USA and NAM/CAR Implementation Experience of SWIM & FICE

For: Joint ACAO/ICAO ASBU Symposium for EUR/NAT and MID Region

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Date: December 10-13, 2018

ASBU Threads

FICE *B1 Elements*

1. **Allocation and use of globally unique flight identifiers (GUFI)**
2. **Use of FIXM**
3. Implementation of submission and maintenance procedures for FF-ICE information elements
4. Use of planning elements not included in FPL 2012 for trajectory description
5. Use of trajectory planning elements for negotiation

SWIM *B1 Element*

1. **Implementation of structure/protocols for sharing information within communities of interest for ground-ground (G/G) data exchanges**

Airport Operations - Full AMAN/DMAN/SMAN	
ACDM	Airport CDM (0/1)
APTA	Airport Accessibility (0/1)
RATS	Remote ATS (1)
RSEQ	Runway Sequencing (0/1/2/3)
SURF	Surface Operations (0/1/2)
WAKE	Wake Turbulence Sep (0/1/2)

Globally Interoperable Systems & Data - through Globally Interoperable SWIM	
AMET	Advanced MET Info (0/1/3)
DATM	Digital ATM (0/1)
FICE	FFICE (0/1/2/3)
SWIM	SWIM (1/2)

Optimum Capacity & Flexible Flight – through Global Collaborative ATM	
ACAS	Airborne Collision Avoi. Sys (0/2)
ASEP	Airborne Separation (0/1/2)
ASUR	Alternative Surveillance (0)
FRTO	Free Route Operations (0/1/3)
NOPS	Network Operations (0/1/2)
OPTL	Optimum Flight Levels (0)
SNET	Ground-Based Safety Nets (0/1)

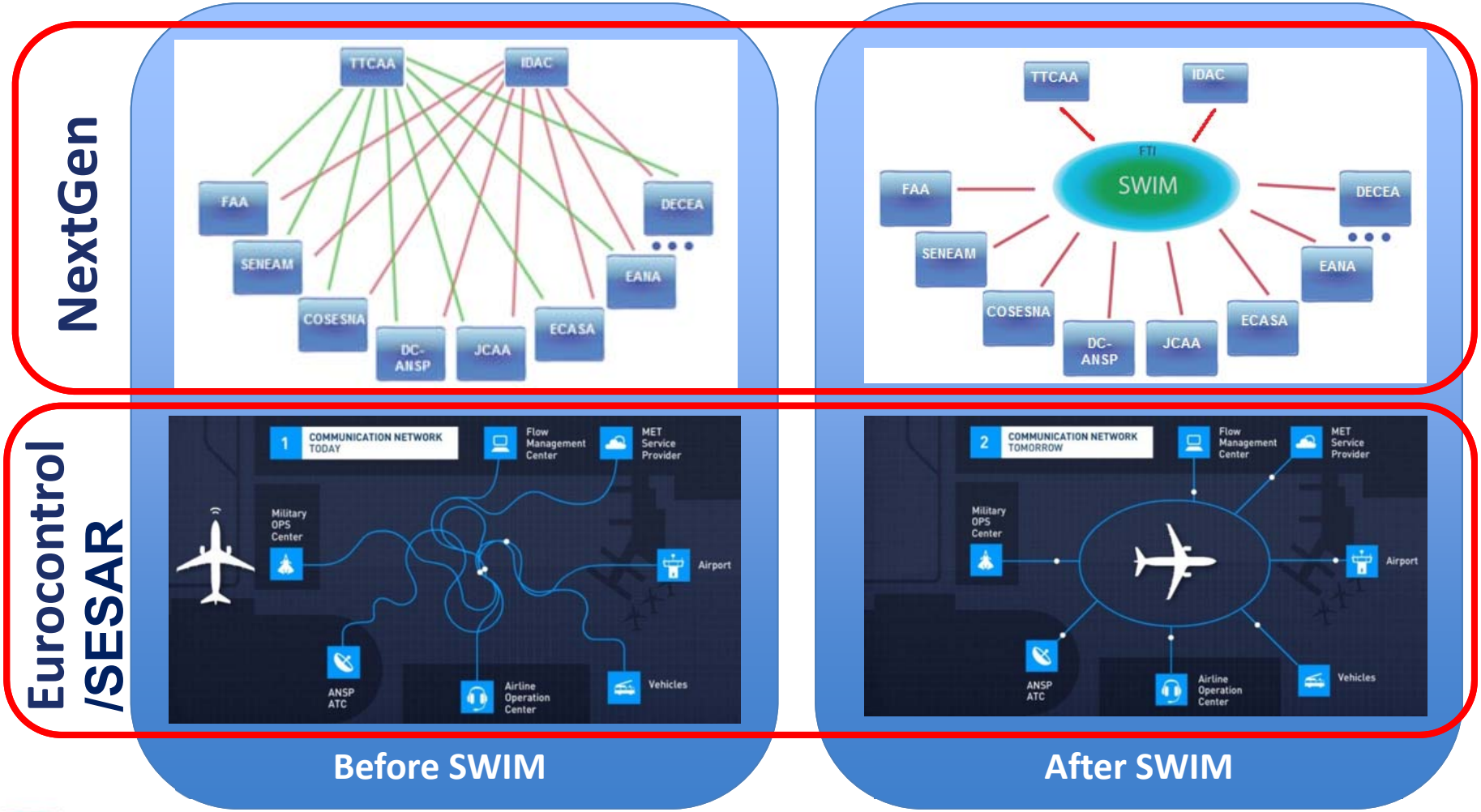
Efficient Flight Paths – through Trajectory-based Operations	
CCO	Cont. Climb Operations (0)
CDO	Cont. Decent Operations (0/1/2)
RPAS	Remotely Piloted Acft Sys. (1/2/3)
TBO	Trajectory Based Operations (0/1)

