and include in the Air Navigation work programme.
Recommendation 1/14 – Long-term very small aperture terminal spectrum availability and protection That: a) ICAO and Member States not support additional international mobile telecommunications spectrum allocations in the fixed satellite service C-band spectrum at the expense of the current or future aeronautical very small aperture terminal networks; and	a) and b): Note.	a) and b): Approve and include in the Air Navigation work programme and request the Secretary General to take appropriate action.

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b) ICAO and Member States pursue this matter in the International Telecommunication Union Radio Communication Sector (ITU-R) and during the World Radiocommunication Conference (WRC-15), with a coordinated proposal to promote a solution where the international mobile telecommunications spectrum allocation does not compromise the availability of the aeronautical very small aperture terminal networks.		
Recommendation 1/15 – Performance monitoring and measurement of air navigation systems That ICAO: a) establish a set of common air navigation service performance metrics supported by guidance material, building on existing ICAO documentation (e.g. Manual on Global Performance of the Air Navigation System (Doc 9883) and the Manual on Air Navigation Services Economics (Doc 9161)); b) promote the development and use of "leading safety indicators" to complement existing "lagging safety indicators" as an integral and key component to drive improvement in performance and in the achieved management of risk; and c) encourage the early and close involvement of the regulator and oversight bodies in the development, proving of concepts and implementation of the aviation system block upgrades and regional programmes.	a) to c): Note.	a) to c): Approve and include in the Air Navigation work programme.
Recommendation 1/16 – Access and equity considerations That States: a) ensure, as part of the aviation system block upgrade implementation, the principles of access and equity are included in all airspace modernization and redesign efforts; and	a) and b): Note.	a) and b): Note and request the Secretary General to take appropriate action and bring to the attention of States and Stakeholders.

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b) detail how they will monitor the service providers to ensure that they are providing fair, equitable, and efficient access to all aviation services including general aviation.		
Recommendation 2/1 – ICAO aviation system block upgrades relating to airport capacity That the Conference: a) endorse the aviation system block upgrade modules relating to airport capacity included in Block 1 and recommend that ICAO use them as the basis of its standards work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to airport capacity included in Blocks 2 and 3 as the strategic direction for this subject; c) recommend that the ICAO Council supports the implementation of the APEX in Safety Programme and asks the Secretary General to continue ICAO participation in safety reviews and sharing of relevant safety information, as provided for in the Memorandum of Cooperation between ACI and ICAO; That ICAO: d) 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* (Doc 9750, GANP); e) States and service providers ensure that airport capacity, including relevant airport planning and operational issues, are addressed and accounted for when planning for air traffic management capacity and system performance; f) work with the Airports Council International (ACI) and other interested parties on guidance material to promote the globally-harmonized	c): Review in light of resources available. d): Note. e): Note. f): Note.	c): Note. d): Approve and include in the Air Navigation work programme. e): Approve, include in the Air Navigation work programme, and request the Secretary General to take appropriate action. f): Approve and include in the Air Navigation work programme.

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implementation of airport collaborative decision-making, including best practices and global technical standards; and That States: g) according to their operational needs, implement the aviation system block upgrade modules relating to airport capacity included in Block 0.	g): Note.	g): Approve and request the Secretary General to bring to the attention of States and Stakeholders.
Recommendation 2/2 – Development of ICAO provisions for remotely operated air traffic services That ICAO provide: a) updates on additional guidelines for surveillance and air and ground communications systems; b) requirements for the use of sensors and display technologies to replace visual observation to air traffic in the provision of air traffic services; and c) requirements for air traffic services (ATS) personnel and flight crew training, ATS personnel licensing and related procedures for remotely operated air traffic services.	a) to c): Note.	a) to c): Approve and include in the Air Navigation work programme.
Recommendation 2/3 – Security of air navigation systems That ICAO: a) seek the support of States and stakeholders to complete its work in developing a robust, secure aeronautical telecommunication network; and b) establish, as a matter of urgency, an appropriate mechanism including States and industry to evaluate the extent of the cyber security issues and develop a global air traffic management architecture taking care of cyber	a) and b): Approve and include in the Security work programme.	a) and b): Approve and include in the Air Navigation work programme.

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security issues.		
Recommendation 2/4 – Optimized management of wake turbulence That ICAO: a) accelerate the implementation of new ICAO wake turbulence categorization systems and to pursue development of dynamic wake turbulence separation provisions with supporting implementation guidance; b) support the continuation of the cooperative work on-going addressing the static pair wise separation, with a view to having revised global provisions in place in advance of Block 1 timescales; and c) develop the wake vortex flight safety system (WVSS) concept description along with a proposed system architecture with the possibility for WVSS to be included in the aviation system block upgrade Modules B1-70, B2-70, B1-85 and B2-85.	a) to c): Note.	a) to c): Approve and include in the Air Navigation work programme.
Recommendation 2/5 – Performance-based navigation for terminal and approach operations implementation That States and stakeholders: a) urgently implement, where appropriate, performance-based navigation for terminal and approach operations in accordance with Assembly Resolution A37-11; b) urgently adopt efficient operations approval procedures and support the mutual recognition of other States' operational approvals; c) share their best practices including required navigation performance authorization required implementation initiatives as well as relevant flight operational safety assessment documentation with other States;	a) to g): Note.	a) to g): Note and request the Secretary General to bring to the attention of States and Stakeholders.

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d) determine operational requirements in support of their airspace concept in accordance with the processes described in the *Performance-based Navigation (PBN) Manual* in order to select the appropriate PBN specification; e) including regulators, airport authorities, air navigation service providers, commercial operators, General Aviation and the military, work together at all levels and in close coordination to ensure successful performance-based navigation implementation; That: f) international organizations and industry continue to provide resources to support ICAO with the development of provisions, guidance and training material in support of performance-based navigation implementation; and g) States, when considering performance-based navigation routes arriving at and departing from airports, should ensure that air navigation service providers and aircraft operators involve airport operators from the outset so that they may consult fully with local communities in order to avoid adverse noise impact on those communities.		
Recommendation 2/6 – Development of ICAO provisions for performance-based navigation for en route terminal and approach operations That ICAO study and make appropriate additions where required to the ICAO provisions, including: a) required navigation performance authorization-required departure navigation specification; b) the application of performance-based navigation standard terminal arrival routes for en route independent simultaneous approaches;	a) to g): Note.	a) to g): Approve and include in the Air Navigation work programme.

