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Validating Trajectory-Based Operations (TBO) Operational Values and Capabilities

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This paper presents AEROTHAI's and CAAS' experience in validating key Trajectory-Based Operations (TBO) operational values and required capabilities through our participation in the Multi-Regional Trajectory-Based Operations (MR TBO) Lab Demonstration project. The MR TBO project is a collaborative effort among Aeronautical Radio of Thailand Ltd. (AEROTHAI), Civil Aviation Authority of Singapore (CAAS), Japan Civil Aviation Bureau (JCAB), NAV CANADA and the Federal Aviation Administration (FAA), targeted at maturing TBO concept elements and envisioned technical capabilities. The partners collaborated to first design and develop operational scenarios, and thereafter built the corresponding prototype systems to simulate these identified TBO capabilities. The multi-regional nature of the operational scenarios enabled a better appreciation of the workings of TBO not only within but also across regions. Such scenarios also highlighted the significance of technical systems, including inter-organization/inter-country connectivity, message exchange mechanisms, automated tools, etc., which allowed the formulation of initial capabilities needed to support TBO. The demonstration provided a good opportunity to understand the roles that critical enablers such as System-Wide Information Management (SWIM), Flight and Flow Information for a Collaborative Environment (FF-ICE) and Connected Aircraft, played in a TBO environment. Importantly, valuable lessons learnt from the demonstration helped further mature the TBO concept and required capabilities.

Key Words: Trajectory Based Operations, System Wide Information Management, Flight and Flow Information for a Collaborative Environment, Demonstration

1. Introduction

To validate the TBO concept and its operational values, AEROTHAI, CAAS, JCAB and NAV CANADA joined the FAA-led MR TBO Lab Demonstration which was conducted in May 2022. The partners developed multiple operational scenarios involving a total of nine flights and connected their prototype systems to perform the identified TBO capabilities.

2. Key TBO Operational Values and Capabilities

Key operational values demonstrated included improved strategic planning, enhanced predictability, increased operational flexibility, and better flight efficiency. Improved strategic planning was achieved through advanced sharing of system limitations and restrictions; enhanced predictability was achieved through timely sharing and update of information such as agreed trajectories; increased operational flexibility was achieved through tighter collaboration between the TBO stakeholders (i.e. TBO capable Air Traffic Management Service Providers (eASPs) and TBO capable Airspace Users (eAUs)), using FF-ICE mechanisms; and better flight efficiency was achieved through eAUs having access to sufficient and timely information to make informed decisions on their preferred trajectories.

3. TBO critical enablers

The three key enablers for TBO were SWIM, FF-ICE and Connected Aircraft (CA). SWIM, considered as an aviation intranet, consisted of standards, infrastructure, cybersecurity, and governance which enabled the management of ATM-related information and its exchange between qualified parties via interoperable services. FF-ICE provided the services and mechanisms to support the sharing and negotiation of trajectory throughout all phases of flight. Lastly, CA, together with associated technologies on the flight deck, enabled the aircraft-derived trajectory data and any additional related data to be exchanged with the ground systems. All these capabilities allowed synchronization of data and usage of the best available information for decision making throughout the flight lifecycle.

4. Conclusion

Through the MR TBO lab demonstration scenarios, AEROTHAI and CAAS validated various key TBO operational values and had a deeper understanding of the capabilities and enablers required to realise these values.

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