FIXM

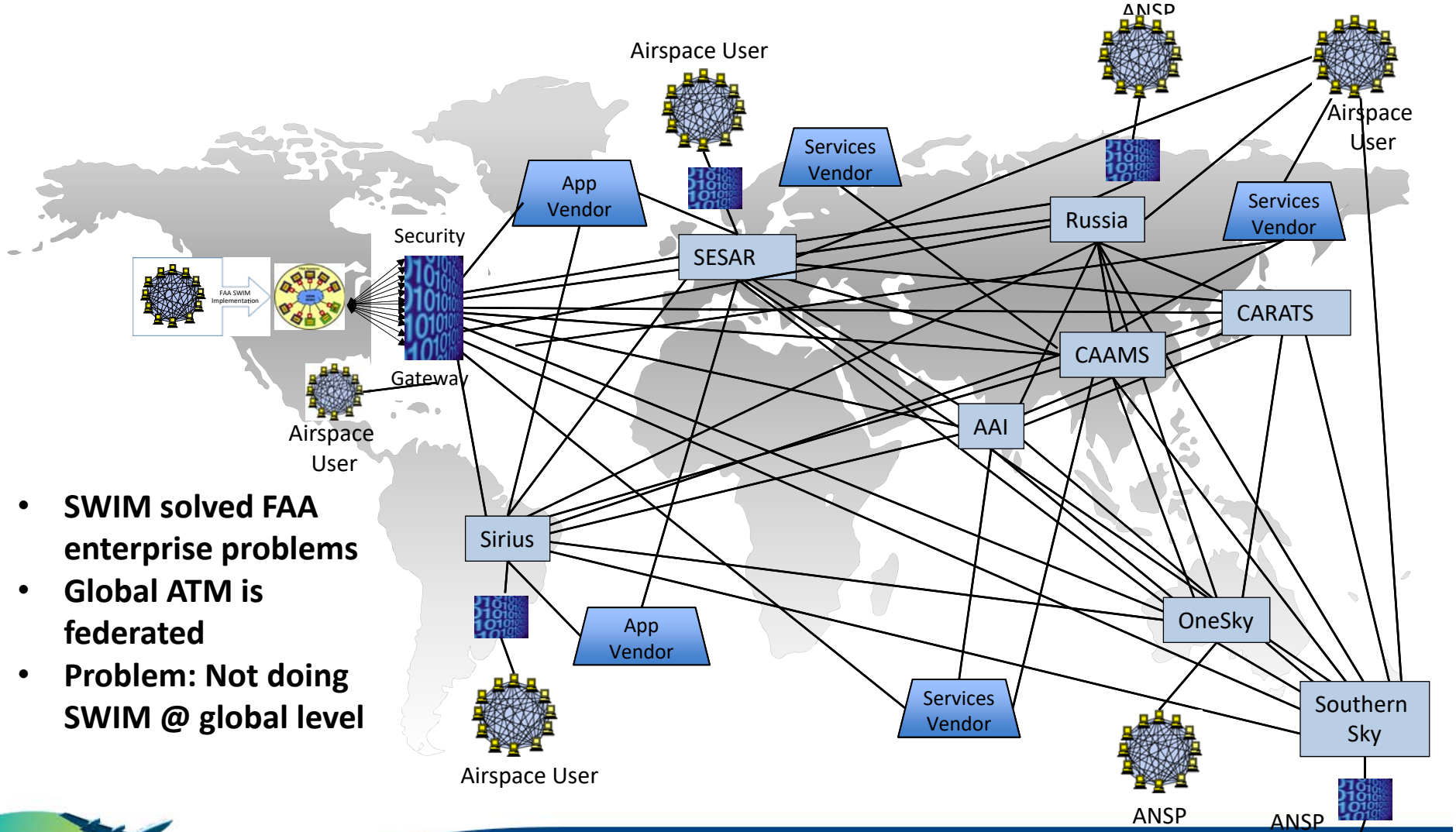
Flight Information Exchange Model

- The12th ANC endorsed FIXM as part of the ASBU
- ICAO ATMRPP identifies the FIXM requirements
- FF-ICE describes the FIXM
- Based on several ISO standards
- Current: **FIXM v4.1 (Dec 2017)**

SWIM: Before and After

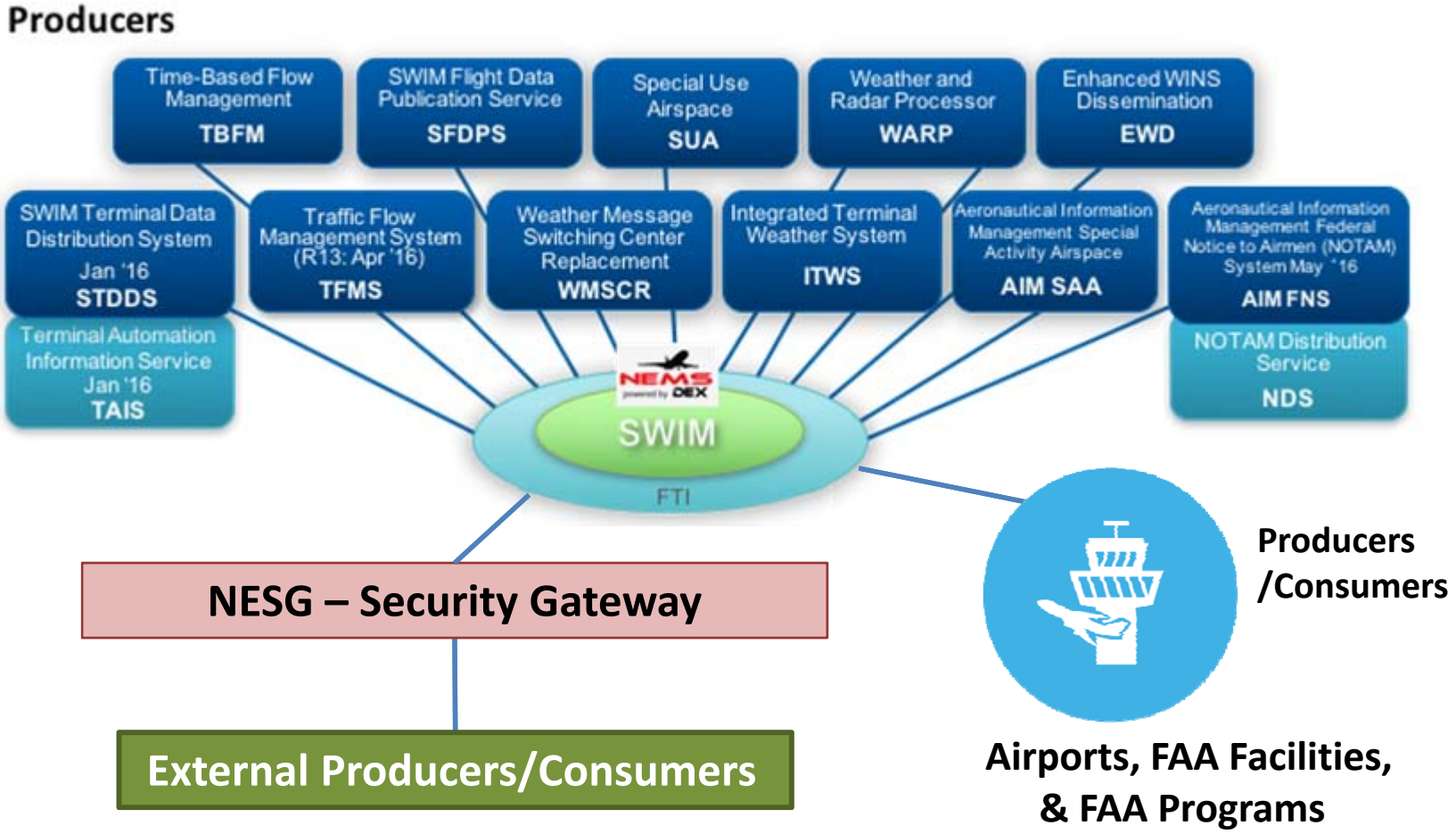


Global ATM Environment



- **SWIM solved FAA enterprise problems**
- **Global ATM is federated**
- **Problem: Not doing SWIM @ global level**

FAA NAS Producers



Current SWIM Product Portfolio (1 of 2)

Flight and Flow Data

Traffic Flow Management System (TFMS): Provides flight data and flow information

- ✓ Flow Constrained Area (FCA) / Flow Evaluation Area (FEA)
- ✓ Airspace Flow Program (AFP)
- ✓ Aircraft Situation Display to Industry (ASDI)
- ✓ Ground Delay Program (GDP) / Unified Delay Program (UDP)
- ✓ Ground Stops (GS)
- ✓ Reroutes
- ✓ Advisories
- ✓ Collaborative Trajectory Options Program (CTOP)

SWIM Terminal Data Distribution Systems (STDDS): Collects and publishes data from 150+ airports

Surface Movement Event Service

- ✓ Spot-In / Spot-Out Times
- ✓ Wheels-Up / Wheels-Down Times
- ✓ Aircraft ID / Type / Wake Class
- ✓ Position / Heading / Speed / Altitude
- ✓ Mode S / Mode 3A
- ✓ Departure or Arrival Runway
- ✓ Departure Fix for Departures
- ✓ Departure Airport for Arrivals
- ✓ Coasted / Suspended Track No.
- ✓ Fused Track Acceleration
- ✓ ADS-B Information
- ✓ Source Information

Airport Data Service

- ✓ Runway Visual Range (100s of feet)
- ✓ Visibility Trend (steady / incr. / decr.)
- ✓ Runway Edge / Center Lighting

Terminal Automation Info. Service

Flight Plan (FP)

- ✓ Aircraft ID / Type
- ✓ Flight Rules in FP Record
- ✓ FP Status (pending, active, etc.)
- ✓ Flight Type (arr. / dep. / enroute)
- ✓ RNAV Indicator
- ✓ Assigned Runway
- ✓ Entry / Exit Fix

Track

- ✓ Track Status (active / coast / drop)
- ✓ Position / Velocity
- ✓ Beacon Code / Mode C

Tower Departure Event Service

- ✓ Aircraft Parking Gate
- ✓ Pre-Departure Clearance Time
- ✓ Taxi-Start / Takeoff Times

Time Based Flow Management (TBFM): Provides metering information

- ✓ Scheduled Time of Arrival (STAs)
- ✓ Estimated Time of Arrival (ETAs)
- ✓ Meter Reference Elements (MREs) Assignments
- ✓ Airport Configuration Information
- ✓ Satellite Airport Configurations

