

Assessment of 4D Applications for Future NAS Operations

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FAA MOIE

The logo for the MITRE Technology Program, featuring a stylized graphic of stacked yellow and orange blocks to the left of the text "MITRE Technology Program" in a bold, yellow, sans-serif font.

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Problem

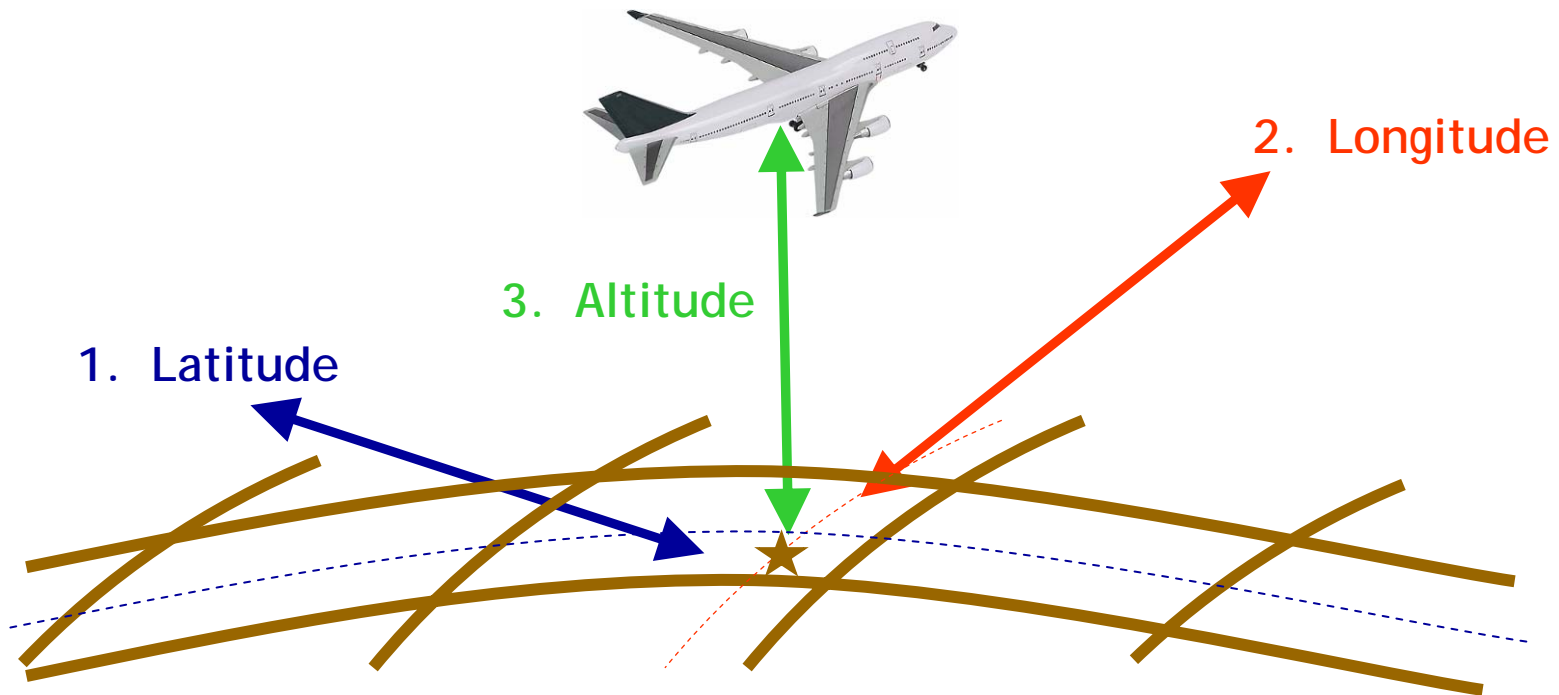
- Many future aviation system concepts include the idea of four-dimensional flight trajectories. However, the interactions of 4D trajectories with specific National Airspace System (NAS) applications and with 4D-capable aircraft are not fully defined.

