International Civil Aviation Organization

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WORKING PAPER

FOURTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 26 August to 6 September 2024

Agenda Item 4: Hyper-connectivity of air navigation system
4.1: Connected aircraft concept and associated challenges

CONNECTED AIRCRAFT CONCEPT

(Presented by International Coordinating Council of Aerospace Industries Associations (ICCAIA) and Civil Air Navigation Services Organisation (CANSO))

EXECUTIVE SUMMARY

This paper presents comments on the Connected Aircraft Concept. The benefits noted in Secretariat Paper AN-Conf/14-WP/13 are clear, using performance-based communication links to accommodate the expected growth in demand for information exchange between aircraft and other stakeholders. Further work is needed to expand on and validate the concept to ensure its safe, harmonized and interoperable implementation.

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

1. INTRODUCTION

1.1 The guiding principles for the *Global Air Traffic Management Operational Concept* (Doc 9854) explicitly identifies the dependence of the air traffic management (ATM) community on system-wide sharing of information. This information sharing includes airborne elements as an essential part of the fully integrated, interoperable, and robust ATM system.

1.2 The dependence on information sharing (and on the supporting connectivity) extends beyond ATM into many areas related to airline and aircraft operation. The sharing and use of information has already produced significant benefits to efficiency of operations through lower fuel burn and improved operational reliability.

1.3 The Connected Aircraft concept envisages a future where some of the load on air-to-ground operational exchange of information is transferred to commercial communication, processing and systems. Moreover, the concept envisions the use of these systems in a manner that ensures the safe operation of all functions, consistent with established safety and security practices. This can be done in a way that is potentially more economical and has wider fleet applicability than traditional methods of avionics upgrades, thus future proofing our systems for increased communication needs.

[1] Arabic, Chinese, English, French, Spanish and Russian versions provided by ICCAIA and CANSO.

2. DISCUSSION

2.1 ICCAIA members acknowledge the growing demand for air-to-ground communications from various stakeholders. Airlines seek new ways to use connectivity in managing and enhancing their operations. Likewise, aircraft and systems manufacturers continue to enhance the performance of their products for the benefit of airlines and passengers. Emerging capabilities like trajectory-based operations hold promise for improving air traffic management and optimizing airspace usage.

2.2 The current connected aircraft concept document introduces high-level concepts on some of the potential functionality but needs additional detail to obtain an accurate picture of how this will function in practice. Therefore, it may be useful to point out some additional areas that need further study and consideration before the concept is brought to operational use. These include, but are not limited to the following:

a) To maintain the safety and integrity of avionics functions, the Electronic Flight Bag (EFB) is envisioned to play only a supplemental role in aiding the flight crew. In the context of trajectory negotiations, the EFB can support trial request and negotiation functions but existing means to deliver a clearance to the aircraft (e.g. CPDLC) are still required.

b) Supplemental direct-loading techniques from an EFB may be employed in order to provide a means to insert alternative routes into inactive flight plans of the Flight Management System (FMS). These are expected to be treated the same operationally as a Flight Operations Centre (FOC)-provided route and must not interfere with the current clearance. Additionally, route loading into the FMS is a complex operation and considerable effort is needed to ensure correct insertion into the FMS. The route information should also adhere to existing message format and loading rules (i.e. airline operational communications). Capabilities such as route loading may also impact Design Assurance Level considerations. Crew actions considering human factors will also need to be assessed.

c) Various aircraft information (including aircraft state, route data, intent, etc) are available from multiple sources on aircraft, including via ADS-C, AOC messaging, avionics buses and potentially other means. An EFB or other device (e.g. Aircraft Interface Device) as well as additional messaging types can also obtain and convey this information to authorized users. This aircraft information can be useful as supplemental data for ATM or other operational purposes. Leveraging additional means of obtaining aircraft information has the potential to provide increased services and efficiencies to a greater number of aircraft as well as make greater use of existing equipage. The exchange and use of this data and integration with ground systems, along with associated cyber security requirements, should be further investigated.

d) As previously mentioned, higher performance commercial links are expected to be part of the Connected Aircraft concept. One of the benefits of this is a communication link with the performance necessary to support new functions (e.g. trajectory negotiations) at a lower cost than obtaining the same performance with existing protected spectrum links. Ideally, Connected Aircraft services will not impose additional requirements on commercial links, however, end-to-end performance requirements have yet to be established. Aircraft operator use of the commercial links, and the impacts of additional Connected Aircraft services utilizing the same commercial links should also be considered.

e) Hyperconnected ATM (HCA) is a developing concept that introduces the notion of utilizing commercial links for services that require demonstrated performance. This is possible due to the addition of a high-performance fall-back mechanism, which allows reversion to a protected spectrum link for retransmission while still meeting required performance requirements. While the HCA concept is compatible with Connected Aircraft, HCA may not be necessary for the Connected Aircraft concepts and services. Further analysis is needed to determine which Connected Aircraft services may have a need for required demonstrated performance.

f) Interoperability and communication continuity across flight information regions (FIRs) is an important element of this concept. For a variety of reasons, commercial communication services may not be authorized in all FIRs, so further consideration should be given to interoperability as aircraft transit this mixed environment.

3. CONCLUSION

3.1 The connected aircraft concept offers opportunities for the future of communications and navigation systems that will enable greater flexibility and efficiency.

3.2 Recognizing the need for further expansion beyond the initial framework, ICCAIA and CANSO believe there should be a continued focus on refinement of the concept, with an emphasis on adding a layer of details around implementation necessary to maintain safe operation of the aircraft.

3.3 Given the cross-cutting aspects of the concept, we would encourage further consideration through an integrated multi-disciplinary approach and are ready to contribute resources and information to assist in the further development of this work.

4. ACTION BY THE MEETING:

4.1 The Conference is invited to:

a) support the ongoing development and testing of the connected aircraft concept;

Recommend that ICAO:

b) further develops the Connected Aircraft concept in the areas identified in this paper and elsewhere by other stakeholders;

c) further examines the implications of the Connected Aircraft concept and the issues in cross-FIR operation;

d) encourages and monitors industry’s progress on testing and validation of the components of the concept; and

e) incorporates findings into the developing concept, to ensure the safety and security of operations.

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