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c) assessment of the need for ICAO provisions on the use of ground-based augmentation system to append standard instrument arrival and standard instrument departure procedures to approach and landing trajectory; d) development of separation minima to support all performance-based navigation specifications and which will also allow for operations where mixed performance requirements are in effect; e) advanced use of performance-based navigation to support aviation system block upgrade modules; f) continued development of provisions, guidance and training material in support of performance-based navigation implementation; and g) develop and make available the minimum qualification requirements for personnel to attend performance-based navigation procedure design training.		
Recommendation 3/1 – ICAO aviation system block upgrades relating to performance improvement through the application of system-wide information management That the Conference: a) endorse the aviation system block upgrade module relating to performance improvement through the application of system-wide information management included in Block 1, and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle with the aviation system block upgrade module relating to performance improvement through the application of system-wide information management included in Block 2, as the strategic direction for this subject;	Note.	Approve and include in the Air Navigation work programme.

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That ICAO: c) include, following further development and editorial review, the aviation system block upgrade modules relating to performance improvement through the application of system-wide information management for inclusion in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP).		
Recommendation 3/2 – Development of a global system-wide information management concept That ICAO: a) undertake further work to develop a global system-wide information management concept for air traffic management operations and related ICAO provisions that may be necessary; b) at the appropriate time coordinate information management principles and performance-based information management; c) perform additional work on the global implementation of those principles and framework for all air traffic management information through the development of appropriate information management/system-wide information management concepts to be ready in 2014 for subsequent system development work in Block 1 and to include in its work programme, specific activities tailored at coordinating system-wide information management deployment at a local, regional and global level; d) update the information management/system-wide information management (IM/SWIM) working arrangements; That States and stakeholders: e) work together to demonstrate how system-wide information management capabilities and functions will meet the needs of the future	a) to d): Note. e): Note.	a) to d): Approve and include in the Air Navigation work programme. e): Note and request the Secretary General to bring to the attention of

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air traffic management system.		States.
Recommendation 3/3 – Development of ICAO provisions relating to system-wide information management That: a) under the leadership of ICAO, develop detailed technical specifications for system-wide information management in close collaboration with the aviation community; b) detailed technical specifications for system-wide information management should be open and rely on generic international standards to the extent possible; and c) ICAO undertake work to identify the security standards and bandwidth requirements for system-wide information management.	a) to c): Note.	a) to c): Approve and include in the Air Navigation work programme.
Recommendation 3/4 – State and industry and industry support of system-wide information management That: a) industry support the transition towards system-wide information management by providing appropriate systems supporting automation and the exchange of all relevant air traffic management data in a globally standardized manner; and b) States and all relevant stakeholders contribute to further development and harmonization of performance-based information management.	a) and b): Note.	a) and b): Note and request the Secretary General to bring to the attention of States.
Recommendation 3/5 – Operational performance through flight and flow – information for a collaborative environment That the Conference: a) endorse the aviation system block upgrade module relating to flight and flow – information for a collaborative environment included in Block 1,		

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	COUNCIL	**AIR NAVIGATION COMMISSION (ANC)**
and recommend that ICAO use it as the basis of its work programme on the subject;		
b) agree in principle with the aviation system block upgrade module relating to flight and flow – information for a collaborative environment included in Blocks 2 and 3, as the strategic direction for this subject;		
That ICAO:		
c) include, following further development and editorial review, the aviation system block upgrade modules relating to flight and flow – information for a collaborative environment for inclusion in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	c) and d): Note.	c) and d): Approve and include in the Air Navigation work programme.
d) investigate, as part of the post-implementation review of the FPL2012, proposals for the implementation of all performance-based navigation codes and other capabilities into the flight plan, having regard to an impact assessment including cost benefit analysis and other factors;		
e) convene a symposium, as soon as possible, where interested partners would develop an end-to-end advanced system demonstrations of new air traffic management concepts to support a common understanding of concepts such as SWIM, FF-ICE trajectory-based operations and collaborative decision-making;	e): Review.	e): Note.
That States:		
f) and industry work through ICAO to mature the flight and flow – information for a collaborative environment concept;	f) to h): Note.	f) to h): Note and request the Secretary General to bring to the attention of States and Stakeholders.
g) support the development of a flight information exchange model;		
h) according to their operational needs, implement the aviation system block upgrade modules relating to improved operational performance through flight and flow – information for a collaborative environment		

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included in Block 0.		
Recommendation 3/6 – ICAO aviation system block upgrades relating to service improvement through aeronautical information management as well as digital air traffic management information That the Conference: a) endorse the aviation system block upgrade module relating to service improvement through the integration of digital air traffic management information included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; That ICAO: b) include, following further development and editorial review, the aviation system block upgrade modules relating to service improvement through digital aeronautical information management as well as integration of digital air traffic management information in the draft in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); That States: c) according to their operational needs, implement the aviation system block upgrade module relating to service improvement through digital aeronautical information management included in Block 0.	b): Note. c): Note.	b): Approve and include in the Air Navigation work programme. c): Note and request the Secretary General to bring to the attention of States.
Recommendation 3/7 – ICAO provisions relating to service improvement through aeronautical information management as well as digital air traffic management information That ICAO: a) expedite the development of relevant Standards facilitating the transition of aeronautical information service to aeronautical information management and the implementation of system-wide information management taking into account the work accomplished in State	a) and b): Note.	a) and b): Approve and include in the Air Navigation work programme.

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programmes; and b) as a matter of urgency, to translate and make available the necessary Standards and guidance material to facilitate the global transition from aeronautical information service to aeronautical information management.		
Recommendation 3/8 – State actions relating to service improvement through aeronautical information management as well as digital air traffic management information That States: a) accelerate transition from aeronautical information service to aeronautical information management by implementing a fully automated digital aeronautical data chain; b) implement necessary processes to ensure the quality of aeronautical data and information from the origin to the end users; c) engage in intraregional and interregional cooperation for an expeditious transition from aeronautical information service (AIS) to aeronautical information management (AIM) in a harmonized manner and to using digital data exchange and consider regional or subregional AIS databases as an enabler for the transition from AIS to AIM; and d) review their NOTAM publication procedures, provide appropriate guidance to NOTAM originators and ensure adequate oversight of the NOTAM publication process is conducted.	a) to d): Note.	a) to d): Note and request the Secretary General to bring to the attention of States and Stakeholders.
Recommendation 3/9 – Review of NOTAM system and development of options for replacement That ICAO initiate a review of the current NOTAM system, building further on the digital NOTAM activities, including the development of options for a replacement system that would enable web-based applications and compliant with the system-wide information management principles	Note.	Approve and include in the Air Navigation work programme.

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that are being developed for the air traffic management system.		
Recommendation 4/1 –Efficient management of airspace and improved flow performance through collaborative decision-making That the Conference: a) endorse the aviation system block upgrade modules relating to network operations included in Block 1 and recommend that ICAO use them as the basis of its work programme on the subject; b) agree in principle with the aviation system block upgrade modules relating to network operations included in Blocks 2 and 3 as the strategic direction for this subject; That ICAO: c) include, following further development and editorial review, the aviation system block upgrade modules relating to network operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); d) include in its work programme the future standardization of all elements to support the collaborative decision-making process underlying the air traffic control (ATC)-air traffic flow management (ATFM) integration as well as of the technical exchanges between ATFM and ATC; e) develop and incorporate into the ICAO *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) implementation guidance on Airport-CDM and provisions on air traffic flow management data exchange format including trajectory information; f) develop and execute global communications, roll-out and training plan for the ICAO *Manual on Collaborative Air Traffic Flow Management* (Doc 9971); and	c) to g): Note.	c) to g): Approve and include in the Air Navigation work programme.

