Exploration of Connected Aircraft Trajectory Information (CATI)

Richard Jehlen, [1]† Diana Liang,[2], Nabil Sandhu[3]

[1]*Richard Jehlen, LS Technologies, LLC, USA*

[2]*Diana Liang, Federal Aviation Administration (FAA), USA*

[2]*Nabil Sandhu, Federal Aviation Administration (FAA), USA*

†*email: richard.jehlen@lstechllc.com*

The FAA is investigating the use of aircraft-derived information for improving trajectories of use to ATM systems through its Connected Aircraft Trajectory Information (CATI) evaluation. This evaluation focuses on obtaining aircraft-derived data from diverse avionics manufacturers, sharing that data through a non-aviation data link, and using the data to improve the ground to enhance trajectory modeling and prediction. The evaluation is also investigating the integration of the sharing of this data with the FF-ICE R2 services through the real-time evaluation of operational use cases.

Key Words: Connected Aircraft, Data, FF-ICE, TBO, Trajectory

1. Introduction

The Global TBO Concept, previously developed by the ATMRPP, describes the maintenance of a trajectory across the various Air Traffic Management (ATM) System participants. Such maintenance is achieved by synchronizing the trajectory across participants through trajectory updates and revisions.

A substantial body of literature exists exploring a variety of techniques for improving the trajectory obtained for ATM applications. Chief amongst these techniques is the use of aircraft-derived information for improving trajectories. The Connected Aircraft Trajectory Information (CATI) project is focused on investigating the ability of obtaining and using Aircraft Operational Intent (AOI) data by leveraging a non-aviation data link with diverse avionics systems.

2. CATI Overview

The FAA's CATI project leverages previous Trajectory Based Operations (TBO) demonstration projects to further explore the use of aircraft-derived trajectory information, or AOI data as the mechanism to align airspace user intent and NAS strategic planning. CATI exploits advances in avionics, communication, and information management to evaluate the use of AOI data to improve ground-based trajectories. Multiple existing Flight Management Systems (FMS) are used to evaluate the impact of differences in AOI that can be exchanged with the ultimate goal of enabling high participation rates.

FF-ICE R2 Services will be developed to support R2 collaborative information exchanges, including the AOI data from the flight deck. The focus of FF-ICE R2 Services (R2S) development for CATI will be on standardization of information exchanges, service orchestration, and management of the flight state – including its Agreed Trajectory. R2S development for CATI will explore the structural exchange of AOI data and identify potential gaps in the Flight Information Exchange Model (FIXM) to address in the eventual support of R2S. R2S will also be developed in a manner that supports portability, flexibility, reuse, and enhancement to support future FF-ICE R2 exploratory activities.

3. CATI Evaluations

The CATI project will be separated in two distinct evaluations: a fast-time evaluation focused on understanding the impact of specific data element exchanges on the trajectory and a real-time evaluation focused on the interaction with the R2S through a series of operational use cases.

Preliminary fast-time results indicate differences in both ETA and altitude predictions as AOI input sets are varied. ETA predictions have a few minutes maximum difference between the AOI baseline and non-AOI cases. Both the climb and descent phases of flight show differences based on the set of AOI data provided to TMS with magnitudes up to a few thousand feet between the cases.

With real-time evaluation with FF-ICE R2 Services, is being explored to support ICAO's effort to mature the FF-ICE R2 Services definitions. This investigation will develop FF-ICE R2 Services, using the AOI elements identified in the fast-time activity, for lab evaluation. Exercise R2 Services with simulated FMS data and operational use cases. Conduct analysis to provide recommendations to ICAO regarding the use of aircraft-derived data in FF-ICE/R2.

4. Conclusion

With CATI, we are not only evaluating the impacts of AOI data on trajectory predictions but also developing FF-ICE R2 Services to support post departure collaborative information exchanges.

Lessons learned from demonstrating FF-ICE/R2 services, will potentially inform the development of the FF-ICE/R2 Implementation Guidance

References

1) ICAO: *Global Air Traffic Management Operational Concept,* Doc. 9854, 2005