A Technical Approach to FF-ICE Planning and Global Harmonization through IIH&V

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April 11, 2018
IIH&V Project Overview

- To address the Global Air Navigation Plan (GANP’s) vision, the International Interoperability Harmonization and Validation (IIH&V) project was conceived.

- IIH&V Validation Exercises focused on operational and technical aspects among National Airspace (NAS) components, and interoperability between NAS and international ATM Service Providers’ (ASP) components.

- Validation Exercises conducted as a series of events:
  - 5 Tabletops Exercises (with Subject Matter Experts (SMEs))
  - 3 Technical Lab Exercises (with Systems)
IIH&V Project Goals

- Validate FF-ICE Planning Provisions and Implementation Guidance
- Assess interoperability and interaction of capabilities across boundaries and users
- Provide feedback on Global ATM Standards
- Explore future initiatives to better integrate the processes of Airspace Users (AUs) and ASPs globally
Flight & Flow Information for a Collaborative Environment (FF-ICE)

• ICAO Doc 9965 defines information for flow management, flight planning, and trajectory management associated with ATM operational components

• FF-ICE has two phases
  + Planning: Pre-departure
  + Execution: Post-departure

• FF-ICE Planning provides new flight planning and filing capabilities focused on improving collaboration and coordination prior to departure
FF-ICE Provisions and Implementation Guidance

• FF-ICE Provisions provides guidance and lays out the components and requirements to achieve a common picture in global ATM
  + Describes what should be done

• FF-ICE Implementation Guidance provides the necessary guidance an ATM Service Provider or Airspace User may require when implementing the SARPS related to FF-ICE Planning
  + Describes how it should be done
High-level Use Cases developed by Operational and Technical teams are down-selected based on mixture of complexity and feasibility of technical implementation.
IIH&V Lab Exercise

• Conducted at the Florida NextGen Test Bed (FTB)
  - Lab environment contains all the Federal Aviation Administration (FAA) NAS components in a research and development environment

• The lab implemented a technical approach to evaluate the following for potential future implementation:
  - Aviation Systems Block Upgrades (ASBU)/FF-ICE provisions
  - Air/Ground (A/G) SWIM Concept and Trajectory Based Operations (TBO)

Validation 1: FF-ICE Planning
Validation 2: Air/Ground SWIM
Validation Trajectory Based Operations
Validation 1 Overview

• Composed of four scenarios
  ✦ Included International exchange of FF-ICE messages over SWIM between Canada, Japan, Trinidad & Tobago and the USA
• Explored Mixed-mode operations between non-capable (legacy) and capable ANSPs and AUs
  ✦ Utilized adapters to translate messages
• Pre-departure FF-ICE message exchanges
  ✦ Preliminary Flight Plan
  ✦ Filed Flight Plan
  ✦ Trial Request
  ✦ Planning Status, Filing Status
• Tested off-nominal use cases via dynamic exercises
Validation 1 Outputs

- Validation 1 outputs resulted in direct recommendations to the FF-ICE Planning Provisions, FF-ICE Planning Implementation Guidance and FIXM.

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Validation 1 Outputs

• Submission Response from enhanced AU
  ✤ Background: Implementation Guidance does not consider the case where the ASP is the message originator
  ✤ Recommendation: Guidance is needed on the need for an eAU to send a submission response back to the eASP

• GUFI Field in Submission Response
  ✤ Background: Provisions document lists GUFI as a mandatory field for all messages but the Implementation Guidance does not
  ✤ Recommendation: Provisions and Implementation Guidance should be reconciled and Implementation Guidance should be amended to state that the GUFI should be mandatory in the Submission Response
Validation 1 Outputs

• Relevant ASP
  ➢ Background: The Implementation Guidance and Provisions regarding the definition of a relevant ASP can have conflicting interpretations
  ➢ Resolution: The definition of the term ‘Relevant ASP’ has since been revised and is no longer ambiguous

• Contact Information
  ➢ Background: When Contact Information is marked mandatory in Impl. Guidance, its unclear which of the sub fields are mandatory
  ➢ Recommendation: ICAO give more guidance on what contact fields are expected in FF-ICE messages
## Decision Trees

