Engineering, Operations & Technology
Boeing Test & Evaluation

The Challenge of Operational Messaging in M&S for the AATM Domain

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Agenda

- Historical Distributed Modeling & Simulation
- NextGEN Concepts
- SWIM Model
- International Airspace Efficiencies Research
- International Airspace Efficiencies Architecture
- International Airspace Efficiencies Instrumentation
- Results
- Challenges
- Going Forward
- Summary

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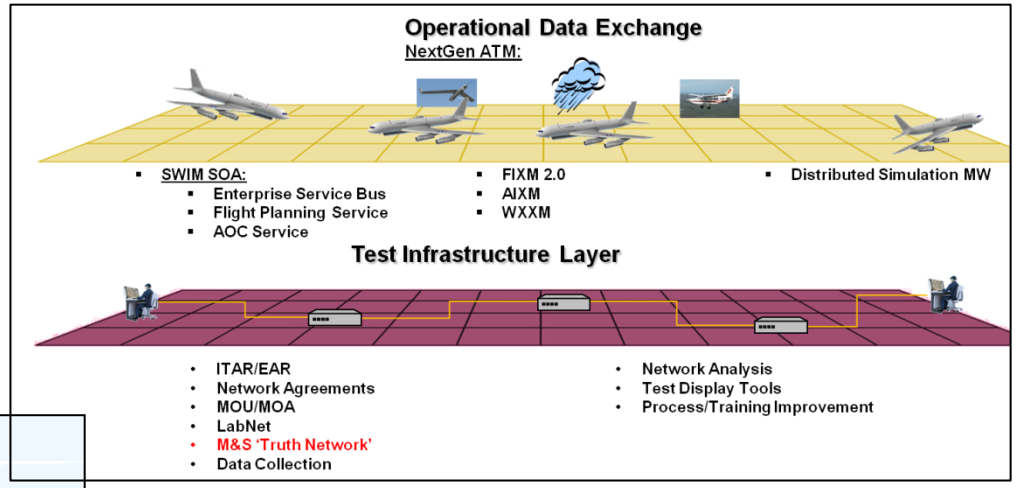
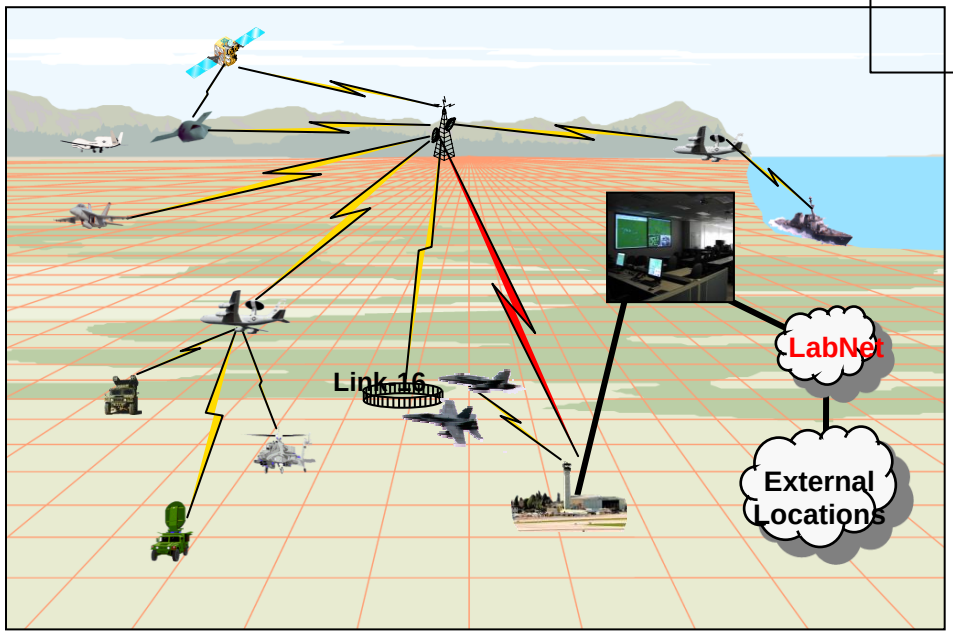
Historical DoD Distributed M&S

