International Civil Aviation Organization

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WORKING PAPER

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

DATA COMMUNICATIONS ISSUES

(Presented by the Presidency of the European Union on behalf of the European Union and its Member States[1]; by the other Member States of the European Civil Aviation Conference[2]; and by the Member States of EUROCONTROL)

SUMMARY

This paper recalls the continuing difficulty in modernizing the air-ground data communication infrastructure and making it able to support new, interoperable ATM concepts. It stresses the need to take a more vigorous approach to this problem, in order to prevent its further perpetuation.

Action: The Conference is invited to agree to the recommendation in paragraph 5.

1. BACKGROUND

1.1 AN-Conf/12-WP/3 introduces the proposed Global Air Navigation Plan (GANP) for endorsement by the Conference, including a high level description of the communications roadmap.

1.2 While this roadmap is generally supported, some aspects of the ATM communications have not found a fully satisfactory solution since the Tenth Air Navigation Conference. This contrasts with the dramatic changes which have been experienced in the commercial telecommunications market for end-consumers and most other industries in the same period.

1.3 It is useful to recall the ambitious extent of the Eleventh Air Navigation Conference (AN-Conf/11) recommendations which have guided the work of the relevant ICAO panels (OPLINK and ACP), namely addressing:

[1] Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. All these 27 States are also Members of ECAC.

[2] Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Croatia, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

Recommendation 7/3 — Evolutionary approach for global interoperability of air-ground communications
Recommendation 7/4 — Investigation of future technology alternatives for air-ground communications
Recommendation 7/5 — Standardization of aeronautical communication systems

1.4 Recommendation 7/3 requested, amongst others, States to:

"a) continue the use of currently implemented ICAO standardized systems for VHF band voice and data communications until such time as either saturation of the VHF band is approached or significant cost/benefit or safety advantages are expected from the implementation of other ICAO Standards;
c) continue the progressive deployment of data communications on the basis of applicable ICAO Standards such as aeronautical telecommunication network (ATN) using VDL Mode 2 as dictated by evolving operational requirements with a view to complementing or replacing voice communications for most routine communications;
f) investigate multi-mode avionics as a transitional method of achieving interoperability of air/ground communications, where global harmonization has not been achieved."

1.5 In this context the US and Europe cooperated on a future communications study (FCS) and produced the communications operating concept and requirements for the future radio system (COCR) with recommendations in the related Final Conclusions and Recommendations Report. This document identified in particular the most promising new technologies and developed harmonized technology recommendations. The outcome of the FCS was used as an input in the NextGen and SESAR as well as the OPLINK and ACP work and is widely visible in the communications roadmap, now included in the proposed GANP.

1.6 Despite all these activities, the picture is nevertheless still not satisfactory. For the short-term standards are available and implementation has started. The operational requirements of 4D trajectory operations and management are now visible as are the related ATM operational improvements needed. However, the multiplication of possible solutions for the short-term is a risk for both interoperability and timely and smooth global deployment. For the long-term, the operational needs are becoming increasingly clearer but have quantitative issues to be resolved depending on operational environments, making the progress on new standards difficult, and raising new issues on the transitory periods.

1.7 Despite progress made, we are still far from the achievement of the actions resulting from the AN-Conf/11 recommendations.

2. PROGRESS MADE

2.1 Within Europe, deployment of a set of CPDLC applications as defined in ICAO Doc 9880 and industrial standards (identified as ATN B1 services) will be mandatory by 2015 above FL 285 within countries participating in the Single European Sky framework. This deployment will be based upon ATN/OSI and VDL Mode 2 technology, The European ATM Master Plan foresees the extension of the services and of the service volume before the end of the decade, based on the agreed convergence technologies supporting Block 1 implementation (ATN B2 services per the joint RTCA SC214/Eurocae WG78 standard under development).

2.2 The US and Europe situations present a number of similarities; reference to COCR, convergence to ATN B2 services, incentives/best efficiency best served envisioned to facilitate implementation, and capacity/performance issues with FANS1/A and VDL2 are being considered. They also present significant differences in the regulatory approach; the way to support early aircraft equipment, the supported technology,

and the planned date for the deployment of initial 4D applications via ATN B2 services hindering a more uniform picture in the short-term.

2.3 Convergence toward an ICAO recognized solution for Block 1 onwards is therefore an essential step for interoperability and for enabling the next steps as explained in paragraph 3 below.

2.4 Progress made in ACP has explored the potential of existing or emerging technologies and reduced the possible choices while taking due account of the aviation requirements in terms of safety, end-to-end performance, and of spectrum availability. There remains significant validation work to be carried out before standards are finalized.

3. DISCUSSION AND POTENTIAL ISSUES

3.1 The Global ATM Operational Concept and the developments towards its realisation clearly indicate that the achievement of greater levels of performance are directly linked to the need for the different ATM actors to work with accurate information on the flight itself and its environment (from planning to actual execution of the flight) and share that information to make more collaborative decisions on the services provided.

3.2 Today's systems and operational concept are stretched to the limits and changes are deployed with many difficulties, generally later than expected. ATM still uses old technology in saturated spectrum bands, limited information exchanges and automation, and is entangled in a heavy legacy of system architecture and technologies. This would preclude the introduction of trajectory management[3]. ATM is a complex network of autonomous but interacting entities with different businesses and needs, facing difficult transition issues in the implementation of new technologies especially if the entities involved do not work in the same direction to implement them. Exacerbated by the fact that aviation life cycles are significantly longer than in other industries, business benefits are often only realized late in the transition once large populations of aircraft are equipped, and made even more difficult in a period where there is pressure on costs. For these reasons, mandates by regulatory bodies in different ICAO Regions could be needed in support of the timely deployment of data link services.

