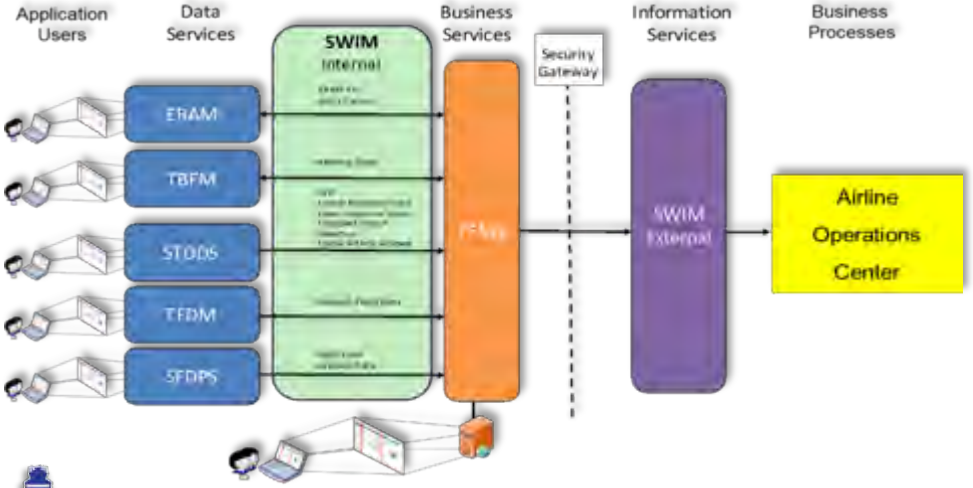
SWIFT: SWIM Industry-FAA Team

SWIFT #20 Collaboration Workshop

Date: 03/23/23

SWIFT: The Intersection of Operations, Technology & Data

- SWIFT addresses industry recommendation to:
  - A community forum that acts as a clearinghouse for collaborative engagement around NAS information and data sharing
  - **Educate**: Synchronize community on information services
  - **Collaborate**: Discuss issues most relevant to community
  - **Communicate**: Inform community about SWIM & NAS programs



The SWIFT Flight Plan…

2023

- Back to Basics: “Right” access, to the “right” SWIM information service for strategic planning
- More Responsive: Focus Groups to address specific ad-hoc Ops issues where data can help
- More Focused: Shift in-person events to Ad-hoc FG activities & report out at SWIFT events

2020-2022

- Worked with NAS Programs & FAA Initiatives
- Industry partnership: flight planning, flow data
- Widget Case Studies: “Art of Possible” in Data
- Applying SWIM information services to support NAS Ops issues (Early Disruptions)

2018-2019

- SWIM awareness, connectivity & data access
- Understanding SWIM data & NAS ops context
- Partnered with TFDM, AIM on new services
- Develop & review case studies

FAA Collaborative Workshop #20

- **Welcome and Introductions:**
  - Introductions: David Almeida – LST
  - Opening remarks: Rebecca Guy – FAA

- **Special Topic: FF-ICE & Flight Planning**
  - NAS Producer Program: CSS-FD Program Update: Lucas Curns – FAA
  - FF-ICE in Europe & Impact to Stakeholders: Magnus Molbaek – SESAR
  - CSS-FD Risk Reduction Update and Conclusions: Cora Buck – FAA

- **NOTAM Update:** Vinod Vallikat & Melissa Matthews – AIM Program Office (FAA)

- **Special Topic: Flight Planning & Flight Information**
  - Widget Case Study: Wind Optimal Flight Planning: Greg Feldman – Cavan Solutions
  - Widget Case Study: North Atlantic Flight Planning: Bernard Gonsalves – FliteX

- **Focus Group Updates**
  - Ops Issues & Developers & Analytics Focus Groups: Xavier Pratt – LST
  - Ad Hoc Focus Group: Initial Discussion on Flight Data & TBO: John Kelley & Mark Hopkins – LST
  - Early Planning for Disruption Demo & Close Out: Nguyen "Dao" Vu – LST

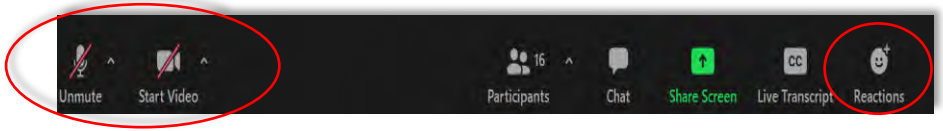
- **SWIFT & SWIM Topics: AES Update and the Developers Workshop**
  - SWIM Message Compression & Service Access Agreements: Kevin Dement - Noblis
  - Information Services Roadmap & Ops Context Document Updates: Xavier Pratt – LST

“Airwave Procedures”

- Please note during the session all attendees will have full control… “Hot Mics” and cameras.

- Please be mindful and mute when not interacting during the presentation.

Zoom Controls: Mic and Camera identified via red circles



- The “Chat & Raise Hand ” features will also be available.
  - During the presentations to ensure you are recognized for an opportunity to voice comments /questions please leverage the “raise hand” feature found under reactions.

SWIFT Stakeholders

General Announcements

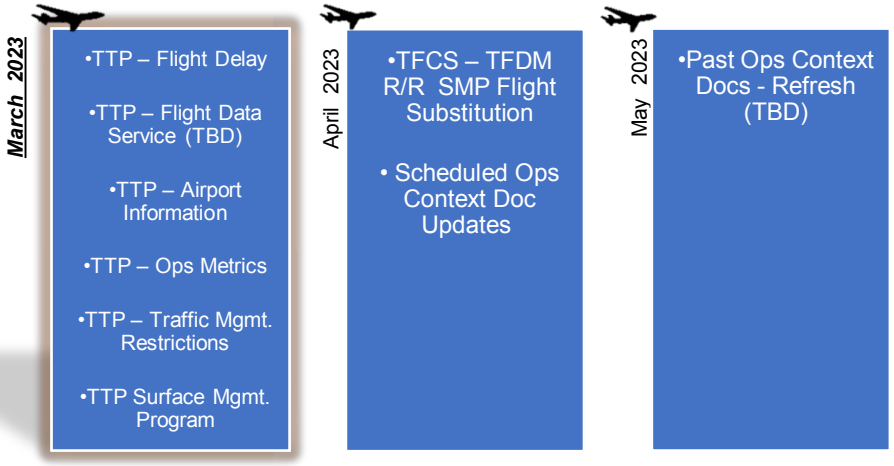
SWIFT 20 Update

Date: March 23, 2023

TFMS Monthly Technical Webinar

- Reminder the next TFMS meeting will be held on **April 13th at 1pm E.T.**
- TFMData R13 is retiring March 31 ,2023
- R15 Patch 2 Deployment Tentatively Scheduled March 25, 2023
- For questions or more information on the webinar please reach out to Thomas Paccione @ thomas.ctr.paccione@faa.gov

Ops Context Document Updates



- **Planned refresh of previous Ops Context Docs**
  - SFDPS: ERADP, ERFDP
  - TFMData Flight, Flow, TFMS R/R
  - STDDS: ADPS, TDES, SMES, TAIS
  - And more...
- **Release schedule coming coon!**
- **Past documents available on NSRR site: https://nsrr.faa.gov/**

Contact Us:

Xavier.Pratt@lstechllc.com

Ray.Mitchell@lstechllc.com

Common Support Services Flight Data (CSS-FD)

Update

Presented to: SWIFT

By: Lucas Curns

Date: March 23, 2023

Federal Aviation Administration

Agenda

- **Flight & Flow Information for a Collaborative Environment (FF-ICE) Overview and Implementation Guidance**

- **Common Support Services – Flight Data (CSS-FD) Overview**

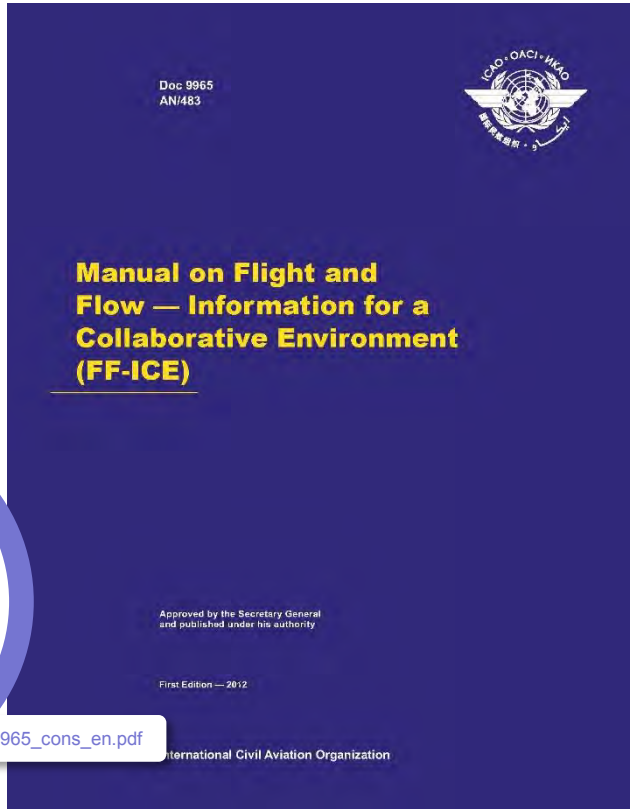
Overview of FF-ICE

- A concept developed by the International Civil Aviation Organization (ICAO), documented in ICAO Doc. 9965 (Volume I) with an applicability date of November 28, 2024
- Addresses information for flow management, flight planning, and trajectory management associated with ATM operational components.
    - It starts with the early submission of flight information by the airspace users to the ATM system and ends with archiving the relevant information after the flight.
    - It concentrates on global needs for sharing flight information but also accommodates regional and local needs.
- The plan for FF-ICE implementation introduces capabilities incrementally
    - FF-ICE Release 1 (FF-ICE/R1) involves planning prior to a flight's departure and introduces several services.
    - FF-ICE Release 2 (FF-ICE/R2) focuses on active flight and the negotiation, creation, management, and delivery of a flight's Agreed Trajectory.

ICAO FF-ICE Implementation Guidance

- **FF-ICE/R1 refers to the pre-departure planning increment of FF-ICE prior to the engagement or involvement of ATC.**
- **FF-ICE/R1 focuses on ground-ground exchanges using a common, global information exchange model, FIXM.**

https://www.icao.int/Meetings/anconf12/Documents/9965_cons_en.pdf



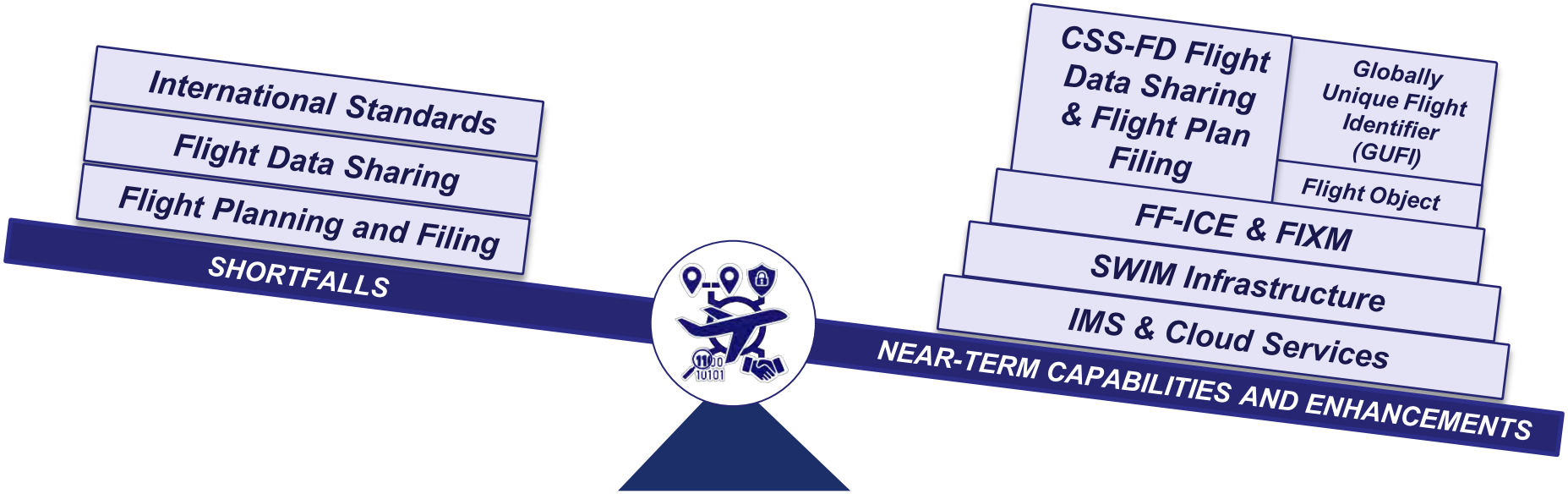
CSS-FD Overview

CSS-FD is the service that will deliver modern flight information management and facilitate the transition to the new FF-ICE information exchange environment

- Establishes standards-based flight planning and filing environment
- Allows for early constraint evaluation and flight specific feedback through trial requests and preliminary flight plans
- Provides single common reference for flight data sharing and management
- Supports international data exchange standards
- Enhances collaborative decision making

CSS-FD Overview Cont…

CSS-FD will leverage current and near-term capabilities and enhancements in order to address shortfalls in flight data exchanges



CSS-FD Phase 1 Capabilities

Phase 1

1. Flight Data Sharing (Data Management & Security Framework)
2. Flight Planning and Flight Plan Filing
3. Feedback by Reference
4. Return ATC Preferences

Phase 2

Focus on Preliminary Flight Planning, management, and additional, expanded integration with other systems (e.g., TFMS/FMDS)

Phase 1 Capabilities Descriptions

Capability 1: Data Management & Security Framework

- Data publication, conversion, matching, reconciliation, and reconstitution
- Data security and access control

Capability 2: Flight Planning and Flight Plan Filing

- File and update the associated Flight Plans with ATC automation
- Receive and respond to trial requests and flight information requests

Capability 3: Feedback by Reference

- Provide feedback by referencing constraints

Capability 4: Return ATC Preferences

- Provide ATC assigned routes and pref routes

CSS-FD Updates Since Last SWIFT Meeting

- Wrapping up Risk Reduction Activity (RRA)
- Coordinating with EUROCONTROL and other international partners to ensure that FF-ICE implementations across the globe are interoperable
  - Working directly with EUROCONTROL as part of the FAA/EC DCOM
- Initiating phase 1 final investment & planning activities
  - Further details on the FAA's FF-ICE implementation will be shared at a later SWIFT
  - We are analyzing the lessons learned to be incorporated into our CSS-FD investment in order to reduce any uncertainties that we may have.
- Our partners in NextGen are conducting an engineering analysis to assess scope/functionality to include in phase 2
- Planning for CSS-FD related engagement with SWIFT to ensure common understanding of impacts, benefits and opportunities that CSS-FD will bring

CSS-FD MS Teams Channel

- **CSS-FD MS Teams channel is being stood up. For those that want to be added to the list, please send an email to Xavier Pratt: xavier.pratt@lstechllc.com**
- **Site will be used for:**
  - Announcements and News Feed
  - Document Sharing (background, technical, presentations and meeting minutes)
  - Polls, Surveys and Lessons Learned
  - Industry Feedback and Community Supporting Documentation

Contact

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FF-ICE R1 Mandate

SWIFT 20

Date: March 23, 2023

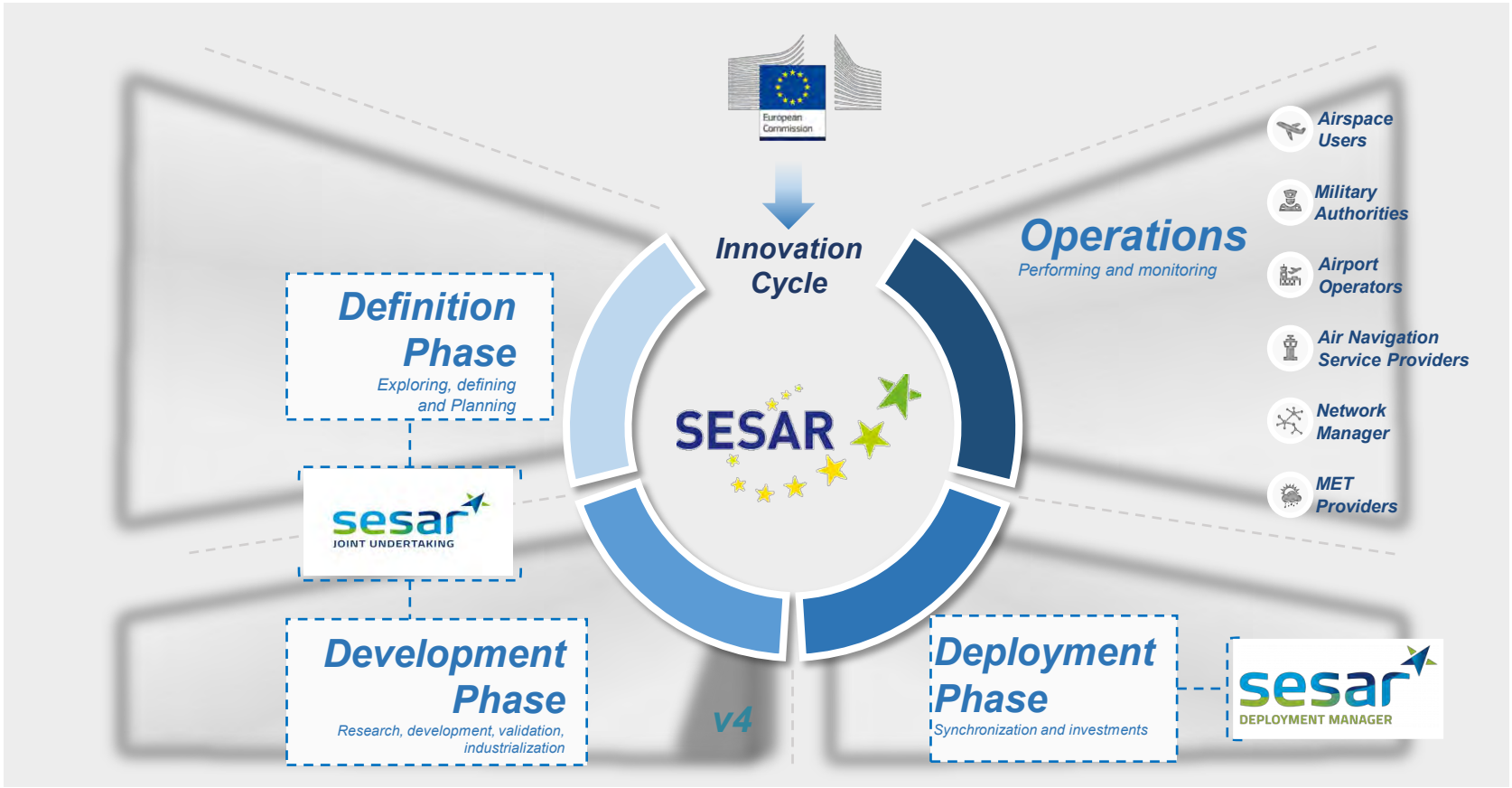
Presented by: Magnus Molbaek - SESAR Deployment Manager

Understanding Europe

Regulatory framework

- 41 Eurocontrol Member States
- 27 Countries in EU
- 10,8 million km2 Airspace
- +60 area Control centres (ACCs)

Single European Sky – Regulatory Framework



Regulatory framework

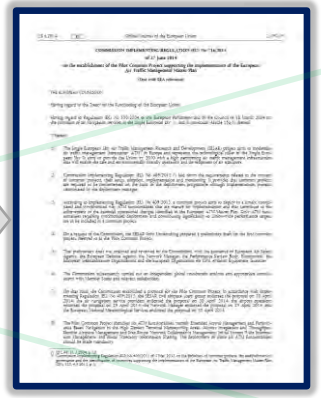
Developed and consulted by all stakeholders

ATM MASTER PLAN

Vision for EU Digital Sky

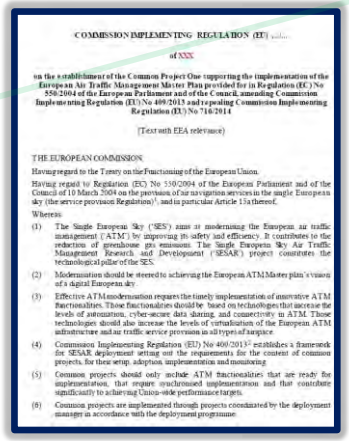
Essential Operational Changes

PILOT COMMON PROJECT REG. (EU) N.716/2014



2014-2021

COMMON PROJECT ONE REG. (EU) N.116/2021



COMMISSION IMPLEMENTING REGULATION (EU)

of XXX

on the establishment of the Common Project One supporting the implementation of the European Air Traffic Management Master Plan provided for in Regulation (EC) No 550/2004 of the European Parliament and of the Council, amending Commission Implementing Regulation (EU) No 409/2013 and repealing Commission Implementing Regulation (EU) No 716/2014

(Text with EEA relevance)

THE EUROPEAN COMMISSION

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 550/2004 of the European Parliament and of the Council of 10 March 2004 on the provision of air navigation services in the single European sky (the service provision Regulation)[1], and in particular Article 15a thereof,

Whereas:

(1) The Single European Sky ('SES') aims at modernising the European air traffic management ('ATM') by improving its safety and efficiency. It contributes to the reduction of greenhouse gas emissions. The Single European Sky Air Traffic Management Research and Development ('SESAR') project constitutes the technological pillar of the SES.

(2) Modernisation should be steered to achieving the European ATM Master plan's vision of a digital European sky.

(3) Effective ATM modernisation requires the timely implementation of innovative ATM functionalities. Those functionalities should be based on technologies that increase the levels of automation, cyber-secure data sharing and connectivity in ATM. Those technologies should also increase the levels of virtualisation of the European ATM infrastructure and air traffic service provision in all types of airspace.

(4) Commission Implementing Regulation (EU) No 409/2013[2] establishes a framework for SESAR deployment setting out the requirements for the content of common projects, for their setup, adoption, implementation and monitoring.

(5) Common projects should only include ATM functionalities that are ready for implementation, that require synchronised implementation and that contribute significantly to achieving Union-wide performance targets.

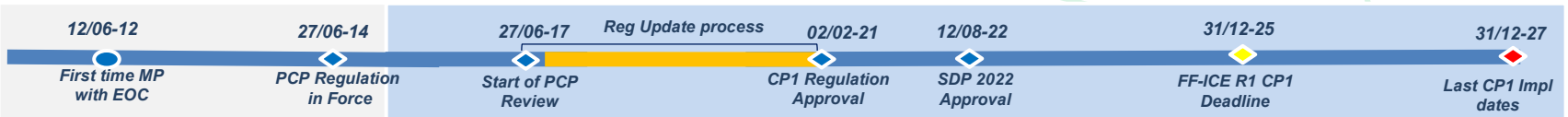
(6) Common projects are implemented through projects coordinated by the deployment manager in accordance with the deployment programme.

2021-2027

SESAR DEPLOYMENT PROGRAMME

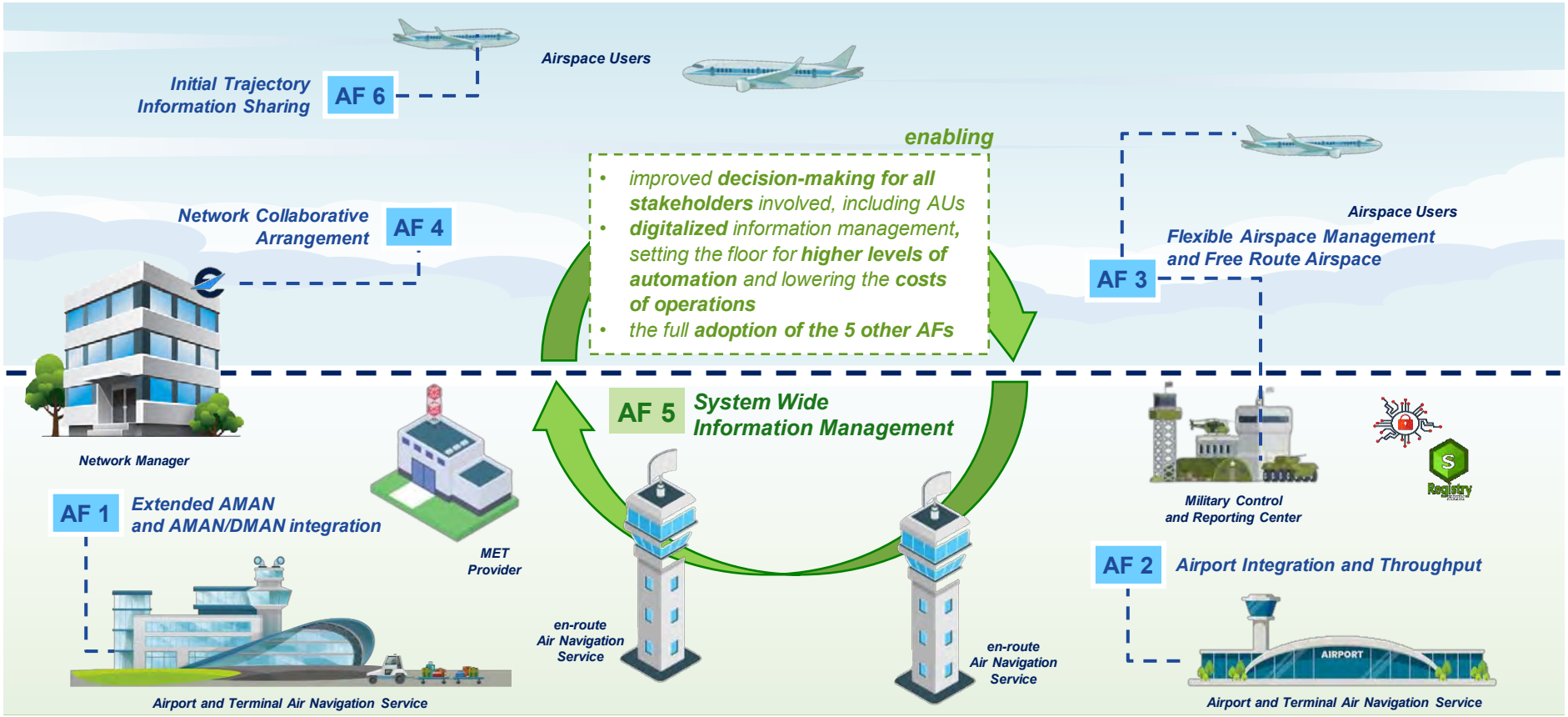
Workplan for CP1 Deployment

Framework for SESAR Deployment



AF 5 – SWIM

Overview of the ATM functionality



ICAO Vs Europe

FF-ICE Release 1 in ICAO

FF-ICE R1 services

Planning Service (Optional)	*Filing Service (Mandatory)*
Trial Service (Optional)	*Flight Data request service (Mandatory)*
Data publication Service (Optional)	*Notification Service (Optional)*