Distributed Modeling & Simulation Traditionally use "Big 3"

- **DIS – Entity State**
- **HLA – RPR FOM**
- **TENA – Gateways-OM**
  - Time Synchronization
  - Event Control – Start, Stop, Pause





DIS- Distributed Interactive Simulation
HLA-High Level Architecture
TENA-Test & Training Enabling Architecture

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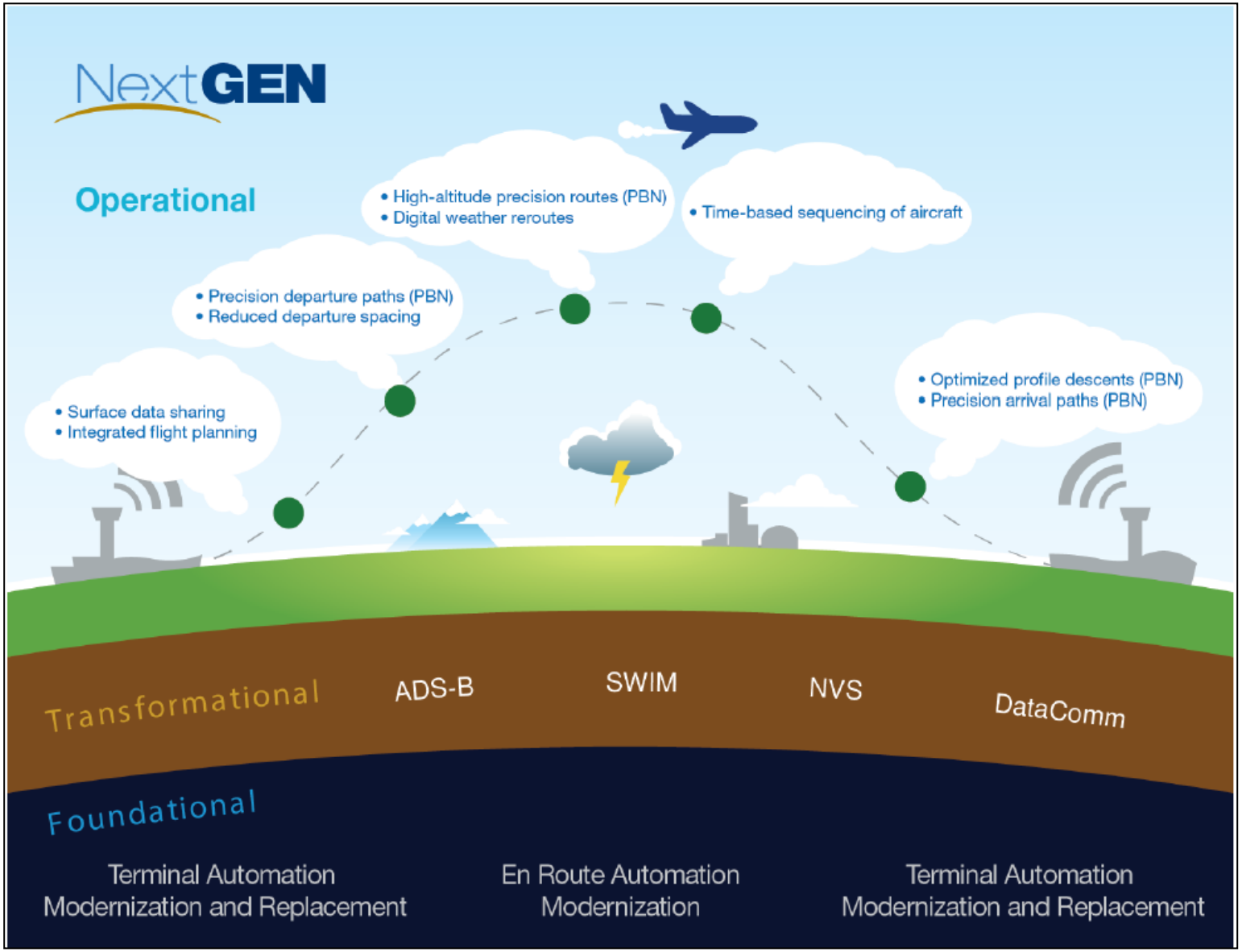
NextGEN Concepts



