

TFDM Tech Talk: TFDM Testbed Demo

Presented to: TFDM Industry Stakeholders

By: FAA TFDM Collaborative Site Implementation Team

Date: October 6, 2021



**Federal Aviation
Administration**

Introductions

Keith Henry	FAA	TFDM CSIT Lead
Mike Hoprich	FAA	Controller/TMC, CLT Tower
Melissa Brown	MITRE	TFDM Systems Engineer
Isaac Robeson	Mosaic ATM	TFDM Systems Engineer
Chris Wells	Leidos	TFDM Systems Engineer
Dave Mattioli	Leidos	TFDM Systems Engineer

Agenda

- TFDM & Surface Metering Program Overview
- Testbed Architecture
- Demo Lab Infrastructure
- Demo Test Cases
 - Flight msg
 - Airport Information msg
 - TFCS NMA Closure
 - Recommended SMP
 - EFS
- Additional Resources & Next Steps



Terminal Flight Data Manager (TFDM) Overview



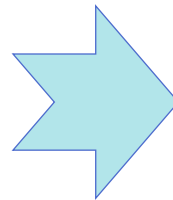
TFDM Program Overview

TFDM is the **surface management solution** for NextGen and iTBO.

https://www.faa.gov/air_traffic/technology/tfdm/

- TFDM will provide an integrated tower flight data automation system, which will improve situational awareness.
- TFDM will improve efficiencies on the airport surface and terminal airspace by providing:

- Electronic Flight Strips in the Tower
- Collaborative Decision Making for the Surface
- Traffic Flow Management Integration
- Systems Consolidation



Key Benefits:

- Fuel Savings
- Carbon Emission Savings
- Improved Situational Awareness
- Pre-scheduling flights



TFDM Program Roll-Out Overview

Build 1

Key Site - PHX

- Full hardware development to support the deployment of Build 1 & 2
- Improved Electronic Flight Data Exchange and Electronic Flight Strips
- Runway Assignment Predictions
- Maintenance tools for life cycle support
- B1 TTP Service Offered

- ❖ Initial Operating Capability: ~~June 2020~~
- ❖ In-Service Decision: ~~September 2020~~

**Dates being replanned due to COVID-19 Impacts
B1 IOC will not occur before Spring 2022**

Build 2

Key Site - CLT

In addition to the Build 1 capabilities

- Surface Scheduling
- Surface Metering
- Runway Load Balancing
- Metric Reporting & Analysis (MRA)
- B2 TTP and TFCS Services Offered

- ❖ Initial Operating Capability: ~~May 2021~~
- ❖ In-Service Decision: ~~September 2021~~

