



TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 6: Future direction

6.1: Implementation plans and methodologies

STEADY TRANSITION TOWARD FUTURE AIR NAVIGATION SYSTEMS – CHALLENGES RELATING TO PRIORITIZATION, TRANSITION AND DIVERGENCE

(Presented by Japan)

SUMMARY

The Fourth Edition of *Global Air Navigation Capacity and Efficiency Plan* (Doc 9750, GANP) has been formulated to assist States and industry to pursue globally harmonized and interoperable air navigation system (ANS) with support of Standards and Recommended Practices and other ICAO provisions as well as ASBUs framework. Whereas, not all modules contained in ASBUs are intended for universal and synchronized implementation. As the reality has proven so far, ATM community has been struggling over transition and divergence issues associated with the continuously evolving ANS. It is imperative that ATM community properly address these challenges and proceed in their modernization efforts based on globally common understanding and policy.

This working paper highlights the transition and divergence issues for the Conference consideration on how to address harmonized implementation and prioritization of ASBUs modules.

Action: The Conference is invited to consider this working paper and agree to the recommendation in paragraph 3.1.

1. INTRODUCTION

1.1 The GANP amendment has been formulated to assist States and industry in realizing harmonized and interoperable ANS by introducing ASBUs framework. The underlying principle in ASBUs reads as follows; “ASBUs are organized into logical and scalable groupings that can be implemented depending operational needs, while recognizing that implementation of a particular module is not mandatory in all areas or circumstances. The broad timescales associated with the ASBUs framework are intended only to depict the initial readiness of all components including, ICAO SARPs, needed for deployment and do not imply a mandated State or regional implementation timeframe.” (ref. to para. 2.2 of WP/3, and Chapter 1 and 2 of the GANP)

1.2 Given that the GANP has its ground on “think global, act local” concept, it is natural that ANS burgeons differently by implementation time and airspaces, and ANS components diversify in accordance with future ATM needs and requirements. This poses a simple question on how ATM community should achieve harmonized global ANS in an expeditious way, while respecting local ATM needs and requirements of States and regions. The question can be dubbed “transition and divergence issues”.

1.3 Since the Conference recommendations are expected to assist States in facilitating ATM modernizations, it is very opportune to consider the eminent or growing transition and divergence issues in many parts of the globe. This working paper highlights transition and divergence issues associated with ATM progression by drawing the Conference's heed to examples of ADS-B surveillance and datalink communication systems, and calls for a globally common comprehension and timely actions to properly address these issues.

2. DISCUSSION

2.1 ANS implementation priority vis-à-vis ANS harmonization and State's obligations

2.1.1 The new GANP, Appendix to WP/3, admits flexibility aspects of ASBUs implementation as has been mentioned in para.1.1 above.

2.1.2 Many working papers proposing ASBU modules, request States to implement modules in Block 0 according to their operational needs, and Conference to endorse Block 1 modules as basis in ICAO work programme, and Blocks 2 and 3 as global strategic directions of each subject.

2.1.3 WP/25 explains the philosophy for prioritization and allocation of priority for Blocks 0 and 1 modules (ref. action a), d) in WP/25). It also requests States and Planning and Implementation Regional Groups (PIRGs) to prioritize ASBUs locally in accordance with the Conference-agreed priority for respective Module (ref. action f) in WP/25). In relation to the States' action in WP/25, WP/19 calls PIRGs for the alignment of Regional Air Navigation Plans with the new GANP to be finalized by May 2014 (ref. action b) WP/19).

2.1.4 On a regional term, APANPIRG/23 in September this year agreed on a regional position as a reference for Asia Pacific States in formulating their own position to AN-Conf/12 as to regional deployment of ASBUs. It represents the States' general supports to ASBUs initiative, but it includes concerns and expectations as well (ref. Appendix A).

2.1.5 With the above background, the following observation has been made from implementation and planning perspective. Shortly speaking, the question can be described as how ATM community should achieve globally harmonized and interoperable systems, while keeping to flexibility principles at national/regional levels. In order to take proper actions, ATM community will need for:

- a) more clear rationale for categorization, especially Essential (E) and Desirable (D);
- b) common interpretation of the four categories vs SARPs and Universal Safety Oversight Audit Programme Continuous Monitoring Approach (USOAP CMA) from the standpoint of States' implementation obligation;
- c) globally applicable provisions for practical harmonization from detailed technical level up through to the high Module level or performance-based level; and
- d) global solutions for the cases where States/regions can't afford to align their national/regional plan or priority with global ones, which are to be endorsed by the Conference.

