

Airspace Technology Demonstration 3 (ATD-3): Applied Traffic Flow Management

Project Overview

August 31, 2016

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NASA Ames Research Center

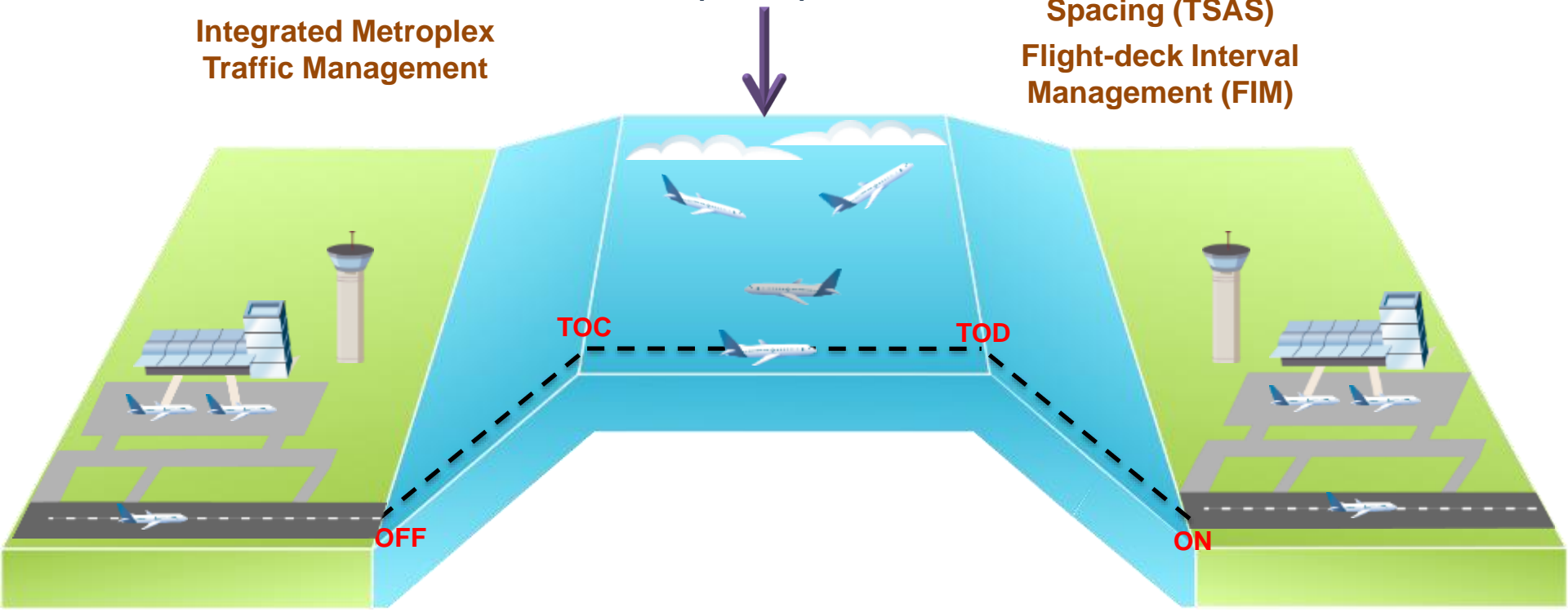
ATD-3 Scope



ATD-2
Integrated Metroplex
Traffic Management

ATD-3
Applied Traffic
Flow Management
(ATFM)

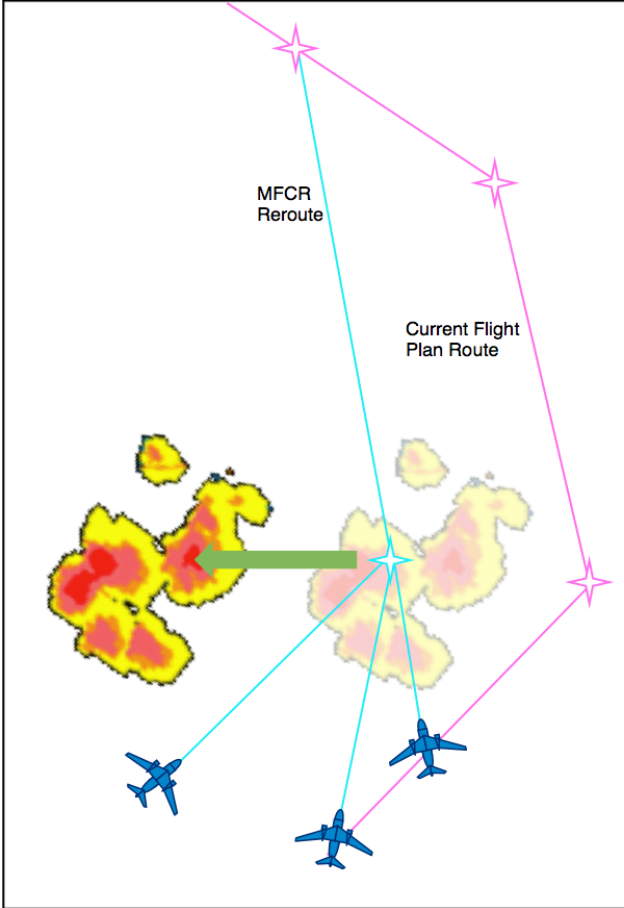
ATD-1
Terminal Sequencing and
Spacing (TSAS)
Flight-deck Interval
Management (FIM)