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g) develop further provisions and guidance on flexible use of airspace principles for future use and in preparation for future 4D trajectory-based airspace management. That States: h) accelerate the implementation of collaborative decision-making processes in the provision of services at the regional level, being guided by the principles set forth in the *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) and the *Manual on Flight and Flow – Information for a Collaborative Environment* (Doc 9965); i) according to their operational needs, implement the aviation system block upgrade modules relating to network operations included in Block 0.	h) and i): Note.	h) and i): Note and request the Secretary General to bring to the attention of States.
Recommendation 4/2 – ICAO aviation system block upgrades relating to ground surveillance using automatic dependent surveillance – broadcast/multilateration, air traffic situational awareness, interval management and airborne separation. That the Conference: a) endorse the aviation system block upgrade modules relating to interval management included in Block 1 and recommend that ICAO use them as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to airborne separation included in Block 2 as the strategic direction for this subject; That ICAO: c) include, following further development and editorial review, the aviation system block upgrade modules relating to airborne separation in the Appendices to the draft Fourth Edition of the *Global Air Navigation*	c) to g): Note.	c) to g): Approve and include in the Air Navigation work programme.

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Plan (Doc 9750, GANP); d) agree in principle to review the concepts and terminology of the "airborne separation" concepts involving controllers assigning tasks to flight crews, with controllers able to apply different, risk-based separation minima for properly equipped ADS-B IN aircraft; e) in the development of provisions, acknowledge the relationship between airborne separation and airborne collision avoidance system; f) modify aviation system block upgrade (ASBU) Module B2-85 to reflect d) and e), modify ASBU Module B2-101 to reflect f); and g) agree in principle to review the concepts and terminology supporting B2-85 "airborne separation" and amend the module accordingly. That States: h) according to their operational needs, to implement the aviation system block upgrade modules relating to ground surveillance, improved air traffic situational awareness and improved access to optimum flight levels included in Block 0.	h): Note	h): Note and request the Secretary General to bring to the attention of States.
Recommendation 4/3 – ICAO aviation system block upgrades relating to airborne collision avoidance systems and ground-based safety nets That the Conference: a) endorse the aviation system block upgrade module relating to ground-based safety nets included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade module relating to airborne collision avoidance systems included in Block 2, as the basis of the strategic direction for this subject;		

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That ICAO:		
c) include, following further development and editorial review, the aviation system block upgrade modules relating to airborne collision avoidance systems and ground-based safety nets in the Appendices to the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	c) to h): Note.	c) to h): Approve and include in the Air Navigation work programme.
d) adopt a coordinated approach towards reviewing and developing as necessary Standards and Recommended Practices, Procedures for Air Navigation Services and guidance material for ground-based and airborne safety nets, taking into account careful evaluation and validations of the effects on safety and performance of downlinking airborne collision avoidance system (ACAS) Resolution Advisories (RAs) to controllers;		
e) when considering Standards and Recommended Practices for airborne collision avoidance system (ACAS) downlink, to emphasize the significant amount of training material already existing and the importance of increased pilot and air traffic controller training on the responsibilities and requirements to reacting correctly to ACAS RA events and then communicating;		
f) develop an ICAO Manual for Ground-based Safety Nets, which includes provision for tools for validation and certification of these;		
g) incorporate the new generation of airborne collision avoidance system (ACAS X) into its work programme;		
h) encourage the Federal Aviation Administration to work with other States with the capacity and capability to do so, in the development of new generation of airborne collision avoidance system (ACAS X);		
That States:		
i) according to their operational needs, to implement the aviation system	i): Note.	i): Note and request the Secretary

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block upgrade modules relating to airborne collision avoidance systems and ground based safety nets included in Block 0.		General to bring to the attention of States.
Recommendation 4/4 – Positioning and tracking over oceanic and remote areas, and flight data triggered transmission That ICAO: a) continue the evaluation of the necessary changes in the field of transmission of flight data, bearing in mind the cost associated with any of these changes as well as the need to improve search and rescue operations; and b) develop suitable proposals for the amendment of ICAO documents, as necessary.	a) and b): Note.	a) and b): Approve and include in the Air Navigation work programme.
Recommendation 4/5 – Civil/military coordination/cooperation and sharing of airspace That States: a) planning and implementation regional groups, and ICAO to analyse the benefits that could be achieved through improved civil/military cooperation and sharing of the airspace serving international traffic flows and express the results of this analysis in terms of: 1) capacity increases and reduction in routine delays as measured by traffic volumes on major traffic flows; 2) document fuel savings and emission reductions through the use of the fuel savings estimation tools; and 3) other additional benefits; b) based on the analysis made by States, planning and implementation regional groups, and ICAO, urge States to develop plans to implement improvements for the cooperative use of airspace related to the top areas	a) to c): Note.	a) to c): Note and request the Secretary General to bring to the attention of States.

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of opportunity and establish concrete targets using tools already available for this purpose; c) in relation to international traffic flows, for each ICAO region urge the planning and implementation regional groups and their associated States to identify the top areas of opportunity that could benefit the most from improvements in civil/military cooperation and sharing of the airspace and develop concrete targets for improvement; That ICAO: d) develop a set of criteria or metrics to enable objective measurement of progress in civil/military cooperation; and e) continue to develop guidance material for States on the flexible use of their airspace, airspace design, interoperability and integration of humanitarian assistance flights in crisis response scenarios in their airspaces to facilitate integrated use of the airspace.	d) and e): Note.	d) and e): Approve and include in the Air Navigation work programme.
Recommendation 4/6 – ICAO aviation system block upgrades relating to integration of remotely piloted aircraft into non-segregated airspace That the Conference: a) endorse the aviation system block upgrade module relating to remotely piloted aircraft included in Block 1 and recommend that ICAO use it as the basis of its work programme on the subject; b) agree in principle to the aviation system block upgrade modules relating to remotely piloted aircraft included in Blocks 2 and 3 as the strategic direction for this subject; That ICAO: c) as a matter of urgency, develop the necessary regulatory framework in its entirety to support the integration of remotely piloted aircraft into	c) to e): Note.	c) to e): Approve and include in the Air Navigation work