2.2 Consideration on transitions and divergence

2.2.1 Transition and divergence issues have already been regarded as brain-twister in the study of CARATS, and they are anticipated to emerge with more visibility unless the globally agreed solutions are applied. Appended to this WP are, a review on ADS-B surveillance and datalink communication systems, which are

regarded as backbones in prime ASBU Modules. In view of steady transition to future ANS and avoidance of confusion induced by disorganized system deployment, globally common approach together with supporting materials needs to be developed and shared taking into account of the characteristics of individual systems in terms of global harmony and interoperability (ref. Appendix B).

Steady transition from conventional to future systems

2.2.2 Since ANS involves a variety of ATM entities, it is naturally toilsome to synchronize system implementation both between ground and airborne and among FIRs when driving the ANS transition to the next generation. Seemingly, this has been a norm that States and regions take a locally acceptable and cost-effective approach on case-by-case basis under a locally/regionally agreed framework.

2.2.3 Even when taking such an approach, they have to cope with the issues such as: being unable to synchronize ground and airborne system deployment because of financial reasons of either party; insufficient coordination mechanism among the ATM stakeholders concerned; and airspace users (aircraft) being obliged to follow ANSP requirements or ground system capability.

Avoidance of confusing divergence of ANS, but with enjoyment of technology evolution

2.2.4 Even when a Module building or an ATM performance improvement is sought, CNS enablers can diversify in respect of interface, algorithm, software version, etc., which more often than not cause controversy on safety concern and interoperability deficiency. Depending on the difference of nature of systems, “*diversification*” or “*proliferation*” may suit the situation rather than “*divergence*”.

2.2.5 Recognizing the global trend toward performance-based ATM systems supported by the corresponding SARPs, assurance of interoperability between systems at detailed level is critical in a real world. Unless timely and positive actions are taken under globally common understanding, this will end up in perplexing divergence of ATM operation as well as CNS systems themselves. These actions need to be properly taken well before different States accelerate their own system implementation without adequate inter-FIR and air-to-ground coordination. ICAO should be a sole coordinator which can objectively and neutrally view the differences and facilitate the resolution of divergence issues.

2.3 Way forward

2.3.1 “Prioritization” issues in paragraph 2.1.5 may be solved naturally over time through iterative discussion between regions and ICAO, but more clear guidance should be provided with States and other ATM stakeholders as appropriate to ensure common understanding by them to properly assign implementation priority in their national/regional implementation planning.

2.3.2 As for “transition” issues in paragraph 2.2, States and regions may take a locally acceptable and cost-effective approach under a collective agreement as they have performed well so far. Local decision makers, however, should be mindful about issues in paragraph 2.2.3 and the case study in Appendix B, and reinforce planning and implementation body comprising stakeholders concerned. Such body should properly address harmonization with adjacent FIRs, taking into account of options such as regulatory or financial vehicles for steady transition and operational constraints imposed on airspace users, especially in the case a rash or indiscreet judgment can hinder cross-FIR seamless ATM operations or lead to the compromise of safety in a State- beyond or region-beyond context.

2.3.3 With regards to “divergence” issues in paragraph 2.2 and the case study in Appendix B, uniformity effort should be exhausted at individually required level such as in terminology, specification, operational rules and implementation timing. When a high-level safety or interoperability is deemed both

universally urgent and essential, mandatory steps or upgrading to SARPs should be elaborated by taking a holistic review of regional developments from a cross regional/global perspective.

2.3.4 In this context, it is highly expected that proactive and timely actions should be taken under ICAO stewardship to avoid adverse effects on aeronautical safety and interoperability well before each ATM modernization diverges into irretrievable state or unilateral mandatory actions lead to adversely affect aeronautical safety and ANS interoperability from beyond-State and cross-FIRs context.

