
Project Overview

October 24, 2016

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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.

~90 min to Meter Fix
Current Flight Plan Routes

DRAW Reroute

Freeze Horizon (~20 min to Meter Fix)

TRACON
Freeze Horizon 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's
MFCR Architecture Diagram

- Dispatch or Traffic Management Coordinator
- AOC or ARTCC
- MFCR
- TFM Data (via SWIM)
- TFR System (FAA)
- SUA System (FAA)
- Rapid Refresh Wind Model (NOAA)
- CIWS

SWIM provides access to aviation information through a single connection.
ATD-3 Integrated Concept

Current Flight Plan Route

Suggested reroute

Freeze Horizon
(20 min to MF)

~90 min to MF

~60 min to MF

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

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
NASSH
MEVDY
JUBDI
AHYOB
PROTN
DOGGS
ODLOE
ALT FL340
Traffic Aware Strategic Aircrew Requests (TASAR)

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

Tool leverages networked connectivity to real-time operational data

Greater flight efficiency en route

Increased ATC approval of requests

Operational Outcomes

NASA Technology

Pilot Interface

Optimization Engine

Real-time Aircraft Data

Internally sourced data

Navigation Database

Aircraft Performance

Traffic

Weather

Airspace

Dispatch

Externally sourced data

Crew Request

ATC Response
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

(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

**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.

Current Flight Plan Route

Suggested reroute

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

Freeze Horizon

Current Flight Plan

DRAW Efficient Reroute

Current scheduled times of arrival and delay

Adjusted times of arrival and metering impact

AC1

AC2

AC3

AC4

AC5

AC1

AC2

AC3

AC4

AC5

Current Flight Plan

Meter Fix 1

Meter Fix 2

AC1

AC2

AC3

AC4

AC5

Current Flight Plan

AC1

AC2

AC3

AC4

AC5

Adjusted times of arrival and metering impact

AC1

AC2

AC3

AC4

AC5

Current Flight Plan

AC1

AC2

AC3

AC4

AC5

Adjusted times of arrival and metering impact
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
Current Flight Plans

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

AC8  AC7  AC6  AC5  AC4  AC3  AC2  AC1  MF1  MF2
### DRAW Advisory List

**Current Arrival Route** | **Time Savings** | **Proposed Arrival Route**
--- | --- | ---
**DEBBI** | GREGS | 0.1 | GREGS.JFRYE3 | OK
**FEVER** | BOOVE | -0.8 | KNEAD.BACHR3/1 | OK
**SWA662/B738** | KOAK/STNL.I.JFRYE3.KDAL | 0.2 | ANGST.BACHR3 | OK
**AAL1184/M82** | KDEN/GEEKY.BOOVE3.KDFW | 17.5 | MDANO.VKTRY1 | OK
**AAL2533/M82** | KFAT/GEEKY.BOOVE3.KDFW | -1.0 | BOOVE.BOOVE3/1 | OK
**AAL2402/A321** | KLAX/GEEKY.BOOVE3.KDFW | 0.0 | BOOVE.BOOVE3/1 | OK
**AAL606/A321** | KSAN/GEEKY.BOOVE3.KDFW | -0.9 | BOOVE.BOOVE3/1 | OK
**AAL1547/A321** | KLAS/GEEKY.BOOVE3.KDFW | 0.9 | BOOVE.BOOVE3/1 | OK
**AAL2207/A321** | KSFO/GEEKY.BOOVE3.KDFW | 2.3 | BOOVE.BOOVE3/1 | OK
**AAL2228/M83** | KSF/GEEKY.BOOVE3.KDFW | 1.6 | BOOVE.BOOVE3 | OK
**AAL2195/M83** | KTUS/GEEKY.BOOVE3.KDFW | -1.7 | BOOVE.BOOVE3/1 | OK
**ASQ789/CJR2** | KMAF/GEEKY.BOOVE3.KDFW | -6.1 | HNKER.VKTRY1 | ALT

**Grouped By Meter Fix**

**Individual Advisory**

**Group Advisory**

### 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: Alternate STAR
DRAW Trial Planning: Transition Fix
DRAW Trial Planning: Auxiliary Waypoint

[Diagram showing an auxiliary waypoint with instructions to click and drag]
DRAW Trial Planning: DRAW List Activation

DRAW List Activation (pre-defined route)
DRAW Trial Planning: Multi-flight Trial Planning
Questions

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