Recommendations

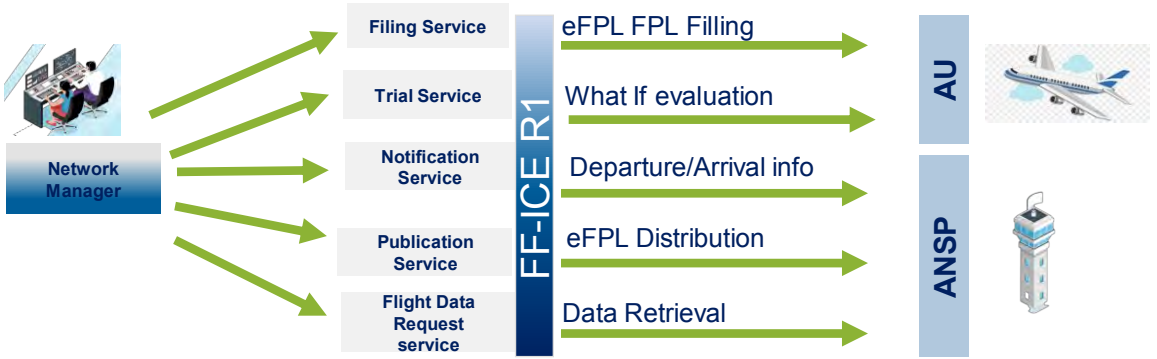
FF-ICE Release 1 in Europe

- *Trial Service* ✓
- *Notification Service* ✓
- *Publication Service* ✓
- *Flight Data Request Service* ✓

Mandatory

FF-ICE Release 1 Services mandated in Europe

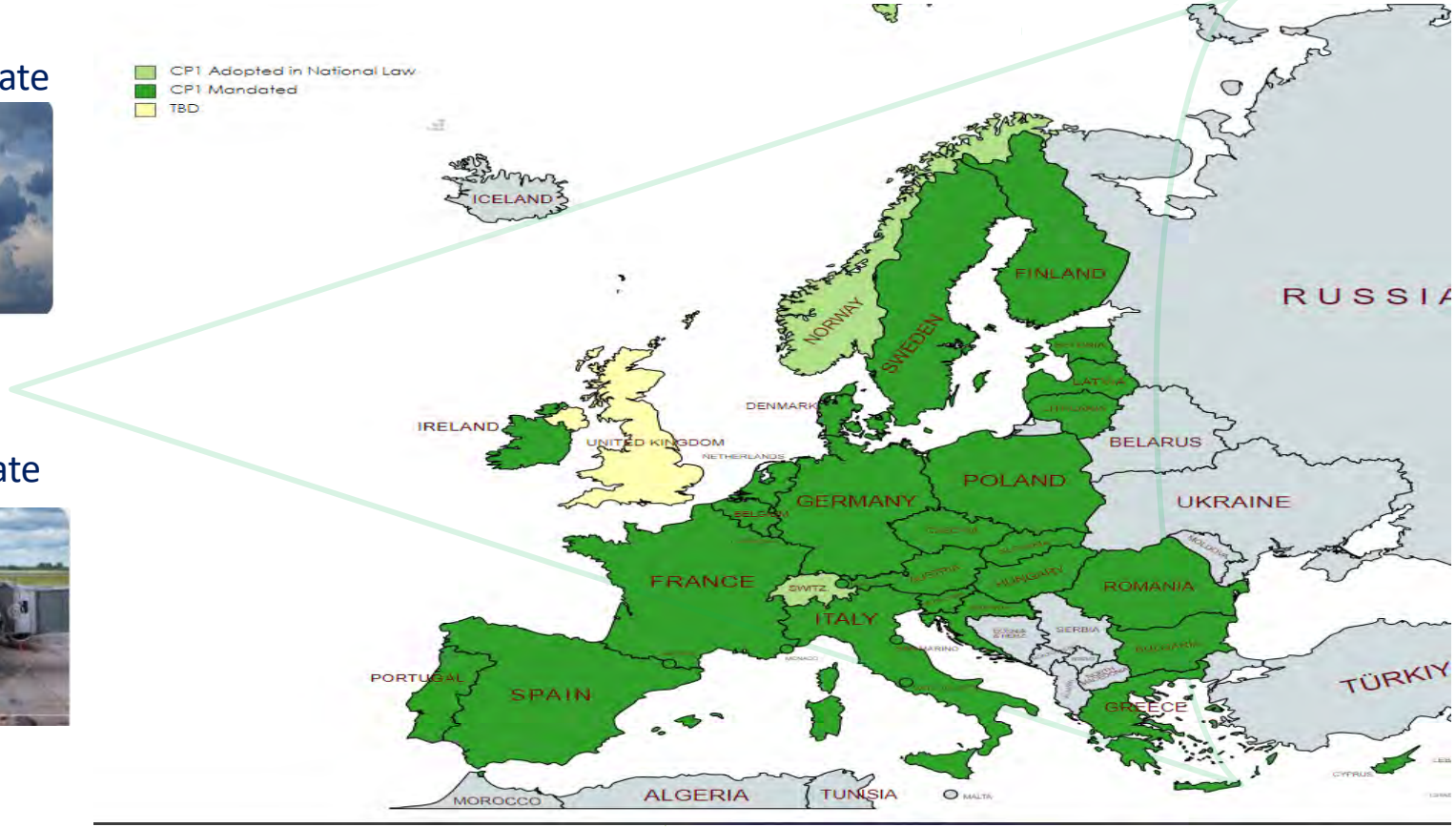
Service	Service Provider	Service Consumer
Filling Service	NM	AU
Flight Data Request Service	NM	ANSP
Notification Service	NM	ANSP
Publication Service	NM	ANSP
Trial Service	NM	AU (Recommended)



Regulatory framework – Geographical Scope – FF-ICE

Airspace Mandate

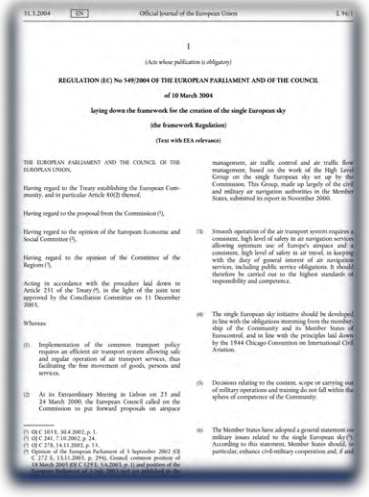
Ground Mandate



Geographical Scope

SWIM Services must be deployed in the European ATM Network (EATMN)

Definition 17 of the (EU) 549/2004



31.3.2004 EN Official Journal of the European Union L 96/1

I

(Acts whose publication is obligatory)

REGULATION (EC) No 549/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 10 March 2004

laying down the framework for the creation of the single European sky

(the framework Regulation)

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 80(2) thereof,

Having regard to the proposal from the Commission (1),

Having regard to the opinion of the European Economic and Social Committee (2),

Having regard to the opinion of the Committee of the Regions (3),

Acting in accordance with the procedure laid down in Article 251 of the Treaty (4), in the light of the joint text approved by the Conciliation Committee on 11 December 2003,

Whereas:

(1) Implementation of the common transport policy requires an efficient air transport system allowing safe and regular operation of air transport services, thus facilitating the free movement of goods, persons and services.

(2) At its Extraordinary Meeting in Lisbon on 23 and 24 March 2000, the European Council called on the Commission to put forward proposals on airspace management, air traffic control and air traffic flow management, based on the work of the High Level Group on the single European sky set up by the Commission. This Group, made up largely of the civil and military air navigation authorities in the Member States, submitted its report in November 2000.

(3) Smooth operation of the air transport system requires a consistent, high level of safety in air navigation services allowing optimum use of Europe's airspace and a consistent, high level of safety in air travel, in keeping with the duty of general interest of air navigation services, including public service obligations. It should therefore be carried out to the highest standards of responsibility and competence.

(4) The single European sky initiative should be developed in line with the obligations stemming from the membership of the Community and its Member States of Eurocontrol, and in line with the principles laid down by the 1944 Chicago Convention on International Civil Aviation.

(5) Decisions relating to the content, scope or carrying out of military operations and training do not fall within the sphere of competence of the Community.

(6) The Member States have adopted a general statement on military issues related to the single European sky (5). According to this statement, Member States should, in particular, enhance civil-military cooperation and, if and

(1) OJ C 103 E, 30.4.2002, p. 1.
(2) OJ C 241, 7.10.2002, p. 24.
(3) OJ C 278, 14.11.2002, p. 13.
(4) Opinion of the European Parliament of 3 September 2002 (OJ C 272 E, 13.11.2003, p. 294), Council common position of 18 March 2003 (OJ C 125 E, 3.6.2003, p. 1) and position of the European Parliament of 1 July 2003 (not published in the

EATMN in CP1 Context

27 EU member states incl MUAC + Norway & Switzerland.

Mandated stakeholders

- ✓ ANSPs
- ✓ Air space users
- ✓ (Indirectly manufacturing Industry)

Mandated AUs are globally

All AUs operating in the EATMN Airspace are mandated by this regulation *to fulfil the obligations explained above and file eFPL the latest 31st Dec 2025,* ***incl. Military GAT Traffic*** *.*

CP1 deadline is 31 December 2025*, status of implementation to be reported in SDM monitoring exercise.*

Military in CP1

CP1 Regulation No. 2021/116

In deploying the SWIM functionality, Member States must ensure that civil or military cooperation is run to the extent required by point 3.2 of Annex VIII to Regulation (EU) 2018/1139.

Interoperability

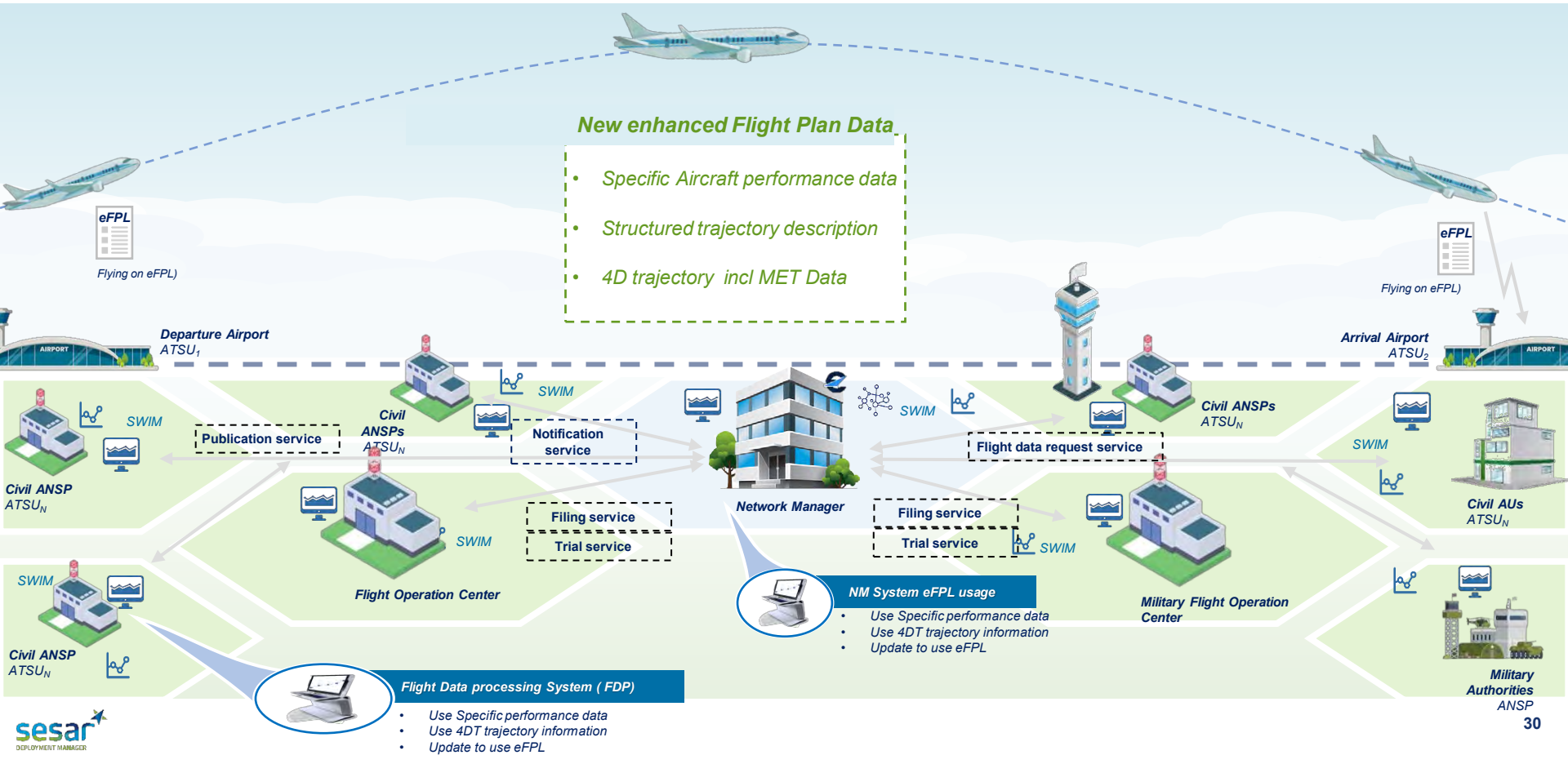
EU Reg 2018/1139

The EATMN, its systems and their constituents shall support the progressive implementation of civil/military coordination, to the extent necessary for effective airspace and air traffic flow management, and the safe and efficient use of airspace by all users, through the application of the concept of the flexible use of airspace.

To achieve those objectives, the EATMN, its systems and their constituents shall support the timely sharing of correct and consistent information covering all phases of flight, between civil and military parties, without prejudice to security or defence policy interests, including requirements on confidentiality.

Flight & Flow information for a collaborative environment (FF-ICE)

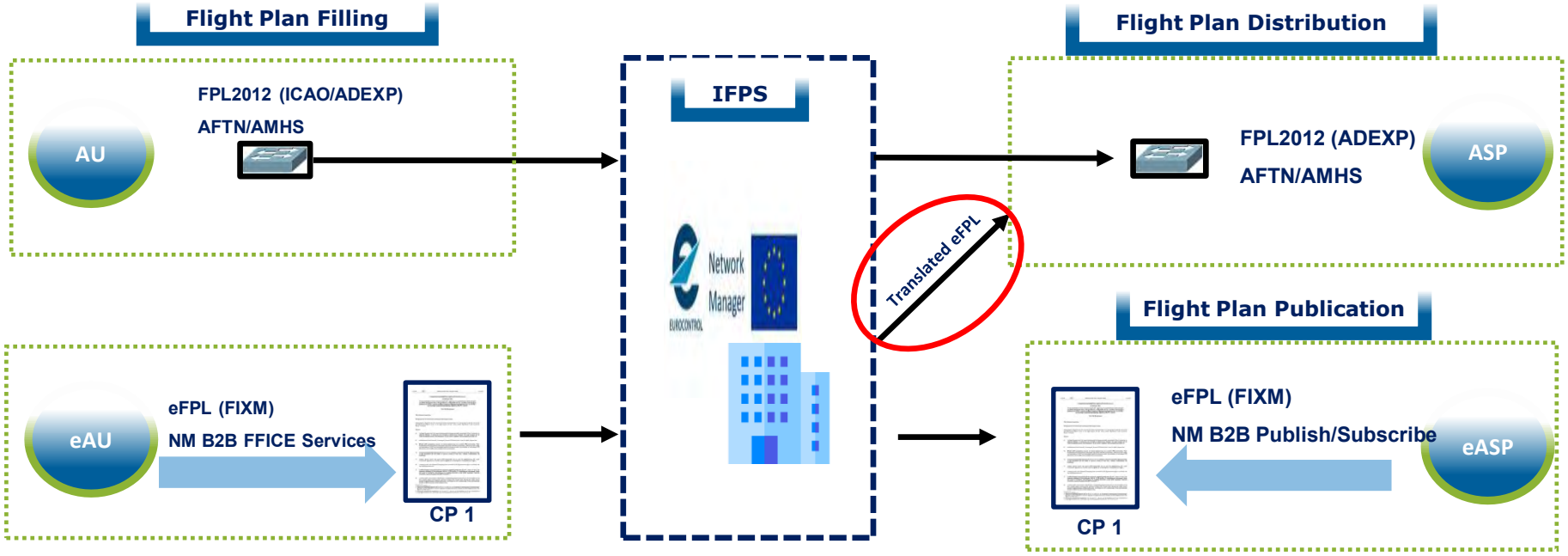
FF-ICE Release 1 deployment in Europe



How it will work?

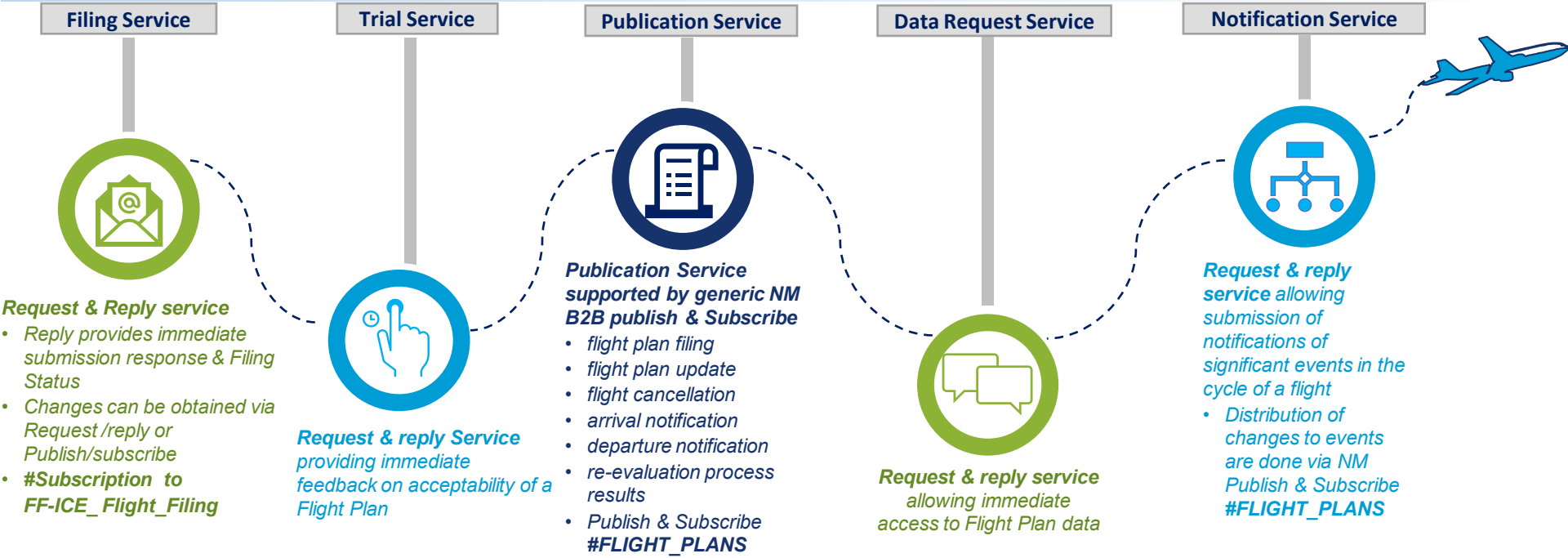
Implements FF-ICE, while still supporting FPL2012 over AFTN/AMHS.

Translation of FF-ICE FPLs to FPL2012 and distribution via AFTN/AMHS to non-migrated ASPs.



FF-ICE services implemented in Europe

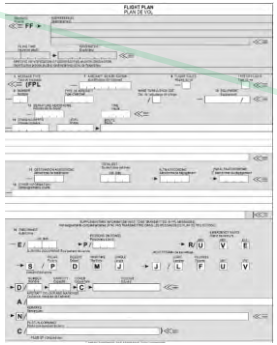
The FF-Ice services in Europe are implemented and provided operationally by Eurocontrol – Network Manager using both NM B2B Request & Supply and Publish & Subscribe as explained below.



Distribution of eFPL to ATS Units

- ANSPs must use the NM B2B Publish/Subscribe
- Subscription topic **“FLIGHT_PLANS”**
- Allows ANSPs to receive the eFPLs filed by the eAUs and accepted by NM
  - Specify the flight set to be selected as the list of concerned ATS unit(s)
  - Specify the payload configuration to receive data in FIXM
  - Once the subscription is active, the ANSP starts to receive messages for flight plans that concern that ATS Unit

FPL vs eFPL



FPL2012

- Only human readable
- Space for errors
- No visual representation

ICAO ATMRPP

eFPL

- System readable
- Possibility for digital and richer Data
- Multiple possibilities for visual representation
- Structured route trajectory description

The magnitude of the change and transition

FPL2012 transition

- No basic FPL Format change
- Main Changes were to field content
- Additional fields in some cases
- Same exchange mechanism – AFTN/AMHS
- Translation to legacy format took place for many years after

eFPL transition

- New FPL Format
- New content e.g. - Flight Performance data
- New Exchange Mechanism - SWIM

Transition from FPL2012 to eFPL

A much greater change than FPL2012 transition

What does it mean for the mandated stakeholders?

Air navigation Service Providers/ Aeronautical info service providers

Flight Data Processing system (FDP) impact

- FDP must use the FF-ICE (eFPL) trajectory data to improve your trajectory fidelity/precision
- FDP will have to use the specific aircraft performance data such as
  - Performance profile
  - Speed schedule
- FDP will have to use the structured trajectory description
- FDP will have to use eFPL contained Met data for the creation of the 4D trajectory

Other systems

- Indirectly all systems connected with FDP – using FPL Data
- Operational Flight planning system used for flight planning (AIS) filling FPLs on behalf of AUs without own Flight plan filing system

What does it mean for the mandated stakeholders?

Airspace Users

Flight Plan filing systems impact

- CFSPs – will have to update/ make available the following capabilities
  - File eFPL via B2B – SWIM services
  - Include in eFPL min. the data required by CP1 – sub-AF 5.1.6
  - File eFPL in operations when flying within EATMN airspace (27+2)

- Airspace Users
  - File eFPL in operations using NM B2B Filing service

Status of European deployment of FF-ICE Release 1
Eurocontrol - Network Manager

Network Manager

- ✓ Provider of all services
- ✓ All Services are implemented
- ✓ All services available in the SWIM registry

100%

Registry SWIM

Status of European deployment of FF-ICE Release 1

Air Navigation Service Providers (ANSPs)

Facts

- 27 EU Member states
- Norway, Switzerland and MUAC
- United Kingdom (NATS)

In Total 31 ANSPs

Status

- Detailed status received
- 10 out of 31 reports Not yet planned
- 18 out of 31 reports **Planned** but with no or limited progress
- 3 out of 31 reports **Ongoing**

Airspace Users & CFSPs

Status

- Limited data received from AUs so far
- Monitoring templates shared with several AU organisation
- Feedback received from limited number of AUs
- Will revisit monitoring later 2023

Status

- LIDO – Testing & deployment in progress
- CAE – In discovery phase
- Nav Blue, Jeppeson, Flight Key, Air Support
    - No reported progress

FF-ICE Operational in Europe

Flight Planning software (Lido Flight 4D) provider Lufthansa Systems (LSY) participated with Eurocontrol NM in SESAR validation exercises since 2011

2011

Common SESAR Deployment project established (Lufthansa, Air France, Lufthansa Systems)

Intense testing between DLH-LSY-NM-DFS since 2019

2019

On 15, Dec 2022, a Lufthansa flight from Munich to Hamburg was supported by the first ever eFPL filed to the NM OPS system – a world premiere

The eFPL was calculated and filed with LIDO FLIGHT 4D – a flight planning solution from Lufthansa system (LSY)

2022

First flight supported by pre-flight 4D-trajectory data exchange performed by Lufthansa in the European Network | EUROCONTROL

Modernising
Air Traffic Management
As One

Thank you!
Questions?

Follow SESAR deployment:

Twitter: @SESAR_DM

LinkedIn: SESAR Deployment Manager

Facebook: @SESARDeploymentManager

Instagram: sesar_deployment

CSS-FD Risk Reduction Activity (RRA) Overview

Update

Presented to: SWIFT

By: Cora Buck

Date: March 23, 2023

Federal Aviation Administration

Risk Reduction Activity Overview

- **RRA Purpose**
  - To reduce the investment risk to the overall CSS-FD program as well as to increase stakeholder buy-in through early evaluation and refinement of proposed functionality

- **Desired Outcomes**
  - The RRA system: a limited-implementation, pseudo-prototype fielded as a formal demonstration system of CSS-FD flight plan filing services
  - Hands-on industry participation in four months of trial and tryout activity
  - Identification of hurdles and opportunities via participant's feedback and implementation lessons learned

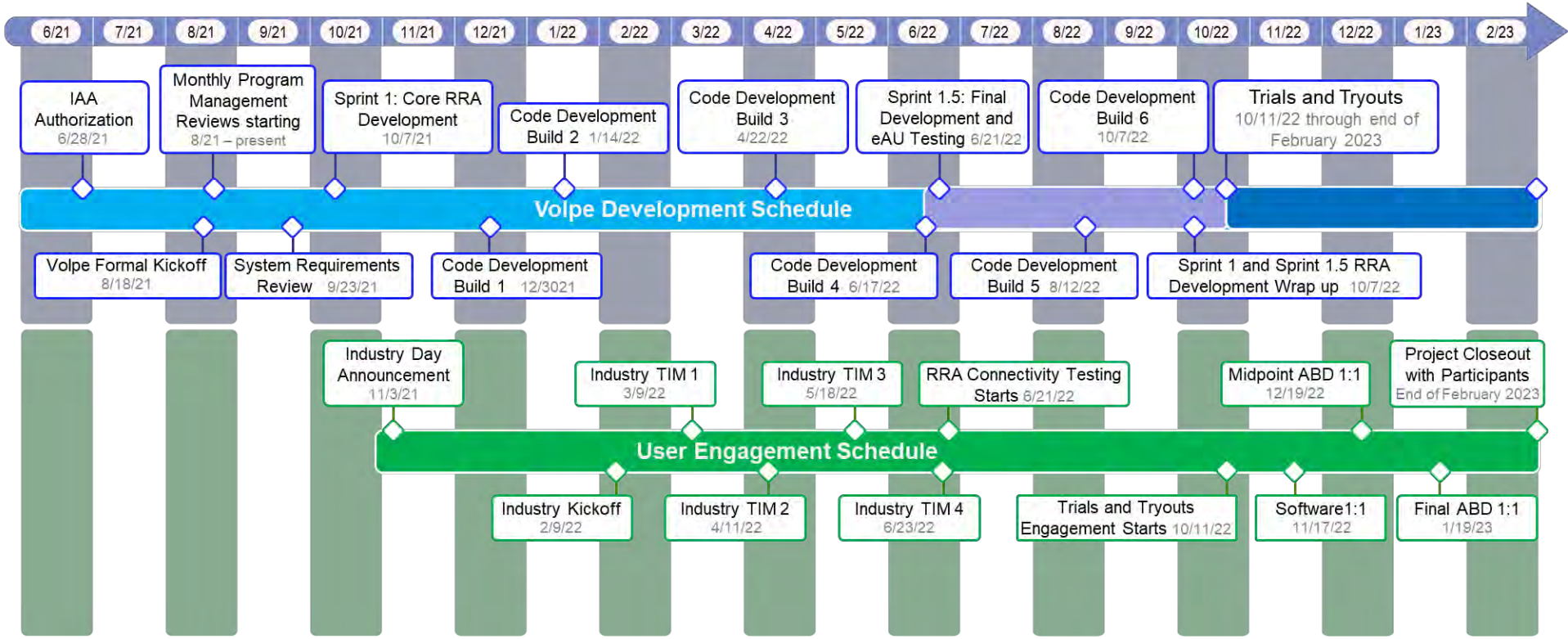
CSS-FD Risk Reduction Activity Engagement

- **Sprint Development Sessions**
  - Requirements and use case sessions with ANG
  - Demonstrations from the flight object
  - Conducted 24 Sprint Build Sessions