3.3 A modern and efficient air-ground communication capability, based on new technology dedicated and standardized for ATM applications, is required and is key to global interoperability. It is also central for the full 4D trajectory operations during the flight and prior to take-off and most of the modules in Blocks 2 and 3 and a number in Block 1 require data communications. Trajectory based operations stresses the increasing integration of ANSP systems, airport operators' systems, aircraft and Flight Operations Centres around a consistent and coherent view of the trajectory. In this context data exchanges through connections with the SWIM network of information are also required for aeronautical and weather information between airspace users, airports and ANSPs information systems.

3.4 In spite of the convergence of views around the communications roadmap, there are still incomplete, multiple and varying replies to a number of fundamental questions, most of which were a main motivation behind the creation of the ICAO FANS Committee in the 1980s, such as:

a) What is precisely needed, for what purpose and when? While not all flights/aircraft need the same services in all environments, there should be development of more specific and detailed operational requirements on the concepts of use, and as a result on data exchange requirements. This follows a process identifying the required quality of service (in

[3] Trajectory management, or 4D Trajectory operations are addressed under Agenda Item 5 through AN-Conf/12-WP/56, which provides a high level introduction to the concept of 4D Trajectory operations being developed in SESAR and to the specific requirements of the Initial 4D operations (I4D) already being demonstrated.

particular end-to-end latency) and introducing classes of service (those which need a deterministic performance or can be rendered as best effort) to facilitate the development of new data-link application/service and their mapping with air/ground communication system capabilities. This should also consider AOC communications, e.g. for aeronautical and meteorological information. It would be useful to reconcile timescales and technologies.

b) What can be done with what is potentially available? Interim solutions for terrestrial or satellite communications exist but are not all used, or their use creates additional transition and costs issues vis-à-vis the next generation.

c) When will the technologies currently in use, or being deployed have reached their capacity and/or performance limits?

d) When can what is needed be delivered? Delayed action now means delayed benefit with no reduction of the transition issues.

e) What will be the business model for researching, deploying and operating the communications system? The current scheme implies a significant research and development investment effort with a return on investment which is so far away that the industry is not willing to invest. Will incentives be needed in order to go from "last-mover-advantage" to a "first-mover-advantage" scheme[4]?

3.5 Quantification of the requirements for trajectory re-negotiation (how frequent and which data) are still evolving but it is clear that exchanges in the en-route/TMA areas will require deterministic and robust performances. But not all information used by flights has the same sensitivity or needs to be handled the same way through the same channels (reference to the class of service concept identified in section 3.4 a) above.

3.6 The roadmap takes into account the available knowledge as well as a number of assumptions on operational requirements which would need to be operationally confirmed and/or refined. A lack of certainty on future operational requirements and quantitative needs for the data communications system may well lead to over-specification and good practical options may be discarded, resulting in higher costs and/or delays.

3.7 This is not only an issue for the long-term, since it also strongly impacts the intermediate period before a new generation is available: capacity and quality of service issues, link issues, and convergence in the choice of solutions among standardized technologies.

3.8 To enable progress, to make a difference to today's situation, to prepare our systems for the future and provide for more efficient solutions, a certain number of tactical actions can be implemented. In particular there is a need to:

a) expedite international work on the trajectory management concept, its validation and use, and on required enablers (trajectory reference and states, automation systems in aircraft and on the ground, supporting technology including data communications etc.), including the impact of abnormal situations and the transition issues;

b) with a stable detailed concept of use and a recognized ATS data link roadmap, identify more precisely when the current system will start to be a constraining factor for ATM;

c) take action to synchronize air and ground deployment plans and develop appropriate rationale (technical, operational and economical) to swiftly make the choices still open in the SARPS, for example by speeding up ATN IPS implementation vs ATN OSI;

[4] The latter issue is connected to the discussion of Agenda Item 6.1 and in particular to the discussion in AN-Conf/12-WP/58.

d) identify a credible business model for new communications systems, and importantly clarify the development model (how to finance at global level);

e) consider the usage of multi-modal systems that can meet ATM safety and performance requirements; and

f) work on the technical solution.

3.9 These issues must be tackled with increased determination, by pulling together different kinds of expertise in a project-type approach. Identifying technology is not the most critical issue, since much of the work has already started and technologies have been clearly identified, some of them (AeroMACS) being almost standardized (see ACP reports regarding protocols and potential radio links), but appropriate choices must be made.

3.10 A window of opportunity is this ICAO Twelfth Air Navigation Conference. If it is agreed that something new is needed around 2025/2030 to support challenging concept elements, we only have fifteen years' notice and absolutely no more time margin. Otherwise it a major risk that the same observations will be made at the next Conference, in the context of critical time lost.

4. CONCLUSION

4.1 Acknowledgement is made of the progress realized; in line with the proposed Communication Roadmap which supports the GANP, in ACP work, in actual deployment and in particular within Europe in line with the ICAO provisions, and in identifying points of convergence along the roadmap which will allow for the differences in deployment timeframes between and within regions to be suitably addressed.

4.2 This is not enough on a number of aspects relating to technology selection, and speed and synchronization of deployments.

5. ACTION BY THE CONFERENCE

5.1 The Conference is invited to:

a) request ICAO to organize a multidisciplinary review of communication requirements and issues in coordination with programmes such as SESAR, NextGen and CARATS; and

b) urge States again:

1) to explore multi modal solutions when appropriate to overcome transition issues; and

2) to anticipate and accelerate the migration of air traffic management communication systems towards more efficient technologies to timely service the ASBU modules.

— END —