# TWELFTH AIR NAVIGATION CONFERENCE

**Montréal, 19 to 30 November 2012**

**Agenda Item 1: Strategic issues that address the challenge of integration, interoperability and harmonization of systems in support of the concept of "One Sky" for international civil aviation**
**1.1: Global Air Navigation Plan (GANP) – framework for global planning**
**b) Communications roadmap**

## COMMUNICATIONS ROADMAP

(Presented by the Secretariat)

**SUMMARY**

The *Global Air Traffic Management Operational Concept* (Doc 9854) presents the ICAO vision of an integrated, harmonized and globally interoperable air traffic management (ATM) system. The ultimate goal of this system is to support airspace users' requirements to follow preferred trajectories on each flight, resulting in fuel savings and reduced emissions. This requires the ATM system to manage each flight in four dimension (4D), the fourth being time.

The communication roadmap shows the communications technologies and applications along with their availability, which will be needed to achieve the goal of the Global ATM Concept and many other benefits. The roadmap timeline is shown against the aviation system block upgrades.

The aviation system block upgrade (ASBU) process defines timelines for the operational use of various ATM capabilities. Some of the ASBUs depend on the implementation of various communications technologies and applications, as described in this document.

## 1. INTRODUCTION

1.1 The 37th Session of the ICAO Assembly requested that the ICAO Secretariat produce CNS Technology Roadmaps. These roadmaps were proposed to assist States and other stakeholders with their implementation decisions.

1.2 The existence of many communications, navigation, and surveillance (CNS) technologies with similar names yet very different capabilities causes confusion. In addition to this, the operational benefits that can be achieved with the various technologies are not clear. This makes it difficult for States and aircraft operators to make long-term investment decisions. These decisions are critical as the advanced capabilities defined in the Global Air Navigation Plan (GANP) will depend on advanced CNS technologies.

1.3 Since the 37th Session of the ICAO Assembly, the aviation system block upgrade (ASBU) initiative was developed by ICAO. The block upgrades and the roadmaps have been developed as complementary tools to assist with air traffic management (ATM) planning and implementation. In the course of the development of the block upgrades, the need for information management and avionics roadmaps were also identified.

1.4 The paper provides important background information, enabling readers to gain a better understanding of the communications roadmaps provided in the GANP and an awareness of the future issues for which solutions must be found.

## 2. ROADMAP DOMAINS

2.1 The communications roadmap is actually three roadmaps:

a) air-ground datalink communication;

b) ground-ground communications; and

c) air-ground voice communications.

2.2 Each roadmap is comprised of two segments:

a) the technology used to provide the link media; and

b) the services which make use of the communications link.

2.3 In the former case, the roadmaps contain a mix of technologies for which standards exist or are under development as well as new, prospective technologies. The roadmaps also describe a number of communications “services” which will evolve over time. This information paper will deal with each of these issues.

## 3. PROSPECTIVE TECHNOLOGIES

3.1 Prospective technologies include items such as:

a) L-band digital aeronautical communication system (LDACS);

b) future satellite system (for datalink);

c) future digital voice system; and

d) future satellite system (for voice).

3.2 These are shown in the roadmap as current indications are that replacement systems will be needed because of capacity or performance limitations of the existing technology. Nonetheless, their development is not assured. Special consideration will be needed in the future to determine the actual need for these. The reader is asked to consider the following arguments.

3.3 The general view is that continued growth in traffic will require media with greater capacity. Nonetheless, various developments may offset this growth, for example:

a) rationalization of airspace through the use of functional airspace blocks could allow greater use of the available very high frequency (VHF) spectrum; and

b) a review of the use of voice in the future data-centric environment could result in reduced demand for the VHF spectrum, thus extending its useful life.

3.4 There is another general view that the introduction of various operational improvements, such as trajectory-based operations (TBO) and system-wide information management (SWIM), will also require media with greater capacity. Again, these demands could be offset through the following:

a) a thorough review of the operations to be conducted in order to determine future traffic loadings and hence, the useful lifetime of existing datalink technology; and

b) consideration that many new information services will not require the same levels of performance as strictly safety-related services and could be adequately carried using commercially available mobile data networks, thus extending the useful life of the available technologies and the aeronautical spectrum for safety-related traffic.

## 4. EVOLVING SERVICES

4.1 Thus far the discussion has focussed on the link enablers; however, services also present issues of their own, namely the:

a) services themselves will evolve over time; and

b) supporting technologies may change.

On the former point, the implementation of TBO and some of the interim applications, such as interval management, will require certification to a high standard (typically Level C). This makes upgrades and even updates costly. The means must be found to allow these systems to be updated, improved and refined based on operational experience without incurring the certification effort and cost that applies today. Controller-pilot data link communications (CPDLC) is a prime example of a communications service or application that will need to be updated, improved and refined based on operational experience.

4.2 A clear example of point b) above is the decision to migrate from communications based on open systems interconnection (OSI) protocols to the internet protocol suite (IPS). For example, VDL Mode-2 is expected to have a lifetime extending over many blocks. This technology is based on the OSI protocols whereas new technologies such as AeroMACS, future satellite systems and LDACS will make use of the IPS.

4.3 To accommodate both technologies, either “gateways” or a protocol conversion layer will be needed. The choice will be implementation specific hence it is not possible to predict which will be used as this time.

4.4 As future communications systems become available, other cases will certainly emerge. Again, the means must be found to accommodate these evolutionary changes with the least possible certification impact.

## 5. CONCLUSION

5.1 This paper points out that operational and institutional decisions could have a significant effect on the future traffic load to be supported by both the voice and datalink communications systems used for ATM. Certain choices, if practical, could in fact, result in a significant reduction in the required infrastructure.

5.2 In other cases, technological change will need to be accommodated to allow a mix of communication technologies. This is not a difficult task, however, forward planning could lessen the impact of this.

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