SWIM Flight Data Publication Service (SFDPS): Provides flight data and updates to clients for filed and active flight plans

- ✓ Flight Plan & Update Information
- ✓ Flight Amendment Information
- ✓ Converted Route Information
- ✓ Cancellation Information
- ✓ Departure Information
- ✓ Aircraft ID Amendment
- ✓ Hold Information
- ✓ Progress Report Information
- ✓ Expected Departure Time Information
- ✓ Position Update Information
- ✓ Tentative Flight Plan Information
- ✓ Tentative Aircraft Identification Amendment Information
- ✓ Tentative Flight Plan Removal
- ✓ Tentative Flight Plan Amendment Information
- ✓ Track / Drop Track Information
- ✓ Interim Altitude Information
- ✓ ARTS Flow Control Track/Full Data Block Information
- ✓ Beacon Code Reassignment
- ✓ Beacon Code Restricted
- ✓ Flight Plan Data Bank (FDB) Fourth Line Information
- ✓ Point Out / Inbound Point Out Info
- ✓ Handoff Status

Airspace Data Publication Service: Published by SFDPS

- ✓ Sector Assignment Status
- ✓ Route Status
- ✓ Special Activities Airspace (SAA)
- ✓ Altimeter Setting

Operational Data Publication Service: Published by SFDPS

- ✓ Instrument Approach / Traffic Count Adjustment
- ✓ Sign In Sign Out
- ✓ Beacon Code Utilization
- ✓ Geographic Beacon Code Utilization

General Information Message Publication Service: Published by SFDPS

- ✓ General Information

Current SWIM Product Portfolio (2 of 2)

Weather Data

Integrated Terminal Weather System (ITWS) Data Publication:
Provides specialized weather products in the terminal area

- ✓ Configured Alerts
- ✓ Forecast Accuracy / Contour / Image
- ✓ ITWS Status Information
- ✓ Gust Front TRACON Map
- ✓ Microburst TRACON Map
- ✓ Tornado Alert
- ✓ Precipitation: 5nm, Long Range, TRACON
- ✓ Wind Shear ATIS
- ✓ Storm Motion: 5NM, TRACON
- ✓ Storm Motion - Storm Extrapolated Positions: 5nm, Long Range, TRACON
- ✓ Tornado Detections Wind Profile
- ✓ Anomalous Propagation (AP) Indicated Precipitation
- ✓ AP Status
- ✓ Gust Front Estimated Time to Impact
- ✓ Hazard Text: 5nm, Long Range, TRACON
- ✓ Runway Configuration
- ✓ Microburst Automatic Terminal Information Service (ATIS)
- ✓ Terminal Weather Text Normal
- ✓ Terminal Weather Text Special

Corridor Integrated Weather System (CIWS) Data Publication*:
Provides specialized 3D storm related weather information in the En Route area

- ✓ Vertically Integrated Liquid (VIL) Mosaic (1km resolution)
- ✓ VIL 2-hr. Forecast
- ✓ Echo Tops Mosaic (1 km resolution)
- ✓ Echo Tops 2-hr. Forecast
- ✓ Satellite Mosaic
- ✓ Storm Info: Echo Top Tags, Leading Edges, Motion Vectors
- ✓ VIL Forecast Contours (Std. Mode)
- ✓ VIL Forecast Contours (Winter Mode)
- ✓ Echo Tops Forecast Contours
- ✓ Growth & Decay Contours
- ✓ Forecast Accuracy: Echo Tops, Std. Precipitation, Winter Precipitation

Weather Message Switching Center Replacement (WMSCR) Publications:
Provides NWS textual aviation weather products

- ✓ Transmission of Voice Pilot Reports (PIREPs) to WMSCR
- ✓ Stored PIREPs
- ✓ Altimeter Settings

Enhanced Weather Information Network System

- ✓ Current Icing Product (CIP)
- ✓ Weather Research and Forecasting-Rapid Refresh (WRF-RR) Model Data
- ✓ North American Mesoscale (NAM) Model Data
- ✓ Global Forecast System (GFS) Model Data
- ✓ Airmen's Meteorological Information (AIRMET)
- ✓ National Convective Weather Forecast (NCWF)
- ✓ National Convective Weather Diagnostic (NCWD)
- ✓ Aviation Routine Weather Report (METAR)
- ✓ Significant Meteorological Information (SIGMET)
- ✓ Collaborative Convective Forecast Product (CCFP)

Weather and Radar Processor (WARP) Publications

- ✓ Next Generation Weather Radar (NEXRAD)

Aeronautical Data

Aeronautical Information Management (AIM) Special Use Airspace (SUA) Data Exchange:
Provides notification and status regarding airspace

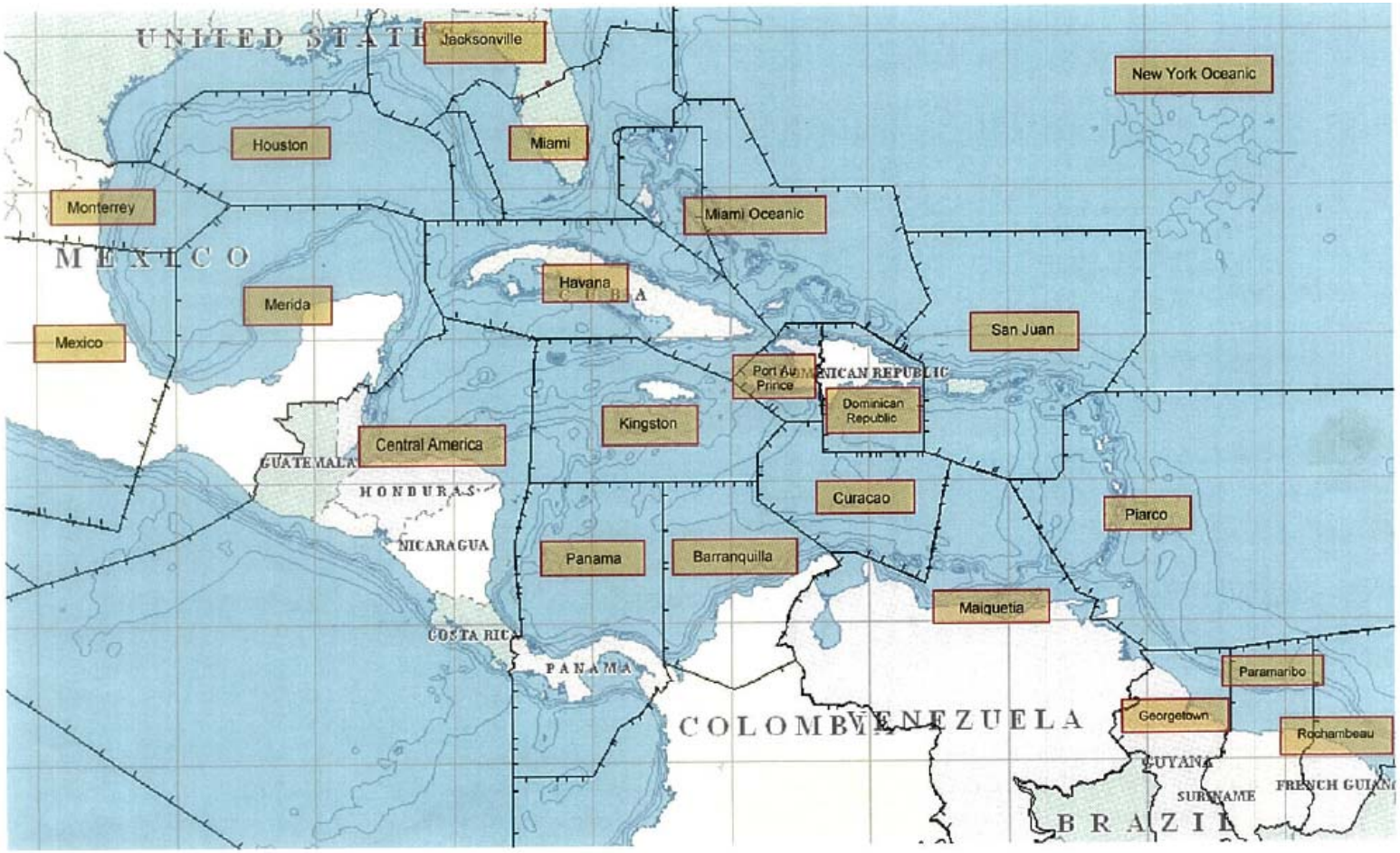
- ✓ SUA Data, dynamically provided in the Aeronautical Information Exchange Model (AIXM) standard
- ✓ AIXM SUA Definitions

Notices to Airmen (NOTAM) Distribution Service

- ✓ Digital NOTAMs AIXM 5.1

***Service in development or on-ramping process**

Why SWIM and FIXM in NAM/CAR?