3. CONCLUSION

3.1 Based on the consideration of the issues in Section 2, the Conference is invited to agree to the following recommendation:

Recommendation 6/x – Steady transition toward future air navigation systems

That the Conference request:

ICAO to:

- a) take an in-depth study of the implication of non-harmonized and unsynchronized implementation of air navigation systems, and reflect the findings into global aviation system block upgrades prioritization accordingly;
- b) provide the study findings above with States with more articulacy so that States make proper judgment when taking national/regional prioritization exercise for local air navigation planning, being consulted on Standards and Recommended Practices amendment and making Universal Safety Oversight Audit Programme follow-ups;
- c) study a more practical scheme for air traffic management (ATM) stakeholders to be engaged in interregional coordination in a both timely and effective manner to achieve harmonization and interoperability of ATM systems by avoiding divergence of air navigation systems; and
- d) review comprehensively the review of the proposals in Appendix B as to two core enablers and extend the similar study to other aeronautical systems as needed.

States to:

- a) continue to take an adequately-coordinated approach among air traffic management stakeholders to achieve effective investment into airborne equipment and terrestrial facilities; and
- b) take a considerate approach when mandating avionics equipage in its own jurisdiction of air navigation services provision, taking into account of burdens on operators including foreign registry and the need for consequential regional/global harmonization both in safety and air navigation systems interoperability.

— — — — —

APPENDIX A

ASIA/PACIFIC ASBU POSITION STATEMENT

Note 1.– The text below is an excerpt of APANPIRG Conclusion 23/49 regarding the said title to supplement to Section 2.1.4 of this WP.

Note 2.– “Annex 1” in item 3 below shows a priority matrix of Block 0 Modules which APANPIRG has applied different prioritization criterion from that in Appendix A to AN-Conf/12-WP/25, and “Annex 2” in item 6 regarding improvement area for Block 0 description is left out hereunder.

1. The Asia/Pacific notes that the ASBU initiative represents an important first step toward a strategic planning direction that is performance-oriented, and should be the subject of further work to determine their final status, effectiveness, coverage and application by ICAO.
2. The Asia/Pacific supports the ASBU initiative and is planning to incorporate these elements as a key part of the Asia/Pacific Seamless ATM Plan.
3. Due to the diverse nature of the States’ aviation environments and the air traffic challenges already facing the Asia/Pacific Region (in progressing the finalisation of an updated GANP and the ASBU’s), ICAO must have regard to the priorities (**Annex 1**) and proposals that will enhance air traffic and aviation safety in the Region.
4. The Asia/Pacific expresses its concern regarding the limited time available for States to properly study and respond to the documentation prior to the AN-Conf/12 decision-making. The Asia/Pacific also requests any economic analysis data on the ASBU elements at the earliest opportunity.
5. The expectations for regional planning and reporting of ASBU implementation, including use of the Air Navigation Reporting Form, need to be clearly articulated.
6. The Asia/Pacific suggests that there are a number of technical, operational and economic improvements that could be made to the ASBU Document, as detailed in **Annex 2**.

Annex 1: Asia/Pacific ASBU Block 0 Priorities

PIA	Element	Economic Analysis	Priority
PIA 1	B0-65 Optimization Of Approach Procedures Including Vertical Guidance	-	2
	B0-70 Increased Runway Throughput Through Optimized Wake Turbulence Separation	-	3
	B0-15 Improve Traffic Flow Through Runway Sequencing (AMAN/DMAN)	-	2
	B0-75 Safety and Efficiency Of Surface Operations(A-SMGCS)	Yes	3
	B0-80 Improved Airport Operations Through Airport-CDM	-	2
PIA 2	B0-25 Increased Interoperability, Efficiency And Capacity Through Ground-Ground Integration (AIDC)	-	1
	B0-30 Service Improvement Through Digital Aeronautical Information Management	-	1
PIA 3	B0-10 Improved Operations Through Enhanced En-Route Trajectories (CDM, FUA)	-	1
	B0-35 Improved Flow Performance Through Planning Based On A Network-Wide View	-	1
	B0-84 Initial Capability For Ground Surveillance	Yes	1

	B0-85 Air Traffic Situational Awareness (ATSA)	-	2
	B0-86 Improved Access To Optimum Flight Levels Through Climb/Descent Procedures Using ADS-B	-	3
	B0-101 ACAS Improvements	Yes	2
	B0-102 Increased Effectiveness Of Ground-based Safety Nets	-	2
	B0-105 Meteorological Information Supporting Enhanced Operational Efficiency and Safety	-	2
PIA 4	B0-40 Improved Safety And Efficiency Through The Initial Application Of Data Link En-Route	-	1
	B0-05 Improved Flexibility And Efficiency In Descent Profiles (CDO)	-	2
	B0-20 Improved Flexibility And Efficiency Departure Profiles - Continuous Climb Operations (CCO)	-	2

Priority 1 = critical upgrade

Priority 2 = recommended upgrade

Priority 3 = may not be universally implemented

The allocation of priority is based on factors including its importance in promoting Seamless ATM.

