ATD Project Overview

Presented by: Shawn Engelland
NASA ATD Project Manager
September 22-23, 2021
NASA Aeronautics
Vision for Aviation in the 21st Century

Global
Sustainable
Transformative

6 Strategic Thrusts

- Safe, Efficient Growth in Global Operations
- Safe, Quiet, and Affordable Vertical Lift Air Vehicles
- Innovation in Commercial Supersonic Aircraft
- In-Time System-Wide Safety Assurance
- Ultra-Efficient Subsonic Transports
- Assured Autonomy for Aviation Transformation

ARMD continues to evolve and execute the Aeronautics Strategy
https://www.nasa.gov/aeroresearch/strategy

ATD delivered capabilities that address NASA Aeronautics Strategic Thrust #1
Every time you fly, NASA’s ATD technologies found in cockpit and ground-based systems are guiding you through your flight. We really are “with you when you fly.”

**ATD-1** Terminal Sequencing and Spacing / Flight Deck Interval Management: *Improve terminal arrival operations efficiency while increasing arrival throughput*

**ATD-2** Integrated Arrival/Departure/Surface: *Improve the predictability and efficiency of airport surface and terminal departure operations*

**ATD-3** Applied Traffic Flow Management: *Reduce weather-related delays through the integration of weather information with en route traffic flow management tools*
ATD-1 Technical Challenge

Develop and deliver integrated aircraft-based and ground-based automation technologies to the FAA NextGen and Air Traffic Organizations, the FAA Surveillance Based Systems Program Office, and flight operators, to enable improved arrival operations efficiency while increasing arrival throughput.

NASA Technologies plus:
- ADS-B Infrastructure Area Navigation (RNAV)
- Arrivals Required Navigation Performance (RNP)
- Optimized Profile Descents (OPD)
ATD-2 Technical Challenge

Develop and deliver an integrated metroplex traffic manager to the FAA NextGen and Air Traffic Organizations, flight operators, and airport operators, that leverages NASA, FAA and industry technologies to enable simultaneous improvement of the predictability and efficiency of arrival, departure and surface operations.
ATD-3 Technical Challenge

Develop and deliver air/ground technologies and procedures to the FAA and flight operators that enable reduced weather-induced delays through the integration of weather information to better manage aircraft, traffic flow, airspace and schedule constraints.
Decision Support Systems (a.k.a. 3Ts) are the engines of NextGen and, along with SWIM, form the foundation for the future of air traffic management.

**Time-Based Flow Management (TBFM)**
Decision support system for metering based on time to optimize the flow of aircraft.

**Terminal Flight Data Management (TFDM)**
A new decision support system for airport surface management and ATC tower functions.

**Traffic Flow Management System (TFMS)**
Decision support system for planning and mitigating demand-capacity imbalances in the NAS.

**System Wide Information Management (SWIM)**
The digital data-sharing backbone of NextGen. Deliver the right information to the right people at the right time.
**ARMD Strategic Thrust:**
Safe, Efficient Growth in Global Operations

**ATD Project Objectives:**
Accelerate the maturation of integrated air traffic management concepts and technologies to higher TRL for transition to stakeholders
Technology & Knowledge Transfers to FAA and Industry

FAA-led companion research activity

ATD2
- Mobile App for GA/BA
- IDAC improvements
- Validate Concept and Benefits
- NTML messaging improvements
- TOS-Related Digital Services
- TIP prototype

ATD1
- FIM (2017)
- TSAS (2015)
- TAP/TASAR (2018)
- DRAW (2019)
- MFCR (2017)
- NASCENT (2018)

ATD3
- STARS
- TBFM
- TFDM
- FAA
- TFMS

Flight Deck

Flight Operations

SWIM
Partnerships / Stakeholders

NASA ATD Project

FAA

NextGen Organization
Air Traffic Organization
• Program Management
• Mission Support
• System Operations
• Air Traffic Services

FAA Industry Forums

Industry

Solution Providers

Boeing
Honeywell

Many other contributors. Highlighting direct cost-sharing partners.
ATD focused on demonstrating NASA technologies in operational environments and transferring them to the FAA and Industry for implementation. ATD technologies really are with you when you fly!
Additional Material
ATD-1 Goal, Objectives, & Outcomes

**GOAL:** ATD-1 will show the sustained use of fuel-efficient procedures throughout the entire arrival phase of flight, and increasing arrival efficiency during periods of high demand at airports.