### Background: The FF-ICE documents do not have decision trees that depict the decisions taken when responding to an FF-ICE message

### Resolution: The IIH&V Decision Trees developed to map message flows are being incorporated into the FF-ICE Implementation Guidance
Validation 1 Outputs

• Flight Plan Version
  ✦ Background: Implementation Guidance states that an error should be raised or a flight plan discarded when a flight plan with a lower version number than the current stored version number is received by the eASP
  ✦ Recommendation: Update Implementation Guidance wording to state that a Submission Response with a status of rejected be returned

• Flight Plan Trajectory
  ✦ Background: Impl. Guidance does not address using latitude/longitude versus route points (fix names) when defining a trajectory
  ✦ Recommendation: More guidance for populating the flight plan trajectory
Validation 1 Outputs

• FIXM Recommendations
  + Background: Several gaps in FIXM 4.0 schema identified
  + Feedback: FIXM WG was notified of gaps and has since addressed some with FIXM 4.1 release, and the team is working with FIXM Working Group to help finalize changes in official FIXM 5.0 release
Validation 2/3 Overview

- Extended information exchange during Validation 1 into post-departure
- Utilized message exchange with ground systems, avionics and A/G SWIM components
- Continued mixed-mode operations
- Explored A/G portions of the SWIM A/G Technical Framework
  - Validation 2 explored 3B through 4 Use Cases and a number of dynamic exercises
  - Validation 3 explored 3C through two Use Cases and a number of dynamic exercises
Validation 2/3 Architecture

Legend
- GEMS
- Service by Harris
- Service by NEC

FTB NEMS

Service by NEC

SkyFusion Frontier

JCAP (gASP)

DGM

TTCAA (ASP)
Validation 2/3 Outputs

• **New FF-ICE Execution Message Types**
  🔹 Background: Distinction necessary for messages requiring manual intervention as change requests require manual intervention for airborne
  🔹 Observation: The two new FF-ICE Execution message types created, Update Request message and Enroute Status message should be added to the Implementation Guidance

• **Routing for Weather Events and Constraints**
  🔹 Background: FF-ICE requires Planning Status and Filing Status messages include a reference to any constraint that affects the route of flight
  🔹 Observation: Make Constraint Services queryable to external users for retrieval of constraints based on constraint reference included in the Planning and Filing Status messages
Validation 2/3 Outputs

- **Mismatching GUFI**
  - **Background:** Having multiple GUFIIs for the same flight could result in boundary coordination issues between two eASPs
  - **Observation:** This scenario be considered at the eASP level and a solution be reached with neighboring eASPs before the issue presents itself

- **Phase of Flight**
  - **Distinction required for pre-departure vs. post-departure phases**
  - **Observation:** Implementation Guidance should mark ATOD field mandatory for departure messages
Validation 2/3 Outputs

• DLA Message in Mixed Mode
  ✪ Background: The ATS Delay message (DLA) utilized to delay the Estimated Off-Block Time (EOBT) for a flight does not contain the original EOBT
  ✪ Observation: Legacy AU’s utilize ATS CHG message when operating in a mixed-mode environment
Conclusion

• Validation 1 validated ICAO FF-ICE Planning Provisions and Implementation Guidance
  ✦ Exercised pre-departure negotiations through FF-ICE Planning message exchanges
  ✦ Included mixed-mode operations to validate global transitional environment
  ✦ System alignment to support global FF-ICE Planning message exchanges uncovered gaps, technical and operational, and prepared international aviation community for FF-ICE Planning environment

• Validation 2/3 initiated FF-ICE Execution environment
  ✦ Explored additional messages required in Provisions and the Implementation Guidance to support FF-ICE Execution phase
  ✦ Leveraged A/G SWIM, Data Comm, and the combination of both to reach state of FF-ICE Execution capability

• Globally it was shown that the EFB, the DMS, the FMS, and the Global EMS provider all have important roles in the future of aviation

• Reaffirmed the need for open standards to achieve global interoperability