



Engineering, Test & Technology
Chief Aerospace Safety Office

The BEACON Project: Boeing & EASA IPC on AI/ML Certification

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Agenda

- The automated taxi system
- Boeing & EASA AI/ML IPC
 - IPC Overview
 - IPC Focus Areas
 - Phase 1 Results
 - Phase 2 & Upcoming Schedule



The automated taxi system

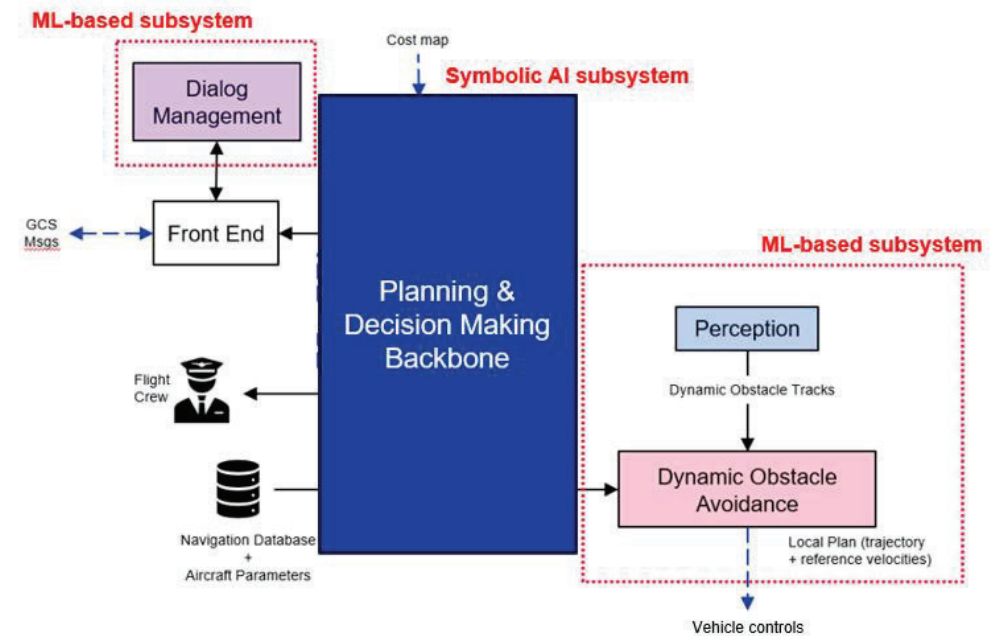
Automated taxi system Overview

- The automated taxi system is an experimental system being researched by Boeing
- It is capable of:
 - Receiving a taxi clearance via radio
 - Parsing that clearance, planning a taxi route, and providing a readback
 - Executing the taxi plan to autonomously taxi the aircraft from one location to another
 - Using its perception system to localize itself on the airport map
 - Using its perception system to sense, classify, and avoid obstacles
- The flight crew monitors the automated taxi system and retains the ability to override and disconnect the system at any time.



Flight Crew Oversight

- The crew will be responsible for:
 - Activation of the system
 - Monitoring the execution (through the provided interfaces)
 - If needed, entering the taxi destination and specific route requirements
 - Monitoring all aspects of the system
 - Overriding the system if abnormal operation or hazards are identified by the crew
- The automated taxi system will provide the flight crew the necessary information in order to monitor the system
 - This information display will be handled by the systems interface with the flight crew