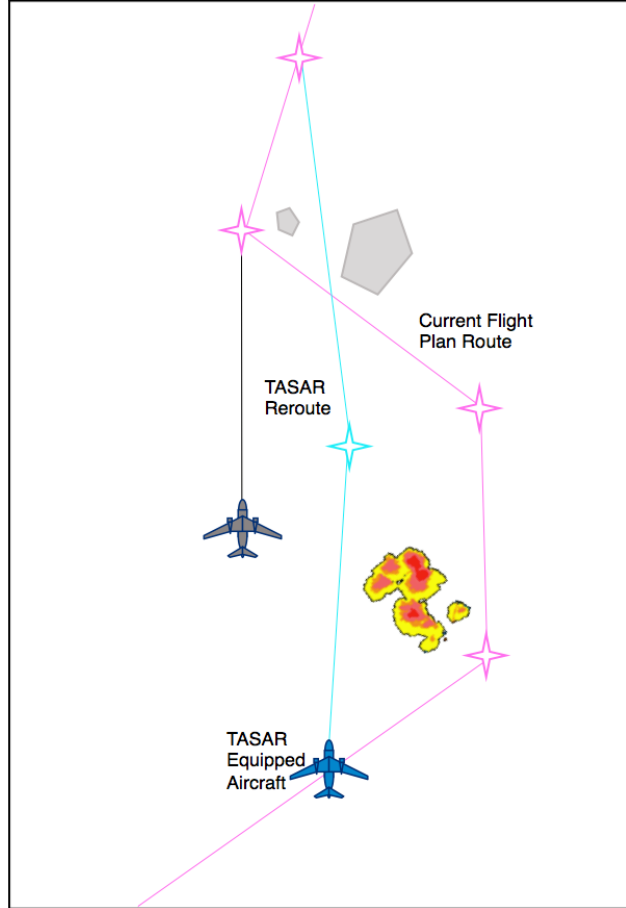
TOC - Top of Climb
TOD - Top of Descent

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.

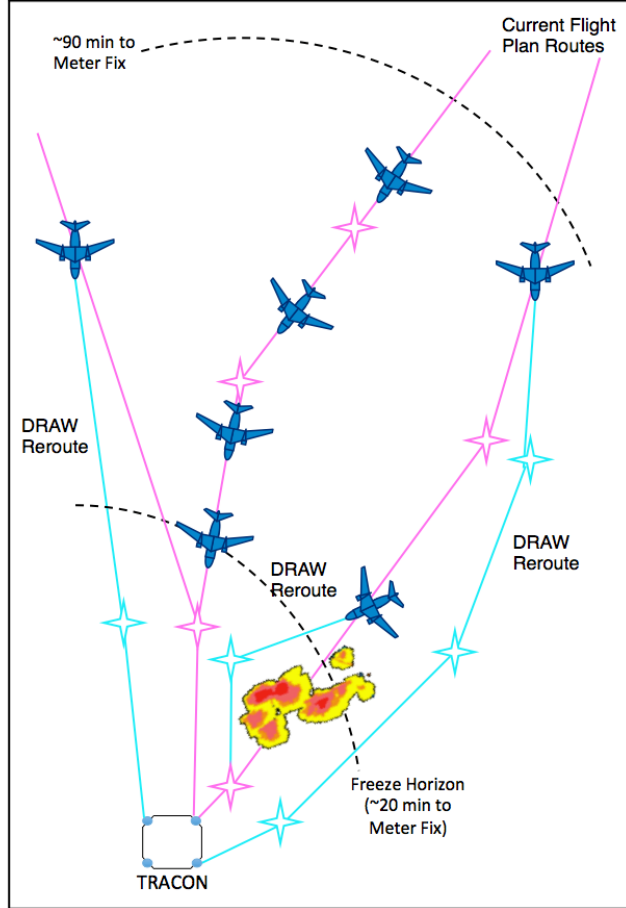
Multi-Flight Common Route (MFCR):
Automated search for efficient high value reroutes for individual flights and common reroutes for multiple flights - delay recovery from stale TMLs.



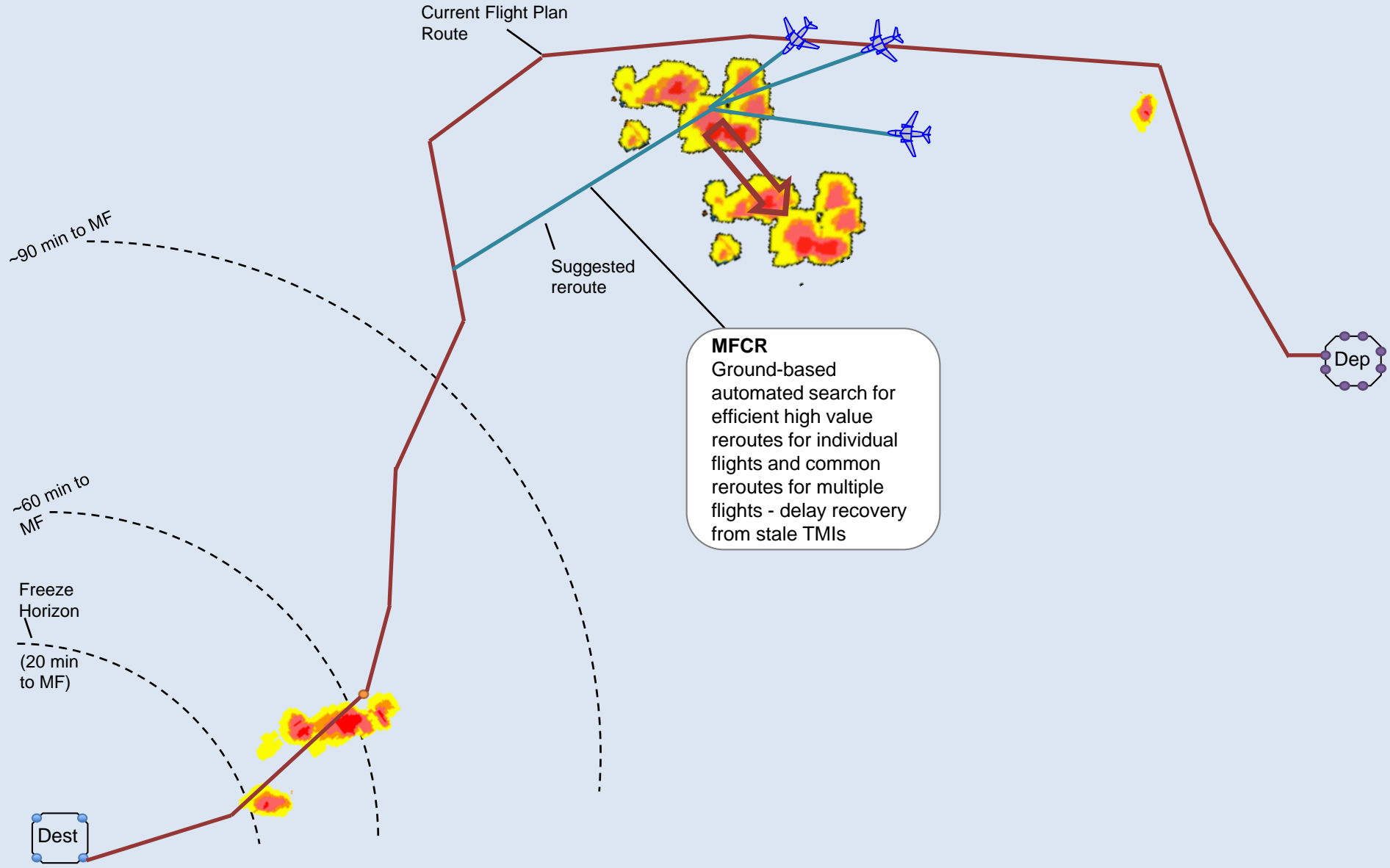
Traffic Aware Strategic Aircrew Requests (TASAR):
Airborne automated continuous searching for efficient reroutes that reduce fuel and/or flight time, avoid interactions with traffic, weather and restricted airspace.