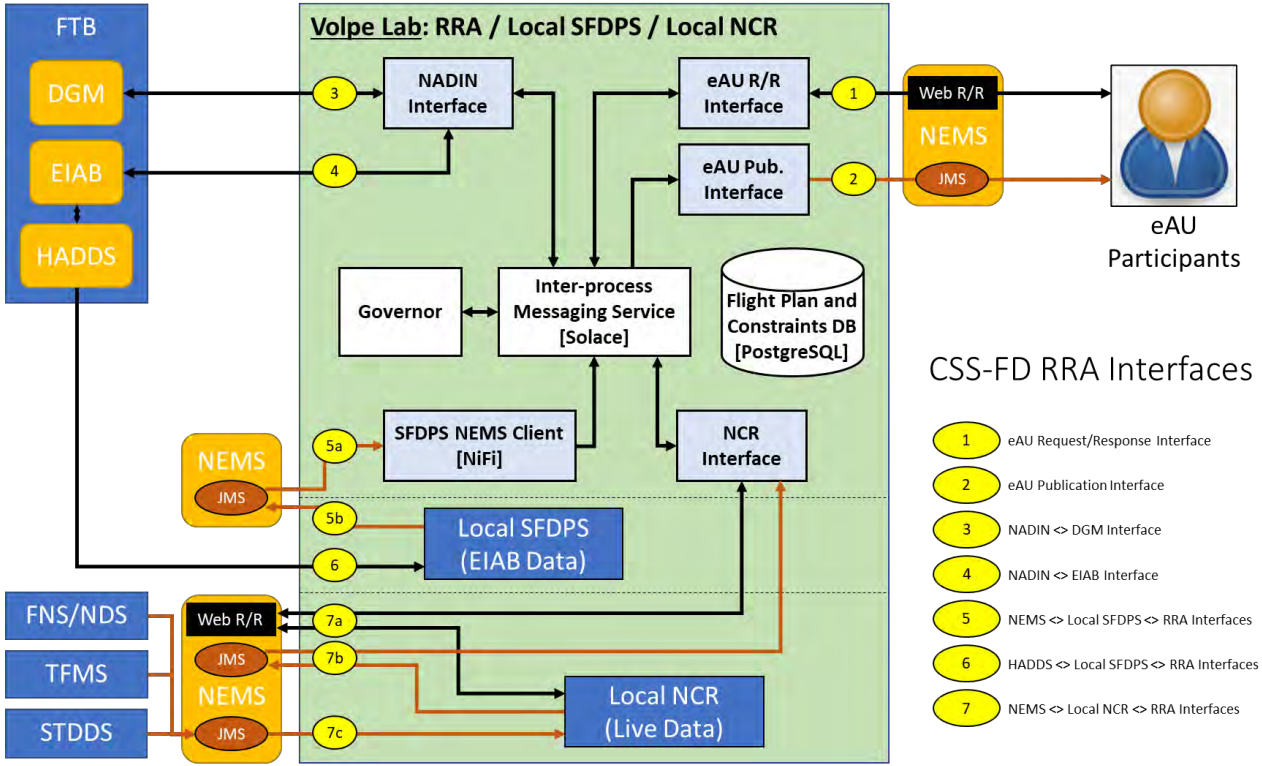
•ERAM-in-a-box from Florida Test Bed (ZNY, ZAU)

- **eAU Engagement Meetings**
  - **TIMs**
    - Conducted 4 TIMs
    - Used to review APIs, SDK, FIXM templates and updates to various use cases/user scenarios
  - **On-Ramping Meetings**
    - Conducted RRA development environment connectivity sessions with participants
  - **Agenda Based Discussions (ABDs)**
    - Gathered user scenario feedback from the operator perspective

CSS-FD Risk Reduction Activity Timeline



CSS-FD RRA Operational View



CSS-FD RRA Participants

Key Activities

- Scheduled workgroups and Technical Interchanges Meetings (TIMs)
- Special Topic Meetings
  - Use case validation and review
  - Client development demo
  - Data collection and user feedback
- Provide feedback on the prototype functionality and overall CSS-FD requirements
  - Software developer 1:1 Meetings (technical perspective)
  - Agenda Based Discussion (operator perspective)
  - Tracking/Logging Issues
  - Captured detailed Usage Metrics
- Participate in lab trials / try-outs (ad-hoc testing of the system)

eAUs Connection to CSS-FD R&D Environment

- Each eAU was On-Ramped to the CSS-FD R&D Environment
  - Allowed eAUs to test the various use cases presented in the TIMs

- The FAA provided an SDK toolkit, documentation and training as needed to exercise the various use cases/user scenarios.

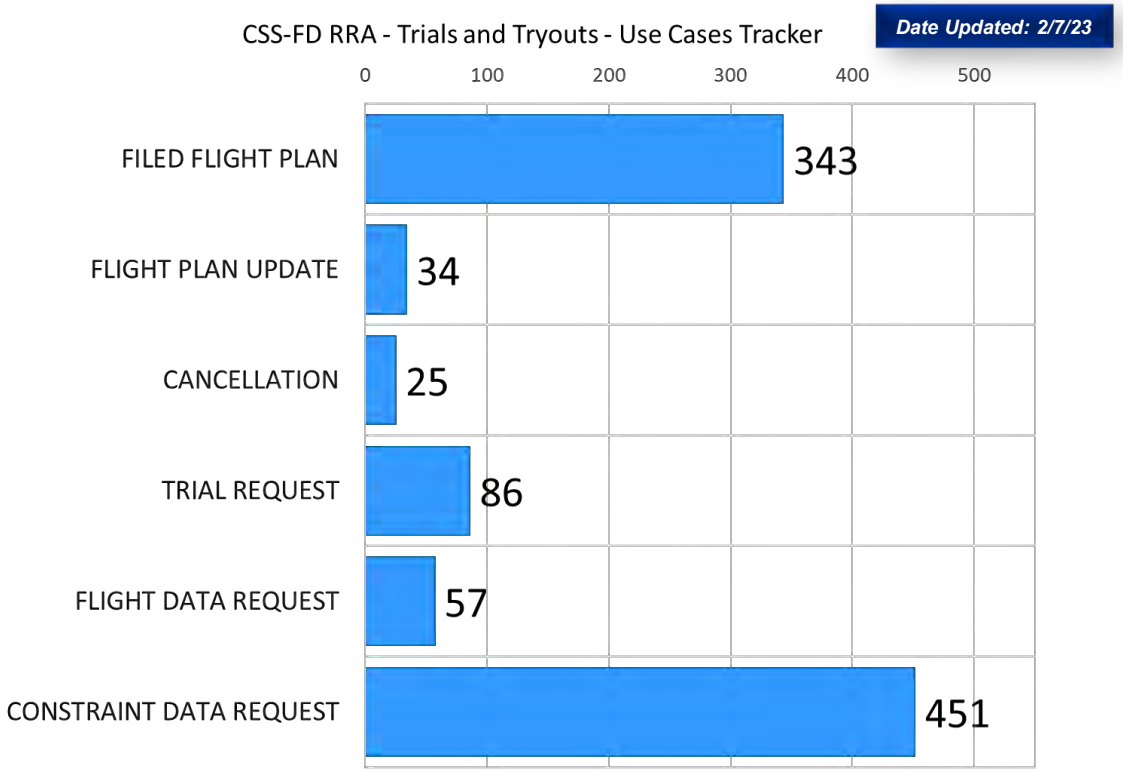
- Some eAUs created a custom GUI to display CSS-FD data
  - Constraint Data, 4DT Data, FF-ICE/FIXM Data, GUFI

CSS-FD RRA Trials and Tryouts

- **The RRA trials & tryouts activity provides eAU participants with the opportunity to freely interact with the RRA system**
  - We recorded detailed usage statistics
  - Tested several use cases: eFPL, uFPL, CNL, fdREQ, tREQ, and Constraints
  - Our feedback efforts were to learn how users would interact with the CSS-FD System
- **Started on October 13th, 2022**
- **Four eAU participants have been exercising all CSS-FD messages and use cases in scope for the RRA, including:**
  - Filing flight plans with FTB's ERAM-in-a-box
  - Responding to live NAS constraints
  - Evaluating alternative solutions with trial flight plans
  - Obtaining current flight plan information and status

CSS-FD RRA Use Case Usage

- **Number of times use cases related to each RRA message type were exercised by the participants during the trials & tryouts activity**
- **Filed flight plan and constraint data requests most frequently exercised**
- **Constraint data allowed for flight planners to make informative decisions along the filed flight plan**



Summary

- **Reduced investment risk to CSS-FD**
- **Increased stakeholder engagement and buy-in**
- **Successfully demonstrated and tested CSS-FD capabilities**
- **Identified user feedback and implementation lessons learned**

CSS-FD RRA Close Out and Next Steps

- **RRA Close Out Activities**
  - Brief other Programs on our findings
  - Take eAU feedback to refine remainder of investment analysis

- **CSS-FD Program Next Steps**
  - Other groups/programs that would benefit from hearing this story?
    - Learn about CSS-FD
    - Lessons learned from RRA (how to go about this)
  - Continued collaboration with European Union (EU) Partners
    - SESAR Airspace Users CP1 mandate to implement FF-ICE Release 1
      - "…Airspace Users must update their flight planning system and start filling eFPL in order to support the exchange of FF-ICE Release 1 Filing Services once they are available which according to the AF5.1.6 mandate should be by 31/12/2025."

Contact

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Increasing Accessibility to NOTAM Data

Update

Presented to: SWIFT

By: Vinod Vallikat

Date: March 23, 2023

Federal Aviation Administration

Background

Motivation – Industry feedback for:

"a simplified machine-to-machine interface to help improve access to NOTAM data"

FAA and NASA collaborated to conduct an industry challenge to develop NOTAM API's

What is the NOTAM API "Challenge"?

- Innovative software development approach that involves developers across the industry and across the globe
- 21 individual solution-building challenges were launched for industry response
- Challenge deliverables were integrated to deliver the final NOTAM API product in Spring 2021
- Collaboration with NASA enabled the FAA to leverage industry talent and accelerate the delivery of the solution industry requested

NOTAM Distribution Interfaces

Interface	Service End Point	Notes
Human Interface	FNS NOTAM Search https://notams.aim.faa.gov/notamSearch/	Publicly accessible website that provides both active and cancelled/expired NOTAMs up to 3-years
Machine Interface	FNS NOTAM Distribution Service via SWIM • Request/Response (Web Service)	Available behind the FAA firewall
	FNS NOTAM Distribution Service via SWIM • Pub/Sub (JMS)	Available behind the FAA firewall
	FNS NOTAM Distribution Service via SCDS • Pub/Sub (JMS)	On the Cloud - Access provided via SWIFT Portal – https://portal.swim.faa.gov
	FNS Initial Load (FIL)	Access to Active NOTAMs to help with baselining/reconstitution delivered via the cloud
	NOTAM API**	REST interface for NOTAM data

** Topic of this briefing

NOTAM Application Programming Interface (API)

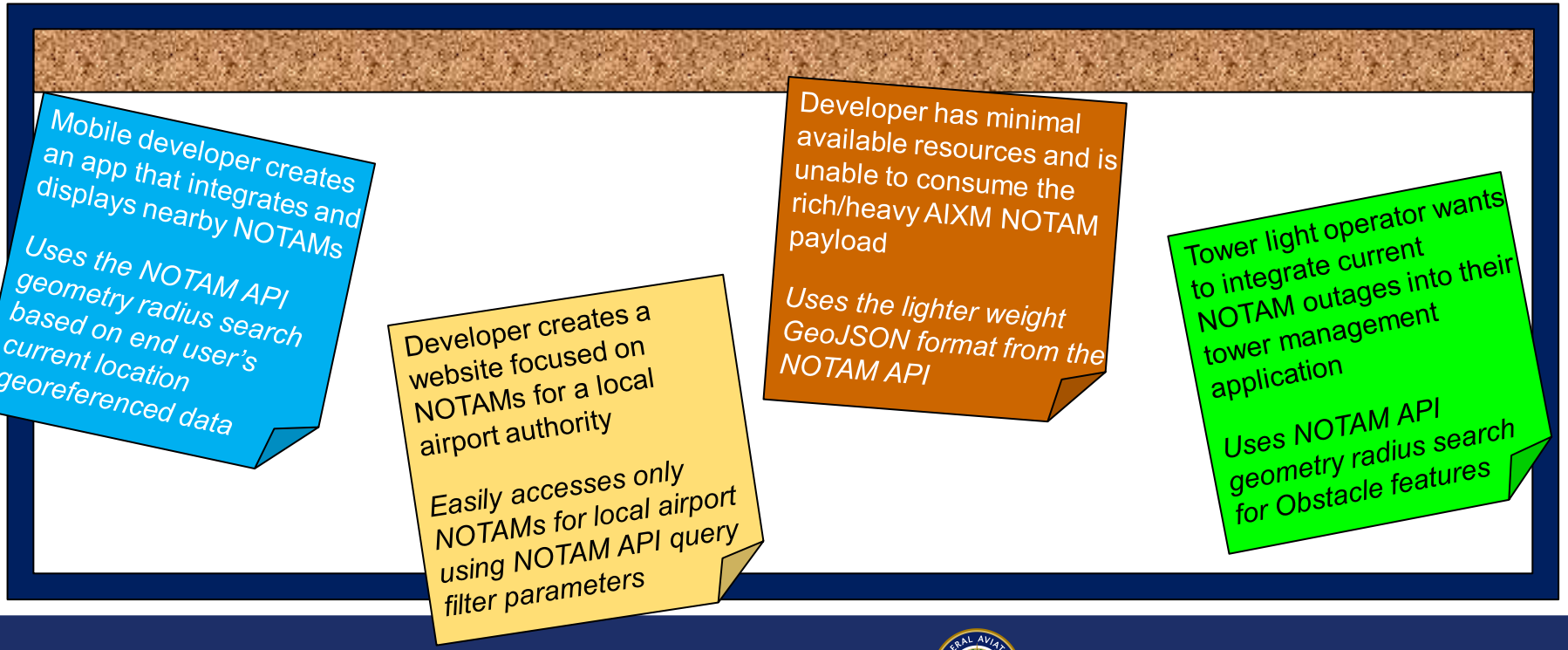
- **What is the NOTAM API?**
  - Machine-to-machine interface providing NOTAM query and filtering capability
  - Standards-based: OpenAPI specification compliant with REST service endpoints
  - Hosted within the FAA's Enterprise API Portal
- **How is the NOTAM API different from other FAA NOTAM sources?**
  - Quick onboarding and access to a request/response service on the cloud
  - Multiple output formats to cater to different user needs
  - Enables direct NOTAM query (doesn't require end system to store all NOTAMs)
- **Who is the target audience for the NOTAM API?**
  - System/application developers
- **Where can I get access to the NOTAM API**
  - FAA API Portal (https://api.faa.gov)
  - Select the API section and subscribe to NOTAMS API (found on the 3rd page)

Benefits of NOTAM API

- **Quick and Easy access**
  - Register online and get access to service end-points and credentials
- **Simplicity & Easy Integration**
  - REST API following Industry standard OpenAPI specification
- **Query Interface with Filtering & Sorting capability**
  - Eliminates the need to maintain a separate database
  - Get relevant NOTAMs leveraging filtering capability (example: Get Runway NOTAMs at an Airport)
- **In three formats meeting different stakeholder needs**
  - AIXM, GeoJSON, and AIDAP (legacy format)
- **All NOTAM and available Geometry data from a single source**
  - Integrates NOTAMs from FNS with published Temporary Flight Restriction (TFR) and Special Activity Airspace (SAA) geometries (where available)
  - Enables graphical visualization

Use Cases for NOTAM API

How might end users take advantage of the NOTAM API? The options are endless…



NOTAM API Concept

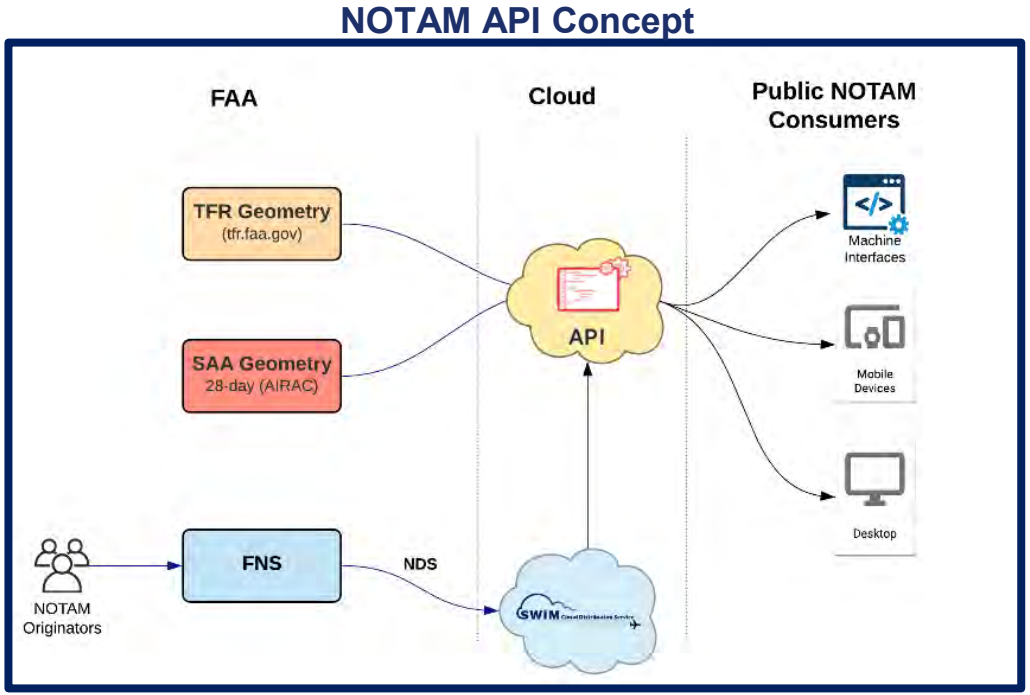
Receives NOTAMs from the Federal NOTAM System (FNS) (authoritative source)

- NOTAM Distribution Service (Pub/Sub) over SWIM Cloud Distribution Service (SCDS)

Integrates with additional & relevant geometry information

- TFR and SAA sources

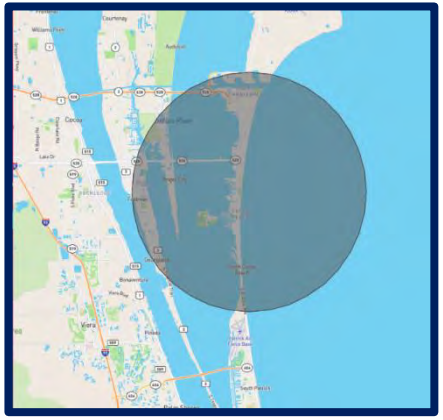
Provides integrated NOTAM data through API deployed as a cloud native application



TFR and SAA Geometry Integration

!FDC 1/3831 ZMA FL..AIRSPACE COCOA BEACH, FL..TEMPORARY FLIGHT RESTRICTION. PURSUANT TO 14 CFR SECTION 91.145, MANAGEMENT OF ACFT OPS IN THE VCY OF AERIAL DEMONSTRATIONS AND MAJOR SPORTING EVENTS, ACFT OPS ARE PROHIBITED WI AN AREA DEFINED AS 5NM RADIUS OF 282008N0803602W (MLB015013.9) SFC-15000FT UNLESS AUTHORIZED BY ATC. EFFECTIVE 2104161430 UTC UNTIL 2104161930 UTC, 2104171530 UTC UNTIL 2104171930 UTC, AND 2104181530 UTC UNTIL 2104181930 UTC. DUE TO COCOA BEACH AIR SHOW AERIAL DEMONSTRATIONS. WAYNE BOGGS, TEL 813-340-5623, IS THE AIRSHOW POINT OF CONTACT. PATRICK /COF/ ATCT, TEL 321-494-0355, IS THE ATC CDN FACILITY. 2104161430-2104181930

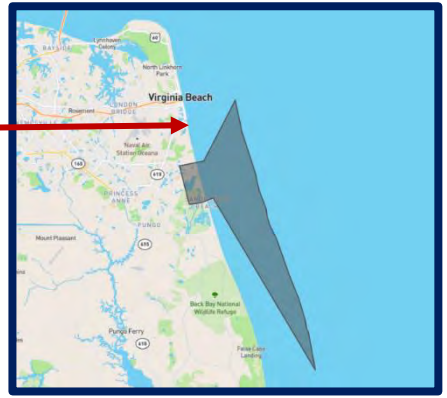
TFR NOTAM



SAA Identifier

!SUAE 04/894 ZDC AIRSPACE **R6606** ACT SFC-FL230
2104122101-2104131159

SAA NOTAM



NOTAM API: Formats

NOTAMs can be requested in the three formats

AIXM 5.1
unmodified from FNS-NDS

AIDAP
legacy – supports system transition from older NOTAM feed

GeoJSON
condensed compared to AIXM, including additional geometry

NOTAM API: Enables Easy Visualization

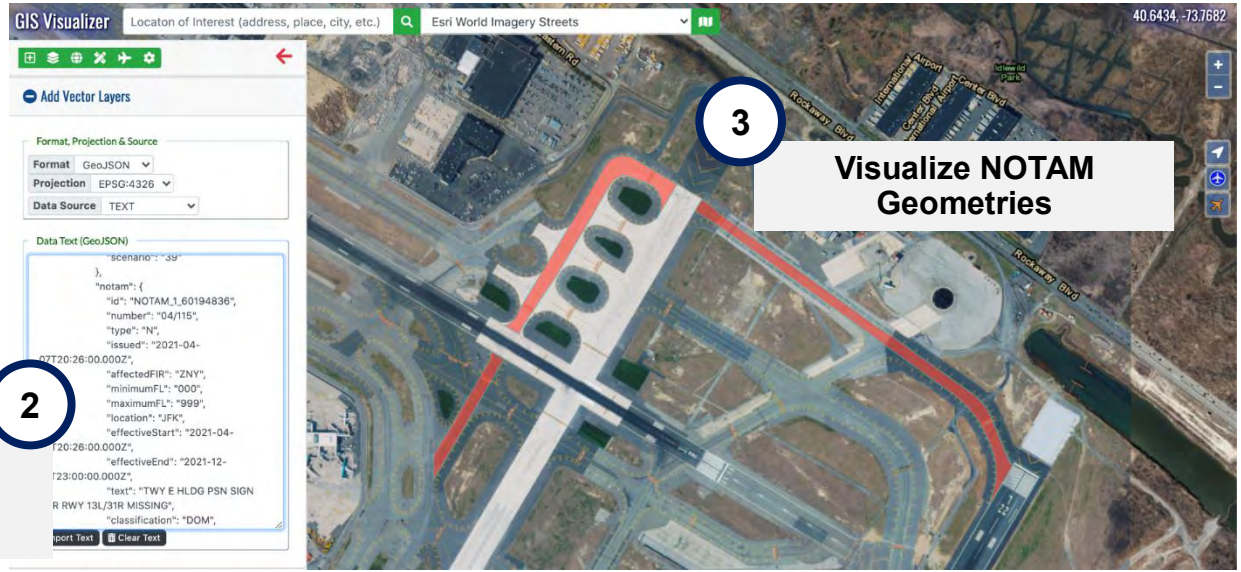
Query NOTAM API for GeoJSON formatted NOTAMs

1


```
{
"type": "Feature",
"properties": {
    "coreNOTAMData": {
        "notamEvent": {
            "scenario": "39"
        },
        "notam": {
            "id": "NOTAM_1_60194836",
            "number": "04/115",
            "type": "N",
            "issued": "2021-04-07T20:26:00.000Z",
            "affectedFIR": "ZNY",
            "minimumFL": "000",
            "maximumFL": "999",
            "location": "JFK",
            "effectiveStart": "2021-04-07T20:26:00.000Z",
            "effectiveEnd": "2021-12-31T23:00:00.000Z",
            "text": "TWY E HLDG PSN SIGN FOR RWY 13L/31R MISSING",
            "classification": "DOM",
            "accountId": "JFK",
            "lastUpdated": "2021-04-07T20:26:00.000Z",
            "icaoLocation": "KJFK",
            "coordinates": "4038N07346W",
            "radius": "5"
```

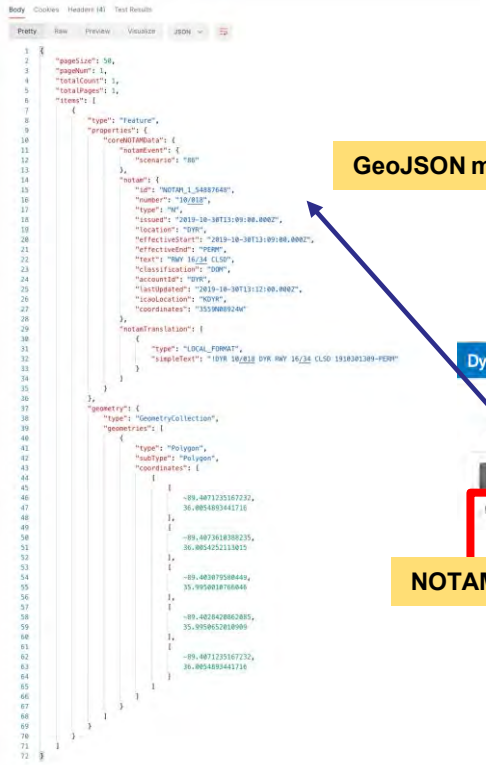

2

Integrate into simple open tools/apps to visualize

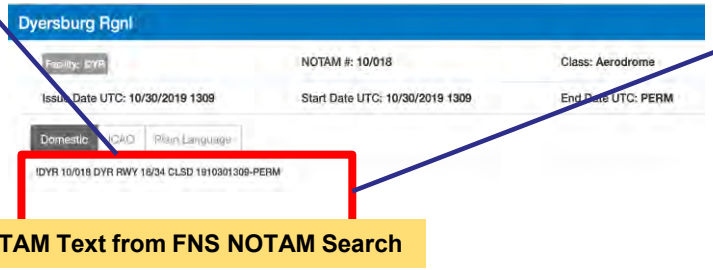


Simple example – Developers can easily use the NOTAM API to programmatically bring NOTAM data and geometries into their custom applications.