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non-segregated airspace and at aerodromes including and clearly showing the scope of such regulation; d) investigate the need for and scope of oversight of datalinks related to command, control and air traffic control communications for remotely piloted aircraft systems; e) include, following further development and editorial review, the aviation system block upgrade modules relating to the integration of remotely piloted aircraft into non segregated airspace in the Appendices to the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); That States: f) be cognizant of the recent amendments to Annexes 2 — *Rules of the Air* and 7 — *Aircraft Nationality and Registration Marks* related to remotely piloted aircraft systems and to support the continuation of this work at ICAO; g) work closely with ICAO and each other to ensure harmonization of provisions if they have an urgent need to accommodate remotely piloted aircraft system operations.	f) and g): Note.	programme. f) and g): Note and request the Secretary General to bring to the attention of States.
Recommendation 4/7 – ICAO aviation system block upgrades relating to meteorological information That the Conference: a) endorse the aviation system block upgrade module relating to meteorological information included in Block 1, including the addition of the provision of information on space weather, and recommend that ICAO uses it as the basis of its work programme on the subject; b) agree in principle the aviation system block upgrade module relating to meteorological information included in Block 3 as the strategic direction		

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for this subject; That ICAO:		
c) include, following further development and editorial review, the aviation system block upgrade modules relating to meteorological information in the draft Fourth edition of the *Global Air Navigation Plan* (Doc 9750, GANP);	c) to f): Note.	c) to f): Approve and include in the Air Navigation work programme.
d) undertake the development of the air traffic management meteorological information integration plan and an associated roadmap by a cross-disciplinary group of experts;		
e) work on defining the meteorological information exchange model as an enabler for system-wide information management;		
f) invite the next Meteorology Divisional Meeting, held in coordination with the World Meteorological Organization, to develop initial provisions in Annex 3 — *Meteorological Service for International Air Navigation* relating to the aviation system block upgrade modules concerning meteorological information and f) above, and to develop a long-term strategy to support their further development and full implementation;		
That States:		
g) according to their operational needs, to implement the aviation system block upgrade module relating to meteorological information included in Block 0, including the addition of the provision of OPMET information;	g) and h): Note.	g) and h): Note and request the Secretary General to bring to the attention of States.
h) work together in the implementation of the aviation system block upgrades relating to meteorological information and to increase investment in education and training.		

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Recommendation 4/8 – Crisis coordination arrangements and contingency plans That ICAO: a) consider how crisis coordination arrangements for potentially disruptive events, similar to that used for volcanic eruptions, could be established on a regional basis; and b) and regional offices continue to support the development, promulgation, maintenance of contingency plans, including the holding of practical exercises, in preparedness for potentially disruptive events, including those events that may adversely impact aviation safety.	a) and b): Note.	a) and b): Approve and include in the Air Navigation work programme.
Recommendation 5/1 – Improved operations through enhanced airspace organization and routing Considering that performance-based navigation (PBN) is one of ICAO's highest air navigation priorities and the potential benefits achievable through creation of additional capacity with PBN: That States: a) implement performance-based navigation in the en-route environment; b) fully assess the operational, safety, performance and cost implications of a harmonization of transition altitude and, if the benefits are proven to be appropriate, undertake further action on a national and (sub) regional basis a first step towards a globally harmonized transition altitude; c) take advantage of improved models for inter-regional coordination and collaboration to achieve seamless air traffic management and more optimum routes through the airspace; d) through the planning and implementation regional groups improve their methods of coordination to increase implementation of en-route	a) to d): Note.	a) to d): Approve and include in the Air Navigation work programme.

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performance-based navigation in order to achieve more optimum routes through the airspace; That ICAO: e) encourage the planning and implementation regional groups to support the early deployment of performance-based navigation in accordance with Assembly Resolution 37-11; f) support, through development of a framework that capitalizes, builds on, and promotes demonstration activities which confirm the benefits of performance-based navigation as an enabler of more efficient operations in the en-route phase of flight; and g) that avionics incorporate fixed radius transition functionality to support closer spacing of performance-based navigation routes and improve airspace capacity.	e) and f): Note. g): Note.	e) and f): Note and request the Secretary General to bring to the attention of States. g): Note and request the Secretary General to bring to the attention of relevant Industry Stakeholders.
Recommendation 5/2 – ICAO aviation system block upgrades relating to trajectory based operations That the Conference: a) endorse the aviation system block upgrade module relating to trajectory-based operations included in Block 1 and ICAO use it as the basis of its work programme on the subject; b) agree in principle with the aviation system block upgrade module relating to 4D trajectory-based operations included in Block 3 as the strategic direction for this subject; That ICAO: c) include, following further development and editorial review, the aviation system block upgrade module relating to 4D trajectory-based operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750,	c): Note.	c): Approve and include in the Air Navigation work programme.

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GANP); That States: d) support development by ICAO of Standards and Recommended Practices and guidance material related to trajectory-based operations; and e) implement, according to their operational needs, the aviation system block upgrade module relating to trajectory-based operations included in Block 0.	d) and e): Note.	d) and e): Note and request the Secretary General to bring to the attention of States.
Recommendation 5/3 – Increased flexibility and efficiency in descent and departure profiles That the Conference: a) endorse the aviation system block upgrade module relating to continuous descent operations included in Block 1; b) agree in principle to the aviation system block upgrade module relating to continuous descent operations included in Block 2; That ICAO: c) include, following further development and editorial review, the aviation system block upgrade modules relating to continuous climb operations and continuous descent operations in the draft Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP); d) incorporate the point merge technique as an interim continuous descent operations measure in Block B0-05; That States: e) as supported by their operational requirements and a positive business	c) and d): Note. e) and f): Note.	c) and d): Approve and include in the Air Navigation work programme. e) and f): Note and request the

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case, implement according to their operational needs as a matter of urgency, the aviation system block upgrade modules relating to continuous climb operations and continuous descent operations included in Blocks 0 and 1; and f) as supported by their operational requirements and a positive business case, use point merge technique as an application towards achieving full continuous descent operations, when developing performance-based navigation standard instrument arrivals (STARs).		Secretary General to bring to the attention of States
Recommendation 6/1 – Regional performance framework – planning methodologies and tools That States and PIRGs: a) finalize the alignment of regional air navigation plans with the Fourth Edition of the *Global Air Navigation Plan* (Doc 9750, GANP) by May 2014; b) focus on implementing aviation system block upgrade Block 0 Modules according to their operational needs, recognizing that these modules are ready for deployment; c) use the electronic regional air navigation plans as the primary tool to assist in the implementation of the agreed regional planning framework for air navigation services and facilities; d) involve regulatory and industry personnel during all stages of planning and implementation of aviation system block upgrade modules; e) develop action plans to address the identified impediments to air traffic management modernization as part of aviation system block upgrade planning and implementation activities;	a) to e): Approve.	a) to e): Note and request the Secretary General to bring to the attention of States and Stakeholders.