**Dates being replanned due to COVID-19 Impacts
B2 IOC will not occur before Spring 2023**



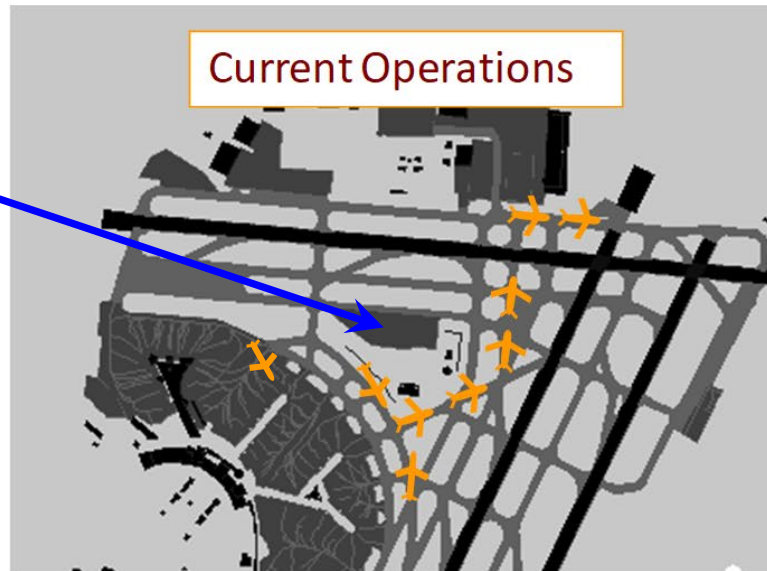
Surface Metering Program (SMP) Overview



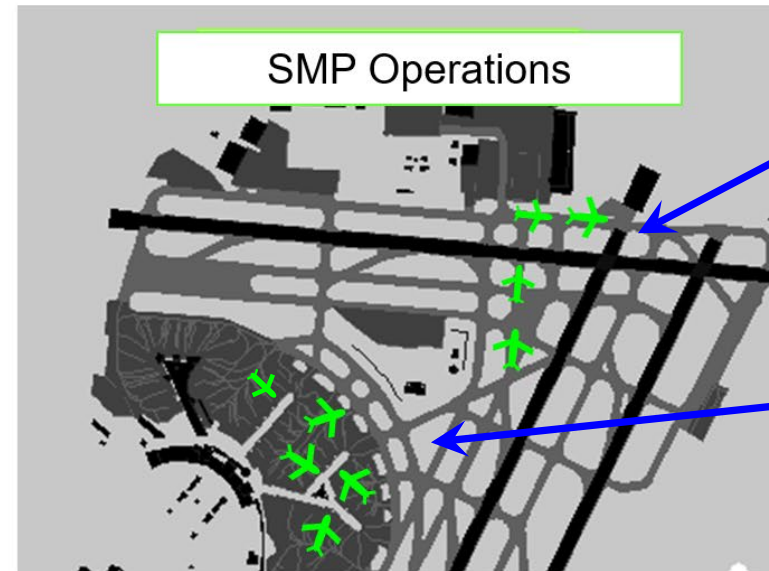
The TFDM SMP Concept

- Departure operations in the NAS are largely managed on a first come, first served basis
- The result is often long departure queues, surface congestion and excess fuel burn
- The goal of SMP operations is to manage the departure queue length by assigning equitable off block times without reducing departure throughput

Long departure queue develops as flights begin taxi as soon as they are ready



SMP Operations



SMP operations result in shorter queues...

...through the control of pushback times



FOS Testbed



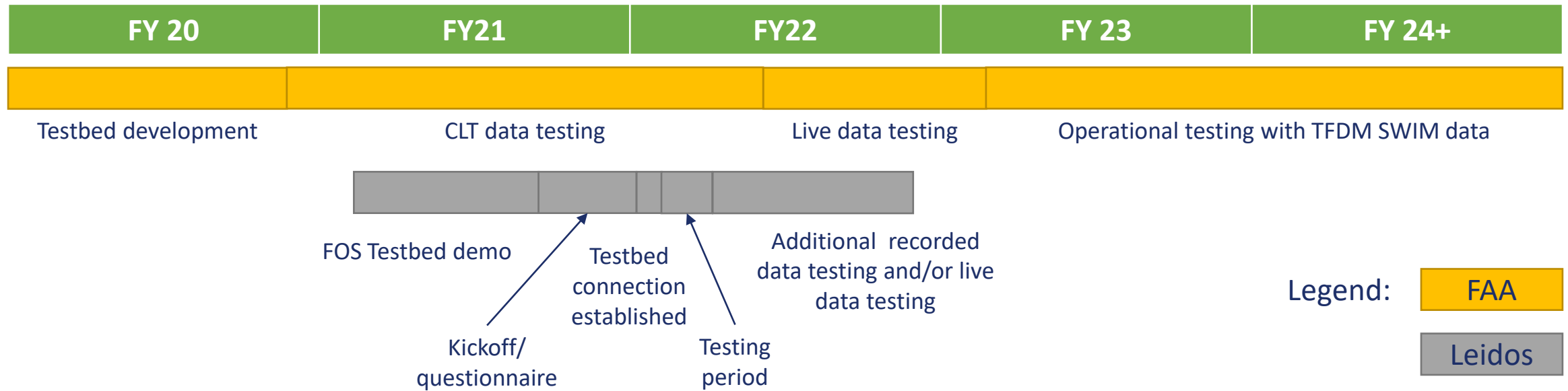
Testbed Overview

- The FAA has developed a laboratory testbed with an instance of TFDM Build 2 software (surface metering)
 - It will allow flight operators, airport operators, or 3rd party vendors the ability to test their connections to the TFDM system in advance of TFDM's deployment.
- The goal is to ensure flight operators, airport operators and 3rd party vendors are able to utilize TFDM's two SWIM services: TFDM Terminal Publication (TTP) and TFDM Flight Operator System (FOS) Collaboration Service (TFCS).
- The testbed can support adaptation for ATL and PHX in addition to CLT



Phases of TFDM testing

- Based on Charlotte, more data available later as more sites are operational
- Notional timeline:



TFDM Testbed

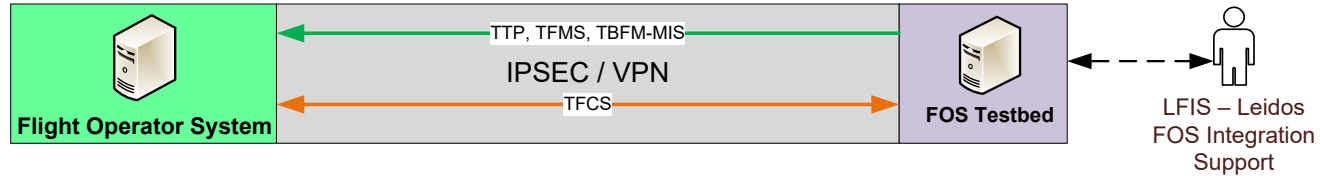
- Open to airports, airlines, and 3rd party vendors to test connections to TFDM prior to TFDM B2 being deployed in the field
- If interested, contact Lidiya Gavrilenko (Lidiya.Gavrilenko@faa.gov) or CSIT (csit@faa.gov)



Testbed Architecture



FOS Testbed Environment



Testbed Details

- TFDM Software Build 2.1
- Adapted as CLT
- Replay of messages from 2/19/2020
- Live CLT messages via SCDS

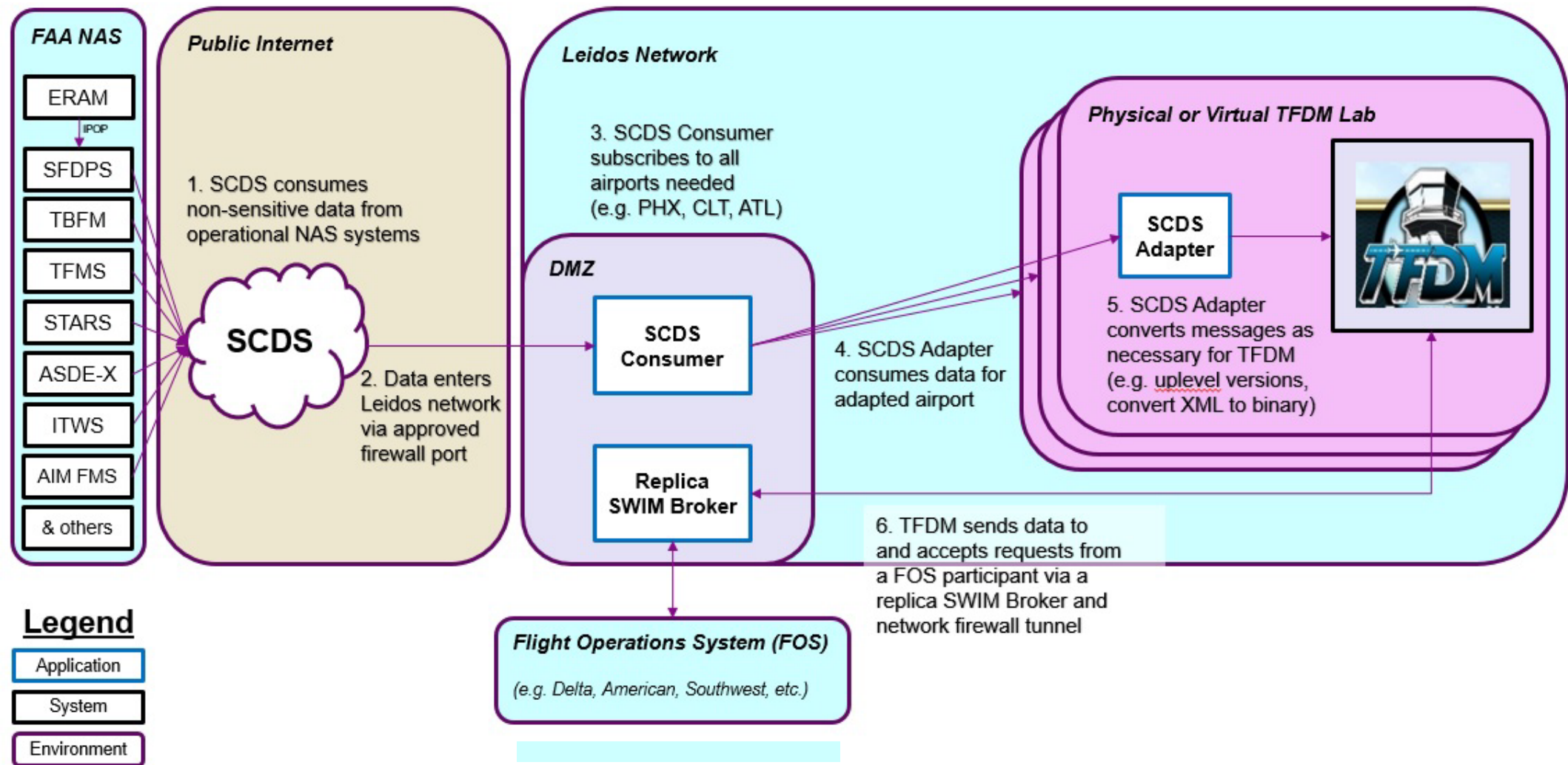


SWIM Cloud Distribution Service (SCDS)

