
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
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

Freeze Horizon

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
MFCR User Interface

Congestion on MFCR Route

Detailed Results for UAL581

Original FF: KDEN / GCX244086..BYP..UF..PKV..IUJ78..HVO..GBB2..KOAD@1748
Reference FF: KDEN / GCX215068..GCX187078..IUJ78..HVO..GBB2..KOAD@1748
NASCENT FF: KDEN / GCX215068..GCX187078..E0V..IUJ78..HVO..GBB2..KOAD@1748
MFCR Architecture Diagram

Dispatch or Traffic Management Coordinator

AOC or ARTCC

Rapid Refresh Wind Model (NOAA)

CIWS

MFCR

TFM Data (via SWIM)

TFR System (FAA)

SUA System (FAA)

SWIM provides access to aviation information through a single connection.
Freeze Horizon (20 min to MF)

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

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

Dep

Dest

~90 min to MF

~60 min to MF

Freeze Horizon

(20 min to MF)
Traffic Aware Strategic Aircrew Requests (TASAR)

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

NASA Technology

Operational Outcomes

Greater flight efficiency en route

Crew Request → ATC Response

Increased ATC approval of requests

Tool leverages networked connectivity to real-time operational data

Navigational Database → Pilot Interface → Optimization Engine → Real-time Aircraft Data → Traffic, Weather, Airspace, Dispatch

Internally sourced data

Externally sourced data
Freeze Horizon

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

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

Dep

Ground station
(AOC or ANSP)

~90 min to MF

~60 min to MF

(20 min to MF)

Dest
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
Freeze Horizon

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

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

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

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

Current Flight Plan

AC1

AC2

AC3

AC4

AC5

FREEZE Horizon

CURRENT Flight Plan

DRAW Efficient Reroute

Meter Fix 1

Meter Fix 2

Adjusted times of arrival and metering impact

Current scheduled times of arrival and delay

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

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

AC8 AC7 AC6

AC5
AC4 AC3
AC1

DRAW Offloading Reroute

Freeze Horizon

Current scheduled times of arrival and delay

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

Meter Fix 1

Meter Fix 2

Adjusted time of arrival and delays

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: Current Flight Plan

Current Flight Plan Route

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

Updated Trial ETA, STA, Delay

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

Auxiliary Waypoint (Click & Drag)
DRAW Trial Planning: Multi-flight Trial Planning
Questions

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