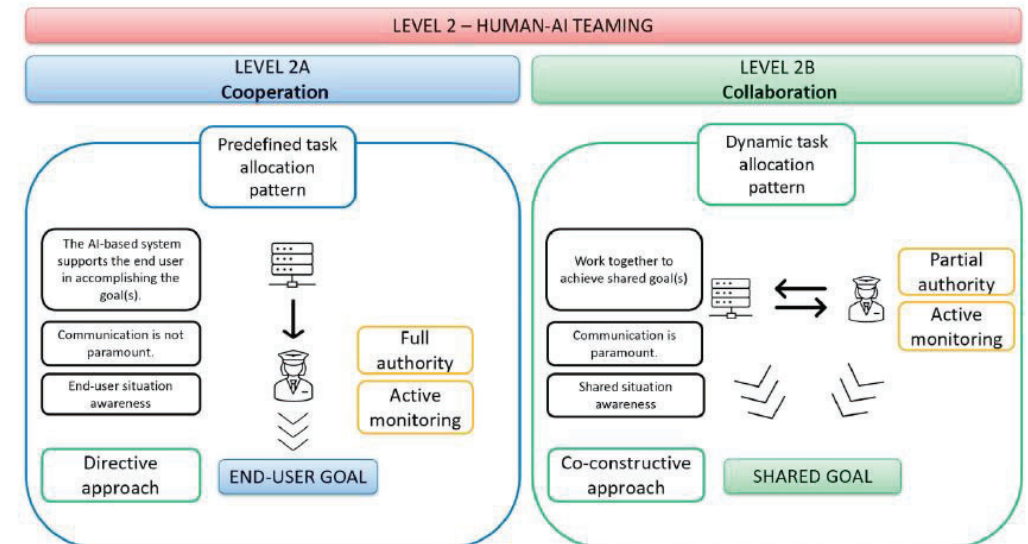
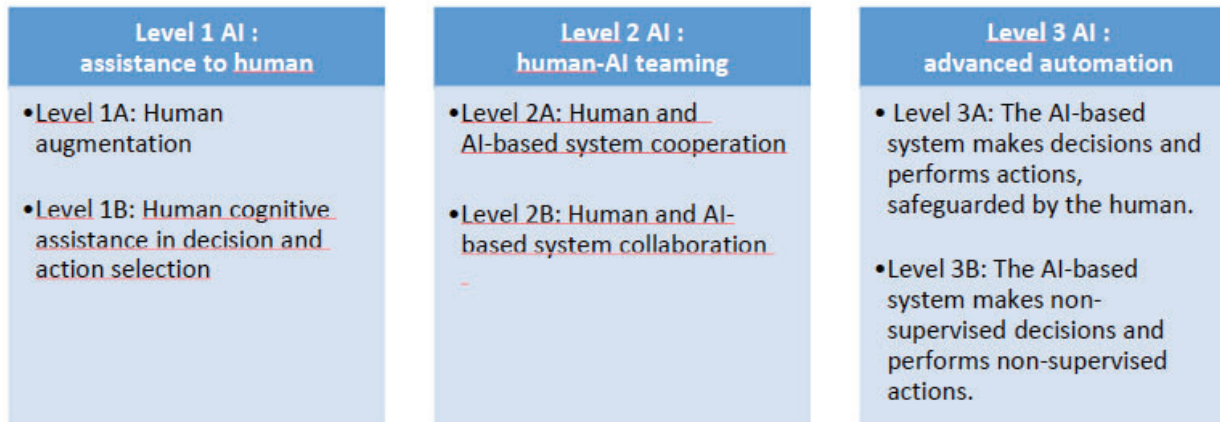


IPC Overview

IPC Overview

The IPC will:

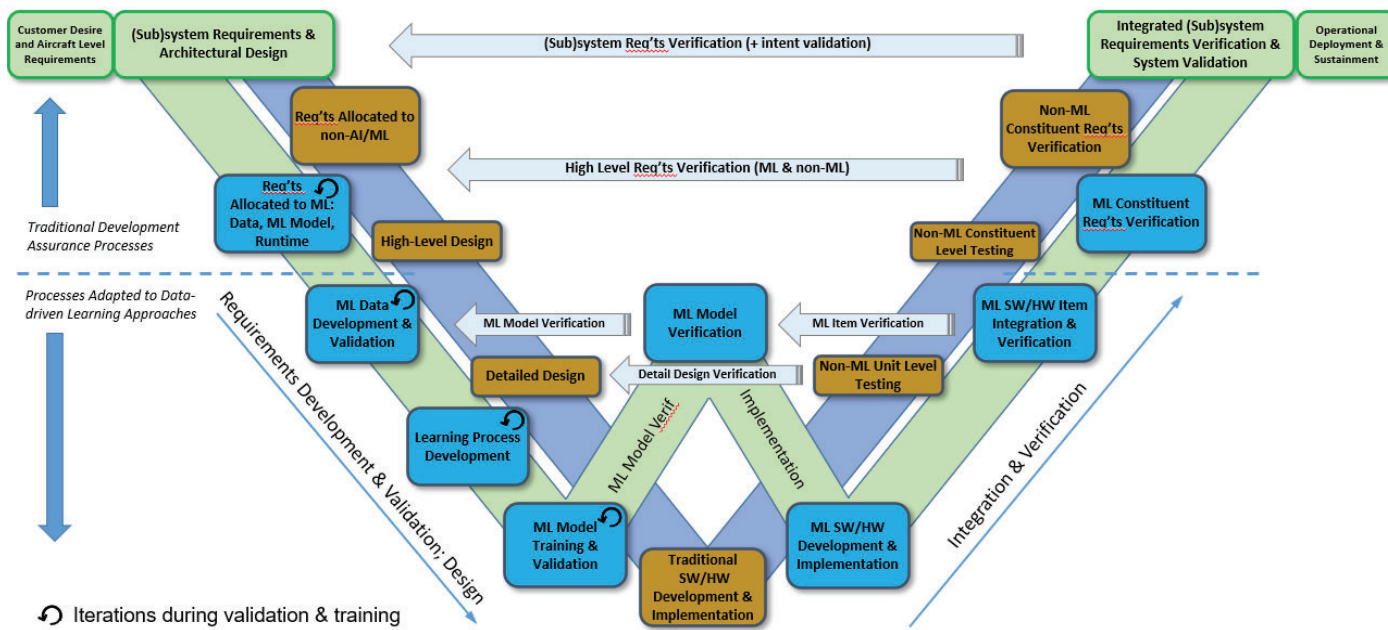
- In collaboration with EASA, establish the regulatory requirements, means of compliance, and V&V strategy for an ML-based system
 - The effort will use the EASA Artificial Intelligence Concept Paper issue 2 as the basis for these requirements and MOCs
- Use Boeing's experimental automated taxi system as the surrogate for the certification process
- Consider both a level 2A (human/machine teaming) system and a level 3A (more autonomous machine) system, per EASA's leveling scheme
- Begin June 2023, and last approximately 18-20 months
 - Expected deliverable: a published report which documents the efforts and findings