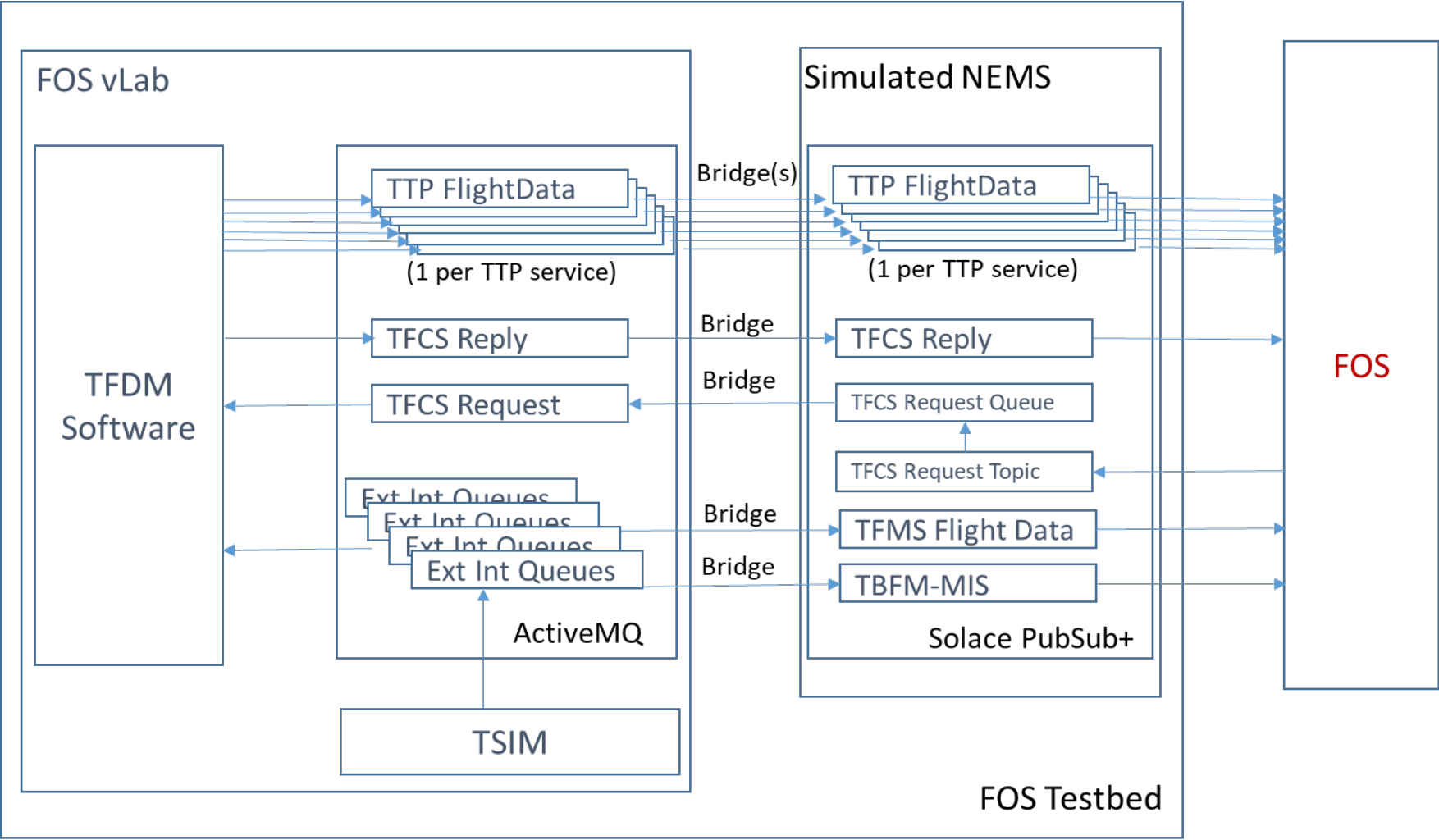
- What is it?
 - Collection of publicly available, real-time SWIM data feeds
 - Designed to share SWIM data with industry stakeholders
 - Anyone can sign up for free (including the general public)
 - Much quicker than the complex process of connecting to the NESG
- Limitations
 - No sensitive (military) data
 - No support for request / response (e.g. can't recon TFMS data)
 - Not all interfaces / systems are included (e.g. FDIO, TDLS, TBFM-RTCS)
 - Internal FAA programs will use SWIM directly, not SCDS
- Easy to use web portal
 - SWIM Industry-FAA Team (SWIFT) Portal
 - Create new data feed subscriptions
 - Some feeds allow filtering (Airport, TRACON, ARTCC)
 - Monitor message rates and feed status



