Airspace Operations and Safety Program (AOSP)

ATD Industry Day

Leighton Quon
Project Manager
Airspace Technology Demonstrations (ATD) Project
Three mega-drivers have emerged that are shaping the future of aviation

- Traditional measures of global demand for mobility—economic development, urbanization—are growing rapidly.
- Severe energy and climate issues create enormous affordability and sustainability challenges.
- Revolutions in automation, information and communication technologies enable opportunity for safety critical autonomous systems.
NASA Aeronautics Research: Six Strategic Thrusts

- **Safe, Efficient Growth in Global Operations**
  - Enable full NextGen and develop technologies to substantially reduce aircraft safety risks

- **Innovation in Commercial Supersonic Aircraft**
  - Achieve a low-boom standard

- **Ultra-Efficient Commercial Vehicles**
  - Pioneer technologies for big leaps in efficiency and environmental performance

- **Transition to Low-Carbon Propulsion**
  - Characterize drop-in alternative fuels and pioneer low-carbon propulsion technology

- **Real-Time System-Wide Safety Assurance**
  - Develop an integrated prototype of a real-time safety monitoring and assurance system

- **Assured Autonomy for Aviation Transformation**
  - Develop high impact aviation autonomy applications
What is the Airspace Operations and Safety Program?

This program integrates the Airspace Systems Program and Aviation System-Safety work.

**Projects**
- Airspace Technology Demonstrations
- SMART NAS - Testbed for Safe Trajectory-Based Operations
- Safe Autonomous System Operations

**Airspace Operations and Safety Program**

Develops and explores fundamental concepts, algorithms, and technologies to increase throughput and efficiency of the National Airspace System safely.

Provides knowledge, concepts, and methods to the aviation community to manage increasing complexity in the design and operation of vehicles and the air transportation system.

Continues Airspace Systems Program research, and the aircraft state awareness research and system wide safety research that was previously conducted within the Aviation Safety Program.
Airspace Operations and Safety Program (AOSP)
Airspace Technology Demonstrations (ATD) Project

Leighton Quon
Project Manager
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Technologies for Airplane State Awareness

- CAST’s Airplane State Awareness Joint Safety Implementation Team (ASA JSIT) Recommended Research Safety Enhancements (SEs)
- NASA’s precursor safety focus to *Increase Pilots’ Ability To Avoid, Detect, And Recover From Adverse Events That Could Otherwise Result In Accidents/Incidents*

**Cause and Effect** ➔ **Safety Enhancements**
ATD Domains

ATD-1
Terminal Sequencing and Spacing (TSAS) and Flight deck Interval Management (FIM)

ATD-2
Integrated Metroplex Traffic Management

ATD-3
Applied TFM

OFF
TOC
TOD
ON
ATD-1 Technologies

**FIM** Flight Deck Interval Management for Arrival Operations

**CMS** Controller-Managed Spacing in Terminal Airspace

**TMA-TM** Traffic Management Advisor (TMA) with Terminal Metering
Operational Environment for the ATD-2 Concept

- Center airspace
- Terminal airspace
- Less-equipped airports
- Well-equipped airport

- Departure meter points
- Arrival meter point
- Downstream demand/capacity imbalance

- Operatioal Environment for the ATD-2 Concept
ATD-3 Integrated Domestic Concept

MFCR
Delay recovery from stale TMLs – automated search for efficient high value common reroutes for multiple flights

TASAR
Airborne automated continuous searching for efficient reroutes

DRAW
Route corrections to maintain metering and avoid weather

ORC
Efficient reroutes for meter fix load-balancing

PRE-FLIGHT ROUTE

Ground station
(FOC or ANSP)

Air-ground integration for dynamic reroutes

Freeze Horizon
(20 min to MF)

Dep

Dest

~90 min to MF

~60 min to MF

Efficient reroutes for meter fix load-balancing
ATD-3 Integrated Oceanic Concept

Traffic-aware dynamic weather re-route

Traffic Conflict Probe

ADS-B enabled reduced separation

ANSP

Wind & Weather

Airspace User Cost

Cost-optimized Routing

AOC

Pre-departure flight planning

ANSP
Industry Day Objectives

• Inform
• Engage
• Collaborations
  – Successes from agency collaborations such as ATD-1
  – Opportunities to collaborate in ATD-2 and ATD-3
Partnership Outreach
Partners’ Opportunities

• Airlines
  – Demonstration metrics
  – Demonstration scenarios
  – Procedure development
  – Participation in tests and studies
  – Training considerations
  – Test Plans
  – Data sharing
  – Demo team participation
Partners’ Opportunities

• Manufacturers
  – Participation in tests and studies
  – Standards collaboration
  – Test Plans
  – Configuring NASA or field facilities
  – Equipment loans
  – Demo team participation
Concluding Remarks

• NASA is pursuing partnerships to operationally demonstrate these integrated capabilities
• NASA has developed several foundational technologies in preparation for demonstrations
• These tools leverage the FAA and Industry investments in NextGen infrastructure: ADS-B, RNAV/RNP routes, and OPD procedures
• These technologies demonstrate the benefits of a critical set of NextGen capabilities for future trajectory based operations
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