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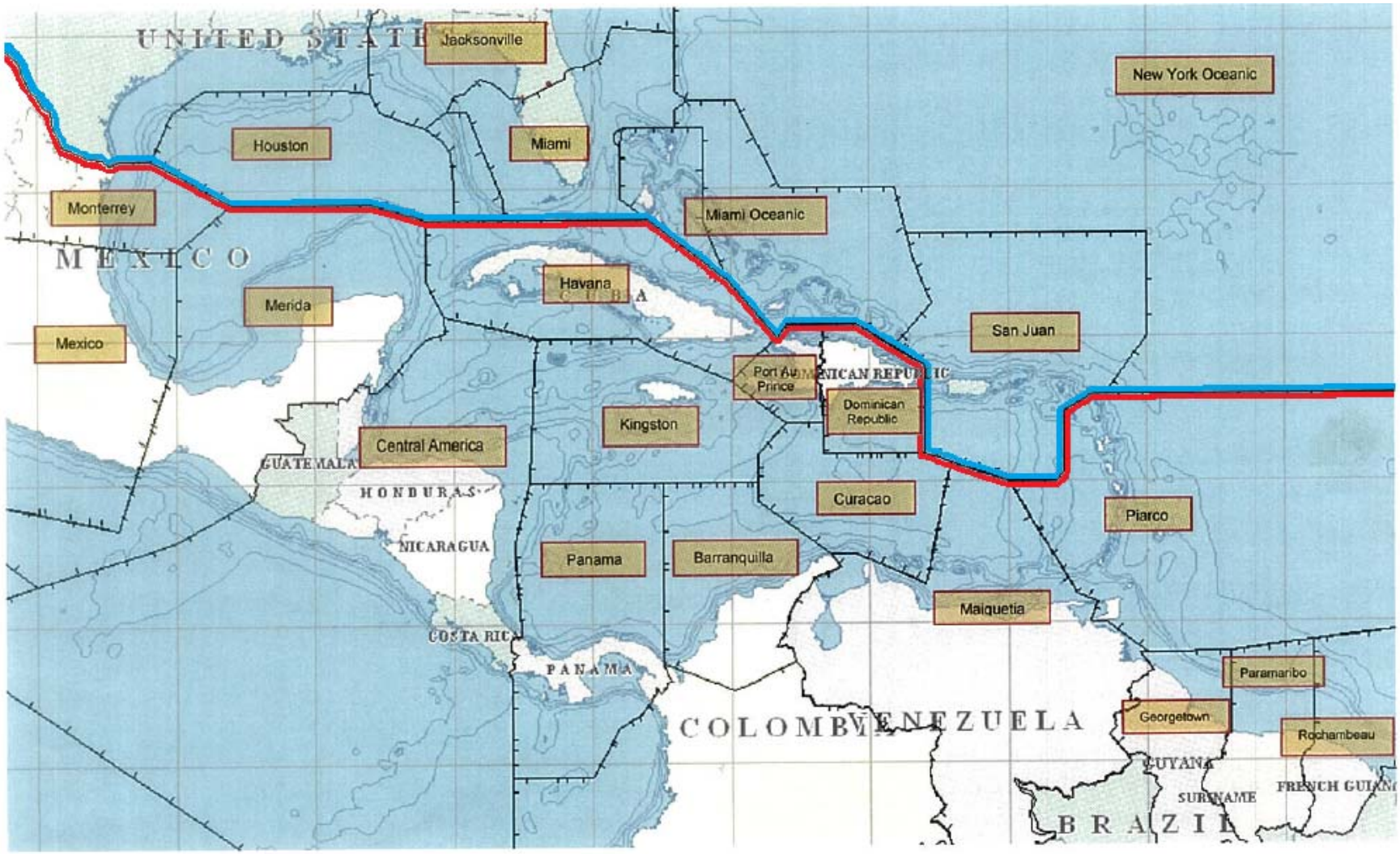
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Central America
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HONDURAS
Curacao
Piarco
NICARAGUA
Panama
Barranquilla
Maiquetia
COSTA RICA
PANAMA
Paramaribo
COLOMBIA
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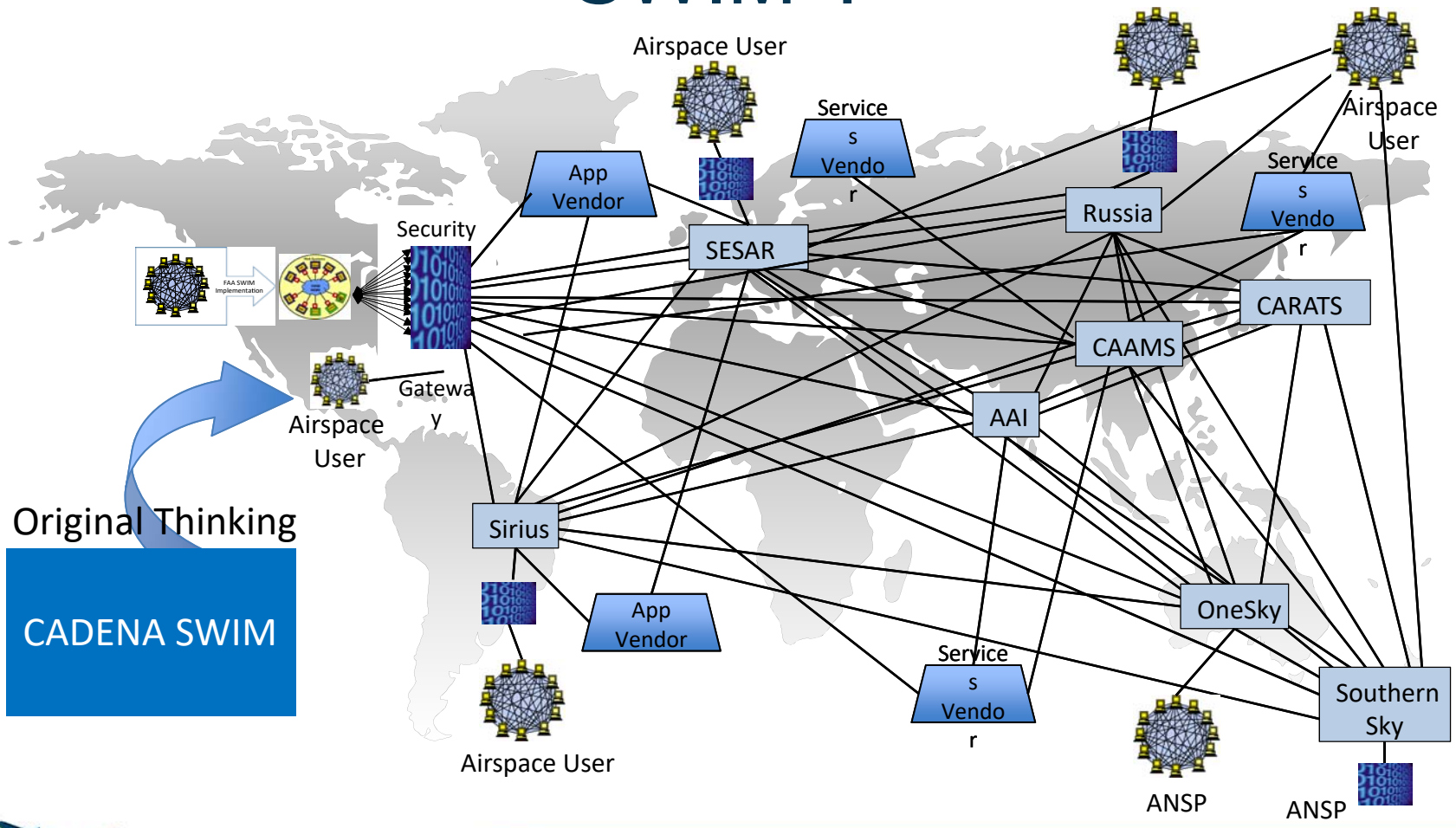
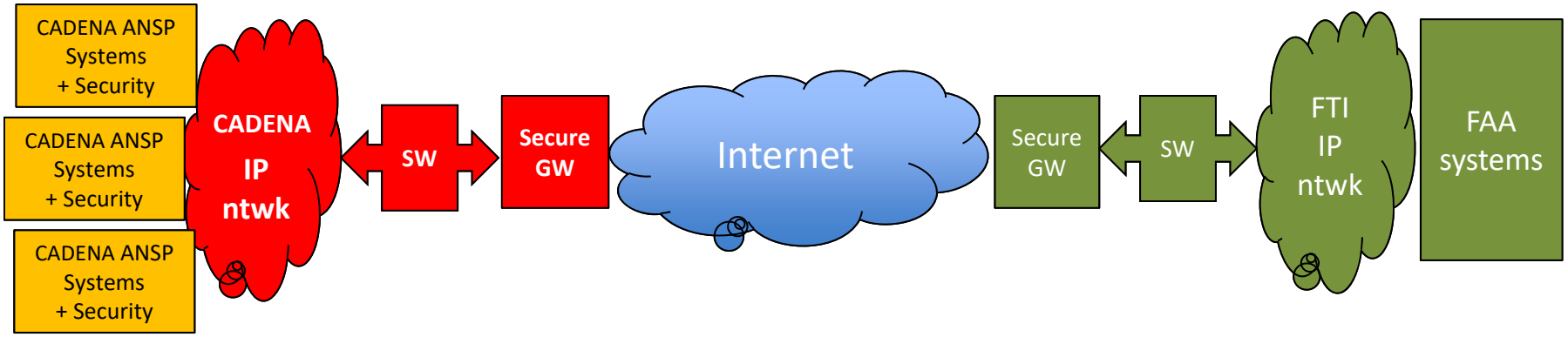
Georgetown
Rochambeau
GUYANA
SURINAME
BRAZIL

