
Project Overview

October 24, 2016

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NASA Ames Research Center
ATD-3 Scope

ATD-2
Integrated Metroplex Traffic Management

ATD-3
Applied Traffic Flow Management (ATFM)

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

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.
ATD-3 Integrated Concept

Current Flight Plan Route

Suggested reroute

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

Freeze Horizon

(20 min to MF)

~90 min to MF

~60 min to MF

Dep

Dest
**ATD-3 Integrated Concept**

- **Current Flight Plan Route**
- **Suggested reroute**

**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
TASAR User Interface

- Lateral: 1937 lbs, 16m 10s
- WAAHU NASSH
- Vertical: 2511 lbs, 5m 26s
- FL340
- Combo: 4272 lbs, 11m 4s
- FL340 / PROTN NASSH
- Message: Processing... (60%)

Objective: Fuel
Limit: NASSH
Max WPTS: Two

RNG: 1120
TRK: 283
MAG

Points: NASSH, MEVDY, JUBDI, AHYOB, PROTN, DOGGs, ODLOB, ALT FL340
Traffic Aware Strategic Aircrew Requests (TASAR)

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

- **Pilot Interface**
- **Optimization Engine**
- **Real-time Aircraft Data**
- **Internally sourced data**
- **NASA Technology**

**Navigation Database**

**Aircraft Performance**

**Traffic**

**Weather**

**Airspace**

**Dispatch**

**Externally sourced data**

**Greater flight efficiency en route**

Operational Outcomes

Crew Request → ATC Response

Increased ATC approval of requests

Tool leverages networked connectivity to real-time operational data
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

Air/Ground Integration
Leverage capabilities of both TASAR and MFCR systems to maximize potential benefits of dynamic reroutes

ATD-3 Integrated Concept

Freeze Horizon
(20 min to MF)

~90 min to MF

~60 min to MF

Current Flight Plan Route

Suggested reroute

Ground station
(AOC or ANSP)
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

**Current Flight Plan Route**

**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

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

**Air/Ground Integration**
Leverage capabilities of both TASAR and MFCR systems to maximize potential benefits of dynamic reroutes

**Ground Station**
(AOC or ANSP)
DRAW System

- 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

**DRAW Efficient Reroute**

- **AC5**
- **AC4**
- **AC3**
- **AC2**
- **AC1**

**Current Flight Plan**

- **Freeze Horizon**

**Adjusted times of arrival and metering impact**

- **AC5** 3
- **AC4** 3
- **AC3** 2
- **AC2** 1
- **AC1**

**Meter Fix 1**

**Meter Fix 2**

**Current scheduled times of arrival and delay**

- **MF1**
- **MF2**
Current scheduled times of arrival do not reflect the need to deviate for weather.
Meter Fix Demand Balancing (future capability)

Current Flight Plans

- AC8
- AC7
- AC6
- AC5
- AC4
- AC3
- AC2
- AC1

Current scheduled times of arrival and delay

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

Adjusted time of arrival and delays

Freeze Horizon

DRAW Offloading Reroute

AC6

MF1 MF2
**DRAW Advisory List**

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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: Capture Waypoint

Updated Trial ETA, STA, Delay

Capture Waypoints
DRAW Trial Planning: Alternate STAR
DRAW Trial Planning: Auxiliary Waypoint

Auxiliary Waypoint (Click & Drag)
DRAW Trial Planning: DRAW List Activation

DRAW List Activation (pre-defined route)
Questions

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