
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
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.

Current Flight Plan Routes
MFCR Reroute

TASAR Equipped Aircraft

Current Flight Plan Route

TASAR Reroute

TRACON

~90 min to Meter Fix

~20 min to Meter Fix

Freeze Horizon

DRAW Reroute

DRAW Reroute

Current Flight Plan Routes
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

ATD-3 Integrated Concept
MFCR User Interface
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
TASAR User Interface

- Cruise: FL300, M0.76
- Lateral: 1937 lbs, 16m 10s
- Vertical: 2511 lbs, (5m 26s)
- Combo: 4272 lbs, 11m 4s
- FL340 / PROTN: NASSH
- Message: Processing... (60%)
- Objective: Fuel
- Limit: NASSH
- Max WPTS: Two
- RNG: 1120, TRK 283, MAG
- Locations: NASSH, MEVDY, AHYOB, PROTN, DOGGS, ODLOE, ALT FL340
Traffic Aware Strategic Aircrew Requests (TASAR)

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

NASA Technology

Greater flight efficiency en route

Operational Outcomes

Increased ATC approval of requests

Tool leverages networked connectivity to real-time operational data

Navigation Database

Aircraft Performance

Pilot Interface

Optimization Engine

Real-time Aircraft Data

Internally sourced data

Traffic

Weather

Airspace

Dispatch

Externally sourced data

Increased ATC approval of requests
**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.

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

- **Freeze Horizon**
  - (20 min to MF)
  - ~60 min to MF

- **Dest**
- **Dep**
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

**Freeze Horizon**
(20 min to MF)

**Current Flight Plan Route**

**Suggested reroute**

**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

**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

**Dep**

**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

Forecasted Nearby CWAM Weather (< 25 nmi)
Forecasted CWAM Weather Conflict

Current CIWS Weather

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

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

Meter Fix 1

Meter Fix 2
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
- AC2
- 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

**Adjusted time of arrival and delays**

- MF1
- MF2
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**DRAW Status**
- OK: Weather Deviation Route
- ALT: Alternate STAR
DRAW Integrated Route and Schedule Trial Planner
DRAW Trial Planning: Capture Waypoint

Updated Trial ETA, STA, Delay

Capture Waypoints
DRAW Trial Planning: Transition Fix
DRAW Trial Planning: DRAW List Activation

DRAW List Activation (pre-defined route)
Questions

Chester.Gong@nasa.gov