What exactly do we mean by “you need SWIM”?

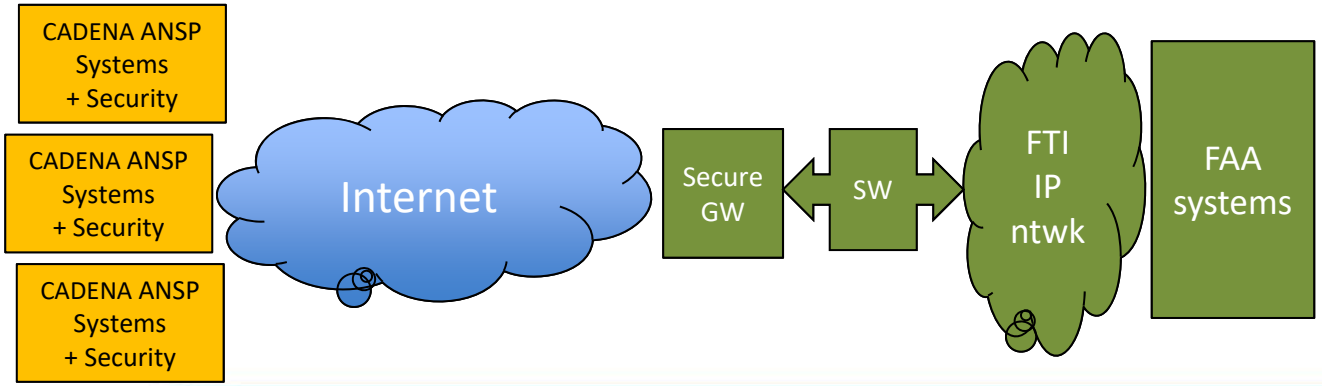


What exactly do we mean by “you need SWIM”?

Original Thinking – CADENA SWIM



Current Approach – Utilize FAA SWIM



Networking

Figure 1
Original - No longer valid

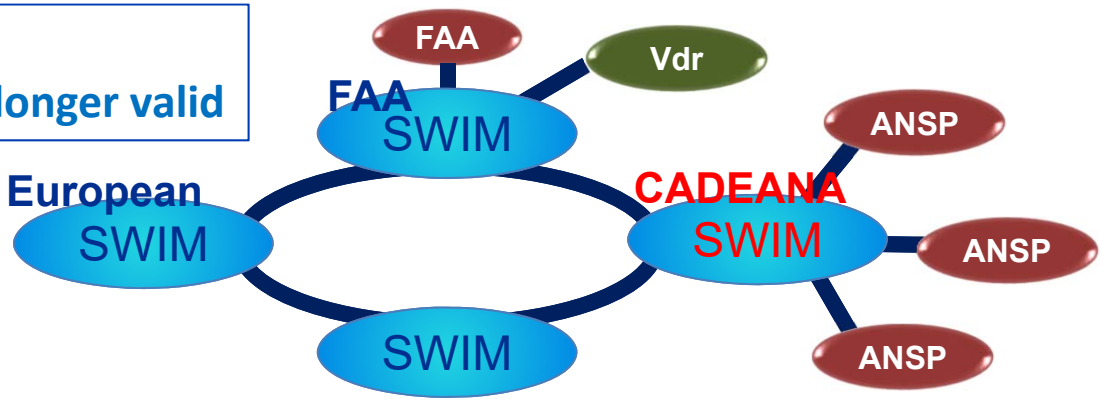


Figure 2
T&T

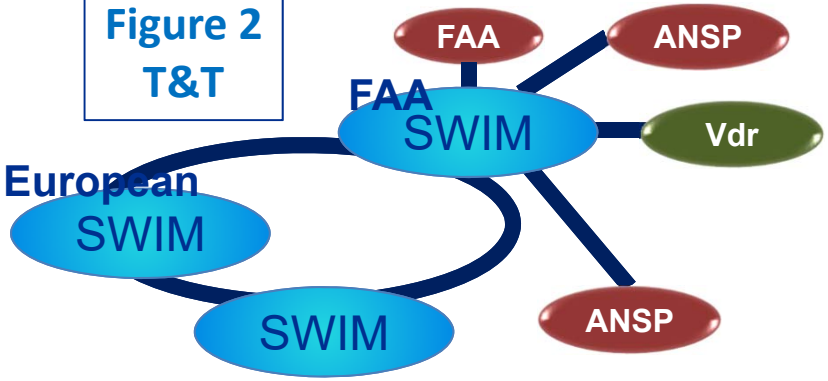
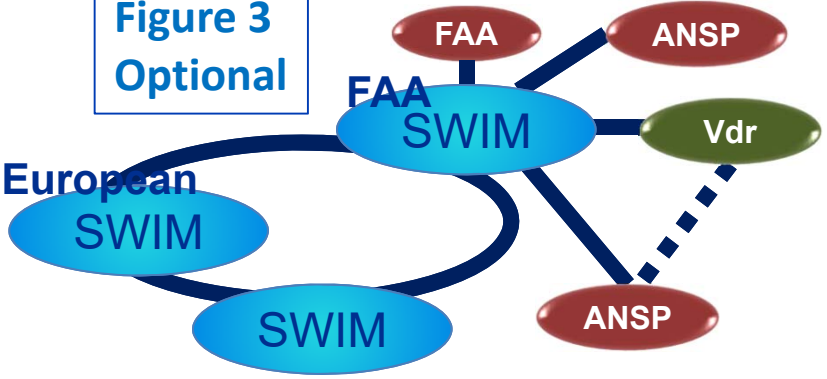


Figure 3
Optional



Requirements for Telecommunications Service Network Connectivity (1 of 8)