Source: FAA SWIM Program Overview

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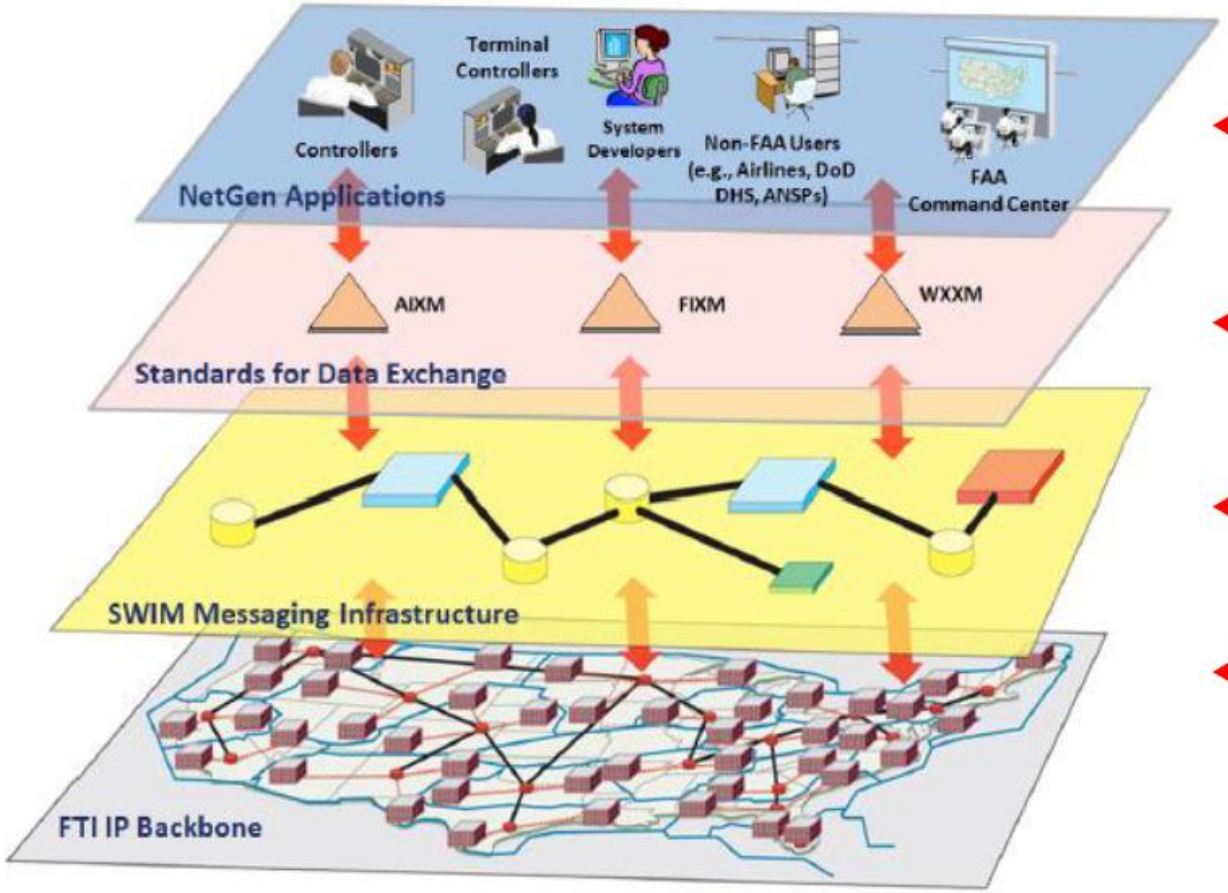
SWIM Model



Mission Services/ Application Layer: FDPS, STDDS, ITWS, AIM, etc.

