
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.
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

~90 min to Meter Fix

TRACON

Freeze Horizon (~20 min to Meter Fix)
Freeze Horizon

ATD-3 Integrated Concept

Current Flight Plan
Route

(20 min to MF)

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 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.
Freeze
Horizon
(20 min
to MF)

Current Flight Plan
Route

Suggested
eroute

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

TASAR - Flight-deck based
automated continuous searches
for efficient reroutes during flight
Traffic Aware Strategic Aircrew Requests (TASAR)

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

- Navigation Database
- Aircraft Performance
- Pilot Interface
- Optimization Engine
- Real-time Aircraft Data

Operational Outcomes

- Greater flight efficiency en route
- Increased ATC approval of requests

Tool leverages networked connectivity to real-time operational data

NASA Technology

Externally sourced data

Internally sourced data

Traffic
Weather
Airspace
Dispatch

Pilot

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 TMLs

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

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

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 s

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

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

Ground station
(AOC or ANSP)
• 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

Adjusted times of arrival and metering impact

Current scheduled times of arrival and delay

AC1
AC2
AC3
AC4
AC5

AC5
AC4
AC3
AC1

DRAW Efficient Reroute

Meter Fix 1

Meter Fix 2

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)
### DRAW Advisory List

**DRAW Status**
- **OK**: Weather Deviation Route
- **ALT**: Alternate STAR

<table>
<thead>
<tr>
<th>TL</th>
<th>TP</th>
<th>GP</th>
<th>ACID/TYPE</th>
<th>DEP/TRAN.STAR.DEST</th>
<th>SAV</th>
<th>TRANS.STAR/AUX</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>DEBBB</td>
<td>GREGS</td>
<td>KOAK/STNLI.JFRYE3.KDAL</td>
<td>0.1</td>
<td>GREGS.JFRYE3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>FEVER</td>
<td>BOOVE</td>
<td>KNEAD</td>
<td>-0.8</td>
<td>KNEAD.BACR3/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VRD878/A320</td>
<td>KLAX/BGTOE.BACR3.KDAL</td>
<td>-0.8</td>
<td>BOOVE.BOOSE3/1</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SWA290/B733</td>
<td>KMAF/BGTOE.BACR3.KDAL</td>
<td>0.2</td>
<td>ANGST.BACR3</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL1184/MD82</td>
<td>KDEN/GEEKY.BOOVE3.KDFW</td>
<td>17.5</td>
<td>MDANO.VKTRY1</td>
<td>ALT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL2533/MD82</td>
<td>KFAT/GEEKY.BOOVE3.KDFW</td>
<td>-1.0</td>
<td>BOOVE.BOOVE3/1</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL2402/A321</td>
<td>KLAX/GEEKY.BOOVE3.KDFW</td>
<td>0.0</td>
<td>BOOVE.BOOVE3/1</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL606/A321</td>
<td>KSAN/GEEKY.BOOVE3.KDFW</td>
<td>-0.9</td>
<td>BOOVE.BOOVE3/1</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL1547/A321</td>
<td>KLAS/GEEKY.BOOVE3.KDFW</td>
<td>0.9</td>
<td>BOOVE.BOOVE3/1</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL2207/A321</td>
<td>KSFO/GEEKY.BOOVE3.KDFW</td>
<td>2.3</td>
<td>BOOVE.BOOVE3/1</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL2228/MD83</td>
<td>KSMF/GEEKY.BOOVE3.KDFW</td>
<td>1.6</td>
<td>BOOVE.BOOVE3</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AAL2195/MD83</td>
<td>KTUS/GEEKY.BOOVE3.KDFW</td>
<td>-1.7</td>
<td>BOOVE.BOOVE3/1</td>
<td>OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ASQ789/CRJ2</td>
<td>KMAF/GEEKY.BOOVE3.KDFW</td>
<td>-6.1</td>
<td>HNKER.VKTRY1</td>
<td>ALT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KARLA</td>
<td>BRDJE</td>
<td>SASIE</td>
<td>FINGR</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HOWDY</td>
<td>DODJE</td>
<td>ORVLL</td>
<td>YEAGR</td>
<td></td>
</tr>
</tbody>
</table>

**Grouped By Meter Fix**

**Grouped**

**Individual Advisory**

- DEBBB | GREGS
- FEVER | BOOVE | KNEAD
- VRD878/A320
- SWA290/B733
- AAL1184/MD82
- AAL2533/MD82
- AAL2402/A321
- AAL606/A321
- AAL1547/A321
- AAL2207/A321
- AAL2228/MD83
- AAL2195/MD83
- ASQ789/CRJ2
- KARLA | BRDJE | SASIE | FINGR
- HOWDY | DODJE | ORVLL | YEAGR
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: Transition Fix
DRAW Trial Planning: Auxiliary Waypoint

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

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

Chester.Gong@nasa.gov