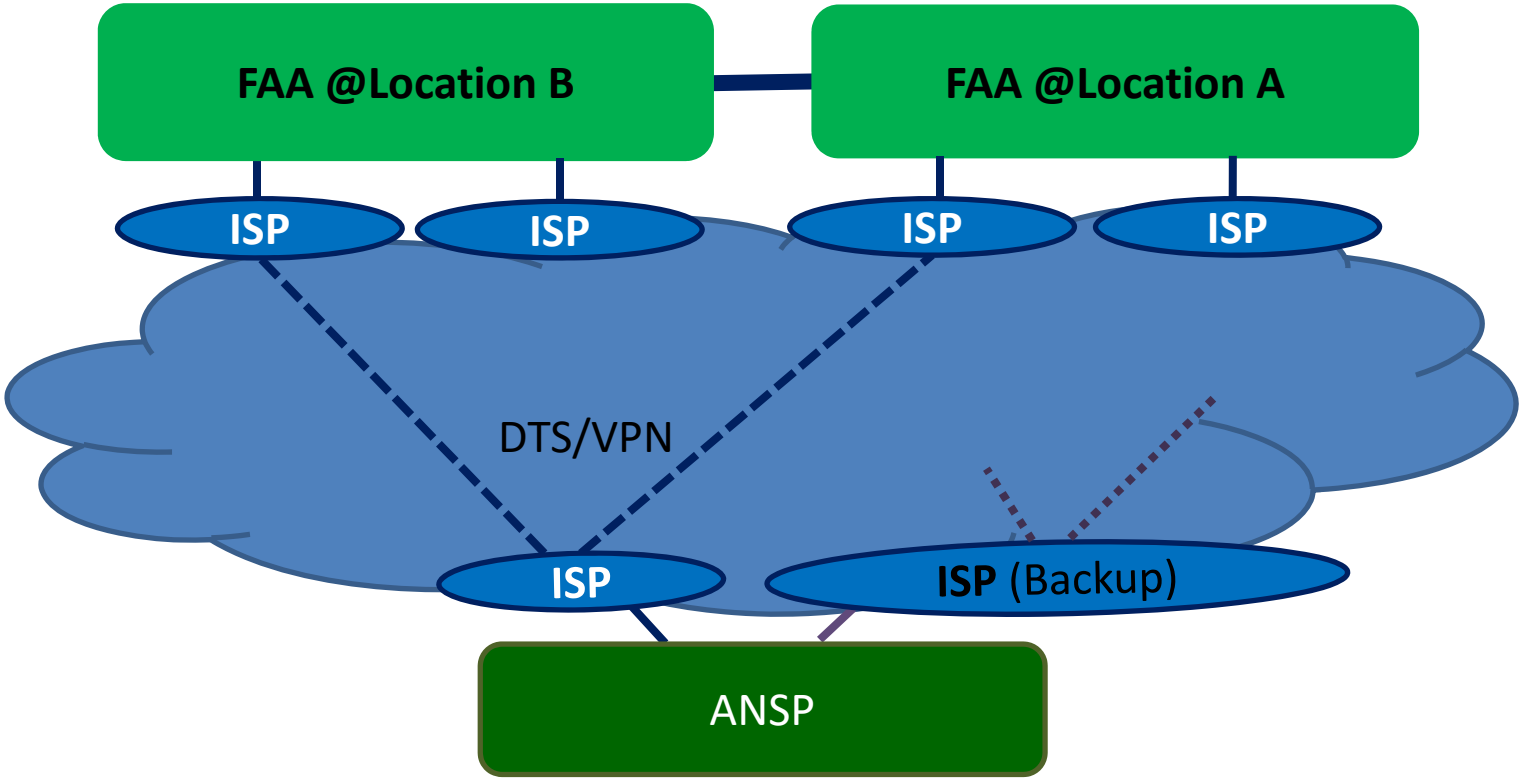
- Bandwidth Requirement:
  - minimum of 2Mbps
  - 5Mbps recommended

- Latency:
  - Consult with local telecommunication service provider

Requirements for Telecommunications Service Network Connectivity (2 of 8)

- Diversity: from most desirable to less desirable
  1. Two connections to the FAA with two Dedicated Telecommunications Services (DTSs)
  2. Two connections to the FAA with one DTS and one Internet VPN
  3. Two connections to the FAA with two Internet VPN
  4. One connection to the FAA with one DTS
  5. One connection to the FAA with one Internet VPN

Requirements for
Telecommunications Service
Network Connectivity (3 of 8)



Requirements for
Telecommunications Service
Network Connectivity (4 of 8)

- Security
  1. FAA Telecommunications Infrastructure (FTI) National Air Space (NAS) Boundary Protection System (NBPS) User's Guide for External Users

https://www.faa.gov/air_traffic/technology/swim/documents/media/user-guide/FAA%20Telecommunications%20Infrastructure%20NAS%20Boundary%20Protection%20System%20Guide%20-%20REV%205.pdf

  2. Enterprise Security Gateway VPN Requirements

https://www.faa.gov/air_traffic/technology/swim/documents/media/user-guide/FAA%20VPN%20Technical%20Requirements%20v1.pdf

Requirements for
Telecommunications Service
Network Connectivity (5 of 8)

- Performance
  - Reliability, maintainability and availability (RMA) metrics
    - Mean Time Between Failure, Mean Time to Restore (MTTR)
    - Service Period is expected to be 7X24X365

Requirements for
Telecommunications Service
Network Connectivity (6 of 8)

- Purchase/Lease Options
  - Cost estimate for purchase
  - Cost estimate for lease
    - Information on one-time installation cost and monthly recurring cost
- SWIM onramp

Requirements for
Telecommunications Service
Network Connectivity (7 of 8)

TFMS Flight Data Consumer

1	2	3	4	5	6	7
External Consumer Contacts SWIM Team	**Select Data Service(s) and Sign Access Agreement(s)**	**Consumer Processing / Formalize Requirements**	**Development and testing of Consumer interface in the R&D Domain**	**Interoperability testing in the FTI National Test Bed (FNTB)**	**Prepare to Connect to Operations**	**Start consuming NAS data**
Send email to Data-to-Industry@faa.gov	Review and identify one or multiple data sets available at data.faa.gov	Create SWIM account and review service metadata www.faa.gov/Nextgen/programs/swim/nsrr_form/	Establish connectivity to the R&D Domain	Conduct a series of formal tests to ensure operational readiness	Establish connectivity to the NESG	
Review SWIM Consumer brief and follow the outlined process	Create account and sign Access Agreement	Confirm services to be consumed and complete on-ramping form	Develop consumer interface		Establish connectivity with the operational NEMS	
FAA POC assigned to external consumer	Receive notification via email that an Access Agreement for specific data set(s) has been signed		Test with the NAS Enterprise Messaging Service (NEMS)			

Requirements for
Telecommunications Service
Network Connectivity (8 of 8)

TFMS IDP Consumer

1	2	3	4	5	6	7
External Consumer Contacts SWIM Team	**Select Data Service(s) and Sign Access Agreement(s)**	**Consumer Processing / Formalize Requirements**	**Development and testing of Consumer interface in the R&D Domain**	**Interoperability testing in the FTI National Test Bed (FNTB)**	**Prepare to Connect to Operations**	**Start consuming NAS data**
Send email to Data-to-Industry@faa.gov	Review and identify on or multiple data sets available at data.faa.gov	Create SWIM account and review service metadata www.faa.gov/Nextgen/programs/swim/nsrr_form/	Establish connectivity to the R&D Domain	Conduct a series of formal tests to ensure operational readiness	Establish connectivity to the NESG	
Review SWIM Consumer brief and follow the outlined process	Create account and sign Access Agreement	Review TFMS JMSDD and XML schema	Develop producer interface		Establish connectivity with the operational NEMS	
FAA POC assigned to external consumer	Receive notification via email that an Access Agreement for specific data set(s) has been signed	Complete producer on-ramping form	Test with the NAS Enterprise Messaging Service (NEMS)			

Requirements for Data Handling (1 of 5)

- IDP Environment
  - Survey of availability, format and accessibility of data requested for exchange
  - Identify existing equipment available for the purpose of flight data exchange and requirements for new equipment as needed

Requirements for
Data Handling (2 of 5)