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



Future ATM Concepts Evaluation Tool (FACET)

Animation Simulation Airspace Aircraft Applications Help

Status: Paused Number Flying: 4959 10/2/2014 14:45:00 UTC

Active Flight Plan

File Options Display

UAL581

Congestion on Flight Plan

Status: Flying Type: A319 Speed: 482 FL: 350 Cruise FL: 350 Heading: 131

Nominal 02:48:40 1329 nms 12448 lb KDEN./GCK244086..BYP..LIT..PXV..IIU

Trial Flight Plan

File Options Display

UAL581 (trial)

Congestion on MFCR Route

Status: Flying Type: A319 Speed: 482 FL: 350 Cruise FL: 350 Heading: 131

Nominal 02:29:50 1187 nms 10953 lb KDEN./GCK215068.GCK187078.ESOV

NASCENT Data (13)

Show results: 15 minutes Add'l Filters Flight List Auto-zoom

Select	ACID/Type	Region	Direct	NAS...	Orig/Dest	Capture Fix	Time	SC	TMI	SU
<input type="checkbox"/>	ASQ2556/CRJ2	KZKC_DAY	21.5	21.5	KDFW/KMLI	IOW	14:45	N	R	N
<input checked="" type="checkbox"/>	UAL581/A319	KZKC_DAY	19.7	16.9	KDEN/KIAD	IIU	14:45	N	R	N
<input type="checkbox"/>	DAL773/B763	KZME_DAY	13.4	12.8	KATL/KPDX	LBL	14:45	N	R	N
<input type="checkbox"/>	SWA2784/B737	KZMP_DAY	8.8	8.8	KPHL/KDEN	SNY	14:45	R	R	N
<input type="checkbox"/>	UAL1643/B752	KZMP_DAY	8.1	8.1	KEWR/KDEN	SNY	14:45	R	R	N
<input type="checkbox"/>	SWA4819/B737	KZME_DAY	7.8	7.8	KHOU/KMDW	OKK	14:45	N	R	N
<input type="checkbox"/>	CHQ6367/E145	KZME_DAY	7.3	7.3	KMEM/KORD	FWA	14:45	N	R	N
<input type="checkbox"/>	SWA574/B737	KZFW_DAY	6.8	6.8	KATL/KDEN	HALEN	14:45	Y	N	N
<input type="checkbox"/>	ASQ6095/E45X	KZFW_DAY	5.5	5.9	KLIT/KDEN	LAA	14:45	Y	N	N
<input type="checkbox"/>	ENY3638/E145	KZKC_DAY	22.7	5.5	KDFW/KCID	IOW	14:45	N	R	N
<input type="checkbox"/>	UAL1163/B739	KZDV_DAY_M	5.1	5.1	KLAS/KORD	MCW	14:45	N	R	N

NASCENT Detailed Results for UAL581

Display routes Display alternative routes Display waypoints

None All 3 letter 5 letter FRDs Others Orig/Dest

Select Capture Fix: Current Data (14:45)

Fix: ACID/Type: UAL581/A319

BYP: 0.3 FL: 350/350

LIT: 7.5 Groundspeed: 482

PXV: 19.7

IIU: 19.7

DACOS: 19.7

MVO: 10.7

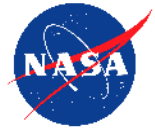
TEST

Savings: 19.7

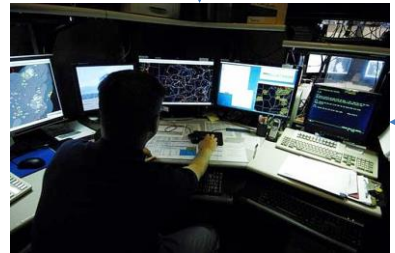
Savings: 16.9

Original FP	KDEN./GCK244086..BYP..LIT..PXV..IIU.J78.HVQ.GIBBZ2.KIAD/1748
Reference FP	KDEN./GCK215068.GCK187078.IIU.J78.HVQ.GIBBZ2.KIAD/1748
NASCENT FP	KDEN./GCK215068.GCK187078.ESOV.IIU.J78.HVQ.GIBBZ2.KIAD/1748

MFCR Architecture Diagram



Dispatch or Traffic Management Coordinator



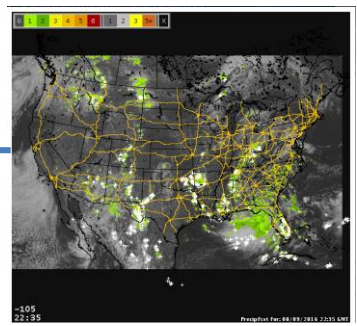
AOC or ARTCC

MFCR

AC/Type	Route	Alt	Speed	FL	CRUISE	FL	CRUISE	FL	CRUISE	FL	CRUISE
UA1581	MDW-DEN	310	482	FL 350	CRUISE	FL 350	CRUISE	FL 350	CRUISE	FL 350	CRUISE
UA1581	DEN-MDW	310	482	FL 350	CRUISE	FL 350	CRUISE	FL 350	CRUISE	FL 350	CRUISE



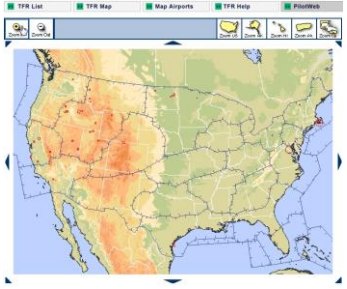
Rapid Refresh Wind Model (NOAA)