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That ICAO: f) considers how the continuous monitoring approach to safety oversight maps to the evaluation of Member States' safety oversight capabilities concerning aviation system block upgrades g) review the current amendment process to the Regional Air Navigation Plans (ANPs) and recommend improvements to increase efficiencies related to the approval and maintenance of the data in the regional ANPs; h) develop guidance material, on the basis of best practices employed worldwide, for the regional/local deployment of new ATM technologies, required procedures, operational approvals and continue to support States in the implementation of the aviation system block upgrades; i) identify the issues, funding, training and resource requirements necessary to support a safety framework that would lay the foundation for successful implementation the aviation system block upgrades; j) develop, together with industry and stakeholders, an engagement strategy to address the economic and institutional impediments to implementation of the aviation system block upgrades; k) develop a mechanism for sharing of best practices for the aviation system block upgrade implementation; and l) define a methodology to ensure interregional and global harmonization of air navigation services through ANRF reporting in an effective and timely manner, and consider the employment of interregional and multi-regional fora.	f) to l): Note. j): Approve and request the Secretary General to address the economic and institutional impediments to GANP implementation.	f) to l): Approve with the exception of j), include in the Air Navigation work programme and request the Secretary General take appropriate action. j): Note and consider contribution to be included in the Air Navigation work programme.

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Recommendation 6/2 – Guidelines on service priority That: a) ICAO develop an appropriate set of operational and economic incentive principles to allow early benefits of new technologies and procedures, as described in the aviation system block upgrade modules, to support operational improvements, while maximizing safety, capacity and overall system efficiency; and b) States and international organizations contribute to this work.	a) and b): Note.	a) and b): Approve, consider contribution to be included in the Air Navigation work programme and request the Secretary General to take appropriate action.
Recommendation 6/3 – Assessment of economic, financial and social implications of air traffic management modernization and aviation system block upgrades deployment That ICAO: a) undertake work toward developing a network-wide operational improvement level assessment for global use, which should include the development of standard values and processes for economic evaluations; b) take the relevant conclusions from the AN-Conf/12, regarding economic, financial and social aspects of the aviation system block upgrades, to the Sixth Air Transport Conference with the aim of developing solutions which would support a safe and sustainable air navigation system; That States: c) conduct their economic, financial and social analyses in a closely coordinated manner with relevant ATM stakeholders in view of their diverse position of involvement in the implementation of aeronautical systems.	a) and b): Note. c): Note and request the Secretary General to bring to the attention of States.	a) and b): Approve, consider contribution to be included in the Air Navigation work programme and request the Secretary General to take appropriate action. c): Note and request the Secretary General to bring to the attention of States.

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Recommendation 6/4 – Human performance That ICAO: a) integrate human performance as an essential element for the implementation of ASBU modules for considerations in the planning and design phase of new systems and technologies, as well as at the implementation phase, as part of a safety management approach. This includes a strategy for change management and the clarification of the roles, responsibilities and accountabilities of the aviation professionals involved; b) develop guidance principles, guidance material and provisions, including SARPs as necessary, on ATM personnel training and licensing including instructors and assessors, and on the use of synthetic training devices, with a view to promoting harmonization, and consider leading this effort with the support of States and industry; c) develop guidance material on using field experience and scientific knowledge in human performance approaches through the identification of human-centred operational and regulatory processes to address both current safety priorities and the challenges of future systems and technologies; d) assess the impact of new technologies on competencies of existing aviation personnel, and prioritize and develop competency-based provisions for training and licensing to attain global harmonization; e) establish provisions for fatigue risk management for safety within air traffic services operations; f) develop guidance material on different categories of synthetic training devices and their respective usage;	a) to f): Note.	a) to f): Approve and include in the Air Navigation work programme.

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That States: g) provide human performance data, information and examples of operational and regulatory developments to ICAO for the benefit of the global aviation community; h) support all ICAO activities in the human performance field through the contribution of human performance expertise and resources; i) adopt airspace procedures, aircraft systems, and space-based/ground-based systems that take into account human capabilities and limitations and that identify when human intervention is required to maintain optimum safety and efficiency; and j) investigate methods to encourage adequate numbers of high quality aviation professionals of the future and ensure training programmes are in line with the skills and knowledge necessary to undertake their roles within a changing industry.	g) to j): Note.	g) to j): Note and request the Secretary General to bring to the attention of States.
Recommendation 6/5 – ICAO work programme to support global navigation satellite system evolution That ICAO undertake a work programme to address: a) interoperability of existing and future global navigation satellite system constellations and augmentation systems, with particular regard to the technical and operational issues associated with the use of multiple constellations; b) identification of operational benefits to enable air navigation service providers and aircraft operators to quantify these benefits for their specific operational environment; and	a) to c): Note.	a) to c): Approve and include in the Air Navigation work programme.

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c) continued development of Standards and Recommended Practices and guidance material for existing and future global navigation satellite system elements and encouraging the development of industry standards for avionics.		
Recommendation 6/6 – Use of multiple constellations That States, when defining their air navigation strategic plans and introducing new operations: a) take advantage of the improved robustness and availability made possible by the existence of multiple global navigation satellite system constellations and associated augmentation systems; b) publish information specifying the global navigation satellite system elements that are approved for use in their airspace; c) adopt a performance-based approach with regard to the use of global navigation satellite system (GNSS), and avoid prohibiting the use of GNSS elements that are compliant with applicable ICAO Standards and Recommended Practices; d) carefully consider and assess if mandates for equipage or use of any particular global navigation satellite system core constellation or augmentation system are necessary or appropriate; That aircraft operators: e) consider equipage with GNSS receivers able to process more than one constellation in order to gain the benefits associated with the support of more demanding operations.	a) to e): Note.	a) to e): Note and request the Secretary General to bring to the attention of States and Stakeholders.

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Recommendation 6/7 – Assistance to States in mitigating global navigation satellite system vulnerabilities That ICAO: a) continue technical evaluation of known threats to the global navigation satellite system, including space weather issues, and make the information available to States; b) compile and publish more detailed guidance for States to use in the assessment of global navigation satellite system vulnerabilities; c) develop a formal mechanism with the International Telecommunication Union and other appropriate UN bodies to address specific cases of harmful interference to the global navigation satellite system reported by States to ICAO; and d) assess the need for, and feasibility of, an alternative position, navigation and timing system.	a) to d): Note.	a) to d): Approve and include in the Air Navigation work programme.
Recommendation 6/8 – Planning for mitigation of global navigation satellite system vulnerabilities That States: a) assess the likelihood and effects of global navigation satellite system vulnerabilities in their airspace and apply, as necessary, recognized and available mitigation methods; b) provide effective spectrum management and protection of global navigation satellite system (GNSS) frequencies to reduce the likelihood of unintentional interference or degradation of GNSS performance; c) report to ICAO cases of harmful interference to global navigation satellite system that may have an impact on international civil aviation operations;	a) to f): Note.	a) to f): Approve and request the Secretary General to bring to the attention of States and Stakeholders.