IDP Types

1. FPL
2. CHG
3. ARR
4. DEP
5. CNL
6. DLA
7. TIZ
8. TIO
9. CLS

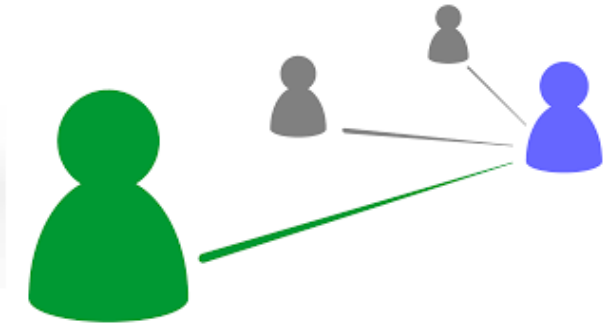
IDP Data Producer

Minimum: FPL & TIZ

TFMS Flight Data Consumer

Messages	Distribution		
	US Gov. Consumer	External Consumer	CDM Participant
Flight Plan Amendment[1] flightPlanAmmendmentInformation	√	√ (if not R)	√ (if not R)
Flight Plan Arrival (AZ) arrivalInformation	√	√ (if not R)	√ (if not R)
Flight Plan Departure (DZ) departureInformation	√	√ (if not R)	√ (if not R)
Flight Plan (FZ) flightPlanInformation	√	√ (if not R)	√ (if not R)
Flight Plan Cancel (RZ) flightPlanCancellation	√	√ (if not R)	√ (if not R)
Boundary Crossing (UZ) boundaryCrossingUpdate	√	√ (if not R)	√ (if not R)
Track Message (TZ) trackInformation	√	√ (if not R)	√ (if not R)
Oceanic Position Report (TO) oceanicReport	√	√ (if not R)	√ (if not R)
Beacon Code (BZ) beaconCodeInformation	√	√ (if not R)	√ (if not R)
ncsmFlightCreate	√	√ (if not R)	√ (if not R)
ncsmFlightModify	√	√ (if not R)	√ (if not R)
ncsmFlightScheduleActivate	√	√ (if not R)	√ (if not R)
ncsmFlightRoute	√	√ (if not R)	√ (if not R)
ncsmFlightSectors	√	√ (if not R)	√ (if not R)
ncsmFlightTimes	√	√ (if not R)	√ (if not R)
ncsmFlightControl	√	No	√ (if not R)
Early Intent (EI)	√	No	√ (if not R)

Requirements for Data Handling (3 of 5)



- Data Conversion

All exchanged data is required to be converted to the specified standard (e.g., FIXM including GUFI, message format, WebLogic JMS settings for the environment.)

  - TFMData Java Messaging Service Description Document (JMSDD)
  - TFMData Java Messaging Service Description Document XML Schema Document (XSD)

https://nsrr.faa.gov

Requirements for Data Handling (4 of 5)

- Database
  - Identify the size and capability of database to store the TFMData and to support the display capability
  - Information on basic and extended data recovery in case of failure is requested
  - Information on data archival is requested

Requirements for Data Handling (5 of 5)

- Connectivity to SWIM
  - Develop clients necessary to interact with FAA's SWIM (Refer to Telecommunications Security section)
- Maintenance/Support
  - Maintenance and support of all software components necessary to interact with FAA's SWIM
- Data Visualization
  - Identify data visualization options
  - Identify data manipulation capability

Requirements for

Data Display and Decision Support Capabilities

- Do we need to have the same displays/capabilities?
- Displays/capabilities similar in contents are acceptable
- Discussion and decision among controllers/operators are needed

Requirements for

Integration of IDP Data with TFMS

- IDP Data Sharing: Define CADENA data sharing needs
- IDP Data Sharing Logic: Current TFMS logic does not support CADENA needs
  (from T&T implementation efforts and the 2nd CADENA meeting discussions)
- Request FAA to support the CADENA data sharing logic

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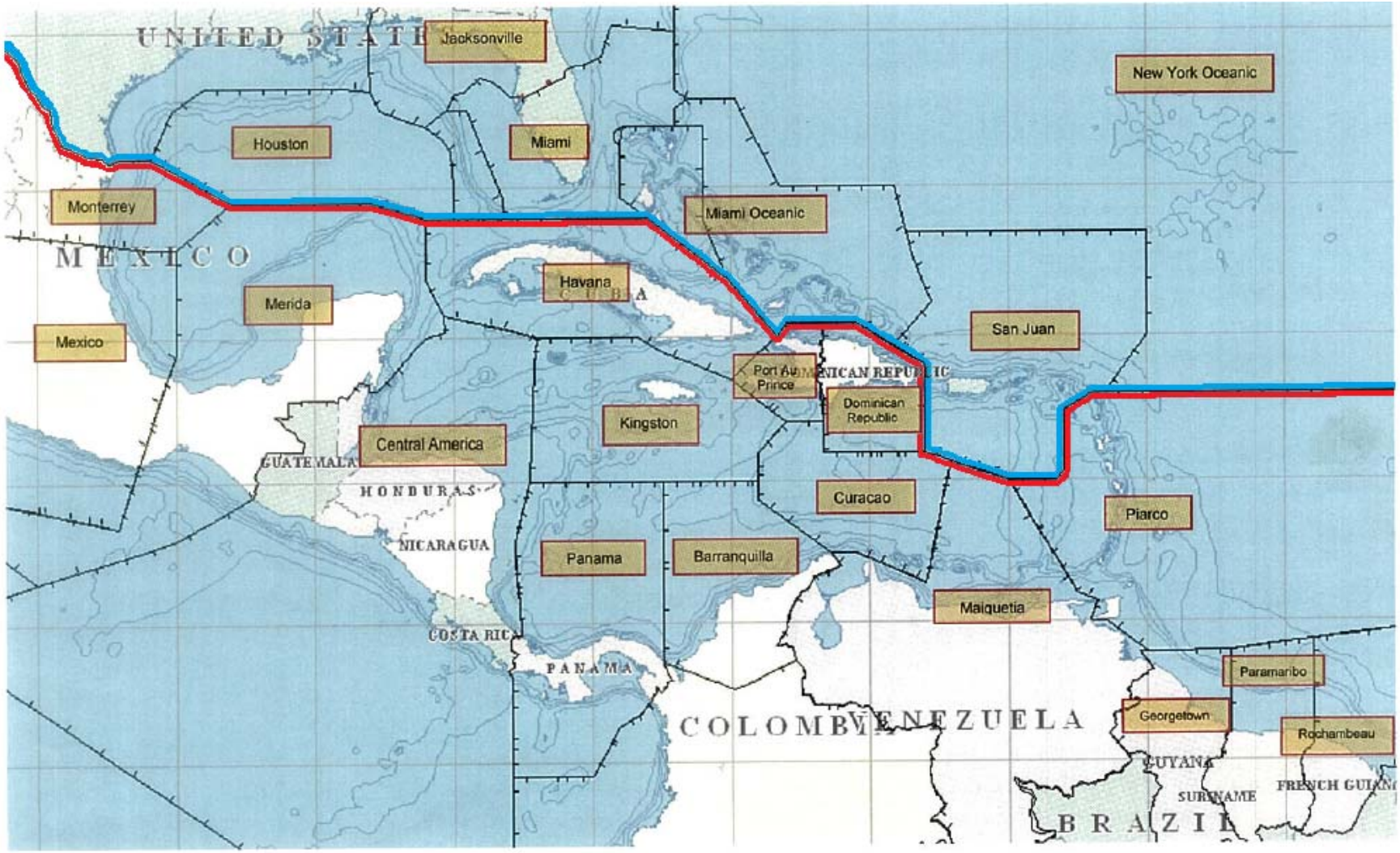
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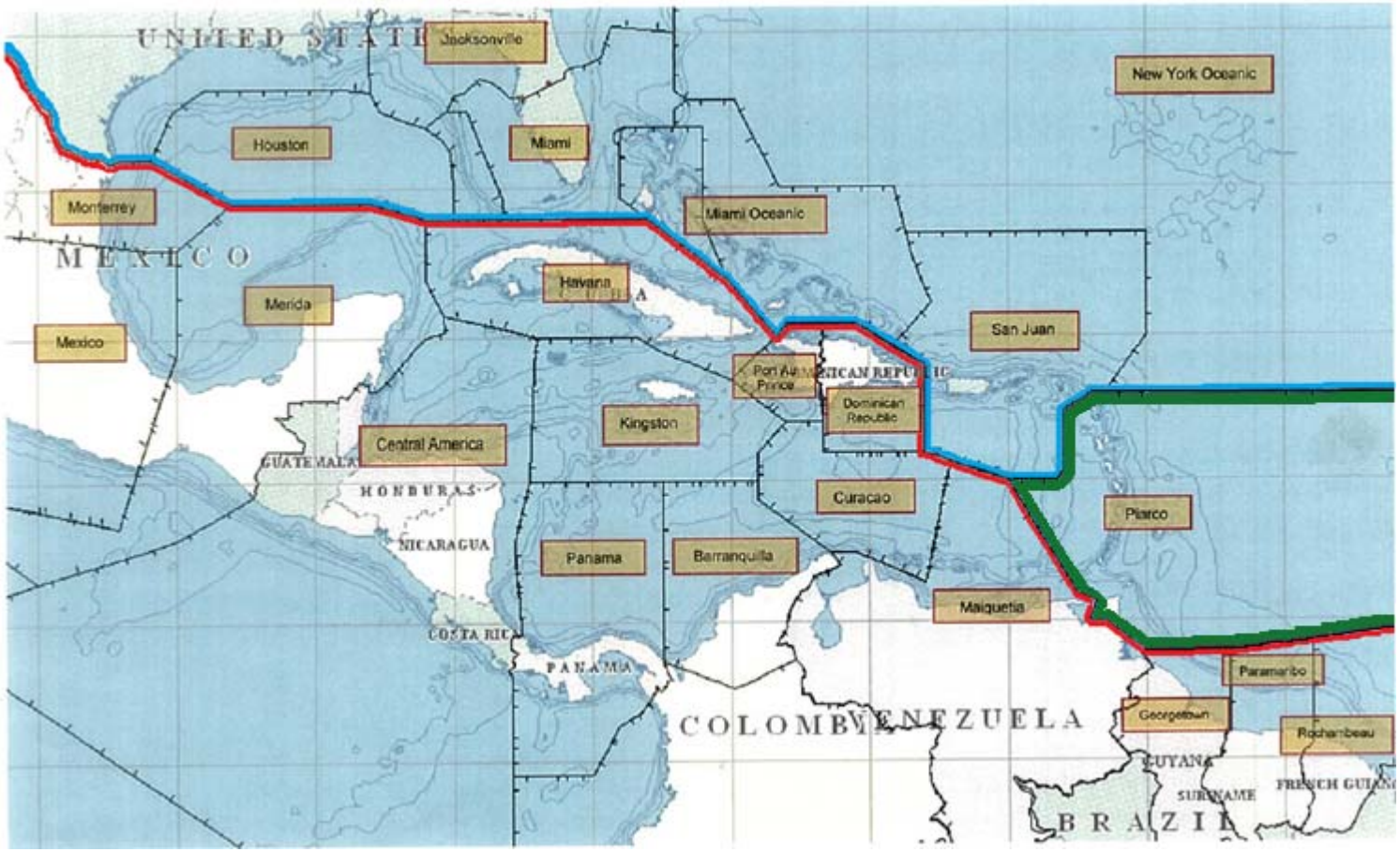
Barranquilla
Maiquetia
COSTA RICA
PANAMA
Paramaribo
COLOMBIA
VENEZUELA
Georgetown
Rochambeau
GUYANA
SURINAME
BRAZIL

