
Project Overview

October 24, 2016

Chester Gong
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
ATD-3 Technical Challenge

*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.
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
MFCR User Interface

Congestion on MFCR Route

Detailed Results for UAL581

Original FP: KDEN, GCK12246860, BYU, UT, PXM, IUJ7870, HVO, G8822, KIAD, 1748
Reference FP: KDEN, GCK12235068, GCK1220708, IUJ7870, HVO, G8822, KIAD, 1748
NASCENT FP: KDEN, GCK12235068, GCK1220708, ESOV, IUJ7870, HVO, G8822, KIAD, 1748
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

Freeze Horizon

(20 min to MF)

~60 min to MF

~90 min to MF

Dep

Dest
TASAR User Interface
Traffic Aware Strategic Aircrew Requests (TASAR)

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

Greater flight efficiency en route

Increased ATC approval of requests

NASA Technology

Operational Outcomes

Pilot Interface

Optimization Engine

Real-time Aircraft Data

Internally sourced data

Navigation Database

Aircraft Performance

Traffic

Weather

Airspace

Dispatch

Externally sourced data

Tool leverages networked connectivity to real-time operational data
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 TMs

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
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

**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.
• 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

Freeze Horizon

DRAW Efficient Reroute

Adjusted times of arrival and metering impact

Current scheduled times of arrival and delay

AC1 1

AC2 2

AC3 3

AC4 3

AC5 3
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
- 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

Adjust time of arrival and delays

Freeze Horizon

DRAW Offloading Reroute

Meter Fix 1

Meter Fix 2
## DRAW Advisory List

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**Grouped By Meter Fix**

**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

STARs
DRAW Trial Planning: Transition Fix
DRAW Trial Planning: Auxiliary Waypoint

Auxiliary Waypoint (Click & Drag)
DRAW List Activation (pre-defined route)
Questions

Chester.Gong@nasa.gov