Example from NOTAM API

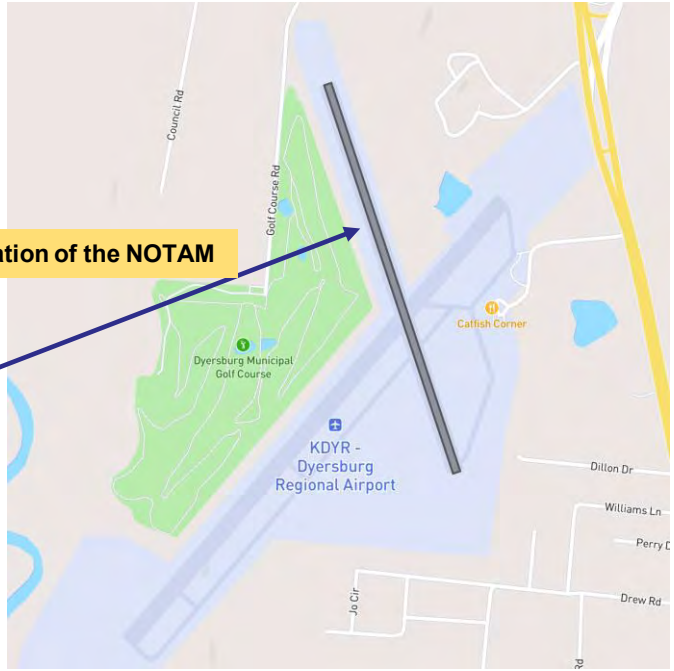


GeoJSON message from NOTAM API



NOTAM Text from FNS NOTAM Search

Graphical Representation of the NOTAM



NOTAM API: Query Parameters

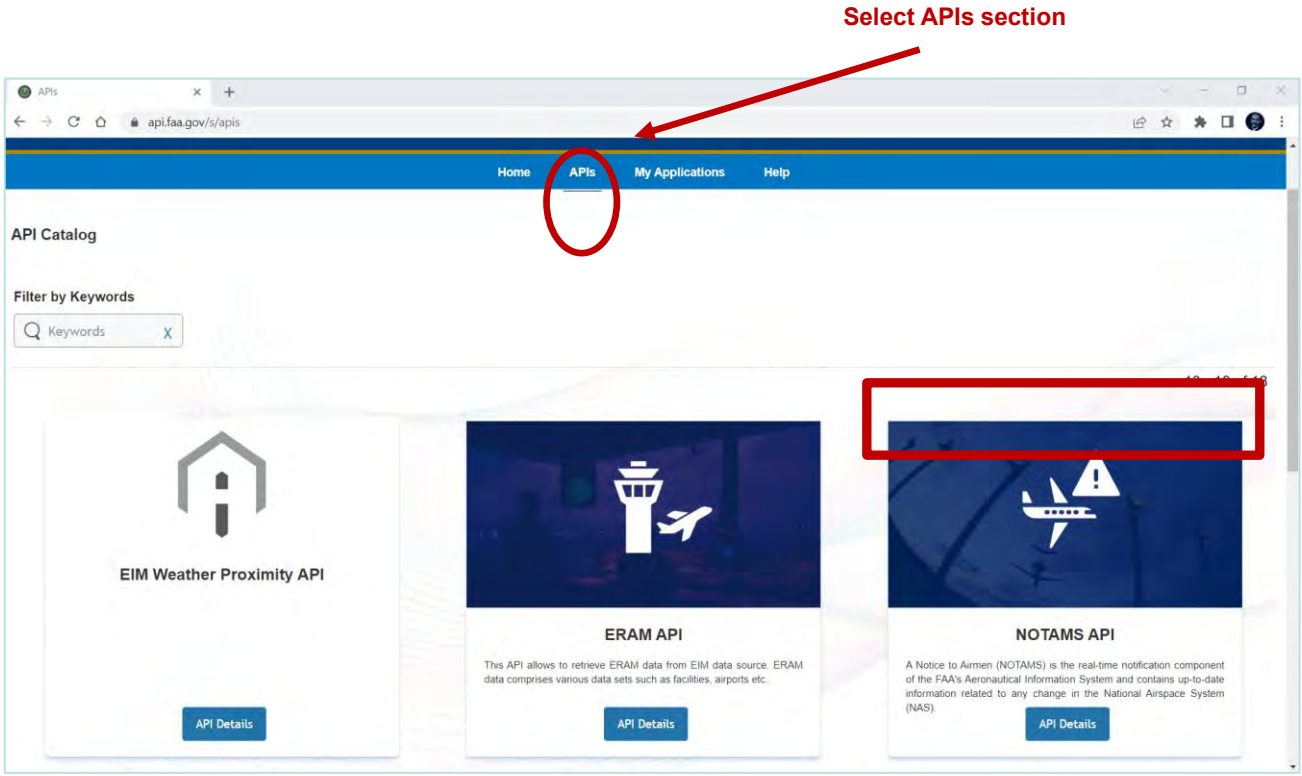
NOTAM API supports a range of Query/Filter parameters to better deliver the specific NOTAMs of interest to the user

- Enables delivery of refined NOTAM results to end application users
- Supports requests for improved NOTAM filtering abilities from the industry

NOTAM API Query/Filter Parameters

- Location (Domestic or ICAO identifier)
- NOTAM Type/Classification
  - 5 types: domestic (DOM), FDC, Military (MIL, LMIL) and International (INTL)
- Location and NOTAM Number
- Effective start and end dates
- Affected feature types (example: Runway, Taxiway)
- Geometry search (Location coordinates and a radius in NM)
- NOTAMs from a date (last update date)

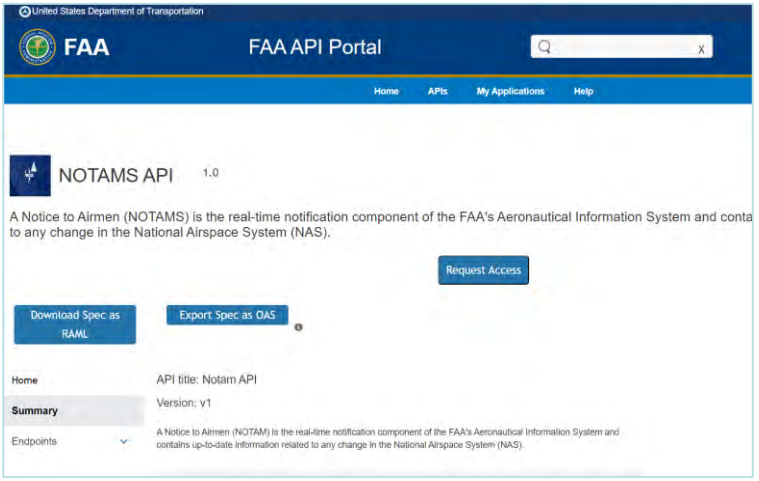
Access via FAA's API Portal

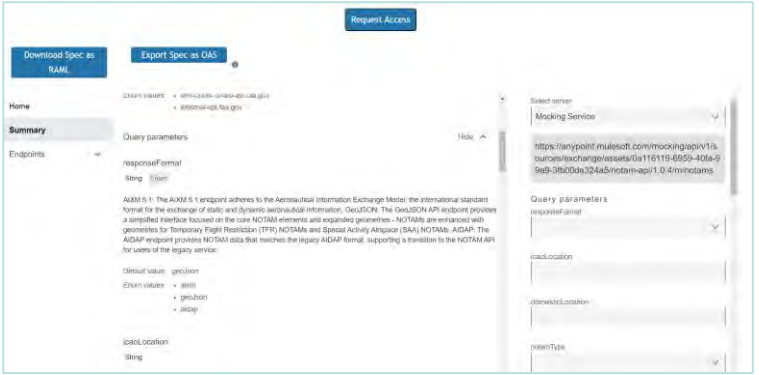


FAA API Portal

API Portal provides users with ready access to development resources

- Simple registration and user approval process
- NOTAM API documentation – based on Open API Specification (OAS)
- Access Keys (Id and Secret)
- Mock Service





Questions?

CAVAN SOLUTIONS

Wind Optimal Flight Planning Using CavanReports

SWIFT 20

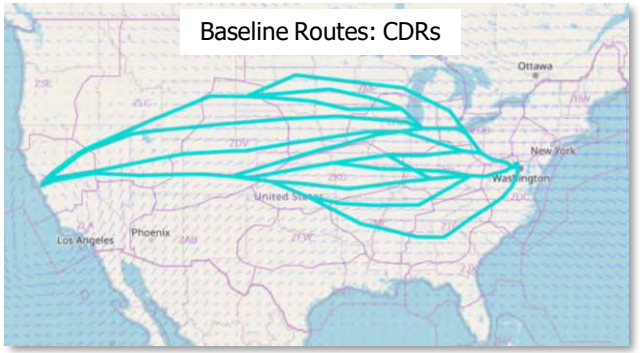
March 23, 2023

Executive Summary

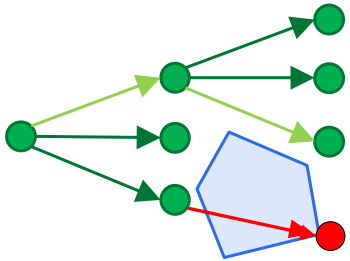
	Wind Optimal Flight Planning	CavanReports
Environment	Flight planning considers wind, available routes, constraints, and company procedures	Operational data is instrumental to real-time decision support, predictive analytics, and post operations analysis
Problem Statement	Access to routing options and wind impacts is not readily available for real-time decisions and post operations analysis	Lack of a readily available **digital information platform** supporting wind optimal routing
Impact	**CavanReports RouteOptimizer** web app and web services support pre-flight planning and post ops analysis based on winds aloft and constraint avoidance	CavanReports is an **existing, cloud-deployed, web services** enabled NAS-wide, SWIM flight data, weather data, and aeronautical information integration and analysis platform
Goal	Improve flight planning and post operations analysis of flight planning decisions	Educate SWIFT community about existing capabilities and opportunities for further involvement and **immediate use**

Wind Optimal Flight Planning Overview

- Flight planning considers wind, available routes, constraints, and company procedures
- Access to routing options and wind impacts is not readily available for real-time decisions and post operations analysis
- Flight planning options:
  - Baseline Routes
    - Latest filed flight plan
    - Coded Departure Routes (CDRs)
    - Great circle
  - Least Cost
    - Wind optimal path through a weighted graph solved using Dijkstra's algorithm
  - Constraint Avoidance
    - e.g., Polygons based on SIGMETs
- Metrics:
  - Wind miles and extra wind miles
  - Estimated Time Enroute (ETE) minutes and extra ETE minutes
  - Optimality compared to Least Cost route
  - Ground miles
  - Headwind miles

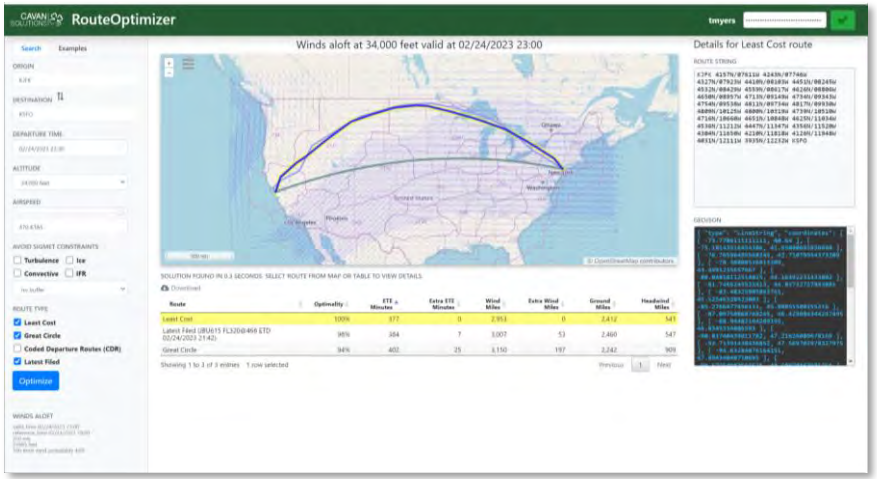


Least Cost route with Constraint Avoidance

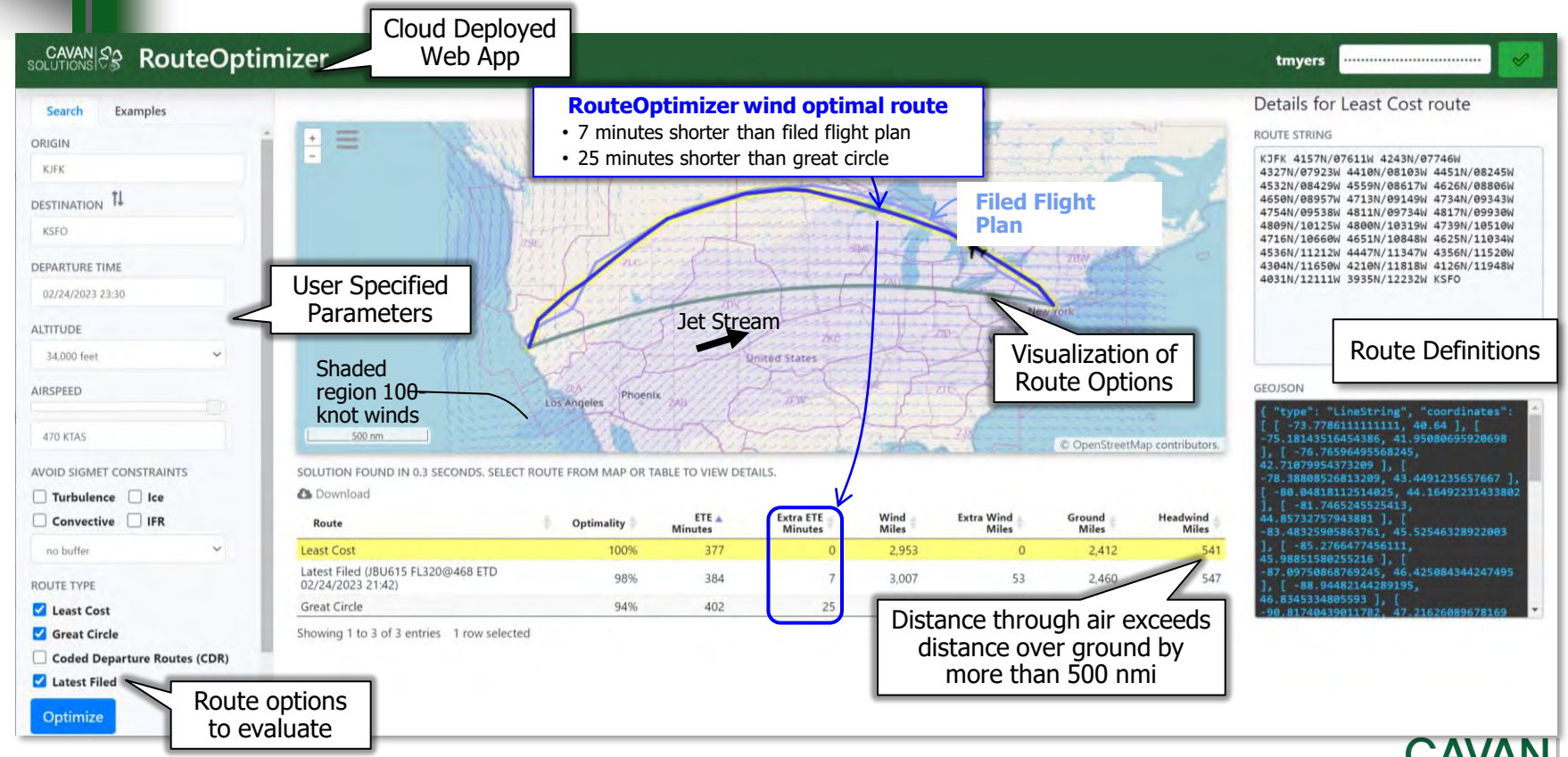


Wind Optimal Flight Planning Case Study #1 (1 of 2)

- A day with strong jet stream
  - Consider a JFK to SFO flight on Feb 25, 2023
  - Highest winds aloft during prior 30 days
  - Many airlines filing low altitude routes
  - Evaluate wind mileage of filed route and great circle
  - Compute Least Cost route for comparison

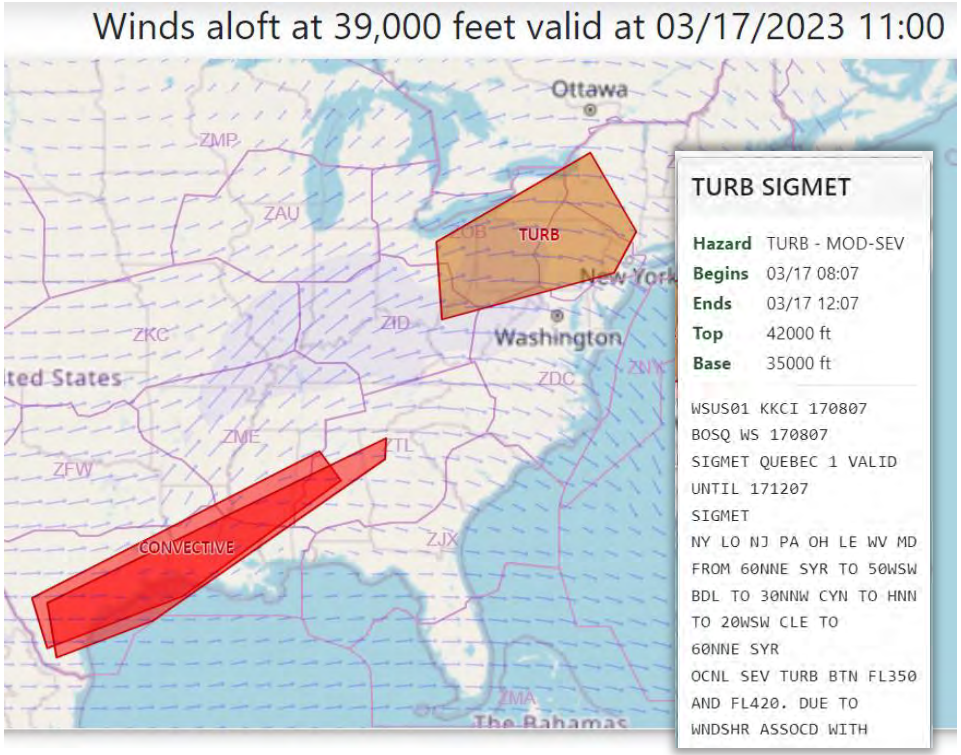


Wind Optimal Flight Planning Case Study #1 (2 of 2)



Wind Optimal Flight Planning Case Study Overview (2 of 2)

- Constraint Avoidance
  - Consider a BOS to LAX flight on March 17, 2023 at 11:00 UTC
  - SIGMET for severe turbulence from FL350 to FL420 in Northeast
  - Convective SIGMETs over Gulf Coast up to FL440
  - Identify CDRs that avoid SIGMET polygons and evaluate wind mileage
  - Compute Least Cost route that avoids SIGMET polygons for comparison



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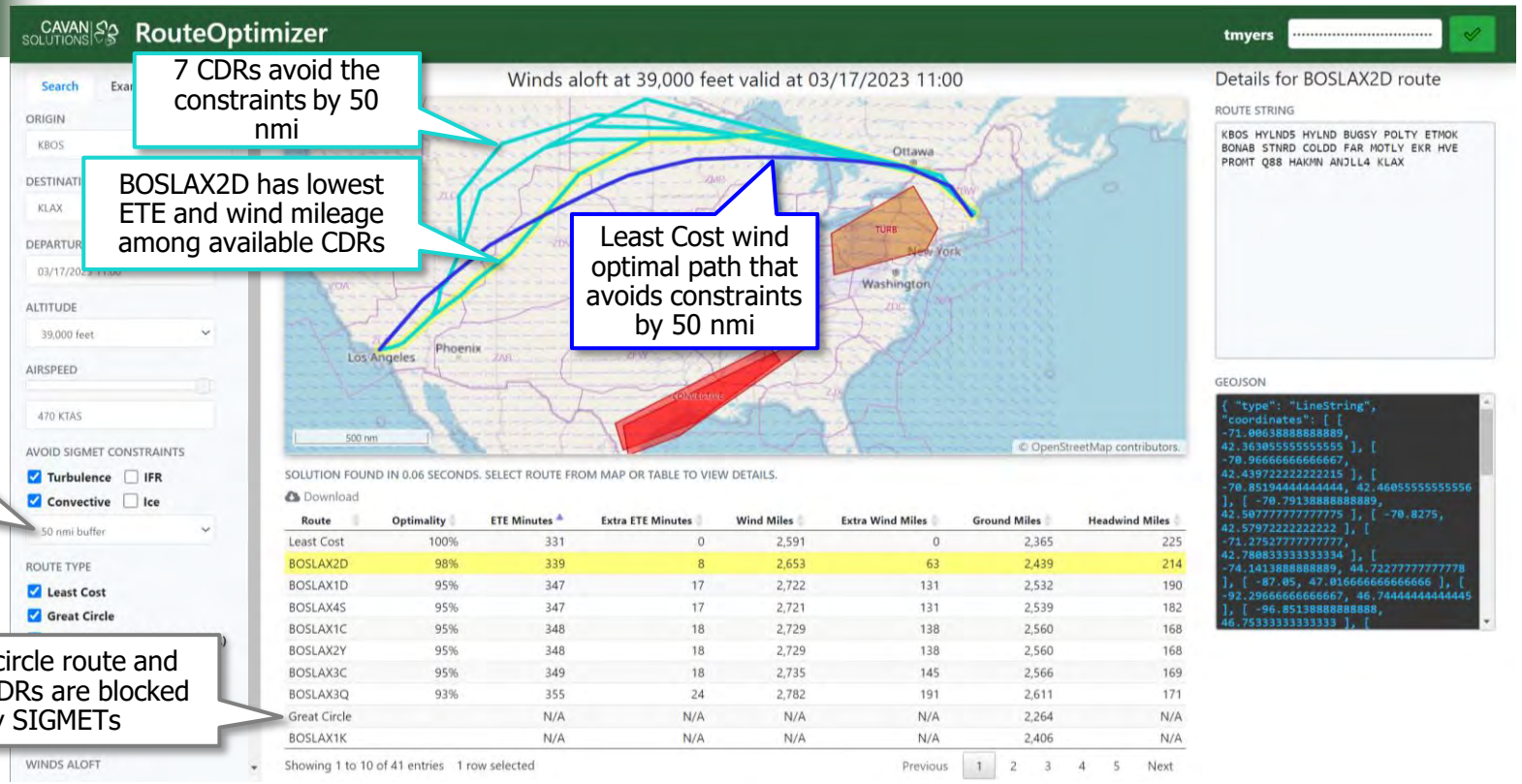
Wind Optimal Flight Planning Case Study #2 (2 of 2)



DEMONSTRATION

CavanReports Solution Architecture

- CavanReports History
  - Initial development in collaboration with NASA (2019-2021)
  - Wind miles service and RouteOptimizer services in support of UAM use case (2020)
    - RouteOptimizer constraint enhancement (2023)
  - Development and maintenance by Cavan for use by our engineers, analysts, and ATC SMEs (2021-present)
- CavanReports Overview*
  - Data integration
  - Web services architecture
  - Value-added metrics
- Alignment to proposed NASA DIP capabilities

*: CavanReports introduced at SWIFT #17, March 2021 – "Fix Conformance Analysis Use Case using SWIM Data"

CavanReports – Data Integration

Winds Aloft: North American Mesoscale Forecast System (NAM)

Winds Aloft: 100-knot contours

METARs

SIGMETs

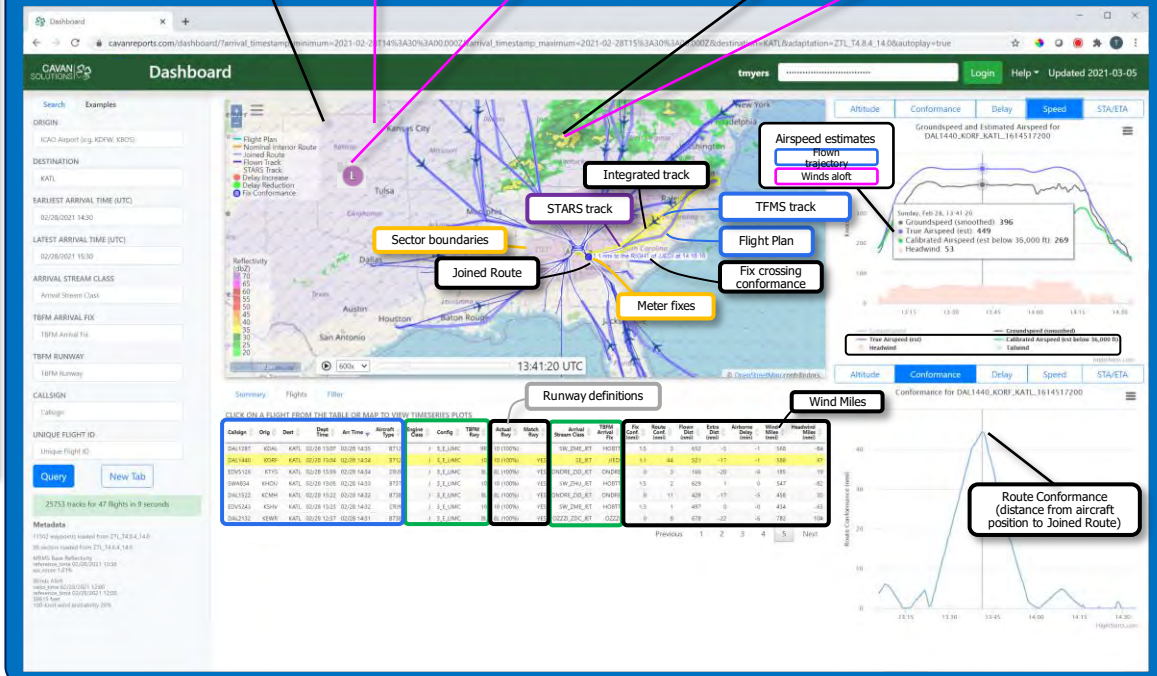
Reflectivity contours

Reflectivity: MULTI-RADAR/MULTI-SENSOR SYSTEM (MRMS)

Operational Data Sources

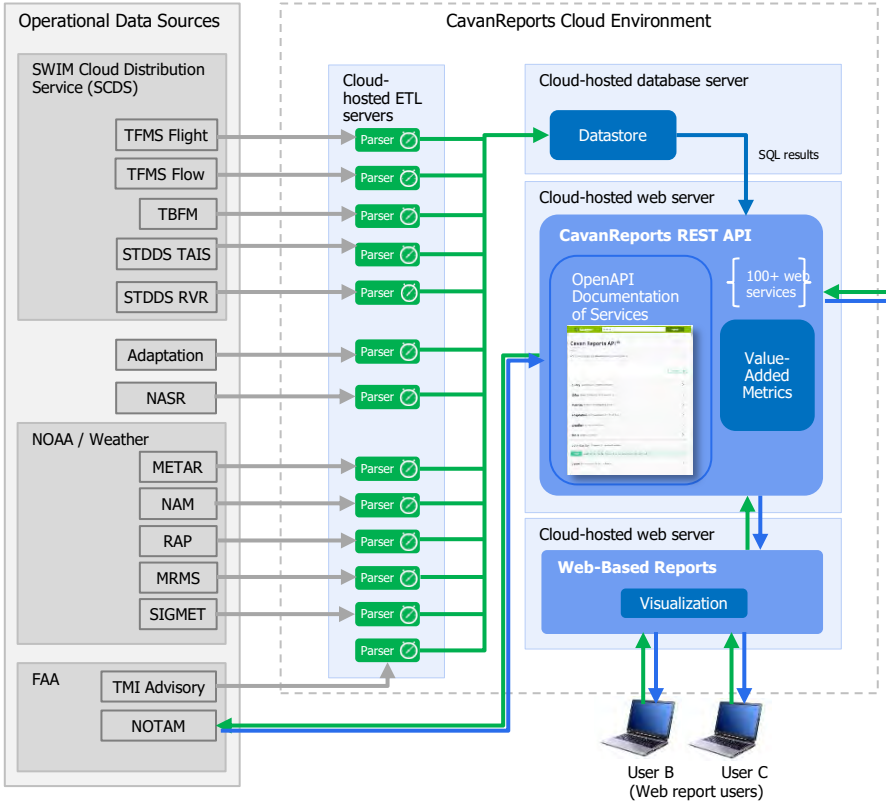
- TFMS SWIM
- STDDS STARS SWIM
- TBFM SWIM
- Aeronautical Information
- Weather
- NFDC
- Value added metric