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d) develop and enforce a strong regulatory framework governing the use of global navigation satellite system repeaters, pseudolites, spoofers and jammers; e) allow for realization of the full advantages of on-board mitigation techniques, particularly inertial navigation systems; and f) where it is determined that terrestrial aids are needed as part of a mitigation strategy, give priority to retention of distance measuring equipment (DME) in support of inertial navigation system (INS)/DME or DME/DME area navigation, and of instrument landing system at selected runways.		
Recommendation 6/9 – Ionosphere and space weather information for future global navigation satellite system implementation That ICAO: a) coordinate regional and global activities on ionosphere characterization for global navigation satellite system implementation; b) continue its effort to address the global navigation satellite system (GNSS) vulnerability to space weather to assist States in GNSS implementation taking into account of long-term GNSS evolution as well as projected space weather phenomena; c) study the optimum use of space weather information that is globally applicable from low to high magnetic latitude regions for enhanced global navigation satellite system performance at a global context; That States: d) consider a collaborative approach to resolve ionospheric issues including ionospheric characterization for cost-effective, harmonized and regionally suitable global navigation satellite system implementation.	a) to c): Note. d): Note.	a) to c): Approve and include in the Air Navigation work programme. d): Note and request the Secretary General to bring to the attention of States.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	SUGGESTED FOLLOW-UP ACTION	
	COUNCIL	**AIR NAVIGATION COMMISSION (ANC)**
Recommendation 6/10 – Rationalization of terrestrial navigation aids That, in planning for the implementation of performance-based navigation, States should: a) assess the opportunity for realizing economic benefits by reducing the number of navigation aids through the implementation of performance-based navigation; b) ensure that an adequate terrestrial navigation and air traffic management infrastructure remains available to mitigate the potential loss of global navigation satellite system service in their airspace; and c) align performance-based navigation implementation plans with navigation aid replacement cycles, where feasible, to maximize cost savings by avoiding unnecessary infrastructure investment.	a) to c): Note.	a) to c): Approve and request the Secretary General to bring to the attention of States and Stakeholders.
Recommendation 6/11 – Regional performance framework – alignment of air navigation plans and regional supplementary procedures That ICAO initiate a formal amendment process in accordance with normal procedures to align the areas of applicability of the air navigation plans and the regional supplementary procedures, observing the following principles: 1) there will be no change to the current accreditation of the ICAO regional offices to Contracting States; 2) there will be no change to the obligation of individual States to provide services in accordance with ICAO Annex 11 — *Air Traffic Services*, 2.1; 3) there will be no change to the governance responsibilities of the ICAO Council, including approval of amendments to air navigation plans and regional supplementary procedures; 4) there will be no change to the current requirements for services and facilities and or to the current supplementary procedures for a given	Approve and request the Secretary General to bring to the attention of States and Stakeholders.	Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	SUGGESTED FOLLOW-UP ACTION	
	COUNCIL	AIR NAVIGATION COMMISSION (ANC)
airspace as listed in current air navigation plans and regional supplementary procedures; 5) there will be no change to the principle that a planning and implementation regional group is composed of the Contracting States providing air navigation service in the air navigation region and that other Contracting States can participate in the activities with observer status; 6) there will be no change to ICAO's assistance to planning and implementation regional groups from the regional offices; 7) the responsibilities of the performance framework management for an air navigation region will now be integrated and will rest with the planning and implementation regional group established for the region; and 8) to the extent possible, the main traffic flows will be accommodated within homogeneous airspaces in order to minimize changes between different air navigation systems and different operational procedures during flight.		
Recommendation 6/12 – Prioritization and categorization of block upgrade modules That States and PIRGs: a) continue to take a coordinated approach among air traffic management stakeholders to encourage effective investment into airborne equipment and ground facilities; b) take a considerate approach when mandating avionics equipage in its own jurisdiction of air navigation service provision, taking into account of burdens on operators including foreign registry and the need for consequential regional/global harmonization;	a) and b): Note.	a) and b): Note.

RECOMMENDATIONS ADOPTED BY AN-CONF/12	SUGGESTED FOLLOW-UP ACTION	
	COUNCIL	**AIR NAVIGATION COMMISSION (ANC)**
That ICAO:		
c) continue to work on guidance material for the categorization of block upgrade modules for implementation priority and provide guidance as necessary to planning and implementation regional groups and States;	c): Note.	c): Approve and include in the Air Navigation work programme.
d) modify the block upgrade module naming and numbering system using, as a basis, the intuitive samples agreed by the Conference; and	d):Note.	d): Approve and request the Secretary General to take appropriate action.
e) 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 with due regard to regional diversity for further consideration by States.	e):Note.	e): Approve and include in the Air Navigation work programme.
Recommendation 6/13 – Development of Standards and Recommended Practices, procedures and guidance material That ICAO:		
a) improve its project management and coordination of contributing ICAO panels, study groups and other expert groups, including task forces and other specialized teams tasked with the development of ICAO provisions and related work, through:	a) to d): Note.	a) to d): Approve and include in the Air Navigation work programme.
1) consistent application of the *Directives for Panels of the Air Navigation Commission* (Doc 7984);		d), 1): Review and update the *Directives for Panels of the Air Navigation Commission* (Doc 7984) along principles stated by the Conference.
2) receiving regular reports from the expert groups against agreed terms of reference and work programmes;		
3) mandating strong coordination between all expert groups developing ICAO provisions to ensure efficient management of issues and avoidance of duplication;		
4) application of the principles of accountability, geographical representation, focus, efficiency, consistency, transparency and		

RECOMMENDATIONS ADOPTED BY AN-CONF/12	SUGGESTED FOLLOW-UP ACTION	
	COUNCIL	**AIR NAVIGATION COMMISSION (ANC)**
integrated planning to the operation of all the expert groups; 5) developing documented procedures for other expert groups, including task forces and other specialized teams as well; and 6) better use of today's communication media and internet to facilitate virtual meetings, thereby increasing participation and reducing costs to States and ICAO; b) continue to coordinate with the other recognized standards-making organizations (Assembly Resolution A37-15 refers) in order to make the best use of the capabilities of these other recognized standards-making organizations and to make reference to their material, where appropriate; c) initiate studies to improve the verification and validation process required within ICAO before material developed by recognized standards-making organizations can be referenced in ICAO documentation; and d) consider a methodology by which ICAO can capture the regional implementation and challenges, and to reflect them in a standardized process to effectively support the aviation system block upgrade deployment.		
Recommendation 6/14 – Guidelines for conducting aeronautical studies to assess permissible penetration of obstacle limitation surfaces That ICAO develop comprehensive guidelines for States in the uniform application in conducting aeronautical studies to assess the permissible penetration of obstacle limitation surfaces (OLS).	Note.	Approve and include in the Air Navigation work programme.

— END —

APPENDIX B

State:…….