CIWS



TFM Data (via SWIM)

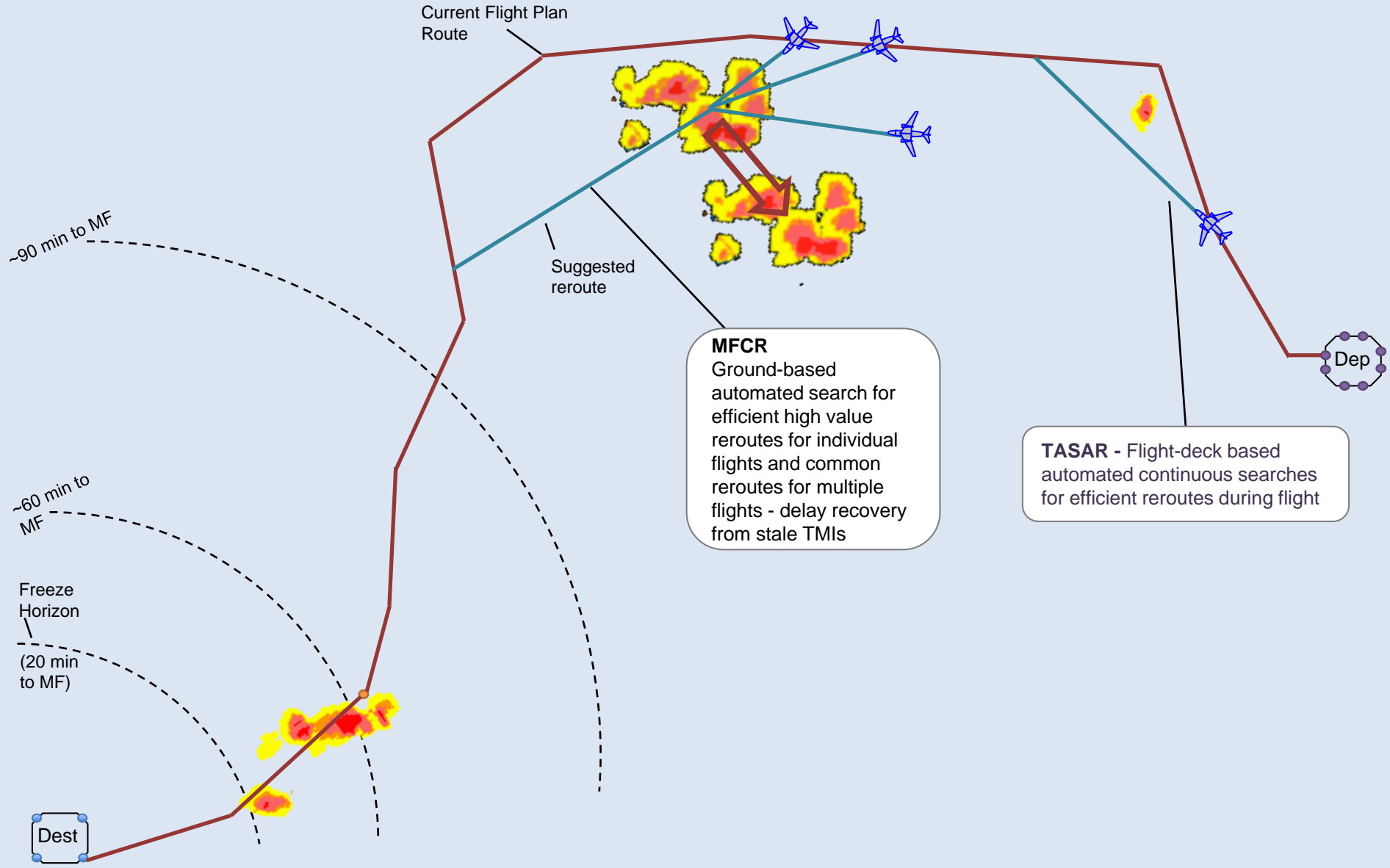


TFR System (FAA)



SUA System (FAA)

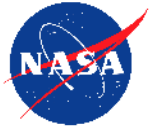
ATD-3 Integrated Concept



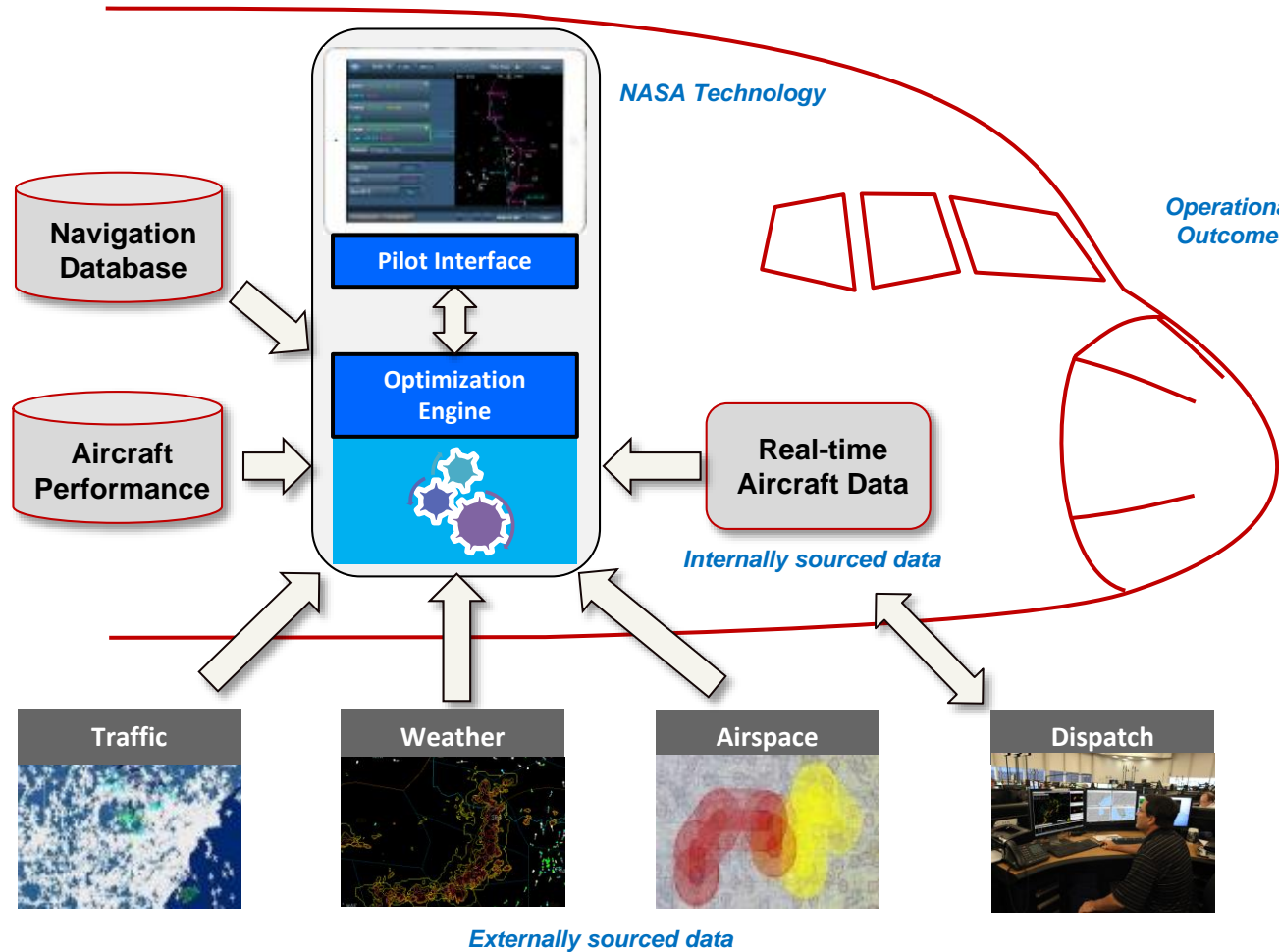
The screenshot displays the TASAR User Interface with the following components:

- Top Bar:** Includes a NASA logo, a 'Cruise' status indicator (green dot), and input fields for 'FL300' and 'M0.76'. On the right, there are 'Data Feeds' (yellow dot) and 'Auto' (dropdown arrow) buttons.
- Left Panel (Flight Data):**
 - Lateral:** 1937 lbs, 16m 10s. Includes a green status indicator and the text 'WAAHU NASSH'.
 - Vertical:** 2511 lbs, (5m 26s). Includes a green status indicator and the text 'FL340'.
 - Combo:** 4272 lbs, 11m 4s. This section is highlighted with a green border and includes a 'Preview' button. The text 'FL340 / PROTN NASSH' is displayed.
 - Message:** Processing...(60%)
 - Objective:** Fuel
 - Limit:** NASSH
 - Max WPTS:** Two
- Map (Right Panel):**
 - Header: RNG: 1120, TRK 283, MAG
 - Route: A pink line with star markers connects waypoints: NASSH, MEVDY, JUBDI, AHYOB, DOGGS, and ODLOE.
 - Waypoint: PROTN is marked with a cyan star.
 - Altitude: A cyan box labeled 'ALT FL340' is positioned near the ODLOE waypoint.
 - Background: A dark map showing terrain and other flight paths.
- Bottom Bar:**
 - Buttons: 'ATC Approved', 'ATC Denied', and navigation icons.
 - Winds: 'Winds FL 300' with a dropdown arrow.
 - Layers: 'Layers' with a dropdown arrow.

Traffic Aware Strategic Aircrew Requests (TASAR)



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



Greater flight efficiency en route



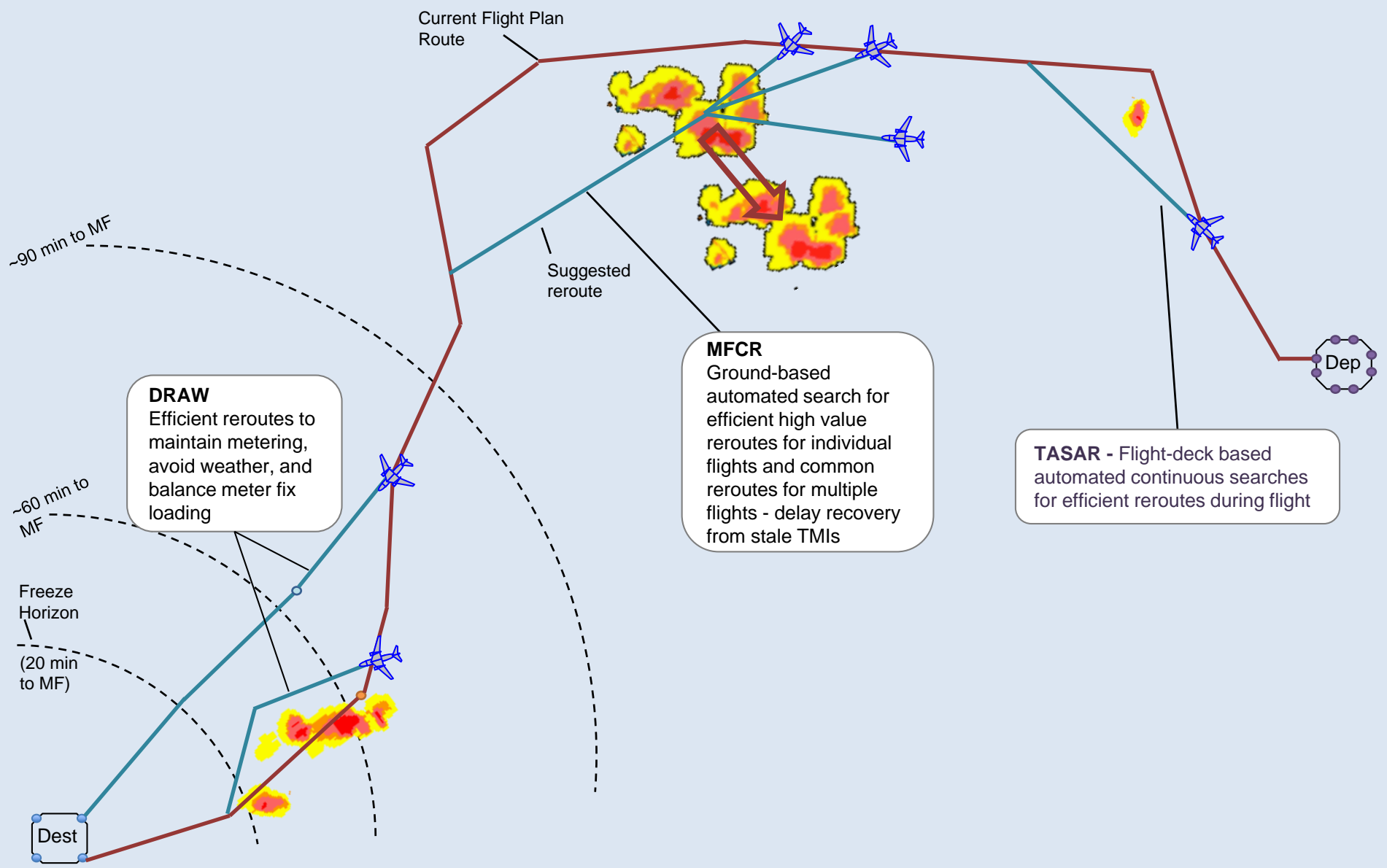
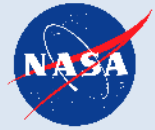
Crew Request ↔ ATC Response