Visualization



CavanReports – Web Services Architecture

- Data parsing is automated and centralized (promotes consistency)
- Data is transformed into a standardized format that can be queried efficiently and is decoupled from the input data sources and end users (reduces complexity)
- Data and metrics are accessed through a standardized, cloud-based REST API where all services are documented ("common, simplified interface to integrated, processed information")
- All communication with the web server is encrypted for security using HTTPS
- Visualizations are interactive, consistent for all users, and accessible over the web via API key. The only software requirement is a web browser (promotes interoperability)
- Authorization is specific to each user and web service (enables controlled access to logic and data)



Cloud-Based Web Services

Cateogry	Endpoints	Access Requirements
Write data to database	29	write_message, delete_message
Query flight data and metrics	23	query_flight
Manage ETL processes	17	view_process
Query weather data	11	query_weather, query_wind
Query adaptation data	9	query_flight
Query TBFM configuration	6	query_flight
Compute performance metrics	5	query_flight
Airspeed conversion tools	4	none
Query route data	3	query_flight
Compute and optimize wind miles	2	solve_network
Compute trend metrics	2	query_flight
Query track data	1	query_flight
Generate email metrics reports	1	write_message
Total Web Services	**113**	

Case Study Web Services (1 of 2)

- The RouteOptimizer web app consumes the following CavanReports' services:
  - Latest Flight Plan: `GET` `/latest-flight-plan/{origin}/{destination}/{limit}` Query the most recent flight plans for a city pair
  - CDRs by city pair: `GET` `/cdr-by-city-pair/{adaptation}/{origin}/{destination}` Retrieve all CDRs from a specific NFDC chart date for a specific city pair
  - Vectorized wind data: `POST` `/winds-aloft` Winds aloft data
  - AIRMETs, SIGMETs `POST` `/airmet-sigmet` Query AIRMETs and SIGMETs valid at a specific time
  - Wind miles*: `POST` `/compute-wind-miles` Compute wind miles for a set of baseline routes
  - Wind optimal routing: `POST` `/optimize-wind-miles` Compute path that minimizes wind miles. Optionally, avoid constraints and evaluate a set of baseline routes

* A wind miles service was identified by NASA at SWIFT #13 (Feb 2021) as a key DIP service goal

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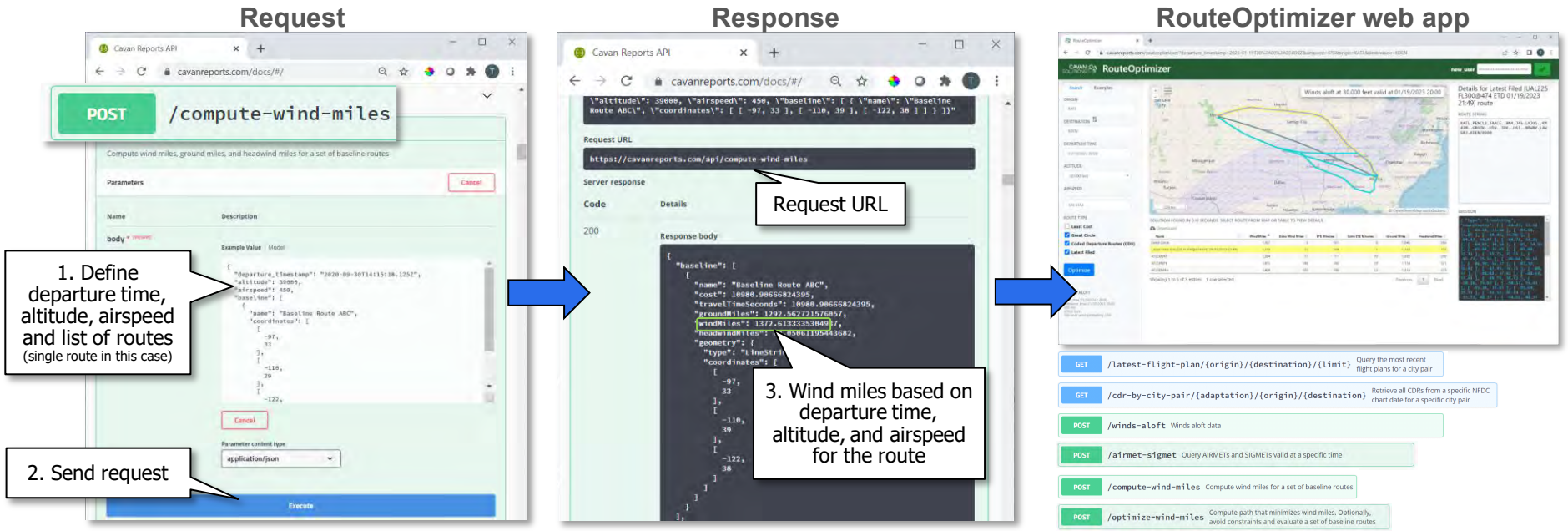
Case Study Web Services (2 of 2)

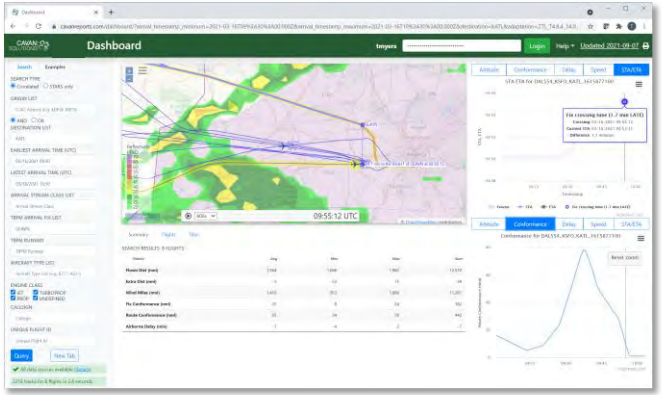
- Details of the CavanReports wind miles web service:

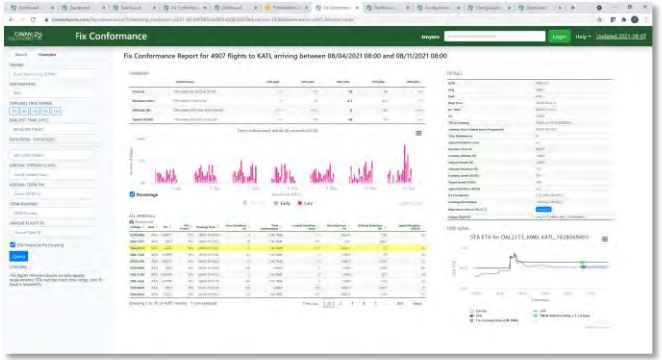


CavanReports Value-Added Metrics

Metrics computed based on SWIM data by cloud-based RESTful web services running on AWS

- Planned distance – Length of filed flight plan
- Flown distance – Length of flown trajectory
- Wind miles – Distance flown through the air calculated from TAS
- Route conformance – Distance between flown trajectory and planned route of flight
- Missed approaches – Identify missed approaches
- Diversions – Identify diverted flights
- Cancellations – Identify cancelled flights
- Circular holding – Identify instances of en route holding
- Closest Point of Approach (CPA) to meter fix – Identified between consecutive position reports
- Fix crossing time, altitude, distance, direction, and speed – Derived from flown trajectory data
- Fix conformance – Distance, altitude, and speed deviation from target
- Meter Fix Arc crossing location, time – identified between consecutive position reports
- Meter Fix Arc conformance – Comparison between STA and Meter Fix Arc crossing time
- Vectoring delay – Geospatial comparison of flown trajectory vs. planned route of flight
- TBFM airborne delay – Difference between STA and ETA when STA first becomes frozen
- Arrival runway – Identify actual landing runway
- Miles-In-Trail / Minutes-In-Trail – Spacing between consecutive aircraft based on flown trajectory
- Joined trajectory – Geospatial matching of position reports from TFMS and STDDS
- Joined route – Geospatial merging of filed flight plan with nominal interior route
- True Airspeed (TAS) - Computed based on flown trajectory mapped to NOAA winds aloft
- Calibrated Airspeed (CAS) - Calculated based on TAS and altitude



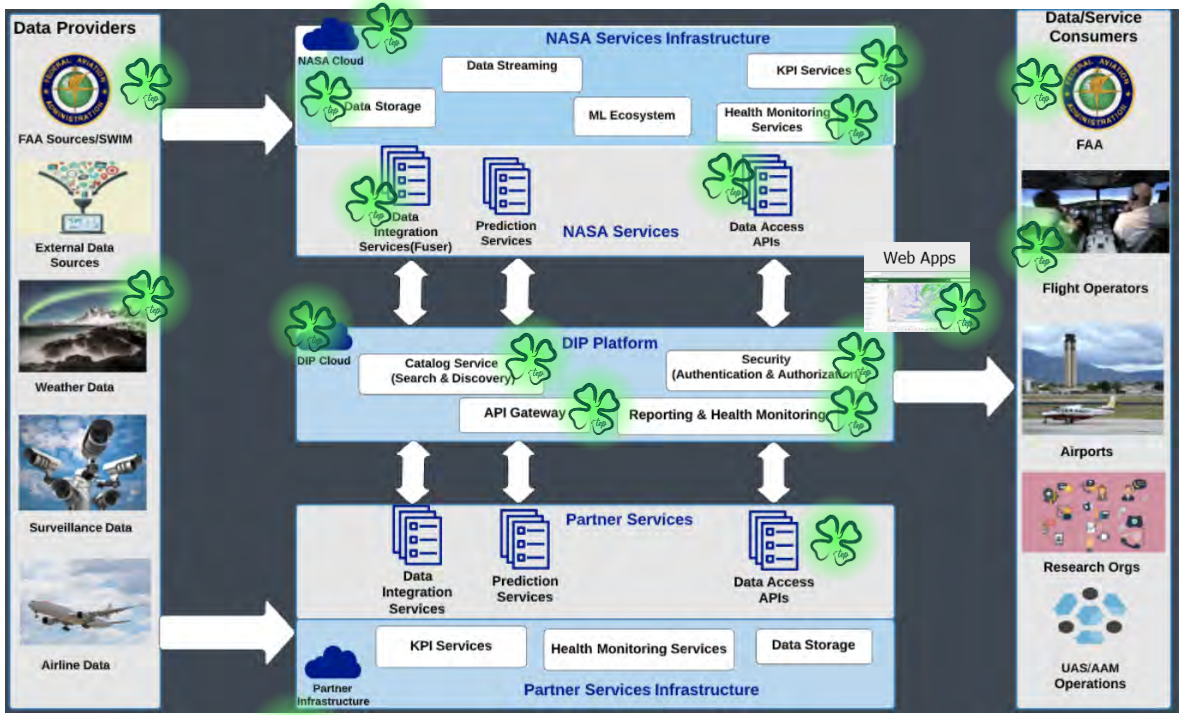


CavanReports existing capabilities compared to NASA DIP

Existing, cloud-deployed CavanReports[1] capabilities

- CavanReports Services Infrastructure
  - Data Integration Services: Consume, parse, analyze, and fuse SWIM flight data (e.g., TFM, TBFM, STDDS), weather data, and aeronautical information – processing over 150M messages per day with value-added metrics computed and stored in real-time
  - Data Storage: ~4 TB of data with at least 1 year data retention
  - Health Monitoring Services: real-time data feed monitoring and alerting
  - KPI Services: indicates if user search response may have incomplete data
  - Data Access APIs: Over 100 deployed end points
- CavanReports Platform
  - Catalog Service: registry
  - Security: API key access control for services, apps, and search parameters by role
  - API Gateway: AWS cloud deployment
  - Reporting & Health Monitoring: real-time monitoring and alerting of service availability
  - Deployed Web Apps
- Partner Services
  - NOTAM search wrapper to FAA NOTAM API
- Complete OpenAPI documentation

NASA DIP Functional Architecture*



Existing, cloud-deployed, CavanReports web services

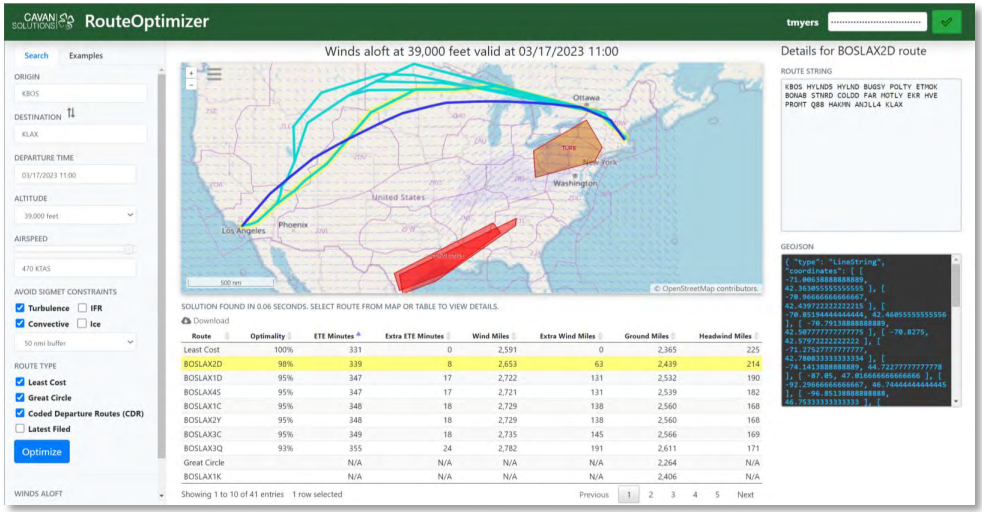
*: Presented at DIP Architecture and Data Integration Services, Workshop series #1 (11/17/2021)

[1]: CavanReports is independent of NASA DIP, NASA cloud, and NASA Fuser

CAVAN SOLUTIONS

Summary

- Wind optimal flight planning is a desirable real-time and post operations analytics capability
- CavanReports RouteOptimizer app meets this need based on Cavan's wind miles, CDR, SIGMETs, and route optimization services
- CavanReports data integration and analysis platform is an existing, cloud-deployed, web services capability



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CAVAN SOLUTIONS

North Atlantic Flight Planning:
Data Sharing through SWIM

SWIFT 20

Presenter: Bernard Gonsalves - FliteX

Date: March 23, 2023

The North Atlantic

Demand For Transatlantic Travel Is Back Stronger Than Ever

Aaron Karp February 27, 2023

Credit: Joe Pries

If airlines' schedules for July hold, more flights will cross the Atlantic than in any month in the history of commercial aviation.

Airlines are slated to operate 4,353 transatlantic flights per week in July, which would break the record of 4,238 weekly flights set in July 2019, according to an Airlines for America (A4A) analysis of publicly available scheduling data. US airlines will operate 44% of transatlantic flights in July, while non-US carriers will fly 56%.

Heathrow-JFK is the world's only billion-dollar airline route

By Maureen O'Hare, CNN
Published 11:33 AM EDT, Fri August 16, 2019

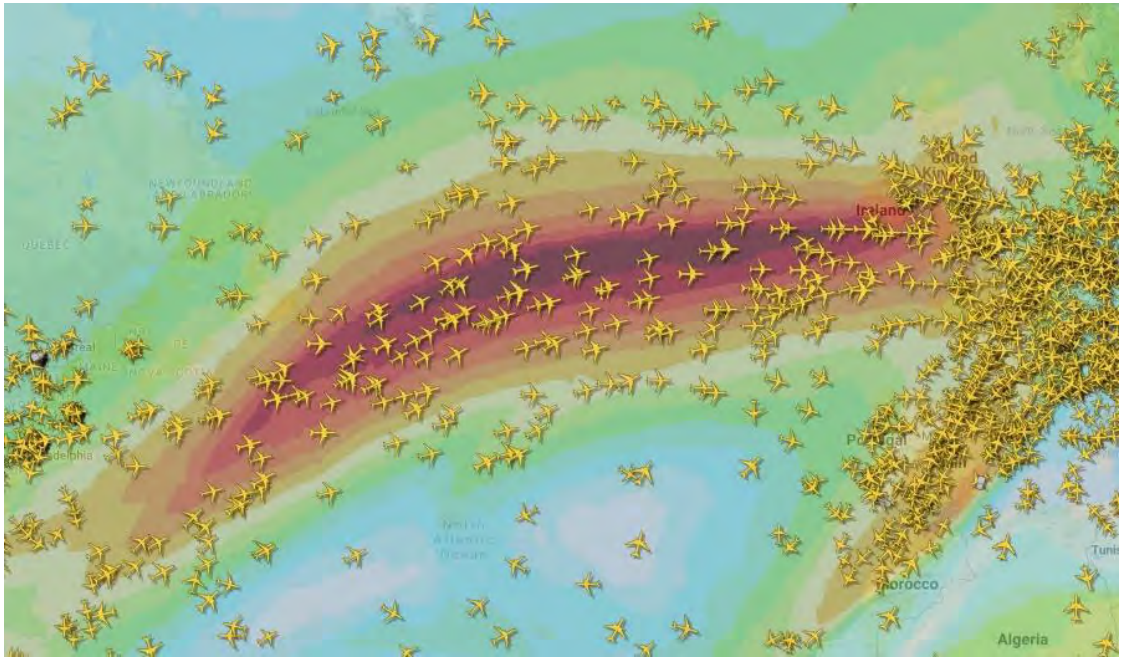
The world's only billion-dollar airline route Courtesy British Airways

2 of 8

Premium: "With over 30% of BA seats on the route in either First or Business Class the importance and the value of the route is clear to see," says air travel intelligence company OAG.

NAT Planning Considerations

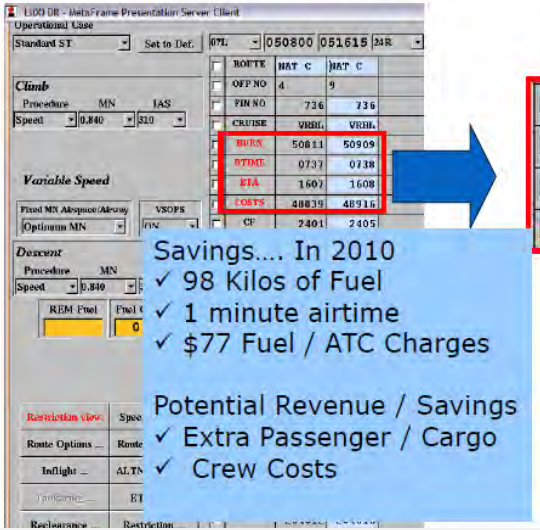
- A 200mph Jetstream can help a B787-900 to reach 780 mph.
- This image shows the set flight paths, and the planes plotted along them.
- The rainbow in the middle marks wind speed, with red signifying the most intense part of the Jetstream.
- BA112/09Feb22 - new subsonic flight speed. JFK-LHR in just 4 hours and 56 minutes (normal flt-time ~6h:30').



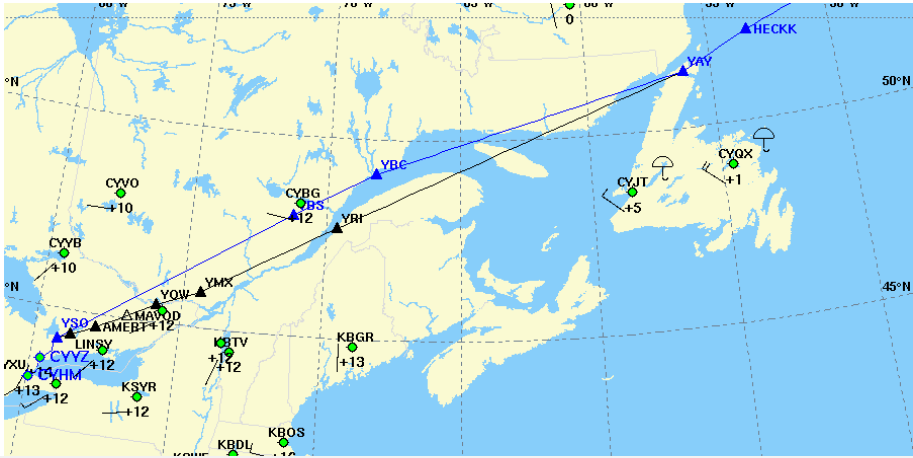
•Courtesy: .FlightRadar24.com, 17 Jan. 2018 0400utc

The Benefits are clear to see!

Comparison: Optimized vs. NAR



BURN	50811	50909
BTIME	0737	0738
ETA	1607	1608
COSTS	48839	48916



Air Canada's presentation at NAT Ops Forum- Sep.2018.

OTS & NARs add 'structure'

- IFALDA presentation to the NAM-EUR Meeting, YYC, March 17, 2019
- Modeled at 2 min savings per flight x 250 flights daily

»Fuel Savings

```
ENTERING FIR. CZQX GANDER DOMESTIC (CANADA)
N75A  SUPRY      086  572      64 014 F370 M829 531/460  15587
 N4530.0 W05200.0 079 2097    2.01     F412 M63  284.07   73641
 SUPRY           069/062
```

»Time Savings

```
ENTERING FIR. CZQX GANDER DOMESTIC (CANADA)
DCT   SUPRY      088  561      63 018 F370 M829 532/460  15285
 N4530.0 W05200.0 081 2097    1.59     F412 M63  284.07   74175
 SUPRY           072/065
```

»Cost Savings

Model	FF savings per min	Minutes saved	Flights Yearly	Total Fuel Savings	Total Fuel Savings	CO2 Savings	DOC Savings
	Cruise- kg/min	min per flight	count	yearly - kgs	yearly - USD$	yearly - kgs	yearly - USD$
Narrow Bodies	36	2	18,250	1,323,125	868,298	4,167,844	1,298,183
Wide-Twins	83	2	54,750	9,138,268	5,996,969	28,785,543	7,270,800
Wide-Tri's & Quads	144	2	18,250	5,242,313	3,440,256	16,513,284	2,447,325
Fuel Costs USD$ per Galon		1.94	TOTALS	15,703,705	10,305,523	49,466,672	11,016,308
						Total $	21,321,832

Fuel Prices Source (NAM) https://www.iata.org/publications/economics/fuel-monitor/Pages/index.aspx

Flight Count: 50 Narrow bodies, 150 Wide Twins, 50 Wide Tris & Quads

The NAT OTS Problem

- Data Silos: Airlines, ATC
- Complex: Access to FPLs & Flown Data
- Dynamics/Volume: Over 1400 daily flights, City Pairs, Routes, Levels
- Fragmented: No central repository for flight data
- Actionable Info: Inability for Track Planners to visualize route patterns, sigwx, FL occupancy, 30W crossings
- Manual Process: Reliance on GAATS… ‘eyeball’ YYZ-FRA route. Inter-Center coordination?
- Interpret: Demand analysis, Airspace capacity, Enroute Wx, CNS

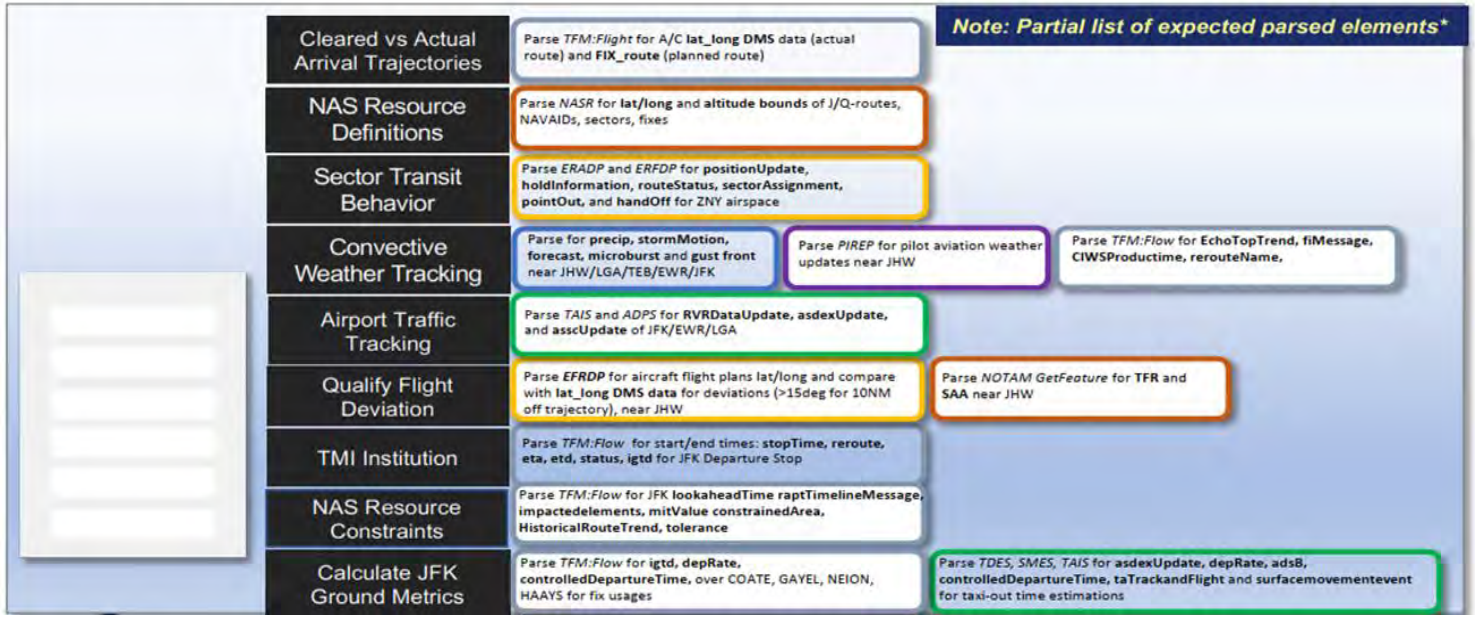
The NAT OTS Solution?

SWIFT 17 Recap & Context

- **Case Study Goals:**
  - Identify drivers and key indicators that would inform disruptions to airspace user operations earlier
  - Apply SWIM Information Services to improve operational decision-making through advanced planning
  - Capture key information to study application of data analytics/ML to improve operational decision-making
- **Case Study Problem Statement:**
  - Determine departure delay impacts resulting from aircraft deviation along flight trajectory.
    - No clear way to readily identify arriving aircraft deviations along the flight trajectory (e.g. due to weather, traffic volume), that drive ground delays
    - Lack of available post-ops data analysis to determine threshold boundaries for traffic deviation and where disruptions are severe
    - Limits the operational community from effectively planning or implementing work-arounds for airspace condition changes and resource constraints

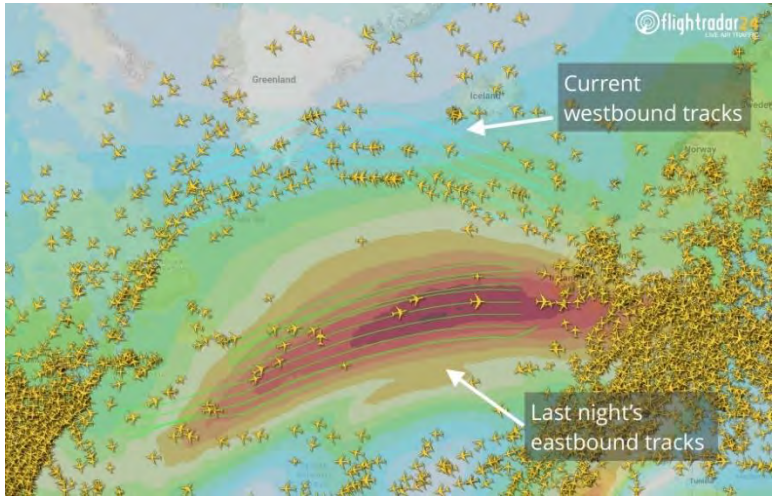
A Eureka moment!