**OBJECTIVES**

- Motivate ADS-B implementation by demonstrating throughput and fuel efficiency benefits in high-density airport operations for arrival flows by integrating flight deck interval management (enabled by ADS-B In/Out avionics), controller-managed spacing tools, and terminal metering
- Transfer ATD-1 technologies beyond NASA

**OUTCOMES**

- Demonstrated the ATD-1 technologies in an operationally relevant environment
- Quantified the benefits, performance, acceptability, and limitations of the ATD-1 technology
- Transfer an integrated set of technology to the FAA, airlines, airports, and suppliers
• **Air Traffic Management (ATM) Technology Demonstration - 1 (ATD-1): Terminal Sequencing and Spacing (TSAS) and Flight Deck Interval Management (FIM),** Technical Project Site, Videos
  – 03.31.2015 [VIDEO] “ATD-1 HITL Simulation”
  – 06.29.2015 [VIDEO] “ATD-1 Animation (v4.4, 4/21/15)”

• 12.18.2017 [Web Feature] Center Snapshot: Kurt Swieringa, Web Feature
• 09.01.2017 [Web Feature] Air Traffic “Win-Win” Wins NASA Software of the Year, Web Feature
• 02.26.2017 [Video] “ATD-1 Team Completes Flight Tests” (Repeat, different channel)
• 02.02.2017 [Media Advisory] Media Invited to See NASA Air Traffic Management Technology in Action, Media Advisory (Mentions ATD-1)
• 01.11.2017 [Web Feature] Prototype Air Traffic Tool Ready for Airborne Workout, Web Feature
• 06.23.2015 [Web Feature] NASA-Developed Air Traffic Management Tool Flies Into Use, Web Feature
GOAL: ATD-2 will improve the predictability and the operational efficiency of the air traffic system in metroplex environments through the enhancement, development and integration of the nation’s most advanced and sophisticated arrival, departure and surface prediction, scheduling and management systems.

OBJECTIVES

• Demonstrate improved aircraft arrival, departure and surface movement predictability and efficiency by integrating evolving collaborative decision-making capabilities with state-of-the-art air traffic management scheduling technologies

• Enable effective use of collaborative decision making by demonstrating efficiency gains through enhanced two-way sharing of prediction and scheduling information

• Transfer ATD-2 technologies beyond NASA

OUTCOMES

• Demonstrate the ATD-2 technologies in an operationally relevant environment

• Quantify the benefits, performance, acceptability, and limitations of the ATD-2 technology

• Transfer an integrated set of technology to the FAA and airlines, airports, and suppliers
ATD-2 Online Content

  - 04.20.2018 **VIDEO** “ATD-2 Concept Animation V2.1”
  - 12.23.2017 **VIDEO** “NASA Software Helps Speed Air Travelers On Their Way”
  - 12.20.2017 **VIDEO** “New NASA Field Demo Tests Software to Reduce Airport Delays” (Repeat)
- 09.10.2018 **Airspace Technology Demonstration 2 (ATD-2) at FutureFlight Central**, Image Feature (NASA Administrator visit)
- 06.25.2018 **Airspace Technology Demonstration 2 (ATD-2) Assessment of Ramp Times Human-in-the-Loop Simulation Shakedown**, News
  - 11.01.2017 **NASA Air Traffic Management Demonstration Goes Live in Charlotte**, Web Feature, Video
  - 11.01.2017 **VIDEO** “NASA Field Demo to Reduce Ground Delays Begins”
- 06.19.2017 **Media Invited to Learn about NASA’s Project to Streamline Air Travel**, Press Release
- 02.28.2017 **Airspace Technology Demonstration 2 (ATD-2) Human-In-The-Loop (HITL) shakedown simulation at FutureFlight Central (FFC) and Airspace Operations Laboratory (AOL)**, News, Video
  - 12.20.2017 **VIDEO** “New NASA Field Demo Tests Software to Reduce Airport Delays” (Repeat)
- 07.01.2016 **NASA and Partners Open New Research Lab at Charlotte Airport**, Image Feature (READ MORE goes on to “Transportation Department, NASA, Partners Visit Charlotte to Open Test Lab to Streamline Air Travel”)
- 06.24.2016 **Transportation Department, NASA, Partners Visit Charlotte to Open Test Lab to Streamline Air Travel**, Press Release
- 06.23.2016 **NASA Launches 5-Year Tech Demo to Improve Air Traffic Flow at Airports**, Web Feature
**Goal:** Develop and demonstrate, by 2020, advanced integrated air/ground automation technologies and procedures that enable strategic user-preferred routes and tactical route corrections to be identified and executed.

**Objectives:** Develop integrated air/ground automation tools which:

- Reduce impact of uncertainty in weather in domestic airspace
- Enable automatic continuous searching for more efficient routes for individual flights in domestic airspace
- Enable automatic continuous searching for more efficient routes for groups of flights in domestic airspace
- Efficiently share route correction options between traffic managers, pilots, dispatchers and controllers in domestic airspace

**Outcomes:**

- Demonstrate ATD-3 technologies in relevant environments
- Quantify benefits, performance, acceptability, and limitations of ATD-3 technologies
- Transfer of ATD-3 technologies to FAA, airlines, and industry
Airspace Technology Demonstration 3 (ATD-3) Applied Traffic Flow Management, Technical Project Site, Videos

11.17.2017 VIDEO “ATD-3 Integrated Concept Animation V1.2”

11.04.2019 NASA Langley Technology Selected as R&D 100 Winner

01.28.2019 Dynamic Routes for Arrivals in Weather (DRAW) at SimLabs

08.30.2018 NASA and Alaska Airlines Test Software that Saves Time, Fuel

06.07.2017 VIDEO “ATD-3:Busting Bad Weather Flight Delays” (Repeat, different channel)

06.06.2017 VIDEO [NASA/YouTube] “ATD-3:Busting Bad Weather Flight Delays”