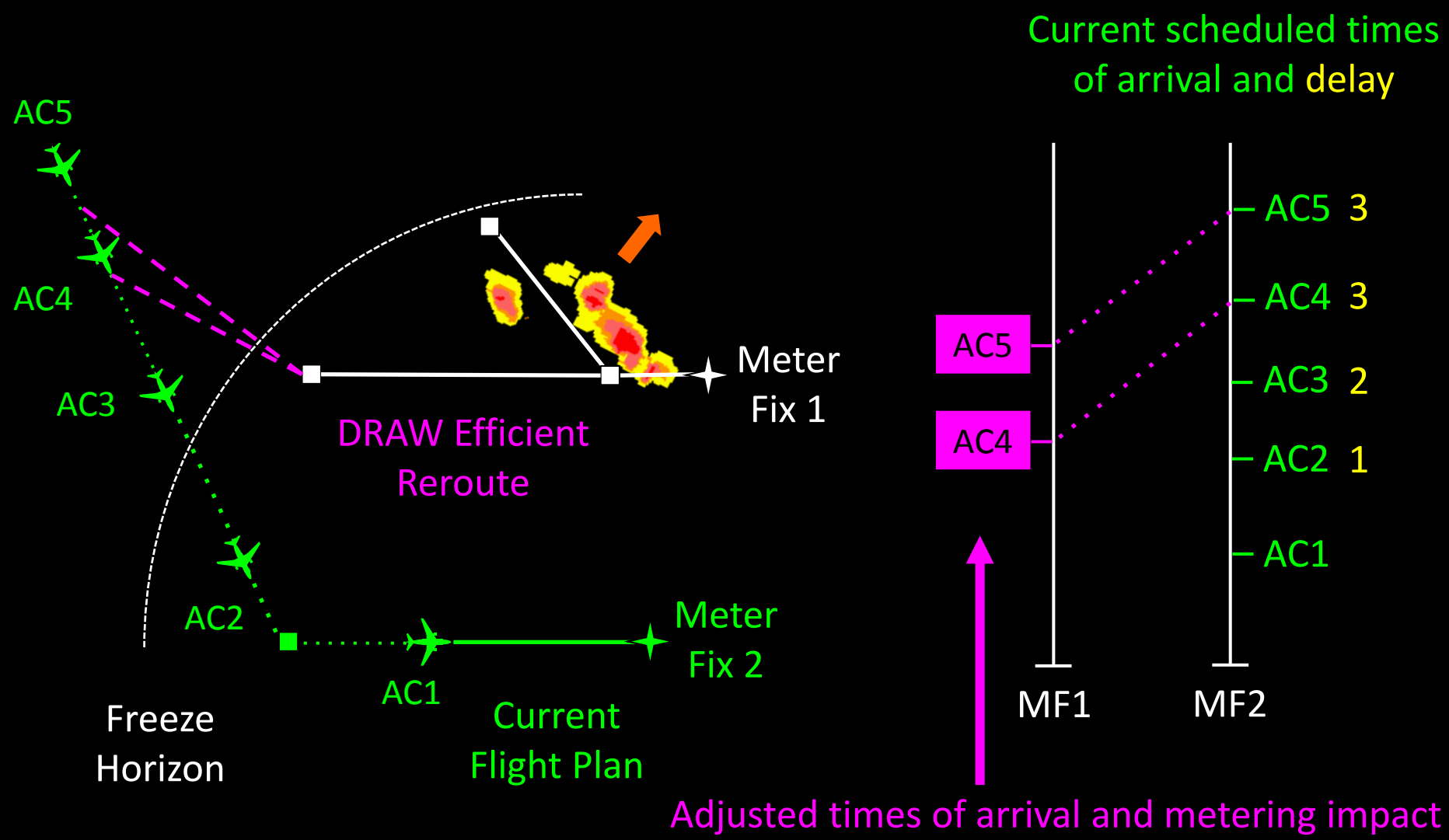
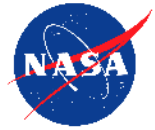
Increased ATC approval of requests

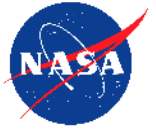
Tool leverages networked connectivity to real-time operational data