APPENDIX B

REVIEW ON HARMONIZED IMPLEMENTATION FUTURE CORE SYSTEMS

Note.– This review is intended for supplementary to the consideration in Section 2.2 of this WP by referring to the advancing implementation of “ADS-B surveillance systems” and “datalink communication systems” as representative core enablers for ASBUs deployment.

I. ADS-B SURVEILLANCE SYSTEMS

1. OVERVIEW OF GLOBAL TREND

1.1 ADS-B based surveillance has been largely recognized as a versatile contributor to air-to-ground and air-to air safety improvement as well as to capacity and efficiency enhancement and efficiency by reducing ATC separation predicated on high accuracy and renewal frequency in an ATC surveillance system. Hence, ADS-B deserves being positioned as core technology to 4D-TBO and other safety enhancement envisioned in ASBUs and Technology Roadmap.

1.2 Deployment of ADS-B surveillance systems comprising both ADS-B avionics and ground facility, has been in good progress in many parts of the world. Given their assurance in ADS-B for becoming a kernel technology of future surveillance system, it is more likely that States utilizing conventional costly radar as prime surveillance system will replace them with ADS-B systems. While, those who are in want of adequate surveillance infrastructure will be able to realize safer and more efficient surveillance by enjoying the benefit of cost-effectiveness of ADS-B.

1.3 In Asia Pacific Region where some States have already mandated or have indicated their national plans as to mandatory ADS-B equipage for a designated airspace, APANPIRG recently agreed that States should exclude the use of ADS-B Ver. 0 no earlier than 2020 in light of the different ADS-B programmes which have been promulgated by States. (See *APANPIRG Conclusion 16/23: Surveillance Strategy for Asia Pacific Region*) While in other ADS-B penetrating regions, some States have mandated ADS-B Ver. 2 equipage with a specific deadline, but diversified requirements in terms of software version, implementation milestone, requirements for navigation data and so forth have been identified as potential challenges have global implication in Section 2.

2. ISSUES TO BE CONSIDERED IN “BEYOND-REGION” CONTEXT

2.1 **Regulatory burden and confusion onto operators:** Different requirements and conditions in different FIRs can oblige aircraft operators to confirm what rules apply to the FIRs they fly through, and to obtain airworthiness certificate from State of Registry and aircraft operation certificate from State of Operation. The argument point is analogous as that of Appendix B to WP/21 “GNSS implementation.)

2.2 **Difference in navigation requirement:** Even in a case where ADS-B systems are implemented in a synchronized manner among FIRs, different requirements for navigation accuracy and metrics employed between FIRs can impose perplexingly various requirements for navigation on aircraft operators.

2.3 **Inefficiency and ineffectiveness in investment:** Should the equipped and non-equipped aircraft continue to fly in a mixed fleet environment in an airspace without a harmonious transition measures, ANSPs need to continue its reliance on a mixture of surveillance sensors. This can lead to delay in not only shifting to fully-utilized ADS-B surveillance but also to non-streamlined investment on airborne and ground equipment.

2.4 Lack in harmony between States and between regions: With ASBUs deployment faced by global ATM community, there appears to be inadequacy in multi-disciplinary discussion on ADS-B harmonization policy between air and ground, between regions, and between surveillance and navigation domains, and lack of such a working body under ICAO umbrella.

3. CONSIDERATION FROM THE VIEWPOINT OF GLOBAL HARMONY

3.1 Mandate timing: In light of the systematic surveillance of the whole airspace within an FIR, consequential safety benefits derived from ASAS, category of aircraft mandated to carry ADS-B(UAS, freighter, GA, military, etc) , technical conditions and version applicable to ADS-B operation, and exemption policy should be pondered discreetly. Even if ANConf/12 directed ICAO to carry out a dedicated study on this matter and a globally-applicable policy was set forth in a few years, it would take a rather long lead time for penetration of ADS-B into majority of the globe, up until Block 1 and 2 onward in light of the customary ICAO process.

3.2 ADS-B version: It is suggested that if global ATM community opt for more enforcing implementation by means such as mandate, the difference between ADS-B versions should be aligned no earlier than 2021 taking into account preceding States of having mandated ADS-B implementation in their FIRs.