Survey on Aviation System Block Upgrades- ASBU Block Zero Modules

Part I – ASBU Modules B0- 05, 20, 65, 75, 80 Enablers (Performance Improvement Areas: Efficiency Flight Path and Airport Operations)

International Aerodromes / ICAO Designator									
1. Certified (YES or NO)									
2. A-CDM (YES or NO)									
3. A-SMGCS (YES or NO)									
4. Number of Runways ENDs used for Landing									
5. Number of Instrument Runways ENDs provided with GNSS Approach Procedures (LNAV)									
6. Number of instrument Runways ENDs provided with APV Approach procedures (VNAV)									
7. Number of instrument Runways ENDs provided with Instrument Landing System (ILS)									
8. CDO (YES or NO)									
9. RNAV STARs (YES or NO)									
10. Conventional STARs (YES or NO)									
11. CCO (YES or NO)									
12. RNAV SIDs (YES or NO)									
13. Conventional SIDs (YES or NO)									
14. Total Flights per Month (ARR + DEP)									

- If your Answer is YES, please indicate the date of Certification or Implementation,
- If your Answer is NO, please indicate the planned date of Certification or Implementation, or N/A If Not Applicable.

Part II- ASBU Modules B0- 25, B0-35 Enablers (Performance Improvement Areas: Globally Interoperable Systems and Data and Optimum Capacity and Flexible Flights)

ATS Unit Designator (ACC, APP, TWR)	AIDC/OLDI			Air traffic Flow Management (ATFM)	
	15. Implemented (YES or NO)	16. capable (YES or NO)	17. If NO, date of Planned Implementation	18. Implemented (YES or NO)	19. If NO, date of Planned Implementation

Part III- ASBU Modules B0- 25, 30, 105 Enablers (Performance Improvement Area: Globally Interoperable Systems)

ASBU Block 0 modules		Implemented Yes/No	IF NO, Date of planned implementation	Remarks
B0-25				
20. Implementation of AMHS based on IP				
B0-30				
21. Implementation of AIXM based AIS database				
22. Implementation of eAIP				
23. Implementation of Digital NOTAM				
Implementation of WGS-84	24. ENR			
	25. Terminal			
	26. Aerodrome			
	27. Geoid Undulation			
Implementation of eTOD	28. Area 1 Terrain			
	29. Area 1 Obstacles			
	30. Area 4 Terrain			
	31. Area 4 Obstacles			
32. Implementation of QMS for AIM				
B0-105				
33. Implementation of SADIS 2G satellite broadcast and/or Secure SADIS ETP service				

Part IV- ASBU Modules B0- 10 Enablers (Performance Improvement Area: Optimum Capacity and Flexible Flights)

34. Percentage of Airspace under Full Control of Civil Authority		Percentage with reference to total volume of Airspace
35. Percentage of Airspace under Full Control of Military Authority (Dangerous, Prohibited, Restricted Areas etc…)		
36. Percentage of Airspace Jointly used by Civil and Military Authorities		
37. Percentage of TIME the portion of Airspace indicated in (36) above is open for Civil Flights		Percentage on weekly basis
38. Number of established Routes overflying segregated airspace, as indicated in (36) above		
39. If no routes established as in (38) above, what is the planned date of implementation of such Flexible Use of Airspace (FUA) Concept.		

Part V- ASBU Modules B0- 84 Enablers (Performance Improvement Area: Optimum Capacity and Flexible Flights)

Technology	ADS -B	MLAT	Remarks
40. Implemented (YES or NO) If NO, Indicate date of planned implementation			
41. Purpose of Implementation (Used for) (Area Control, Approach Control, Tower Control or Ground Movement Surveillance)			

- Use N/A where Not Applicable.
- Date of implementation should be precise (Month and Year)

-END-

PBN/GNSS TF/5 WP/3
Appendix C

ATTACHMENT A
SL Ref.: AN 7/26.1 – 13/056

State...JORDAN .....

Survey on Aviation System Block Upgrades- ASBU Block Zero Modules

Part I – ASBU Modules B0- 05, 20, 65, 75, 80 Enablers (Performance Improvement Areas: Efficiency Flight Path and Airport Operations)

International Aerodromes / ICAO Designator	OJAI	OJAM	OJAQ	Remarks
1.Certified (YES or NO)	NO	NO	YES	Queen Alia airport is the renewal in process: Amman Marka Airport filed application:
2.A-CDM (YES or NO)	YES	NO	YES	
3.A-SMGCS (YES or NO)	NO	NO	NO	
4.Number of Runways ENDs used for Landing	4	2	2	Currently due to closure of runway 26R-08L
5.Number of Instrument Runways ENDs provided with GNSS Approach Procedures (LNAV)	4	2	2	
6.Number of instrument Runways ENDs provided with APV Approach procedures (VNAV)	4	2	1	
7.Number of instrument Runways ENDs provided with Instrument Landing System (ILS)	3	1	1	Currently due to closure of runway 26R-08L
8. CDO (YES or NO)	NO NA	NO NA	NO NA	
9.RNAV STARs (YES or NO)	YES	YES	YES	
10. Conventional STARs (YES or NO)	YES	YES	YES	
11. CCO (YES or NO)	NO NA	NO NA	NO NA	
12. RNAV SIDs (YES or NO)	YES	YES	YES	
13. Conventional SIDs (YES or NO)	YES	YES	YES	
14. Total Flights per Month (ARR + DEP)	67189	8681	6019	

- If your Answer is YES, please indicate the date of Certification or Implementation,
- If your Answer is NO, please indicate the planned date of Certification or Implementation, or N/A If Not Applicable.

Part II- ASBU Modules B0- 25, B0-35 Enablers (Performance Improvement Areas: Global Interoperable Systems and Data and Optimum Capacity and Flexible Flights)

ATS Unit Designator (ACC, APP, TWR)	AIDC/OLDI			Air traffic Flow Management (ATFM)	
	15. Implemented (YES or NO)	16. capable (YES or NO)	17. If NO, date of Planned Implementation	18. Implemented (YES or NO)	19. If NO, date of Planned Implementation
Amman ACC	NO	YES	2015	NO	NA
Amman APP	NO	YES	2015	NO	NA
OJAI	NO	YES	2015	NO	NA
OJAM	NO	YES	2015	NO	NA
OJAQ	NO	YES	2015	NO	NA

Part III- ASBU Modules B0- 25, 30, 105 E[illegible]blers (Performance Improvement Area: Glo[illegible]ly Interoperable Systems)

ASBU Block 0 modules		Implemented Yes/No	IF NO, Date of planned implementation	Remarks
B0-25				
20. Implementation of AMHS based on IP		YES		
B0-30				
21. Implementation of AIXM based AIS database		YES		
22. Implementation of eAIP		ON GOING	2014	
23. Implementation of Digital NOTAM		NO		
Implementation of WGS-84	24. ENR	YES		
	25. Terminal	YES		
	26. Aerodrome	YES		
	27. Geoid Undulation	YES		
Implementation of eTOD	28. Area 1 Terrain	YES		
	29. Area 1 Obstacles	YES		
	30. Area 4 Terrain	ON GOING	2014	
	31. Area 4 Obstacles	ON GOING	2014	
32. Implementation of QMS for AIM		YES		
B0-105		YES		
33. Implementation of SADIS 2G satellite broadcast and/or Secure SADIS ETP service		YES		