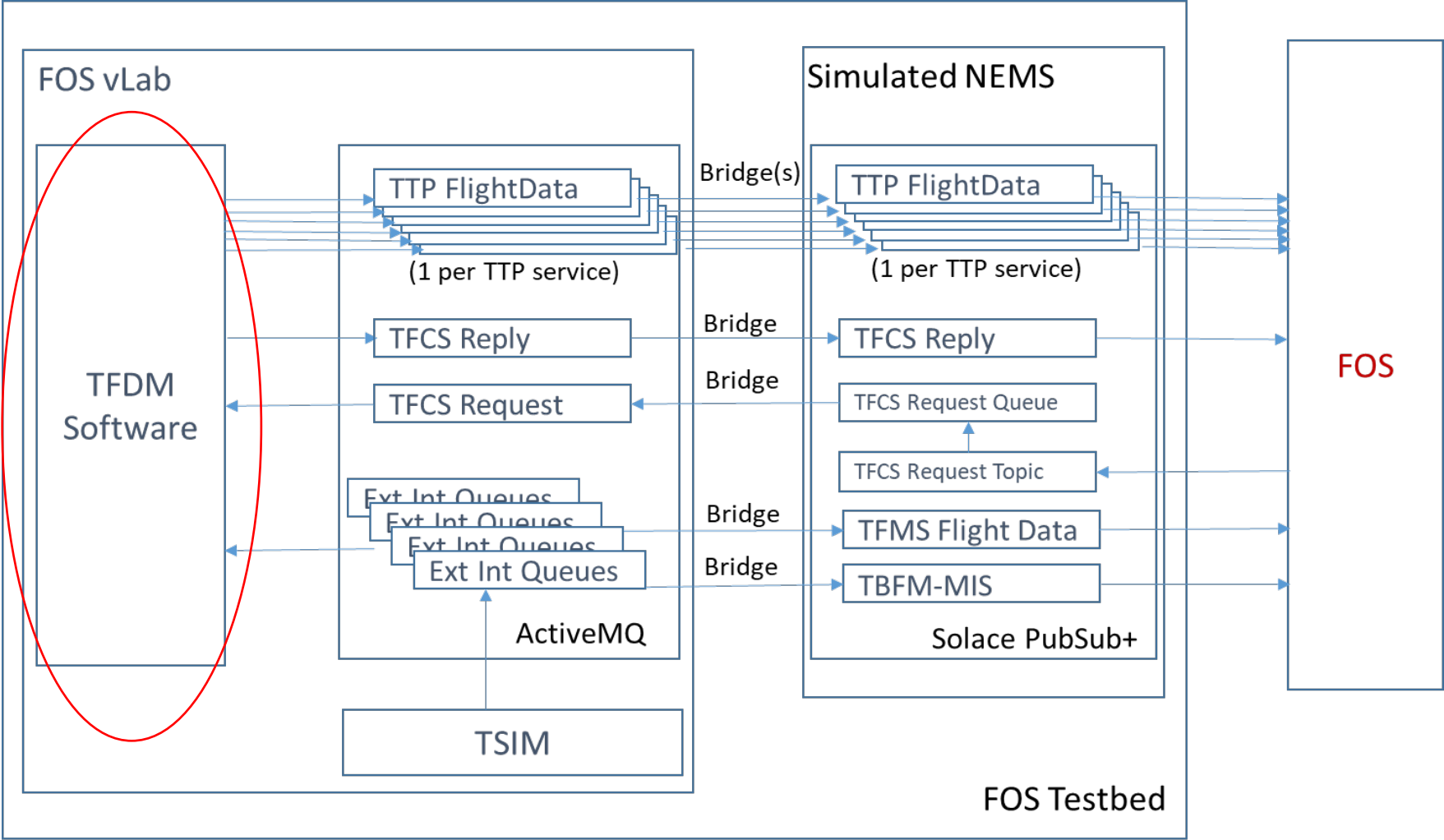
SCDS in TFDM



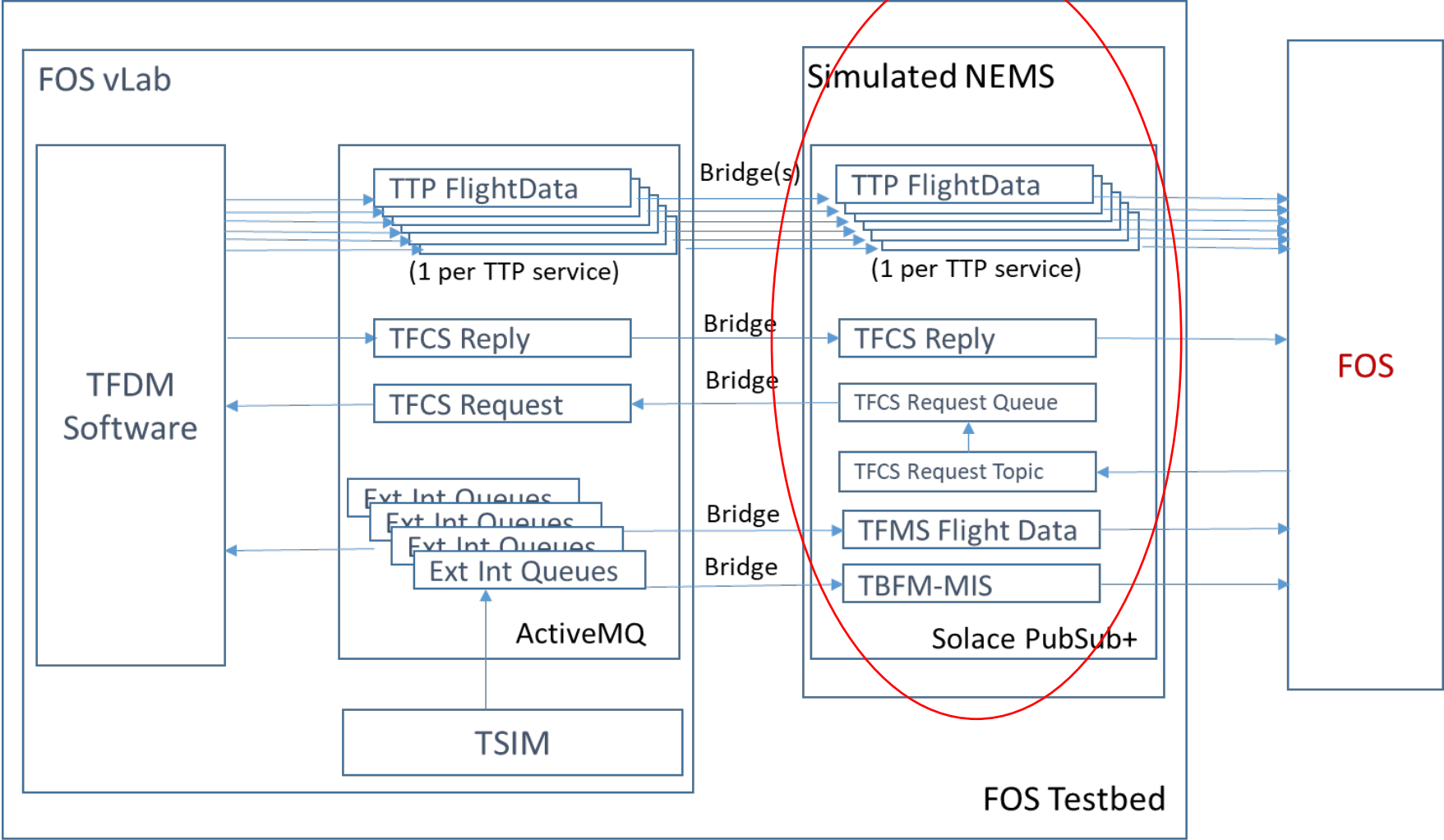
Demo Lab Infrastructure



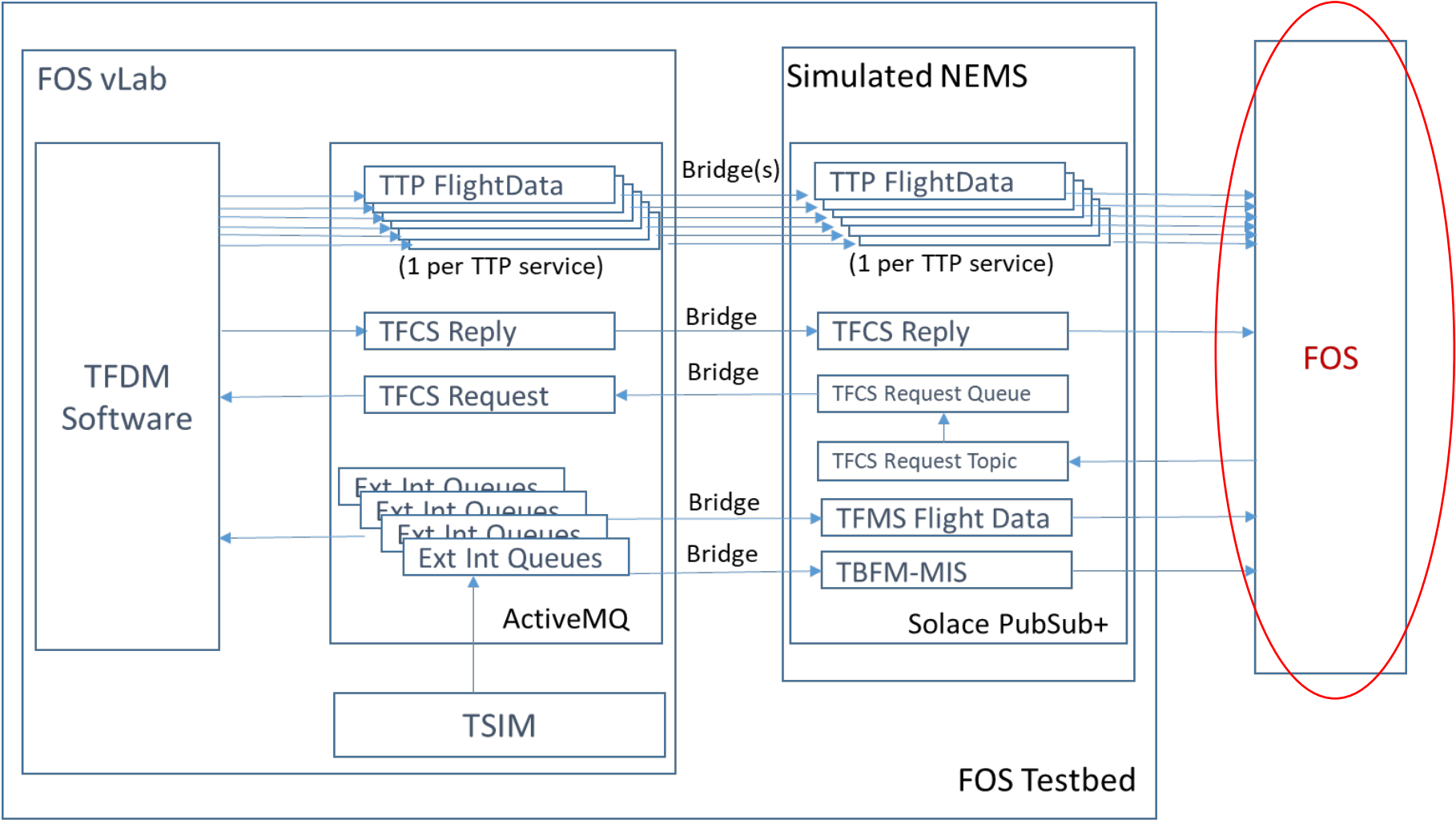
Demo Lab Infrastructure



Demo Lab Infrastructure



Demo Lab Infrastructure



Test Cases

Test Case	Flight Data	Flight Delay	AI	TMR	SMP	OM	TFCS
<u>Week 1 - FOS receives TTP messages</u>							
Flight Departure – simple	X						
Flight Arrival – simple	X						
Airport Information – initial set			X				
Operational Metrics – initial set						X	
Operator System Start Up	X	X	X	X	X	X	X
<u>Week 1 - FOS sends/receives TFCS request/response</u>							
NMA Closure			X				X
NMA Gridlock			X				X
<u>Week 2 - FOS receives TTP messages</u>							
Flight Departure - ATC commands	X					X	
Flight Departure – Delay	X	X					
Closure in AMA			X				
SMP Params/Config					X		
Traffic Mgt Restrictions (& effect on departure)	X			X			
Recommended SMP (& effect on departures)	X				X		
Affirmed SMP (& effect on departures)	X				X	X	
Recommended SMP Adjustment (& effect on departures)	X				X		
Completed SMP					X		
<u>Week 2 - FOS sends/receives TFCS request/response</u>							
Flight Substitution	X				X		X