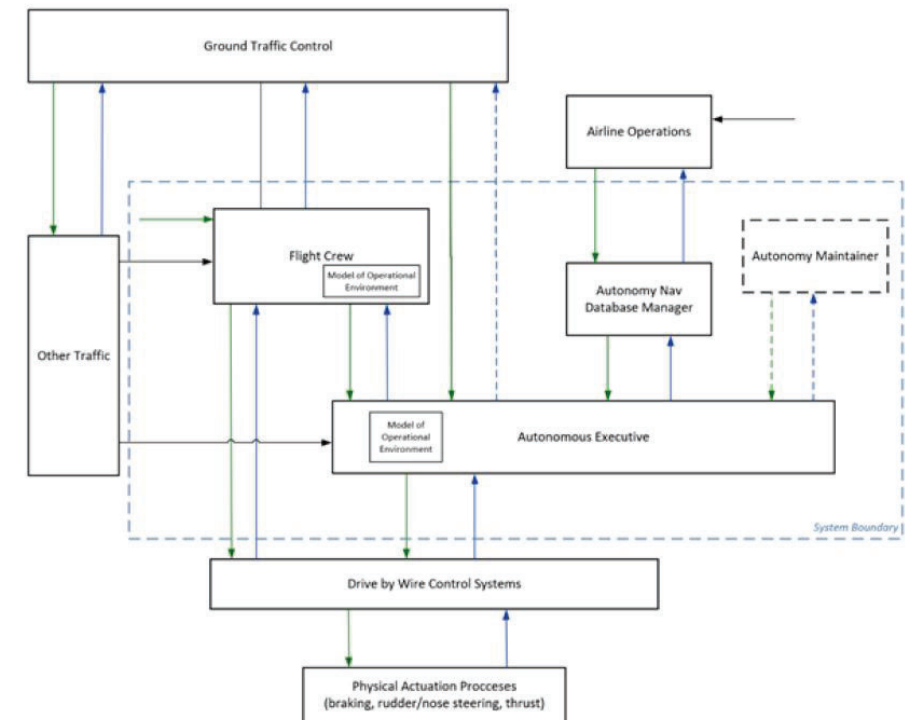
IPC Focus Areas

- Application of Concept Paper Objectives and MOCs
- Validation and Verification approach
- Human Factors, and the use of System-Theoretic Process Analysis (STPA)

AI/ML Development Lifecycle (MLDL) in context with traditional Engineering "V"



High Level Control Structure for existing system



IPC Phase 1 Results

Phase 1 Results

- Leveling
 - Clarified the application of Concept Paper leveling requirements
 - Line of division between levels

- Concept Paper Objectives
 - Suggested refinements of the objectives
 - Tailoring to specific systems

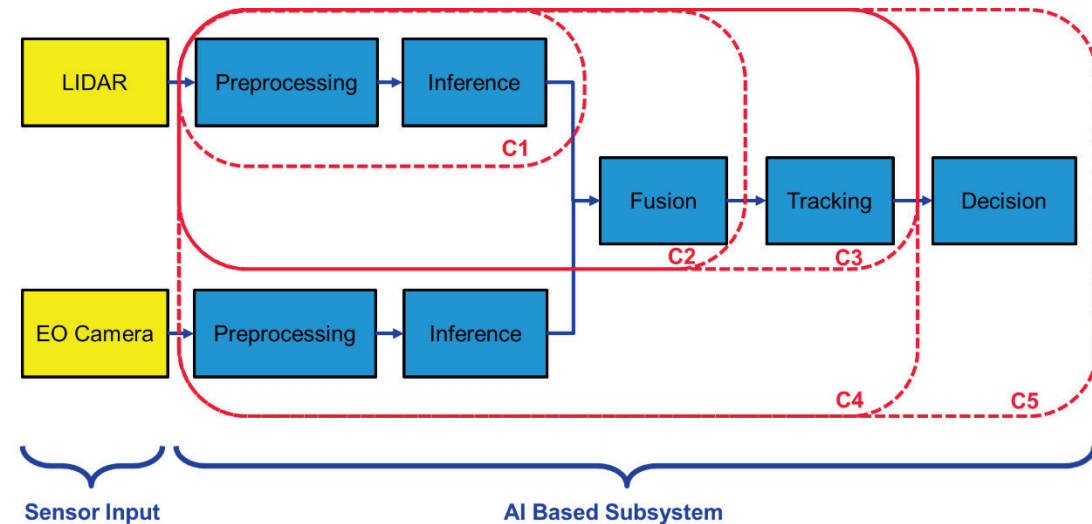
- STPA
 - HMI requirements
 - STPA as a MOC

- Validation and Verification
 - Learned vs. Symbolic approaches
 - OD and the refinement to ODD
 - Defining the MLC

Full Showing
CO-01
CO-02
EXP-10

Partial Showing
CO-06
CO-04
ET-07
EXP-01
EXP-02
EXP-09
EXP-11
EXP-12
EXP-13
EXP-14

Partial Showing (cont.)
EXP-15
EXP-19
HF-02
HF-03
HF-04
HF-07
HF-26
HF-27
HF-28



Phase 2 & Upcoming Schedule

Key Takeaways and Upcoming Schedule

- Phase 2 will consider a Level 3A version of the automated taxi system
 - System installed in an uncrewed vehicle overseen by a remote multi-vehicle supervisor

- Major focus areas of Phase 2
 - Human Factors requirements
 - Objectives
 - Quantitative Safety Assessment
 - Continuous Safety Assessment

- Upcoming Schedule
 - First Half 2025
 - Phase 2 completion
 - Mid-2025
 - Final Report published
 - Mid-2025
 - EASA AI Days Presentation