ATD-3 Integrated Concept

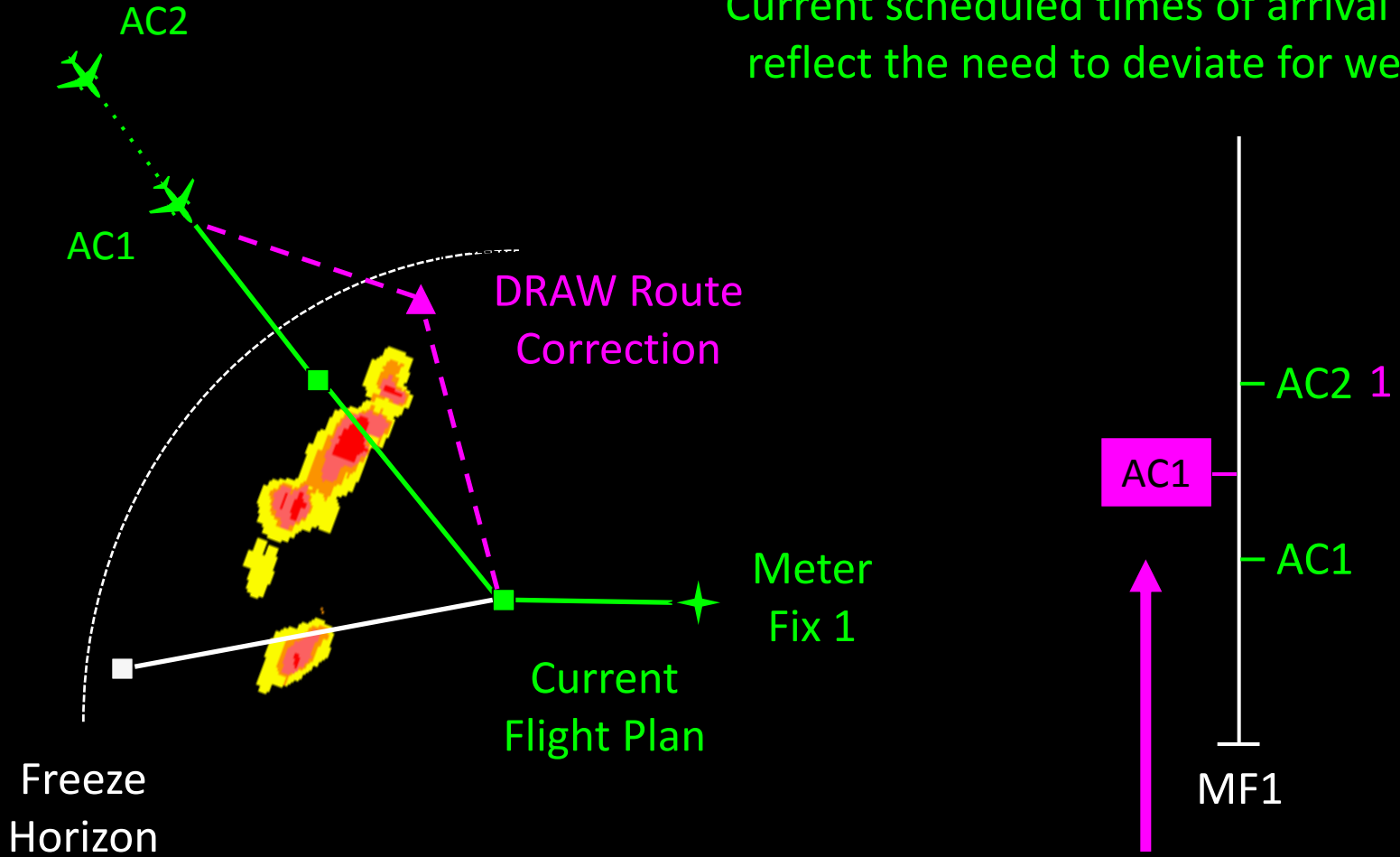


DRAW – Time-Saving Reroutes to Alternate Meter Fix



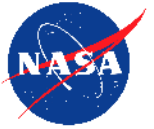


Current scheduled times of arrival do not reflect the need to deviate for weather