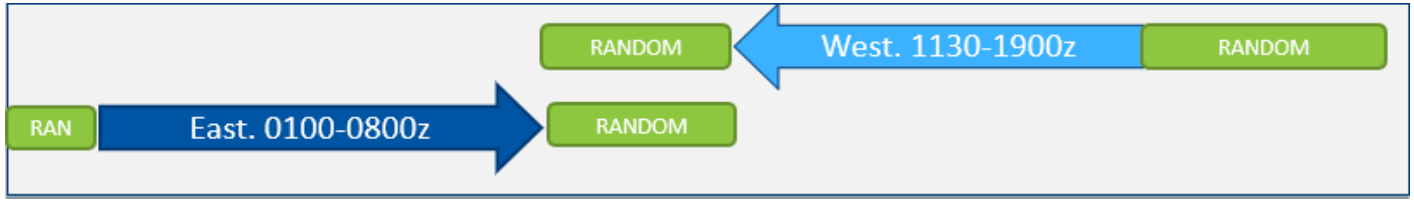
SWIM Information Services Prediction Model



Understanding the NAT Tracks- Validity

- The Eastbound OTS is valid
  0100z – 0800z
- The Westbound OTS is valid
  1130z – 1900z
- Planning outside & between is
  - Random for WBs
  - Random + NARs for EBs





Stitching it together
the ZBW ADVISORY- 1st part

The BOSTON Advisory provides the connect from

1. **JFK** – the system airport
2. **MERIT**- the East Gate
3. **HFD..PUT** – the Domestic Portion
4. **N381B**- the Coded NAR
5. **ALLRY** – the Oceanic Entry Point

ATCSCC Advisory

ATCSCC ADVZY 032 DCC/ZBW 04/27/2019 NATOTS_RQD

RAW TEXT:

```
EVENT TIME: 27/2100 - 28/0500
ZBW NORTH ATLANTIC ADVISORY FOR 04/27/19 2100Z - 04/28/19 0500Z

NOTE: CERTAIN TRACKS HAVE MORE THAN ONE OPTION. USERS MAY FILE
EITHER OR BE TACTICALLY REROUTED.
-----------------------------------------------------------------
JFK NORTH ATLANTIC DEPARTURES MUST FILE THE FOLLOWING ROUTES TO
MINIMIZE DEPARTURE DELAYS:

TRACK P/  JFK..GREKI..JUDDS..MARTN..QUBIS..CUDDY.NATP
TRACK Q/  JFK..GREKI..JUDDS..MARTN..TAFFY.N681A.JANJO.NATQ
TRACK R/  JFK..GREKI..JUDDS..MARTN..TOPPS.N441A.TUDEP.NATR
TRACK S/  JFK..MERIT..HFD..PUT..EBONY.N381B.ALLRY.NATS
TRACK T/  JFK..BETTE..ACK..ALLEX.N353B.BUDAR.NATT
TRACK U/  JFK..BETTE..ACK..TUSKY.N321A.ELSIR.NATU
TRACK V/  JFK..BETTE..ACK..BRADD.N255A.JOOPY.NATV
TRACK W/  JFK..HAPIE..YAHOO..KANNI.N225A.MUSAK.NATW
TRACK X/  JFK..HAPIE..YAHOO..WHALE.N193A.NICSO.NATX
TRACK Y/  JFK..HAPIE..YAHOO..VITOL.N133A.PORTI.NATY
```

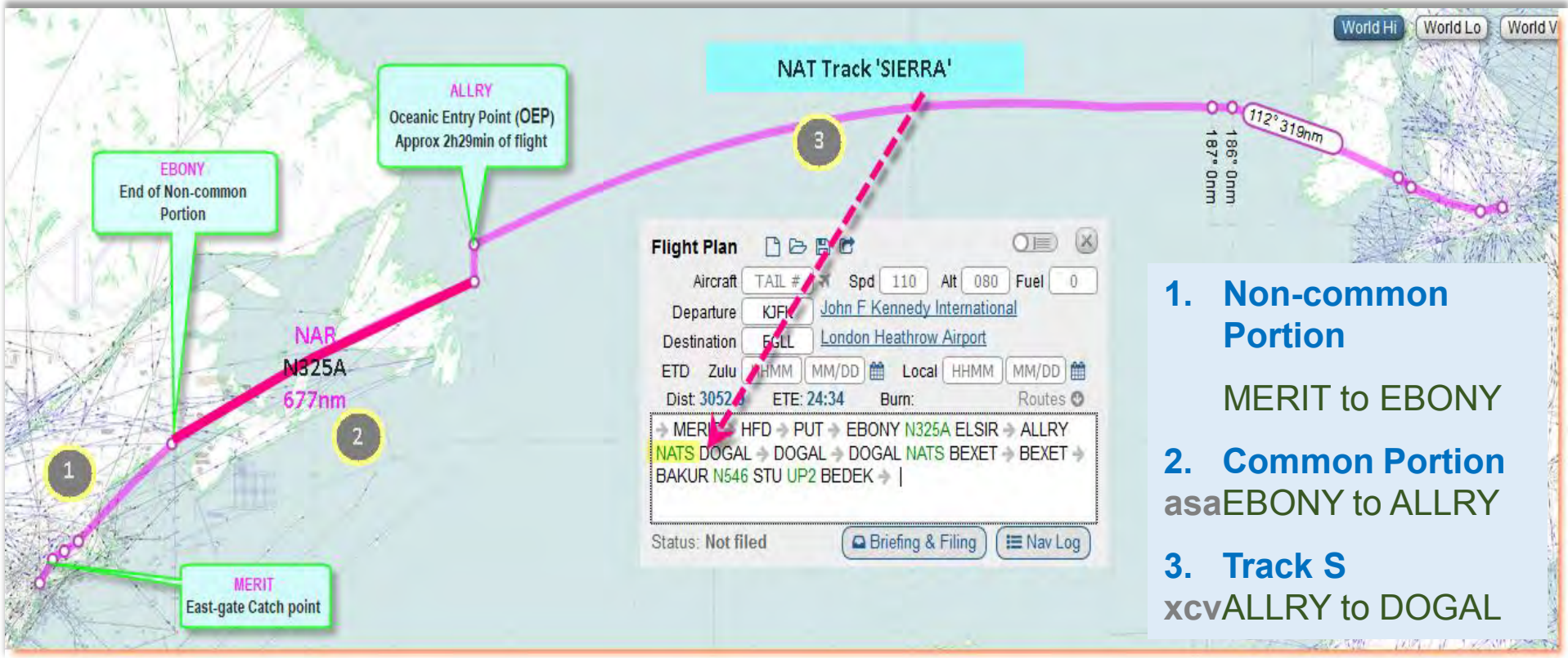
Stitching it together
2nd part - The NAT OTS Message

The NAT OTS message provides the connect from

1. **ALLRY** - the Oceanic Entry Point to
2. **Track S**… the Oceanic Crossing to
3. **DOGAL**… the Oceanic Exit Point to
4. **BEXET** – the Domestic landfall pair

```
271324 CZQXZQZX
(NAT-1/3 TRACKS FLS 320/400 INCLUSIVE
APR 28/0100Z TO APR 28/0800Z
PART ONE OF THREE PARTS-
P CUDDY 57/50 58/40 58/30 58/20 58/15 GOMUP GINGA
EAST LVLS 320 340 360 380 400
WEST LVLS NIL
EUR RTS EAST NIL
NAR N815A-
Q JANJO 56/50 57/40 57/30 57/20 SUNOT KESIX
EAST LVLS 320 340 360 380 400
WEST LVLS NIL
EUR RTS EAST NIL
NAR N687A N681A-
R TUDEP 52/50 54/40 55/30 55/20 RESNO NETKI
EAST LVLS 320 330 340 350 360 370 380 390 400
WEST LVLS NIL
EUR RTS EAST NIL
NAR N445A N441A-
S ALLRY 51/50 53/40 54/30 54/20 DOGAL BEXET
EAST LVLS 320 330 340 350 360 370 380 390 400
WEST LVLS NIL
EUR RTS EAST NIL
NAR N389B N381B-
T BUDAR 5030/50 5230/40 5330/30 5330/20 NEBIN OLGON
EAST LVLS 350 360 370 380 390
WEST LVLS NIL
EUR RTS EAST NIL
NAR N365A N353B-
END OF PART ONE OF THREE PARTS)
```

The 3 phases of Planning an EB NAT Track



1. **Non-common Portion**

   MERIT to EBONY

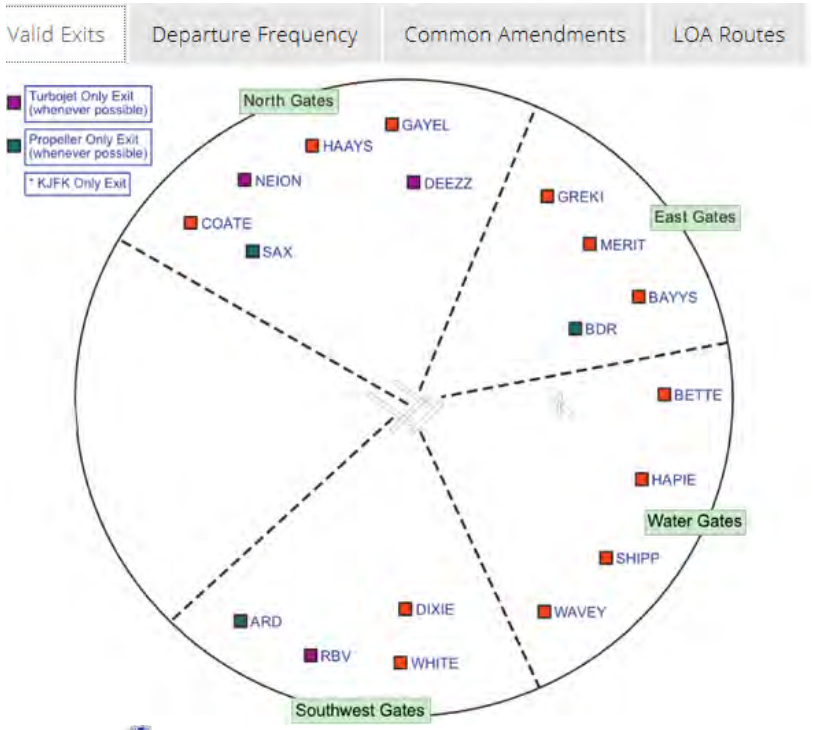
2. **Common Portion**

asaEBONY to ALLRY

3. **Track S**

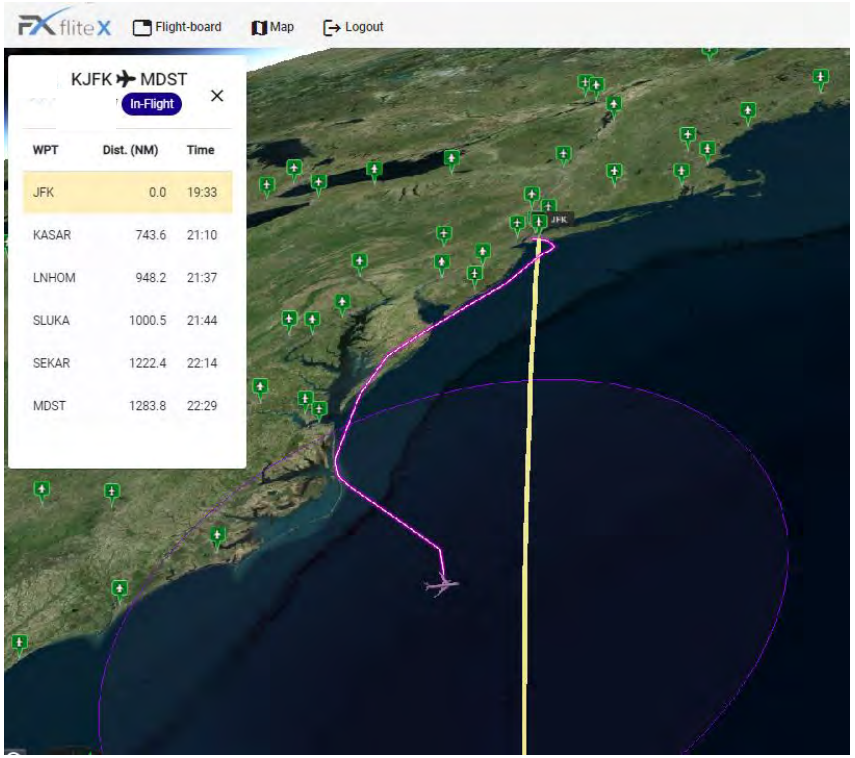
xcvALLRY to DOGAL

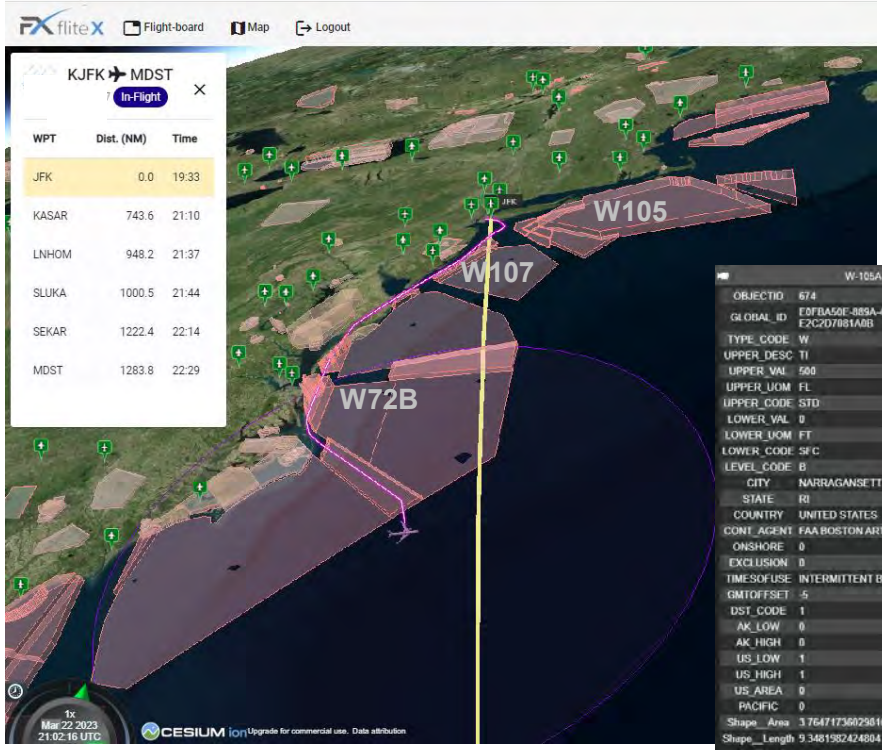
NAT EB Choke Points



- Metering at the Water & East Gates
- Controller R/T & Workload
- Disruptions due Weather or W105 that causes reroute off of N90 departure fixes (GREKI, MERIT, BETTE, HAPIE)
- Could create the need for NARs between Inner Navigational Fixes (INFs) to Coastal Fixes (OEFs).
- Calls for Miles-in-Trail or Minutes-in-Trail over saturated departure fix, and extra flight miles flown to INF.

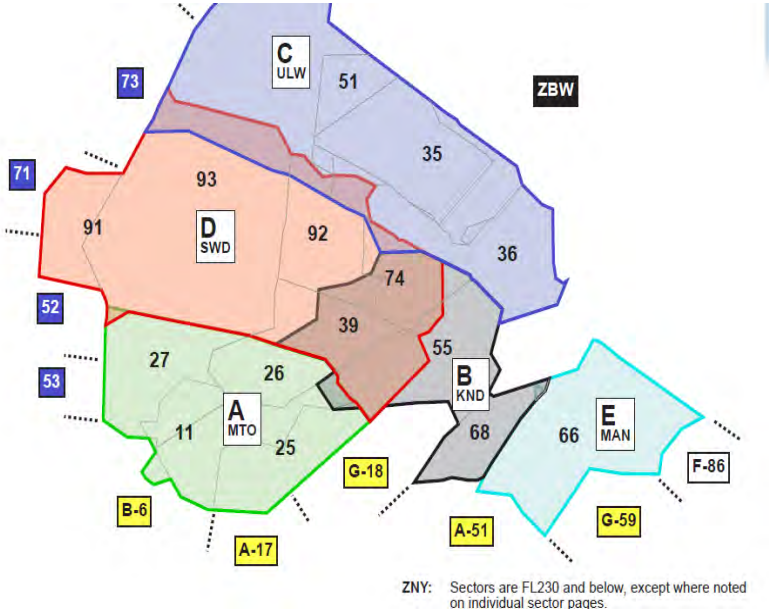
Plan vs Flown- other factors



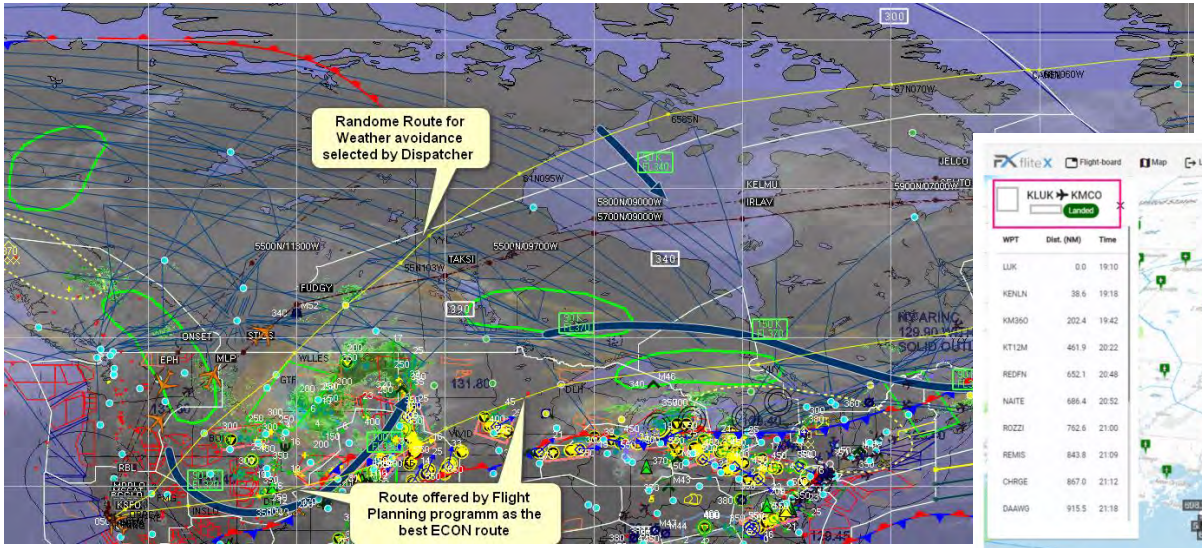


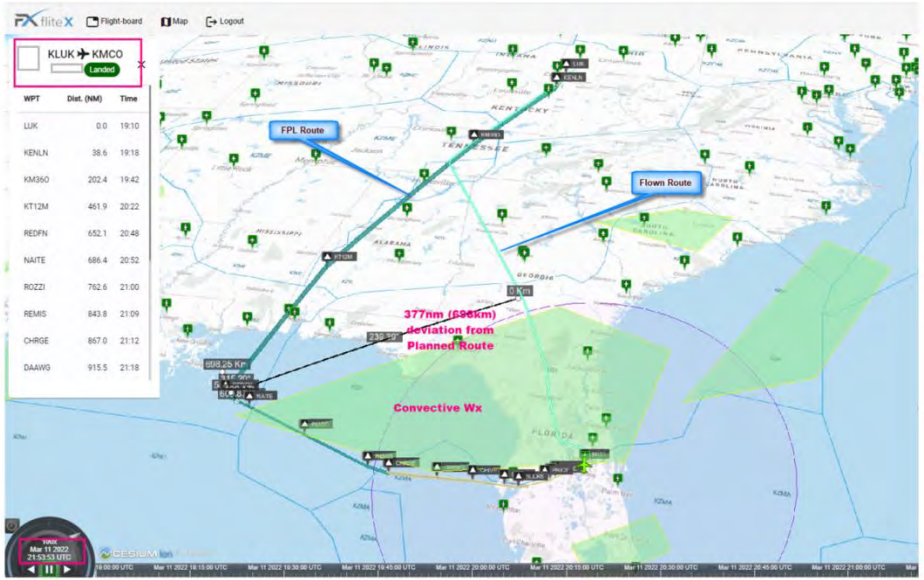
Other ATM Complexities Transition beyond Area E

- Area E maintains 2 radar sectors…considered ‘offshore'
- Sec.66 ‘owns’ airspace to the southeast of JFK (south of Long Island)
- There are no VORs or airports within this sector.
- One of the busiest, and most difficult sectors within the facility,
  - numerous aircraft that are 'head-on' and
  - required to climb/descend thru each other's altitudes.
- A lot of vectoring and speed control involved.



Dispatch - the OODA Loop





SWIM Fusion Components

Each Day
- 30,000 Flight Plans handled
- Matched with ~ 6 million Flown data points

Flight Board
- SID-STAR, Transition Fix, Enroute Segment
- Clearly distinguish Plan, Flown, Landed
- 5 days Historical Data
- Machine Learning integration
- Filter, Search
- Build Offices, Desks

Other Data
- Restricted Areas
- SIGMET – only see those affecting flight
- Severity/Hazard
- Notams: AD & RWY Closures
- Notams: COVID related
- D-ATIS
- CAT, CBs, INCL.TB, EDR etc.

GIS Tool
- 3-D Real-time Simulation
- Play & Validate Filed FPL prior Takeoff
- View Current Position
- Flight Replay
- Time (Clock Speed), Lateral (Camera Setting), Vertical Dimension (extrusions)
- Distance Circle
- Distance Ruler

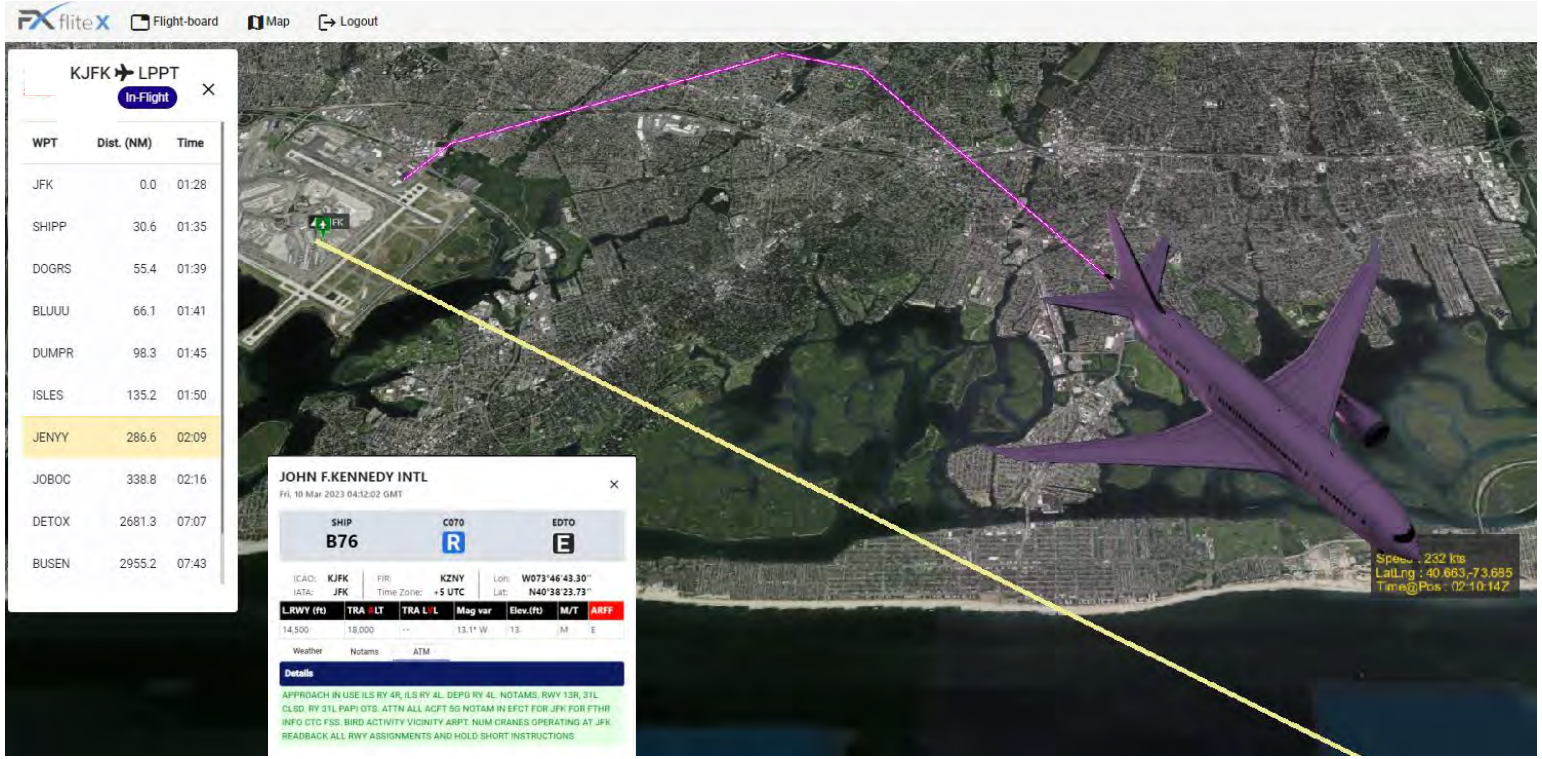
SWIM
- Always 'ON'
- Integrates Multiple Services
- Current: R13, TDES, Gate, D ATIS
- Planned: SAA, CTOP, TFDM, LLWS

C070 Airports
- Ship association
- Airport Table
- Live updates for
- MET, ATM, Notams
- COM Capability for ARFF, Station, Center etc.