Week One: Flight Departure Test Case

- **Flight Departure – simple**

- Overview: A departure pushes back, transits the ramp, crosses into the AMA, taxis to the runway and takes off.
- Steps:
 - FOS receives TTP-FlightData FlightAdd message triggered by input to the TFDM system from an external system such as TFMS or FDIO .
 - FOS receives TTP-FlightData FlightUpdate messages as the flight progresses to the runway. These messages contain fields such as:
 - Flight identification fields: ACID, DEP, DEST, IGTD, GUF1, CID, TFDM ID, TFMS ID
 - Operational Flight State (AT_STAND, RAMP_TAXI_OUT, AT_SPOT_OUT, AMA_TAXI_OUT, LUAW, TAKEOFF_ROLL, DEPARTED)
 - EOBT, ETD, AOBT, ActualRunwayEntryTime, ATOT, Estimated taxi times, Elapsed taxi time, ActualDepartureSpot, Runway



Demo – FlightUpdate msg

Week One: Airport Information Test Case

- **Airport Information – initial set**

- Overview: Periodically, information about the airport surface is published.
- Steps:
 - FOS receives TTP-AirportInformation message every 15 minutes. This message includes the following:
 - Delay information
 - Demand
 - Actual Queue Lengths
 - Predicted Queue Lengths
 - TFDM Predicted Gridlock



Demo – Airport Information “Cyclic” msg

Week One: NMA Closure Test Case

- **NMA Closure**

- Overview: Flight Operator closes a section of the NMA and observes the closure as reflected by the TFDM system.
- Steps:
 - Flight Operator support manipulates FOS to send a TFCS request message, the intent of which is to schedule an NMA closure.
 - FOS receives TFCS response message indicating success of request.
 - FOS receives TTP-AirportInformation message indicating the NMA regions are scheduled for closure.
 - Flight Operator support manipulates FOS to send a TFCS request message, the intent of which is to activate the NMA closure.
 - FOS receives TFCS response message indicating success of request.
 - FOS receives TTP-AirportInformation message indicating the NMA regions' closure has been activated.
 - Flight Operator support manipulates FOS to send a TFCS request message, the intent of which is to update information pertaining to the NMA closure.
 - FOS receives TFCS response message indicating success of request.
 - FOS receives TTP-AirportInformation message indicating the NMA regions' closure has been updated.
 - Flight Operator support manipulates FOS to send a TFCS request message, the intent of which is to deactivate the NMA closure.
 - FOS receives TFCS response message indicating success of request.
 - FOS receives TTP-AirportInformation message indicating the NMA regions' closure has been deactivated.



Demo – NMA closure

Week Two: Recommended SMP Test Case

- **Recommended SMP (& effect on departures)**
 - Overview: The TFDM system recommends an SMP.
 - Steps:
 - Based on traffic in the scenario, (and the use of a configuration that matches what the airport would have had in place on the day of the recording), the TFDM system recommends an SMP. (The LFIS FLM may need to manipulate the Airport Configuration parameters related to metering or manipulate the SMP parameters slightly in order to create a recommended SMP.)
 - FOS receives TTP-SMP smpDataMessage containing:
 - Metering resource
 - Start and End Times for the recommended SMP
 - Metrics with and without the SMP
 - A list of flights and their recommended TMATs
 - Predicted queue lengths without the SMP
 - Proposed queue lengths with the SMP



Demo – SMPDataMsg – Recommended SMP

Questions?

Additional Resources & Next Steps



TFDM Data Exchange Resources

- TFDM has available interface resource documentation for guidance on exchange of data to/from TFDM and stakeholders available on the NAS Service Registry and Repository (NSRR) [nsrr.faa.gov]
 - TTP JMSDD
 - TFCS JMSDD
- TFDM has additional resources to guide stakeholders in the purpose, use, and exchange mechanisms on the CDM website [<https://cdm-staging.infinaweb.com/surface-cdm-team/>]
 - TFDM Data Operation User Guide (DOUG)
 - TFDM S-CDM User Guide



Questions & Upcoming CSIT Events

- Tech Talk #6: Deep dive on adaptable parameters
 - Proposed timing: First week of December, 2021
- DOUG, User Manual, and Previous Tech Talks and other CSIT resources available at:
https://cdm.fly.faa.gov/?page_id=3152
- Follow-up questions: csit@faa.gov

