
Project Overview

October 24, 2016

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NASA Ames Research Center
ATD-3 Scope

ATD-3
Applied Traffic Flow Management (ATFM)

ATD-2
Integrated Metroplex Traffic Management

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

TOC - Top of Climb
TOD - Top of Descent

TOC - Top of Climb
TOD - Top of Descent
Reduce weather-induced delays through integration of weather information to better manage aircraft, traffic flow, airspace and schedule constraints by delivering air/ground procedures and user-tool technologies.
ATD-3 Technologies

Multi-Flight Common Route (MFCR):
Automated search for efficient high value reroutes for individual flights and common reroutes for multiple flights - delay recovery from stale TMIs.

Traffic Aware Strategic Aircrew Requests (TASAR):
Airborne automated continuous searching for efficient reroutes that reduce fuel and/or flight time, avoid interactions with traffic, weather and restricted airspace.

Dynamic Routes for Arrivals in Weather (DRAW):
Efficient reroutes to maintain metering operations in the presence of weather, find efficient arrival routes, and balance meter fix demand.
Freeze Horizon

Current Flight Plan
Route

Suggested reroute

ATD-3 Integrated Concept

MFCR
Ground-based automated search for efficient high value reroutes for individual flights and common reroutes for multiple flights - delay recovery from stale TMI's
MFCR User Interface
**ATD-3 Integrated Concept**

Current Flight Plan Route

- **MFCR**
  Ground-based automated search for efficient high value reroutes for individual flights and common reroutes for multiple flights - delay recovery from stale TMLs

- **TASAR**
  Flight-deck based automated continuous searches for efficient reroutes during flight

Freeze Horizon

- (20 min to MF)

- ~90 min to MF

- ~60 min to MF

Dep

Dest
Traffic Aware Strategic Aircrew Requests (TASAR)

Pilot uses onboard automation tool to optimize an aircraft’s trajectory

Tools leverages networked connectivity to real-time operational data

NASA Technology

Greater flight efficiency en route

Operational Outcomes

Crew Request

ATC Response

Increased ATC approval of requests
ATD-3 Integrated Concept

Current Flight Plan Route

MFCR - Ground-based automated search for efficient high value reroutes for individual flights and common reroutes for multiple flights - delay recovery from stale TMI

TASAR - Flight-deck based automated continuous searches for efficient reroutes during flight

Freeze Horizon
(20 min to MF)

~90 min to MF

~60 min to MF

Ground station
(AOC or ANSP)

Leverage capabilities of both TASAR and MFCR systems to maximize potential benefits of dynamic reroutes

Air/Ground Integration
Air/Ground Integration

Plan through Q2FY17

- Qualitative benefit assessment of candidate air/ground concepts
- Leveraging existing airline and FAA partnerships and agreements, solicit feedback on top candidate concepts, establish demonstration partnership(s)
- Develop Objectives, initial ConOps, and top-level requirements for air/ground concept and demonstration
- Complete Air/Ground Integration Plan through FY20 leading to demonstration
**ATD-3 Integrated Concept**

- **DRAW**
  - Efficient reroutes to maintain metering, avoid weather, and balance meter fix loading

- **TASAR** - Flight-deck based automated continuous searches for efficient reroutes during flight
  - Ground-based automated search for efficient high value reroutes for individual flights and common reroutes for multiple flights - delay recovery from stale TMIIs

- **MFCR**
  - Ground-based automated search for efficient high value reroutes for individual flights and common reroutes for multiple flights - delay recovery from stale TMIIs

- **Air/Ground Integration**
  - Leverage capabilities of both TASAR and MFCR systems to maximize potential benefits of dynamic reroutes
• Planned as future TBFM enhancement
• Integrated Route and Schedule Trial Planner
• Two-hour convective weather forecast updated every five minutes
• Hourly atmospheric updates (e.g., winds)
• ERAM traffic feed from home and adjacent Centers
• Reroute candidate automatically identified and posted on DRAW Advisory List
Trajectory Based Weather Modeling

Current CIWS Weather

Forecasted Nearby CWAM Weather (< 25 nmi)

Forecasted CWAM Weather Conflict

Current Weather

30 Minute Forecast

60 Minute Forecast

CIWS*: Corridor Integrated Weather System (precipitation, echo tops)
CWAM*: Convective Weather Avoidance Model (pilot deviation model)

*- Products of MIT Lincoln Laboratory
DRAW – Time-Saving Reroutes to Alternate Meter Fix

**Diagram Description:**

**Current Flight Plan**: AC1, AC2, AC3, AC4, AC5

**Freeze Horizon**: AC1

**Meter Fix 1**: AC1

**Meter Fix 2**: AC1

**DRAW Efficient Reroute**: AC2

**Current scheduled times of arrival and delay**
- AC5: 3
- AC4: 3
- AC3: 2
- AC2: 1
- AC1

**Adjusted times of arrival and metering impact**

**Legend**:
- MF1
- MF2
DRAW - Route Correction to Avoid Weather & Maintain Accurate Schedule Time of Arrival

Current scheduled times of arrival do not reflect the need to deviate for weather

Adjusted time of arrival and delay
Meter Fix Demand Balancing (future capability)

Current Flight Plans

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<th>AC8</th>
<th>AC7</th>
<th>AC6</th>
<th>AC5</th>
<th>AC4</th>
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Current scheduled times of arrival and delay

| AC8 | 6 | 1 |
| AC7 | 6 | 1 |
| AC6 | 3 |
| AC5 | 3 |
| AC4 | 2 |
| AC3 | 2 |
| AC2 | 1 |
| AC1 |

Draw Offloading Reroute

Freeze Horizon

Adjusted time of arrival and delays
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**DRAW Status**
- **OK**: Weather Deviation Route
- **ALT**: Alternate STAR
DRAW Integrated Route and Schedule Trial Planner
DRAW Trial Planning: Trial Plan Activation

Flight Data Block (Current Flight Plan)

Trial Planner Window
DRAW Trial Planning: Current Flight Plan

Trial ETA, STA, Delay
DRAW Trial Planning: Capture Waypoint

**Updated Trial ETA, STA, Delay**

Capture Waypoints
DRAW Trial Planning: Multi-flight Trial Planning
Questions

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