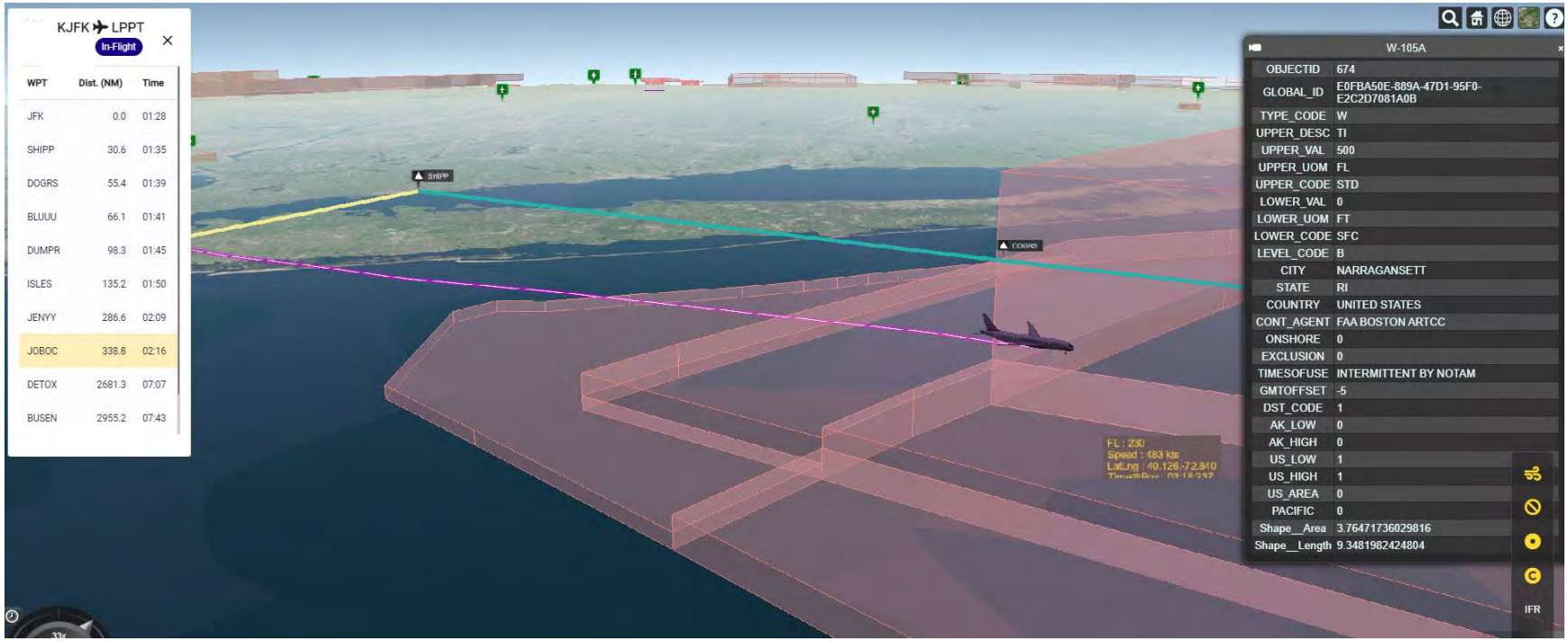
DEMO

Working with SWIM Data, Fusion & Live Simulation

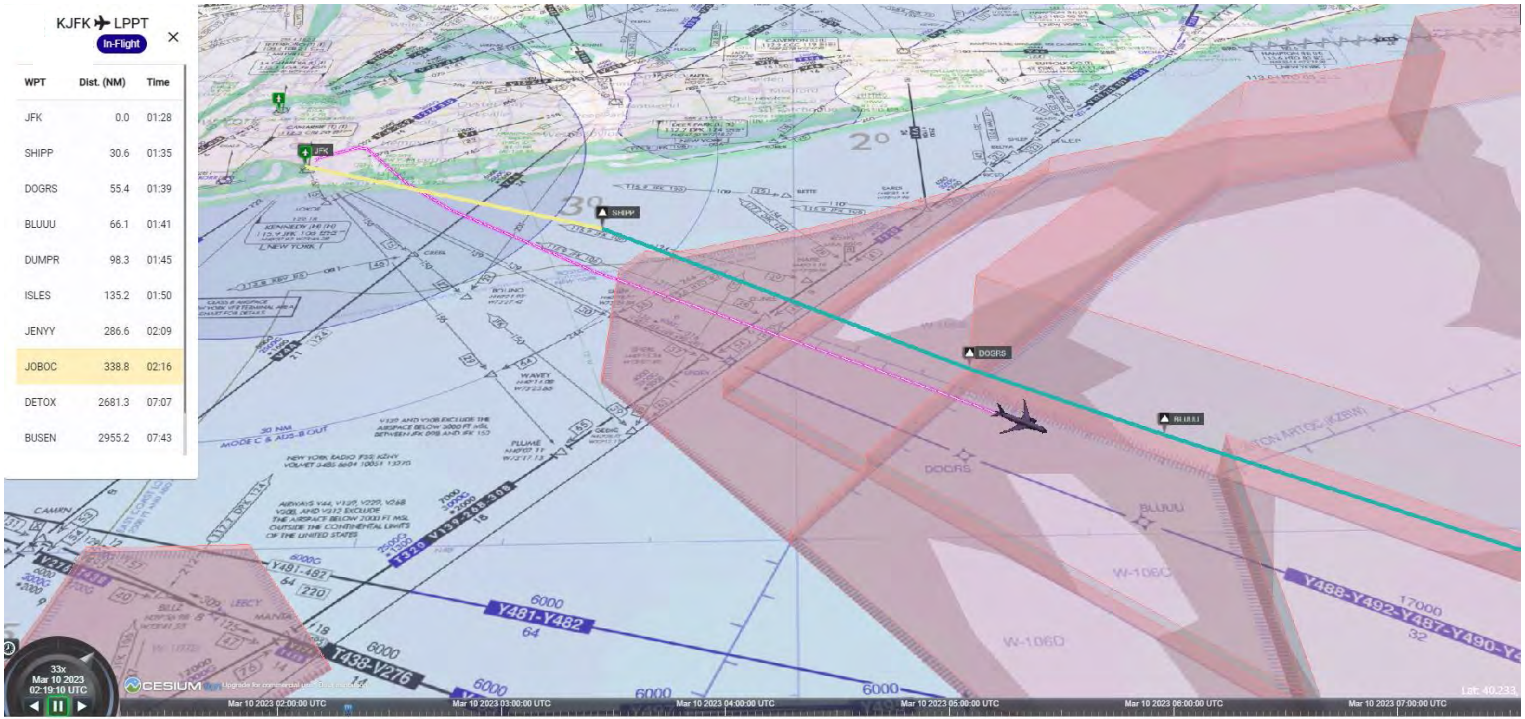
Plan vs Flown- Live Sim



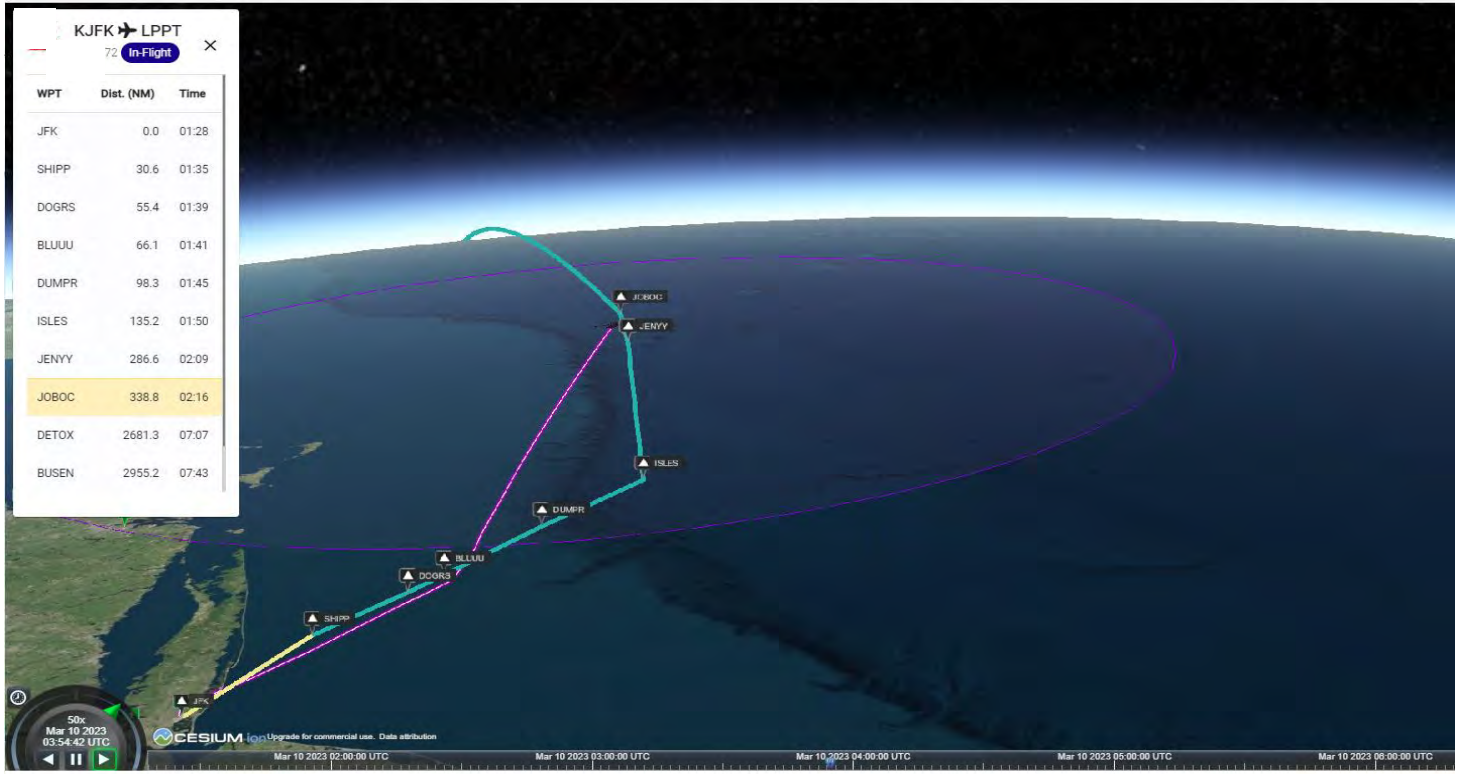
Plan vs Flown- Live Sim



Plan vs Flown- Live Sim



Plan vs Flown- Live Sim



Plan vs Flown- SIGWX

Plan vs Flown- Current POS

Thank you! Merci!

“Every once in a while,

a new technology, an old problem, and a big idea

turn into an innovation”

Dean Kamen

“ De temps en temps,

une nouvelle technologie, un vieux problème et une grande idéé

se transforment en innovation”

Dean Kamen

https://www.flitex.net

contact@ flitex.net

@ PlanVol

SWIFT Focus Group Updates

SWIFT 20

Presenter: Xavier Pratt – LS Technologies
Chris Gottlieb – JetBlue
Erin Cobbett – Delta
Mike Jagmin – United

Date: March 23, 2023

Ops Issues Focus Group

Leads: Chris Gottlieb (JBU) and Xavier Pratt (LST) (Contract Support)

Background & Purpose Recap:

Ops Analysis

- Address NAS-wide operational issues that might benefit from information sharing between organizations
- Identify SWIM services, messages and data elements to resolve NAS user challenges

SWIM Data Use Cases

- Explore Ops issues through use case studies
- Leverage SWIM Operational Context documents and SWIM Info-services Roadmap to inform user investment decisions

Want to join us? Contact Us:

Chris Gottlieb - Christopher.Gottlieb@jetblue.com

Xavier Pratt - Xavier.Pratt@lstechllc.com

Current Prioritized Ops Issues:

- **Flight Planning over IP (SWA)**
  - Status: CSS-FD Engineering Team finalizing requirements to support user FP filing, planning and data sharing needs through SWIM
  - Outreach to SWIFT Community encouraged to join discussion and activities
- **Early Planning for Disruptions**
  - ***Early Detection of Deviations over a Fix (JBU)***
  - ***Early Detection of Airport Surface Delays (JBU)***
  - *Taxi Out Return to Gate tracking / visibility (DAL)*
  - *Long taxi issues at JFK (JBU)*
    - Status: NY/North TX Prediction Model developed to apply SWIM data context to assess arrival deviation impacts on ground taxi times, during convective weather
- **Flight Data & Trajectory Based Operations (NEW!)**
  - Status: Introduce Operational Context Study at SWIFT #20
  - Socialize study through OIFG to promote discussion and collaboration
- TBFM delay (UAL) who, what, why it matters
  - Status: TBD

Bolded Issues – actively engaged

Development & Analytics Focus Group (DAFG)

Leads: Erin Cobbett (DAL), Mike Jagmin (UAL) and Xavier Pratt (LST) (Contract Support)

Background & Purpose Recap:

Data Analytics

- Identify smaller scale data, operational, and analytical problems that already exist in the community
- Identify services, messages, data elements, logical transformations to solve problems

Development

- Create logical software design to solve problems
- Develop physical representations of data as designed by group

Current Prioritized Ops Issues:

- **Flight Data & Trajectory Based Operations (NEW!)**
  - Status: Introduce Operational Context Study at SWIFT #20
  - Socialize study through Focus Groups to promote discussion and collaboration
- **TBFM "Best" Estimated Times**
  - Status: TBFM Program incorporating Focus Group/Airline feedback into planned changes for TBFM MIS next release version schema
- Developers Webinars & Workshop
  - Status: Completed Developers Workshop Webinar Series and Developers Workshop
  - Future events TBD

Want to join us? Contact Us:

Erin Cobbett - erin.cobbett@delta.com

Mike Jagmin - michael.jagmin@united.com or Xavier Pratt – xavier.pratt@lstechllc.com

Operational Context Study:

Flight Data & Trajectory Based Operations (TBO)

SWIFT 20

Presenters: John Kelley – LS Technologies
Mark Hopkins – LS Technologies

Date: March 23, 2023

Introduction to Ad hoc Concept

- We're changing the nature of the focus group concept
- Instead of being generically an "Operations Focus Group", we're identifying a specific issue that's important to the community and we are going to attack these issues as single topics
- A single issue will be the basis of the work where we will have operations people, technical people, and anyone else who wants to collaborate, working towards solving a specific circumstance or issue

CASE STUDY: Data driving 4DT

- A Case Study lead by an ad hoc focus group
- Concentrated on operational improvements that airlines can take advantage of by applying the flight data availability and trajectory-based operations concepts
- Leveraging current SWIM data, and planning for future operations utilizing the advanced tools that CSS-FD will deliver

Trajectory Based Operations

- **DATA** (As-Is) - enables the full realization of the benefits of TBO
  - Readily available, actionable data is available today (SWIM)
  - As more services come online, data will become even richer
  - Rich data allows for informed decisions and better outcomes

- **CSS-FD** (To-Be) - Services allow for more interactive planning
  - Awareness of constraints through feedback during planning
  - More informed plans require less intervention
  - Less intervention results in predictable results and efficiency

Benefits

- Most efficient trajectory research via Trial Requests
- Constrained airspace awareness feedback during planning
- Reevaluation of filed trajectory up until departure
- Routing preferences to support business priorities
- Potential for predictive analysis leveraging SWIM data via ML

Executive Summary

Problem Statement

- Airspace Users/Operators need access to rich, timely data to efficiently plan, execute and deliver operations which support more predictable 4D-trajectory outcomes.

Impacts

- ***TBO Environment -*** *Need for effective Airspace Service Provider collaboration and utilization of Airspace User set of capabilities (e.g. Pre/Post Departure Negotiation, Trajectory Prediction Accuracy)*
- ***Integrated NAS Picture*** *-Impeded stakeholder strategic planning due to lack of integrated depiction of historical, real-time and planned/foreseen future state of the ATM situation*

Operational Environment

- East Coast Center Traffic: Flights transiting between ZNY, ZDC, ZTL, ZJX, ZMA
- Airports: JFK, MIA
- NAS Resources: WAVEY, RBV, Airways

Introduction of Use Case Concept

Covers a flight from JFK – MIA that includes:

- Use of SWIM data
- Ground and departure congestion
- Space launch constraints
- TOS routes / user submitted preferences
- Machine Learning (ML) predictive algorithms from third parties
- Includes FF-ICE principles through utilization of CSS-FD

Contains two scenarios

- As-Is highlighting the importance of timely SWIM data availability

- To-Be leveraging the data availability with CSS-FD / FF-ICE tools

Scenario 1 JFK – MIA As-Is

Timely awareness of the changing environment through SWIM data drives success.

Dynamic environment often requires adaptations / mitigations to address the issues

Some of these constraints can result in TMIs

Due to their dynamic nature, they are often difficult to plan for

Access to SWIM data allows informed decisions

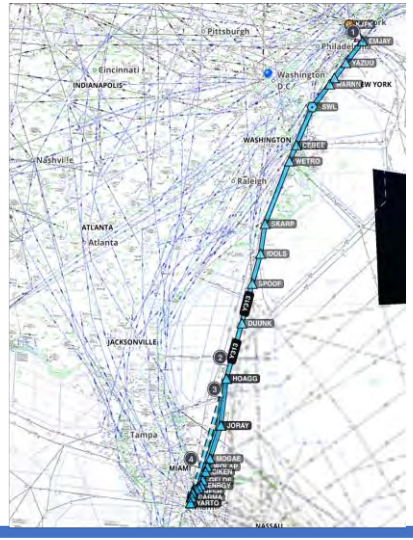
How best to adjust operations to adapt to the changing environment

Each user and every flight may have different priorities

Collaborative solutions including the ability for users to prioritize options on an individual flight basis allows tailoring to meet user needs (e.g. TOS)

Assumptions

- User is subscribed to SWIM data to have access to timely data feeds.
- Space Launch Data is retrievable through NAS automation systems that would make it quickly able to update and disseminate changes to launch area constraints.
- User is able to submit a flight plan with multiple trajectory options (TOS).
- A flight plan with multiple, prioritized trajectories can bee seen by the TMC and would be issued based on the change to constraints with minimal communication from the flight operator required.



Scenario 2 JFK – MIA To-Be

- Principles of FF-ICE will be implemented through CSS-FD

During CSS-FD phase 1, predeparture planning capabilities will be enabled

Direct feedback on constraints to 4DT

Trial request service allows for interactive analysis

Re-evaluation service monitors for constraints up until departure

In this scenario, the user would prefer to utilize the AR routes for time and fuel savings.

That area is becoming increasingly constrained by an increase in volume

Dispatch uses SWIM data and Trial requests for decision making and avoids constraints

Ground delays are also building prior to the dispatch of the flight

SWIM data and predictive analytics can be utilized to find solutions

Assumptions (To-Be)

- CSS-FD phase 1 has been implemented which includes Trial Requests for enhanced Airspace Users (eAU), Flight Plan Filing, and Re-evaluation Services (for eAU's and only pre-departure).
- TFDM and FMDS are functional and contributing to flow management on the surface and in flight.
- Some predictive analytics applications are available through NASA's Digital Information Platform (DIP) to dispatchers offering microservices to predict runway and departure availability.
- Dispatchers utilize these tools and monitor them up until lockout to enable tactical adjustments.
- Flight is operated by an airline with capabilities to be considered an eAU.

Note: *CSS-FD phase 1 does NOT include preliminary flight plans or consumer data filtering.*

Why does this matter?

Some benefits that Airspace Users may prioritize:

- More flexibility with routing options in and around constrained airspace
- More efficient utilization of available airspace
- User priorities of trajectory options to support business objectives
- Tailored (filtered) information feed
- Integrated surface model data to enhance ground operations
- Fewer reroutes leading to more trajectory predictability
- Fewer and more narrowly scoped delay programs

We Need Your Participation

TBO promises to deliver real value to the agency and SWIM information services can help enable airspace users to leverage those benefits into their operations.

To effectively study this use case and how it utilizes SWIM data to enable TBO, we need maximum participation from airspace users and stakeholders.

- We need to understand your concerns and priorities
- We need your operational expertise to define the issues
- We need to know where you are headed and what you need
- What technologies should be leveraged to enhance operations

This ad hoc focus group needs participating members

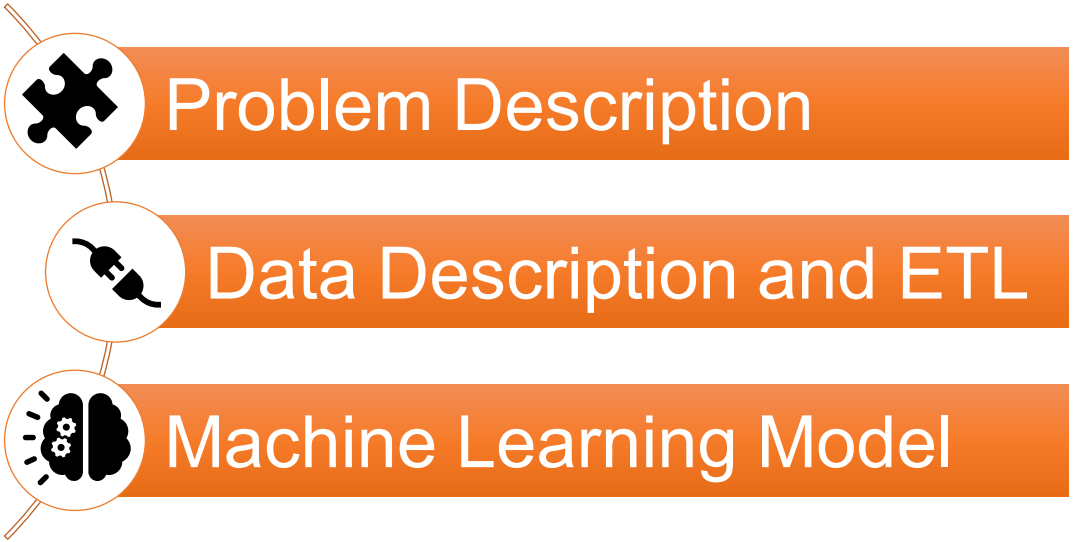
- To sign up please contact Xavier Pratt / Xavier.Pratt@lstechllc.com before **April 15th**

Early Planning for Disruption Demo & Close Out

SWIFT 20

Presenter: Nguyen D Vu – LS Technologies
Xavier Pratt – LS Technologies

Date: March 23, 2023


Problem Description
Data Description and ETL
Machine Learning Model

Case Study Summary

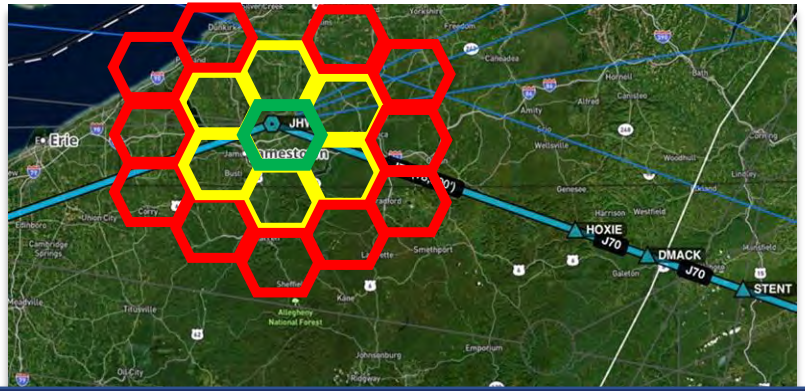
Operations Problem Statement

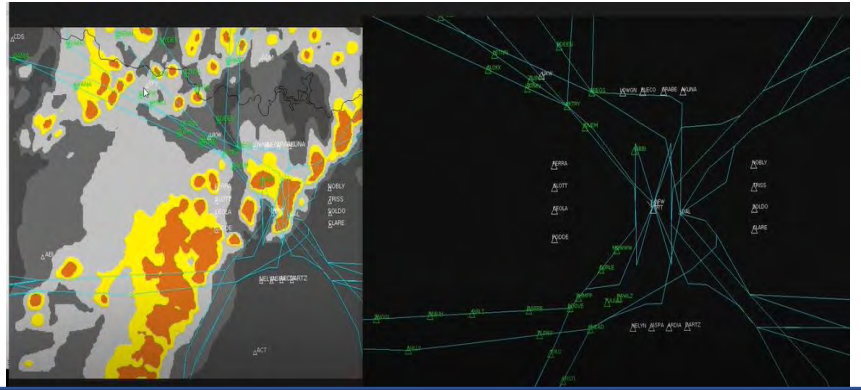
- Determine departure delay impacts resulting from aircraft deviation along flight trajectory during convective weather.

Operational Environment

- New York and Cleveland Center Boundary: ZNY and ZOB
- North Texas Region and Adjacent Centers: ZFW, ZHU, ZAB

June 21, 2021





***New York Perspective**: We focus in the vicinity of Jamestown VOR (JHW) on any of the J,Q or other trajectory cleared through that area, in which, local convective weather forces N90 arrivals north.*

***North Texas Perspective**: Typically, controllers will align inbounds at FL240 near Wichita Falls Navaid (SPS). This gives D10 controllers the spacing needed to manage flights for RWY 13R - leaving remaining runways of other corners.*

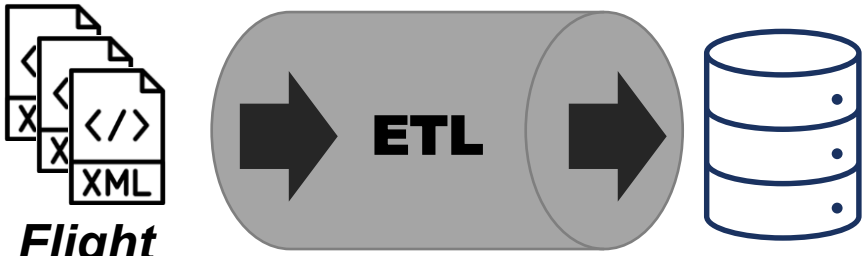
Transition: NY to NTX, Ops Perspective

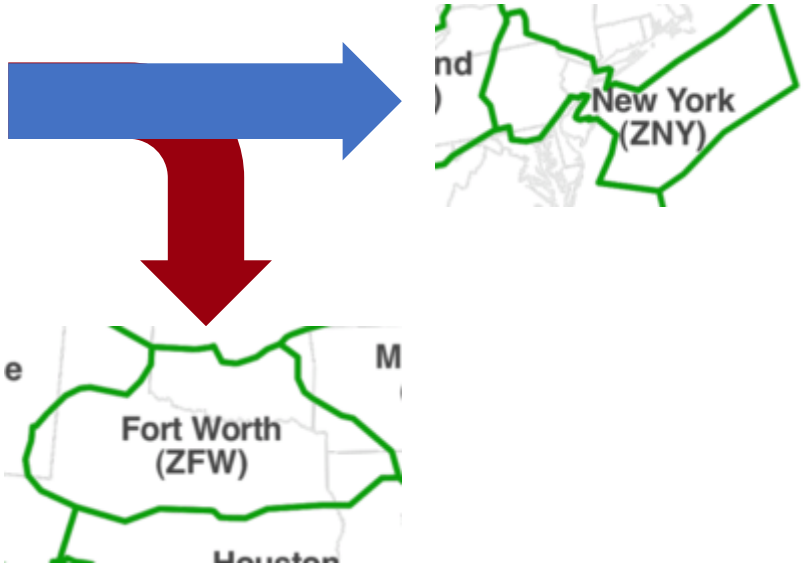
Operationally, the New York and North Texas airspace models differ considerably. When considering the applicability of the ML model to the different airspace, we sought to ensure smooth transition.

1. Evaluated the arrival and departure flow patterns of the NTX airspace
2. Leverage ATO SME input to characterize the Operational Environment and Problem Space
3. Expanded the density map overlay despite NTX utilizing different flow than NY
4. Account for increased airspace, NAS resource designations and corner post operational design
5. Evaluated the applicability by testing for specific circumstances
6. Arrival and departure procedures were analyzed to look for areas where deviations would cause the greatest impact

Summary: Compared to NY, North TX deviations to backflow and resulting surface delays due to the larger available airspace, was less likely. However, the model mapped effectively from one area to another, and can be applicable to other airspaces throughout NAS.