3.3 Navigation data and systems: In the same context as above, navigation accuracy metrics (NIC, NAC, SIL, etc) and technical requirements to GNSS receiver (FDE, SA-Aware, etc) need to be aligned in a harmonized manner to assure aeronautical safety and to avoid confusion and burden on airspace users.

3.4 Back-up and complementary system: Since ATC surveillance using ADS-B is dependent solely on the position measurement and transmission capability the object aircraft feature, a combination of surveillance media need to be properly considered to complement or back-up ADS-B when ADS-B goes out of service through individual safety assessment. In the case where ADS-B is the sole surveillance means, a wider ATC separation should be stipulated compared with ATC surveillance supported by multi-surveillance means.

3.5 Safety Assessment: In anticipation of the potentially continued divergence of ADS-B deployment until any action is taken for global harmonization, States are requested to carry out safety assessment of airspaces concerned on individual basis as per Annex 11 provisions.

4. PROPOSAL FOR WAY FORWARD

4.1 In view of the analysis above, the below is a proposal to harmoniously implement ADS-B operation in global context.

Proposal

- To be mindful about the growing divergence in ADS-B surveillance systems deployment and inherent challenges (as in Section 2 above) ATM community will face in a near future.
- To initiate work on harmonization of ADS-B surveillance systems in a both intensive and multi-disciplinary manner, taking into account of the relevant discussion of the Conference on ASBUs prioritization, inter-region coordination and air-to-ground harmonization (as in Section 3 above).
- Based on the study results above, to accelerate the development or amendment of ICAO policy, SARPs, PANS-ATM and other pertinent provisions which underpin for globally harmonized ADS-B based surveillance and safety system of international civil aviation.

II. DATALINK COMMUNICATION SYSTEMS

1. PREMISES FOR CONSIDERATION

1.1 Quite a few of AN-Conf/12-WPs deal with ASBUs which are predicated on datalink technology and its derivative ATM application, in particular trajectory-based operation (TBO). These papers provide for comprehensive ideas on technological upgrades as well as operational ones in envisioned future performance-based ATM environment.

1.2 Now that Japan is in the phase of deliberation of future datalink systems with elementary R&D activities under CARATS programme and it has not be involved in RTCA/EUROCAE discussion on datalink standardization, it has pondered future datalink implementation and operation based on the following factual information and relevant AN-Conf/12-WPs.

- As follow-up on ANConf/11 recommendations relating datalink communication, the US and Europe undertook an intensive technical study (FCS) on communication operating concept and requirements (COCR), which has been a basis for further technological and operational standardization work at ICAO ACP and OPLINKP.
- The 37th ICAO Assembly underscored issues such as datalink proliferation and uncertainty of investment on future technology and so forth. (Refer to A37-WP/14)
- ICAO expert bodies have been at standardization work on ATS datalink operation and communication technology with a target for foreseeable future datalink communication systems.
- Recognizing not only similarities of different datalink technologies but also their disparities between the two major aviation-leading regions, they are now seeking convergence solution through RTCA SC214/EUROCAE WG78 fora and bilateral coordination.
- WP/37 on “European’s view on data communications” and WP/99 on “CANSO’s visions for global datalink for ATM ” strike the salient points as to dtalink convergence challenges.

2. PROPOSALS FOR WAY FORWARD

2.1 With the premises above and in view of the proposed recommendations in relevant WPs, the followings are additionally proposed to facilitate the datalink convergence not only between the two vanguards, but also among other followers including both ANSPs and airspace users.

Proposal

- Expeditious work on datalink convergence policy and guidance with coherent terminology and widely understandable language to be published in a timely manner
- Project-driven approach focusing on key ASBUs Modules to study the global challenges, to put forth global solutions and to set priority accordingly
- Conduct of worldwide educational campaign targeting at wide range of ATM stakeholders with focus on datalink, net-centric, performance-based future communication systems in the form of global symposia and regional workshops
- Thoughtful consideration on economically-challenged States with both willingness and recognition of the need to incremental transition per ASBUs
- Avoidance of confusion by aircraft operators which are imposed on with different mandates in different States under the deficiency of harmonized global policy
- Consideration on proper accommodation of non-SARPs-based FANS-derivatives and SARPs-based ATN-derivatives under ICAO's standardization policy

— END —