Part IV- ASBU Modules B0- 10 Enablers (Performance Improvement Area: Optimum Capacity and Flexible Flights)

34. Percentage of Airspace under Full Control of Civil Authority	70%	Percentage with reference to total volume of Airspace
35. Percentage of Airspace under Full Control of Military Authority (Dangerous, Prohibited, Restricted Areas etc…)	30%	
36. Percentage of Airspace Jointly used by Civil and Military Authorities	10%	
37. Percentage of TIME the portion of Airspace indicated in (36) above is open for Civil Flights	50%	Percentage on weekly basis
38. Number of established Routes overflying segregated airspace, as indicated in (36) above	1	
39. If no routes established as in (38) above, what is the planned date of implementation of such Flexible Use of Airspace (FUA) Concept.		

Part V- ASBU Modules B0- 84 Enablers (I formance Improvement Area: Optimum Ca ity and Flexible Flights)

Technology	ADS -B	MLAT	Remarks
40. Implemented (YES or NO) If NO, Indicate date of planned implementation	YES	NO	2014
41. Purpose of Implementation (Used for) (Area Control, Approach Control, Tower Control or Ground Movement Surveillance)	Area control Approach control		Area control Approach control

- Use N/A where Not Applicable.
- Date of implementation should be precise (Month and Year)

END

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ATTACHMENT A
SL Ref.: AN 7/26.1 – 13/056

State: QATAR

Survey on Aviation System Block Upgrades- ASBU Block Zero Modules

Part I – ASBU Modules B0- 05, 20, 65, 75, 80 Enablers (Performance Improvement Areas: Efficiency Flight Path and Airport Operations)

International Aerodromes / ICAO Designator	OTBD	OTHH							
1.Certified (YES or NO)	Yes March 2010	Yes March 2013							
2.A-CDM (YES or NO)	No N/A	No Jan 2015							
3.A-SMGCS (YES or NO)	Yes Jan 2011	Yes April 2013							
4.Number of Runways ENDs used for Landing	2	2							
5.Number of Instrument Runways ENDs provided with GNSS Approach Procedures (LNAV)	2	2							
6.Number of instrument Runways ENDs provided with APV Approach procedures (VNAV)	1	2							
7.Number of instrument Runways ENDs provided with Instrument Landing System (ILS)	2	4							
8. CDO (YES or NO)	No N/A	No N/A							
9.RNAV STARs (YES or NO)	NO (JAN 2014)	NO (JAN 2014)							
10. Conventional STARs (YES or NO)	NO (JAN 2014)	NO (JAN 2014)							
11. CCO (YES or NO)	No N/A	No N/A							
12. RNAV SIDs (YES or NO)	NO (JAN 2014)	NO (JAN 2014)							
13. Conventional SIDs (YES or NO)	NO (JAN 2014)	NO (JAN 2014)							
14. Total Flights per Month (ARR + DEP)	17,334 (Jan 2013 figure)	Ops commence April 1st 2013							

- If your Answer is YES, please indicate the date of Certification or Implementation,
- If your Answer is NO, please indicate the planned date of Certification or Implementation, or N/A If Not Applicable.

Part II- ASBU Modules B0- 25, B0-35 Enablers (Performance Improvement Areas: Globally Interoperable Systems and Data and Optimum Capacity and Flexible Flights)

ATS Unit Designator (ACC, APP, TWR)	AIDC/OLDI			Air traffic Flow Management (ATFM)	
	15. Implemented (YES or NO)	16. capable (YES or NO)	17. If NO, date of Planned Implementation	18. Implemented (YES or NO)	19. If NO, date of Planned Implementation
APP & TWR	YES	YES			

Part III- ASBU Modules B0- 25, 30, 105 Enablers (Performance Improvement Area: Globally Interoperable Systems)

ASBU Block 0 modules		Implemented Yes/No	IF NO, Date of planned implementation	Remarks
B0-25				
20. Implementation of AMHS based on IP		**Yes**	**JAN 2012**	**AUH set up 2012 at OTBD. At OTHH awaiting for partners BAH, KWI and Jeddah to be based as IP**
B0-30				
21. Implementation of AIXM based AIS database		No	JAN 2014	
22. Implementation of eAIP		No	JAN 2014	
23. Implementation of Digital NOTAM		No	JAN 2014	
Implementation of WGS-84	24. ENR	Yes		
	25. Terminal	Yes		
	26. Aerodrome	Yes		
	27. Geoid Undulation	Yes		
Implementation of eTOD	28. Area 1 Terrain	Yes		
	29. Area 1 Obstacles	Yes		
	30. Area 4 Terrain	Yes		
	31. Area 4 Obstacles	Yes		
32. Implementation of QMS for AIM		Yes		
B0-105				
33. Implementation of SADIS 2G satellite broadcast and/or Secure SADIS ETP service				

Part IV- ASBU Modules B0- 10 Enablers (Performance Improvement Area: Optimum Capacity and Flexible Flights)

34. Percentage of Airspace under Full Control of Civil Authority	20%	Percentage with reference to total volume of Airspace
35. Percentage of Airspace under Full Control of Military Authority (Dangerous, Prohibited, Restricted Areas etc…)	70%	
36. Percentage of Airspace Jointly used by Civil and Military Authorities	10%	
37. Percentage of TIME the portion of Airspace indicated in (36) above is open for Civil Flights	25%	Percentage on weekly basis

38. Number of established Routes overflying segregated airspace, as indicated in (36) above	2	Not strictly FUA in application
39. If no routes established as in (38) above, what is the planned date of implementation of such Flexible Use of Airspace (FUA) Concept.	TBA	Concept currently under discussion with military authorities

Part V- ASBU Modules B0- 84 Enablers (Performance Improvement Area: Optimum Capacity and Flexible Flights)

Technology	ADS –B OTBD	ADS-B OTHH	MLAT OTBD	MLAT OTHH	Remarks OTBD	Remarks OTHH
1. Implemented (YES or NO) If NO, Indicate date of planned implementation	YES	Yes	YES	Yes	Installed in 2010 and in service 2011 2 ADSB Receivers 13 MLAT Sensors	Installing 2013 Commissioning Dec 2013
2. Purpose of Implementation (Used for) (Area Control, Approach Control, Tower Control or Ground Movement Surveillance)	Tower Control and Ground Movement Surveillance		Approach Control (Wide Area Multilateration), Tower Control and Ground Movement Surveillance			

- Use N/A where Not Applicable.
- Date of implementation should be precise (Month and Year)

END