Background



4. Time

4D Trajectories add the 4th dimension of time to flight plans



Objective

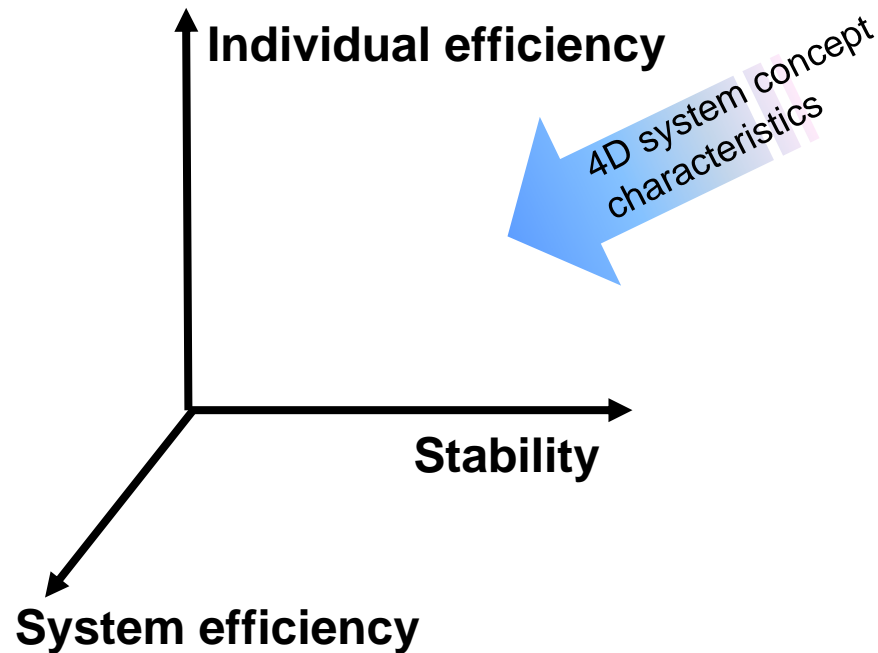
- **Identify specific NAS applications of 4D trajectories and 4D-capable aircraft that provide high benefits at a low risk in the mid- and far terms (2015+)**

Activities

- **Generate a framework to facilitate discussion and move towards consensus on the uses and benefits of 4D trajectories and 4D-capable aircraft by NAS applications**
- **Assess and compare the performance implications of different 4D concepts at a system level by building “simple” models using an equilibrium approach**
- **Understand how the need to conduct air traffic control-related maneuvers may have an impact on a flight’s ability to arrive at a specific point at a specified time**

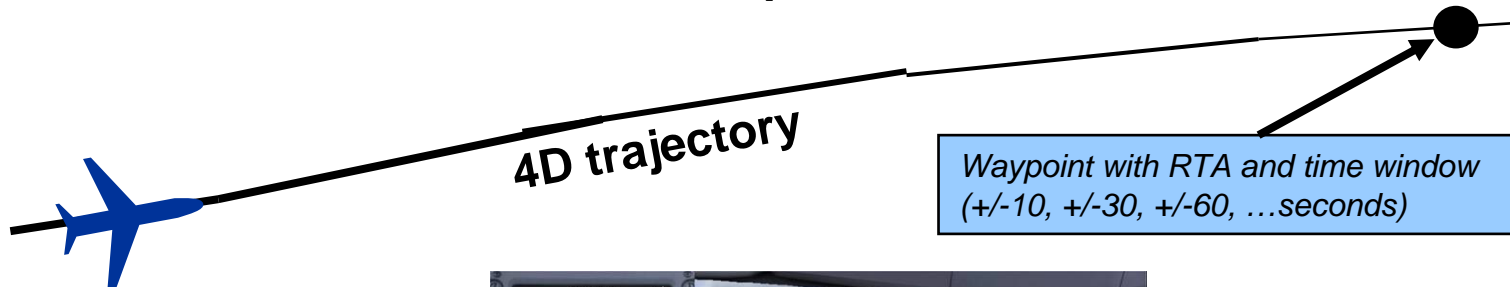
Highlight

How do 4D trajectories balance the trade-offs between individual efficiency, system efficiency, and the robustness of the system?



Highlight

Conduct experiments using an aircraft Flight Management System (FMS) simulator to “fly” a 4D trajectory, using RNAV, RNP, and other avionics and capabilities



Inputs to FMS:

- Winds
- Aircraft Type
- Engines
- Cost Index
- Weight
- Path
- Etc.



Output from FMS:

- 4D trajectory
- Specific to this aircraft and flight leg

Impacts

- **Help to identify the role 4D trajectories and 4D-capable aircraft can realistically play in the future NAS, which is a core concept in the “Next Generation Air Transportation System”**
- **Maintain CAASD position as the “systems engineer” of the NAS by providing a system view rather than a partial solution**
- **Identify benefits of 4D trajectories to both the FAA and system users**

Future Plans

Detailed investigations using human-in-the-loop experiments to study most promising 4D trajectory applications



Cockpit Simulator



*Enroute and Terminal
Air Traffic Control
Simulation*