Adjusted time of arrival and delay

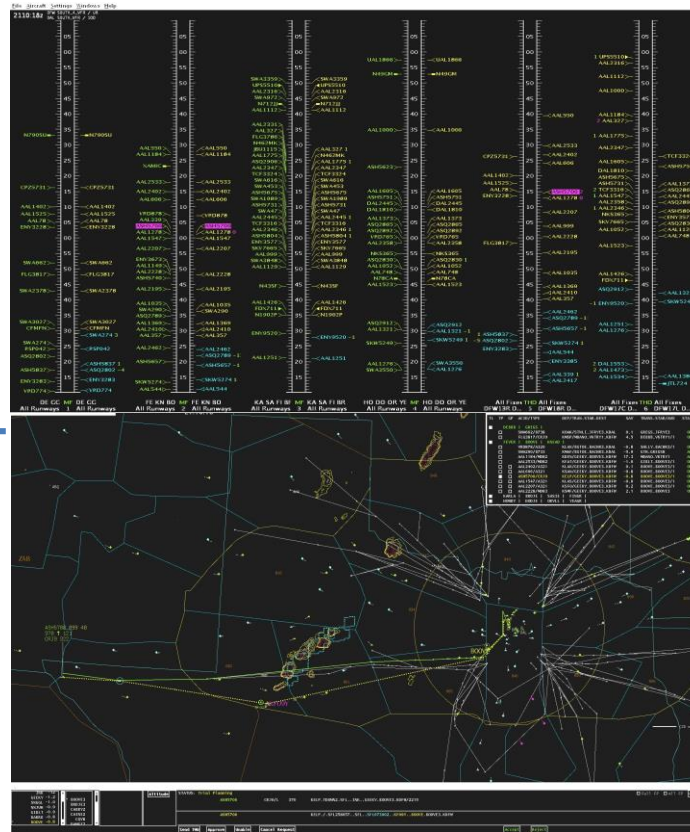
DRAW Architecture Diagram



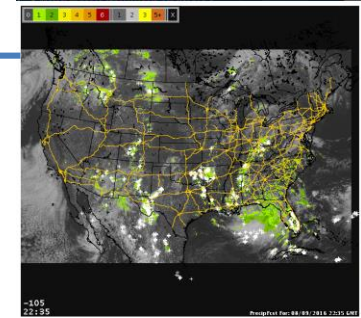
Traffic Management Coordinator
In ARTCC



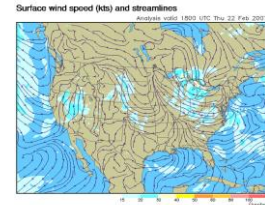
Traffic Management Unit
In ARTCC



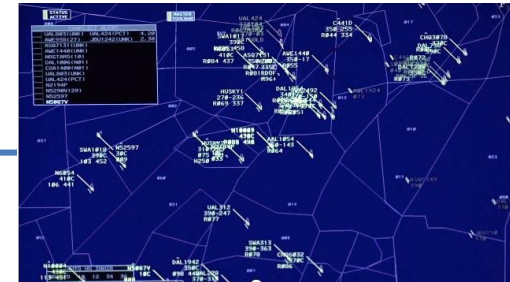
DRAW



CIWS

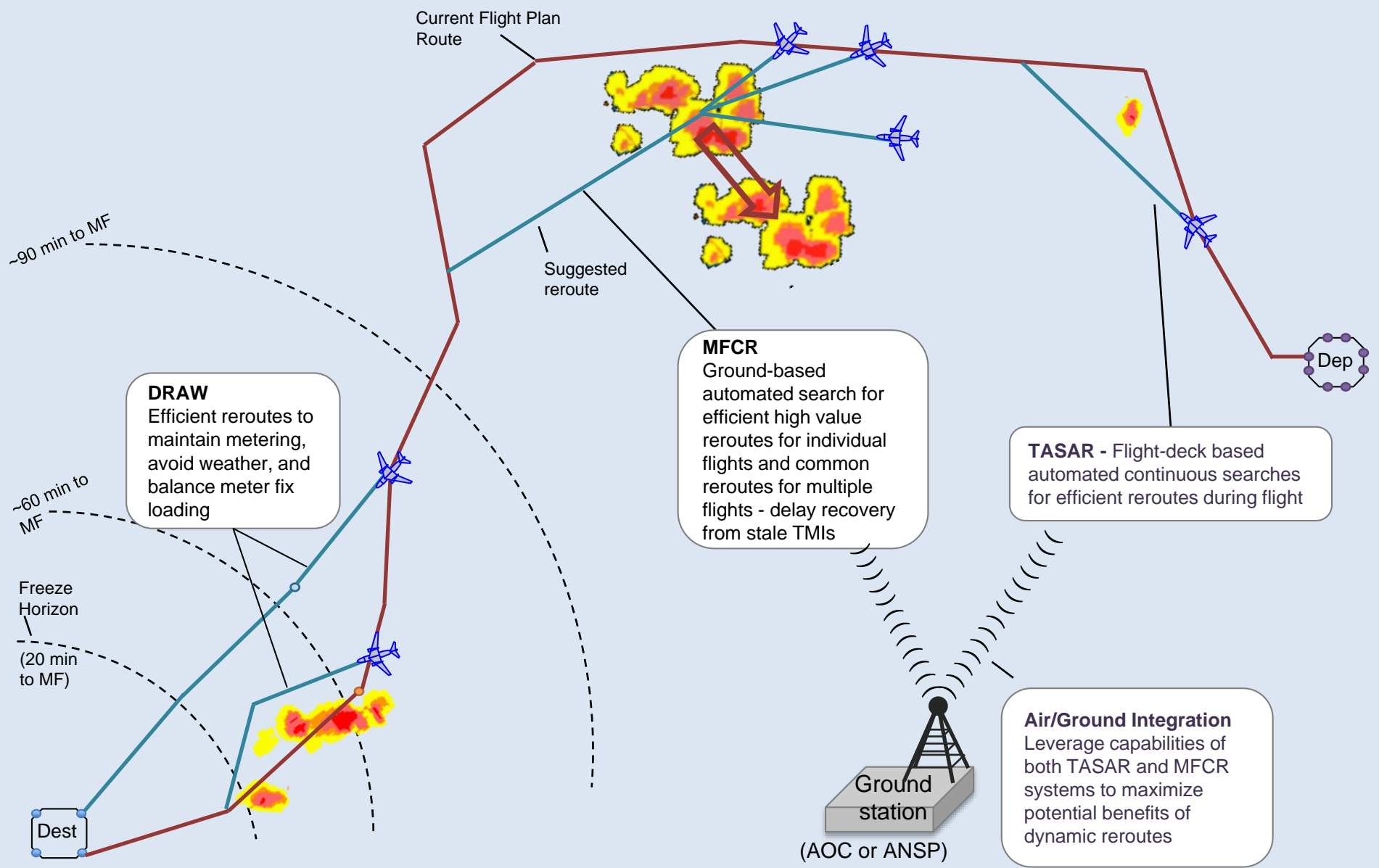


Rapid Refresh Wind Model (NOAA)



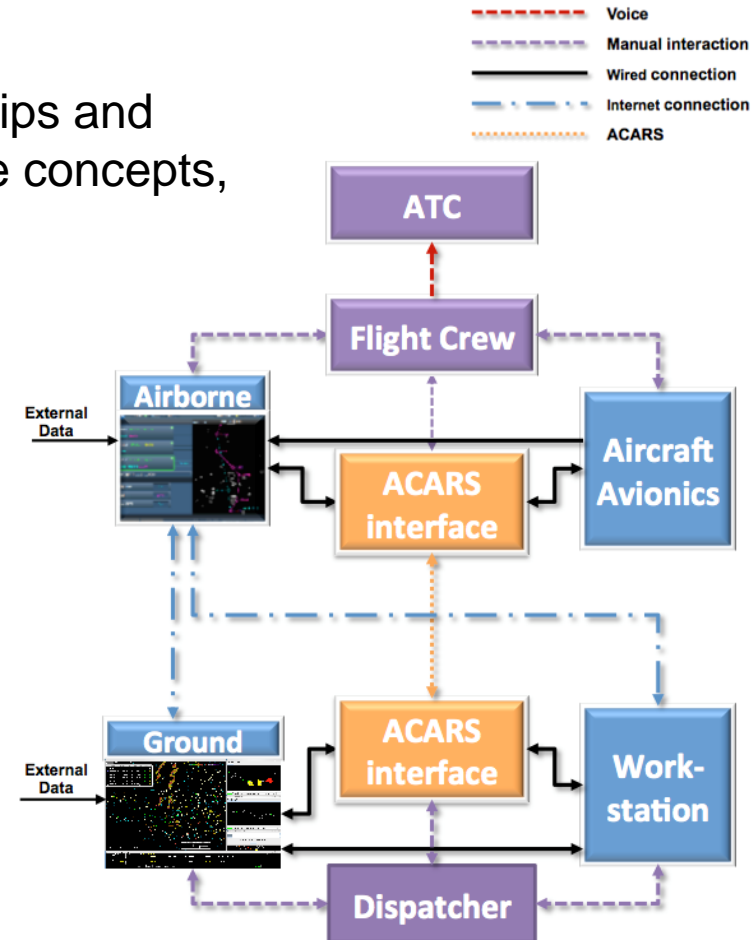
ERAM

ATD-3 Integrated Concept



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



DRAW System Demonstration