Looking back…

- June 14 and 15, 2016 – Technical Working Meeting hosted at the TTCAA
- Feb 6, 2017 – TT completed the TFMData Consumer Test
- Sep 21, 2017 – US/TT (FAA&TTCAA) TFM Data Exchange Bilateral Agreement signed
- **Oct 31, 2017 – TT successfully transmit IDP data to FAA operationally** (FPL, ARR, DEP, TIZ messages)
- Nov 21, 2017 – TT successfully started to consume TFMSData that include TT's IDP data
- May 14, 2018 – TT passed to exchange CNL & CHG

With T&T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NICARAGUA
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Maiquetia
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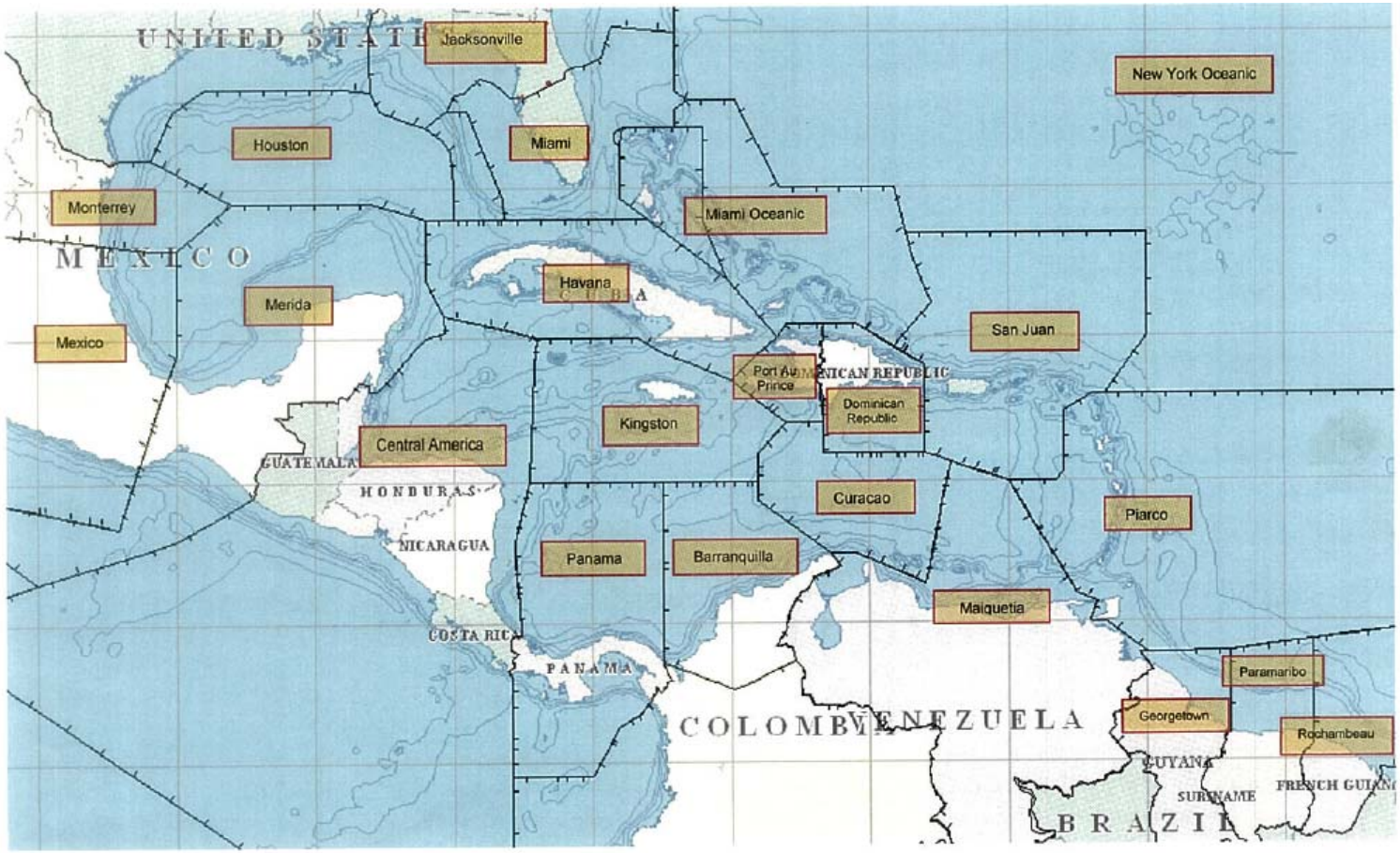
SURINAME
BRAZIL

Looking into…



Lessons Learned

- FIXM is the way to go
- SWIM – what does it mean to you?
- Implementation details
  - What is your need?
  - What can you afford?
  - What is the regional desire?
  - Piggy back on FAA's TFMS and SWIM
  - Issues on data exchange/sharing

Questions?

Thank you!

Midori.Tanino@faa.gov