Transition: NY to NTX, Data Perspective

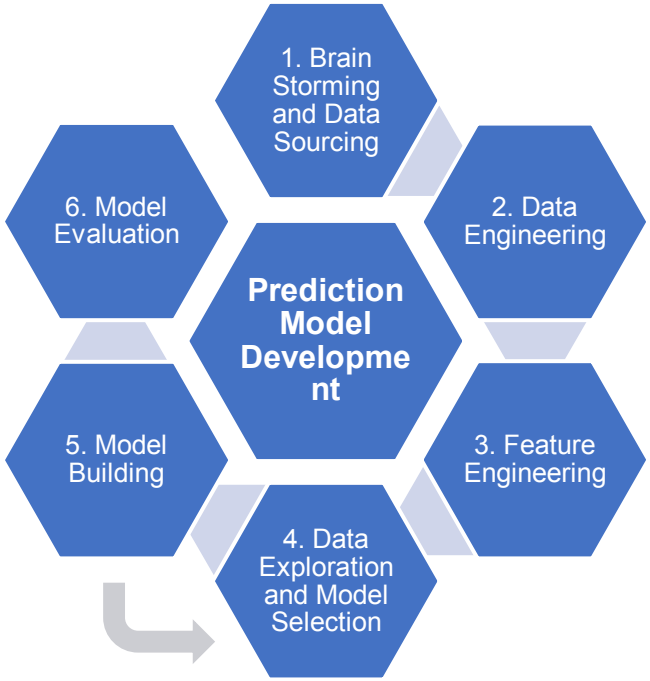




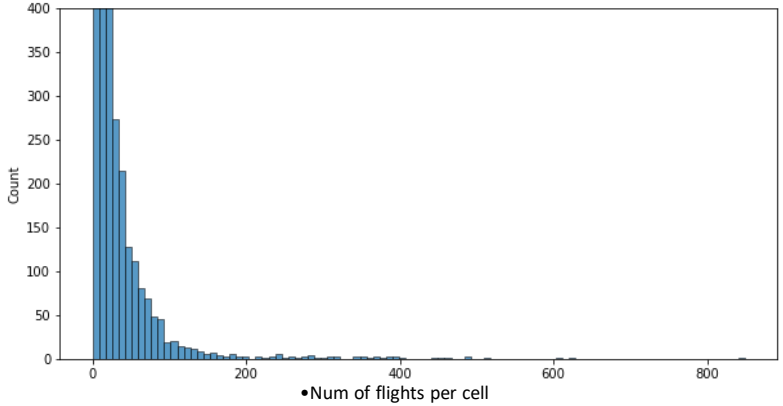
- Transition between the airspace of interest occurs in the back end of the data pipeline to extract relevant flight information from the interested airspace(s).

Understanding the Problem Space:

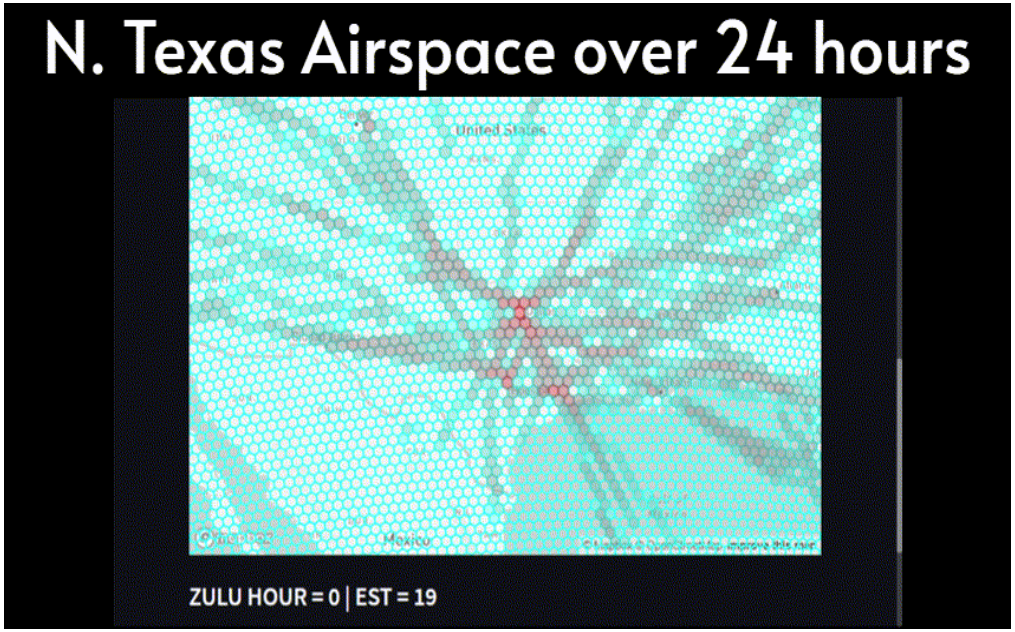
Machine Learning model building steps



Visualization and problem analysis for the North Texas Airspace On 21-Jun-2021



- 1000 miles Radius, cell Edge =13 Nautical Miles
- Over 1500 unique flights identified and 25,000 flight messages found each day
- Data is very right-skewed, root or log transformation may be appropriate



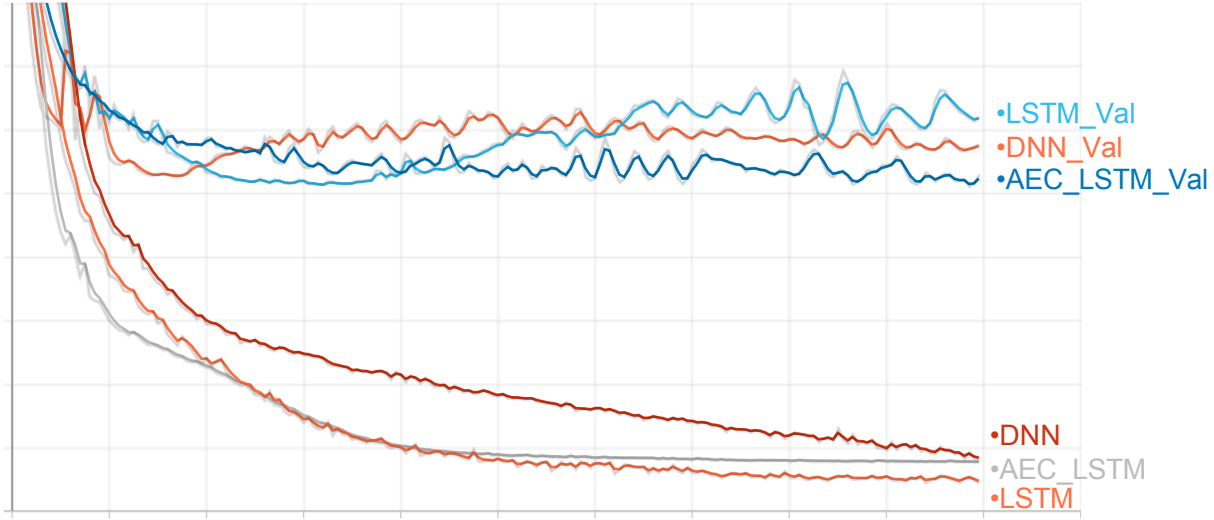
•Uber-H3 library implemented to index geospatial data over the interested airspace

Modeling Selection RATIONAL: Deep Learning

- The problem can be treated as a sequence-to-sequence prediction
- Model latent relationships in the dataset with minimal feature engineering necessary
- NN's scalability with performance as more data is fed into the model
- Deployed model has relatively quick test time to accommodate live streaming data

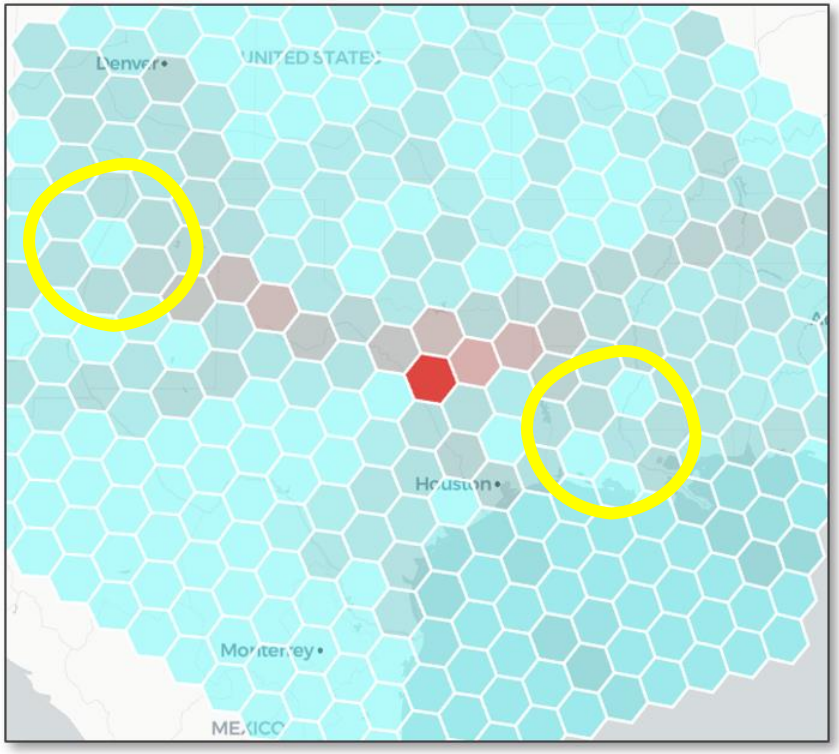
- Arrival traffic flow deviations should directly correlate to departure flow changes of rate and path
- Irrespective of weather or other factors driving traffic deviation, the model can holistically capture all changes in traffic density over time in the airspace of interest
- A critical element to support a view of an Integrated NAS Operational State)

Training Results

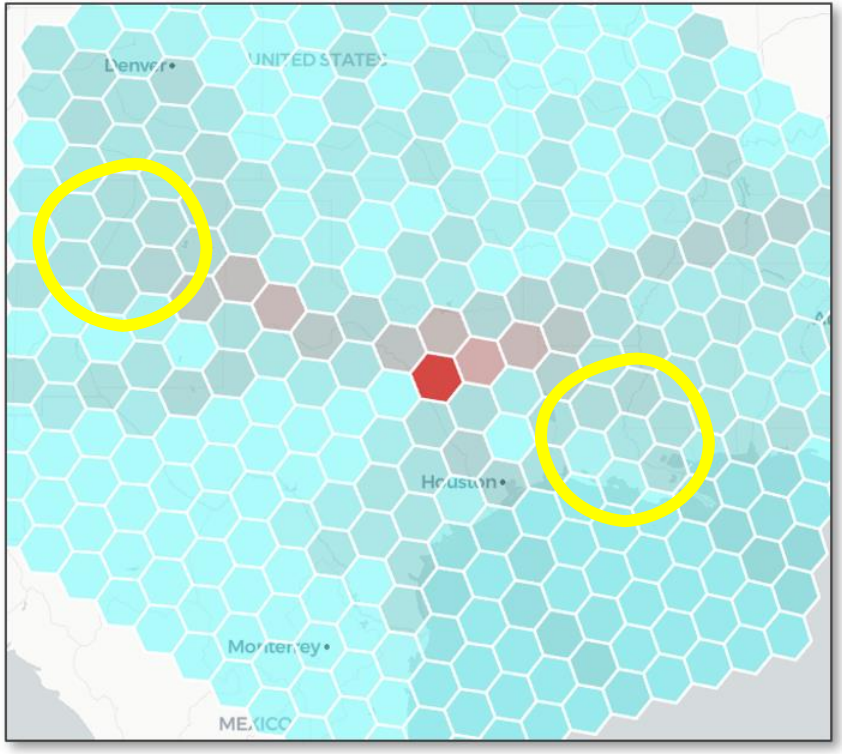


- Long Short-Term Memory (LSTM) model with autoencoding (AEC) layers performs the best during training compared to Deep Neural Network (DNN) and LSTM models
- Validation loss curves indicates overfitting training data in all three cases
- Fluctuation in training and validation may indicate underrepresentation in the training set

Predicted



Actual



•Actual versus Predicted Departure Density using the LSTM-AEC at 1500Zulu on 21 June 2021

Discussion

- Additional data would improve model training and validation
- Limited scope of the problem space (e.g., limit airports, type of deviation)
- Collaborate with Ops SME and stake holders to obtain and identify additional features
- Experiment with different network topologies and hyperparameter tuning to improve performance
- Scale model to multiple areas simultaneously for a more holistic look at the entire US airspace

OPERATIONAL IMPACTS

Proactive / Reactive Traffic Management System

Air Center (e.g. Airports) Support

Sector TRACON[1] Support

Pilot / Airline Support

SWIFT Portal Update

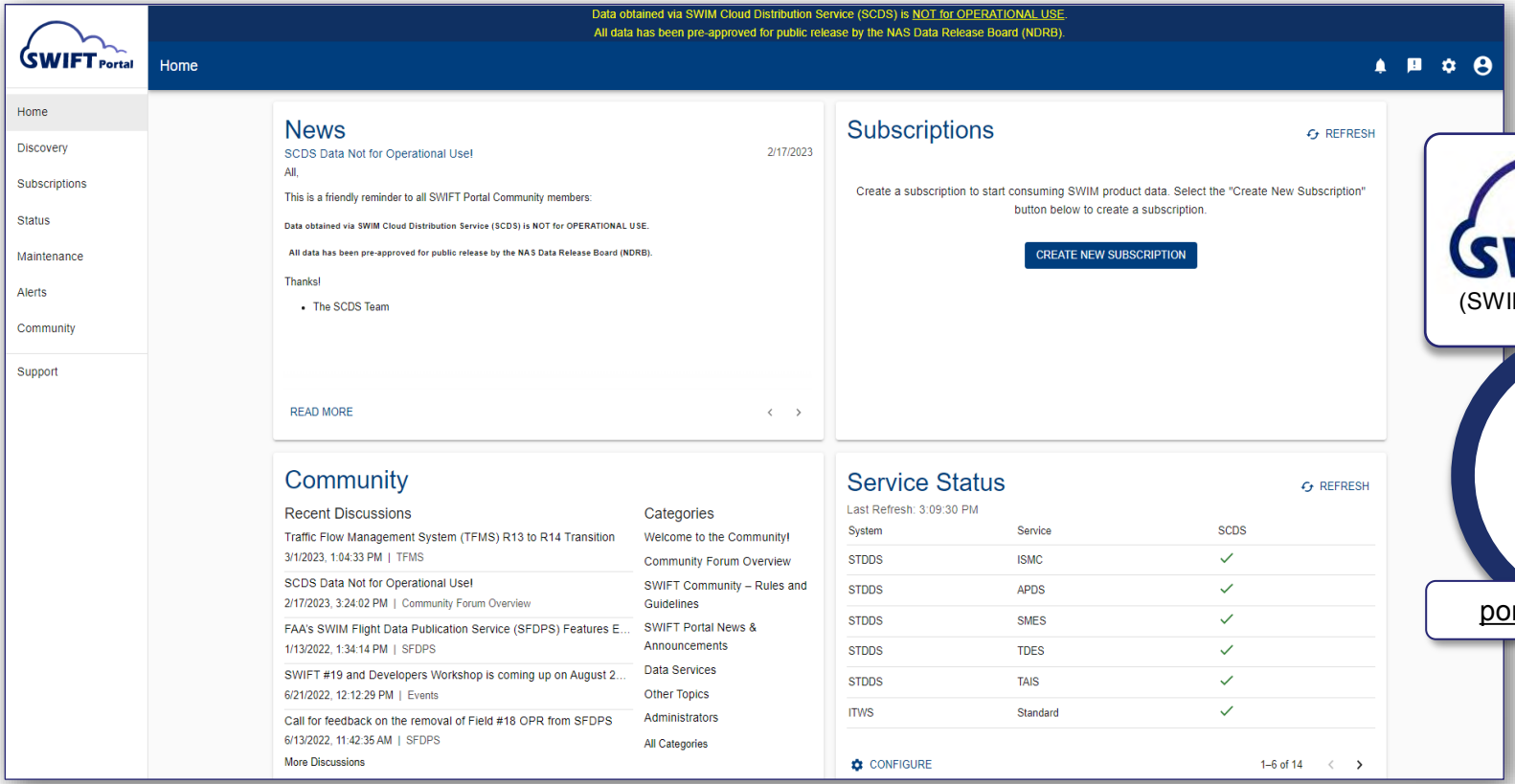
Important Announcements for SCDS Users

Presented to:
SWIFT 20

By:
Kevin Dement (Noblis)
SWIM Program Support
SWIFT Portal Engineer

Date:
March 23, 2023

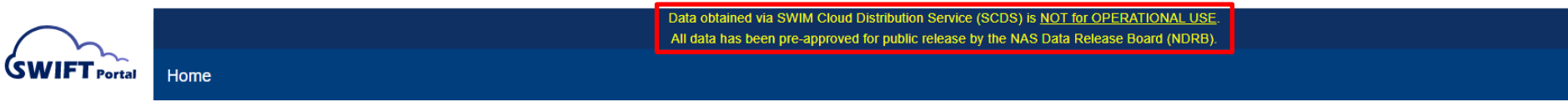
SWIFT Portal



SWIFT Portal
(SWIM Industry-FAA Team)

portal.swim.faa.gov

Important Reminder!!



- **Data obtained via SWIM Cloud Distribution Service (SCDS) is NOT for OPERATIONAL USE.**
- **All data has been pre-approved for public release by the NAS Data Release Board (NDRB)**
- **For external consumers of SWIM data for operational use, please continue to use your legacy NESG connections.**

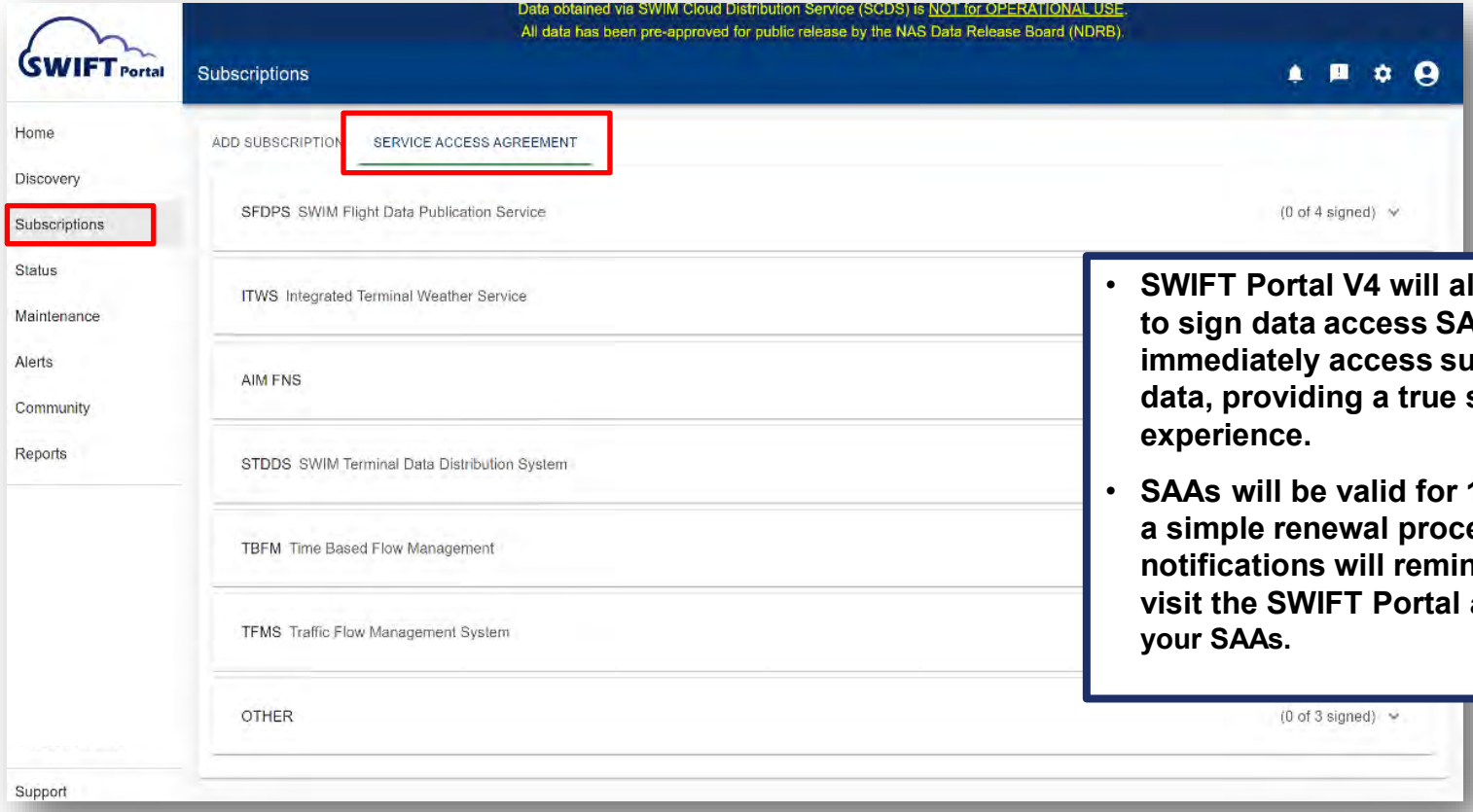
SCDS Certificate Validation

Attention! To all users locally storing Root Certificates for validation:

- **Each April, SCDS will perform its annual SSL Certificate renewal**
- **In the past this has caused problems for consumers with hard coded certificate file values. These consumers reported receiving application initialization errors.**

Details relating to the error messages and fixes will be posted on the "Community Forum" under "Common Errors after SCDS Portal Annual SSL Certificate Renewal"

SWIFT Portal V4 Release



- **SWIFT Portal V4 will allow users to sign data access SAAs and immediately access subscription data, providing a true self-service experience.**
- **SAAs will be valid for 1 year with a simple renewal process. Email notifications will remind you to visit the SWIFT Portal and re-sign your SAAs.**

SWIFT Portal Best Practices

Access Agreements

- The new version of the SWIFT Portal will require users to renew all their Service Access Agreements
- Users will have 60 days to sign new Service Access Agreements following the release of the new version of the SWIFT Portal
- All existing subscriptions will be terminated after the 60 day Grace Period

Data Compression

- Data compression helps reduce SCDS operational cost.
- Please do not turn this feature off.
- Violators may be subject to account termination in the future.

Clients per Organization

- To further reduce SCDS operational cost, we ask that organizations please work to consolidate their Portal accounts. Please fan out (distribute) SWIM Data inside your organization.

Contact

Waldo E. Ford
SWIFT Portal Lead
Waldo.E.Ford@faa.gov

SCDS Helpdesk
9-ATO-SECC-OPS@faa.gov

Information Services Roadmap

SWIFT 20 Update

Presenter: Xavier Pratt – LS Technologies

Date: March 23, 2023

SWIM Services Deployment (Near-Term Milestones)

What's New?

***TFMData*: R15 Patch 2 deployment targeting March 2023.**

***NCR*: R1.1 Available.** Allows for consolidating and correlating NAS data and filtering 4DT constraints based on submitted flight route.

***STDDS*: R6.1 targeting key sites Summer 2024.** Under development.

***TFDM Build 1*: Targeting 2023. Key site IOC achieved at CLE 2022.** Includes TFDM/TTP airport and electronic flight data, surface scheduling and traffic restrictions information.

***TFDM Build 2*: Key Site IOC at CLT targeting Spring 2024.** Includes SMP information and TFDM Request/Reply service (TFCS) undergoing development and testing.

***NWP*: IOC targeting 2024.** Provides real time weather radar info, 0-8 hour aviation weather products and Convective Weather Avoidance Fields

***CSS-Wx*:** Single provider of weather products within NAS using standards-based dissemination. Includes NOAA, NOW and other sources

***WMSCR*: Targeting Deployment End 2023.** Allows for submitting PIREP in XML. Distributes to PIREP data users in and outside of NAS

Final Announcements

SWIFT 21:

- **TBD**

SWIFT Site Information

SWIFT@faa.gov

- Any SWIFT-related questions
- Sign up for SWIFT mailing list

https://www.faa.gov/air_traffic/technology/swim/swift

- Register for future SWIFT meetings
- Stay up to date with SWIFT
- Past meeting slides

SWIFT Contact Information

SCAN ME

Joshua Gustin, Deputy Director Air Traffic Systems (Acting)

- Email: Joshua.Gustin@faa.gov

Stefanie Calabrese, SWIFT Chair & FAA Lead

- Email: Stefanie.C.Calabrese@faa.gov
- Email: SWIFT@faa.gov

David Almeida, SWIFT Community Moderator

- Phone: (321) 735-2774
- Email: David.Almeida@LSTechLLC.com

Back Up Slides

Use Case Content

Executive Summary

Problem Statement

- Airspace Users/Operators need access to rich, timely data to efficiently plan, execute and deliver operations which support more predictable 4D-trajectory outcomes.

Impacts

- ***TBO Environment -*** *Need for effective Airspace Service Provider collaboration and utilization of Airspace User set of capabilities (e.g. Pre/Post Departure Negotiation, Trajectory Prediction Accuracy)*
  - *Lack flexibility may require conservative decisions on re-routing (TOS) around uncertain weather (include NAS constraints; expand on it)*
  - *Airspace capacity may not be fully utilized when available*
  - *Flight planning without awareness of system constraints is sub-optimal. Less flexible response to constraints changing prior to departure.*
  - *Airspace User cannot optimize impact of constraints across their own fleet*
- ***Integrated NAS Picture*** *-Impeded stakeholder strategic planning due to lack of integrated depiction of historical, real-time and planned/foreseen future state of the ATM situation*
  - *Readily available on-demand static/dynamic information to receive tailored information based on planned route (NCR, SFDPS, TBFM MIS, TFMData)*
  - *Need for integrated surface domain information for improved view of airport operations*
  - *Collaborative Air Traffic Management to support data sharing that enables flight trajectories aligning closer to business objectives*

Operational Environment

- East Coast Center Traffic: Flights transiting between ZNY, ZDC, ZTL, ZJX, ZMA
- Airports: JFK, MIA
- NAS Resources: WAVEY, RBV, [Airways and jet routes]

Scenario 1 JFK – MIA As-Is

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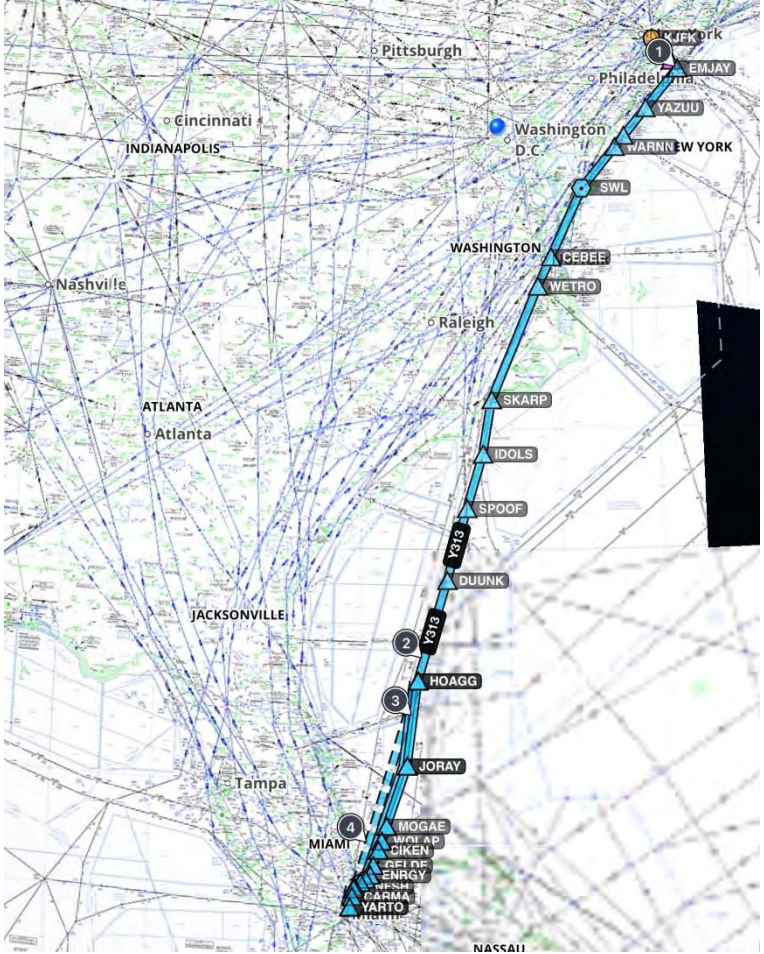

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