Common Support: Data Standards & Harmonization

Enterprise Messaging: SWIM Core Services

Physical Network: FTI Operational IP network provides secure transport

Source: FAA SWIM Program Overview

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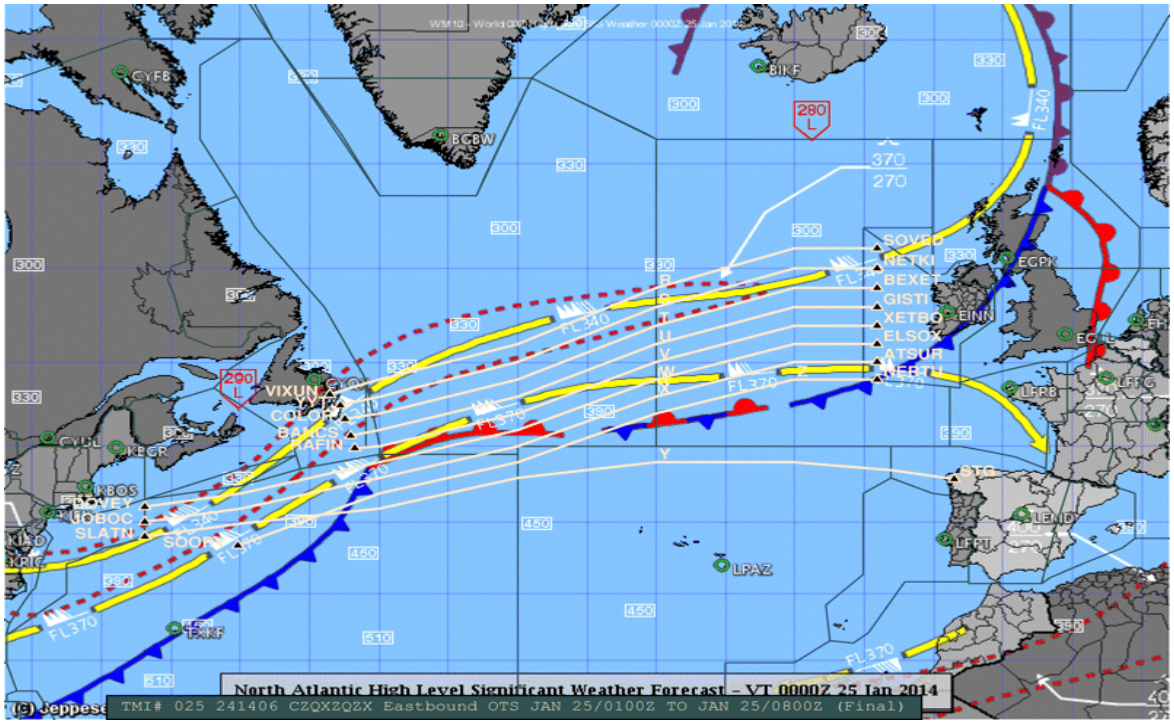
International Airspace Efficiencies (IAE) Research

2014 Objectives

1. Operational
2. SOA (Service Oriented Architecture)
3. GSIL (Global System Integration Laboratory)



Flight No	Departure	Destination	ETA from Scheduled Departure time	NA Tracks	IAE Scheduled Arrival time	Estimated Fuel Burn	Estimated Fuel Saving
BAW45B	KBOS	EGLL	05:46	U ➢ V	06:00	27,804	3181
BAW9E	KEWR	EGLL	05:55	U ➢ V	06:02	19,219	1464
BAW32N	KMIA	EGLL	06:05	Y ➢ T	06:04	38,439	(359)
BAW66V	KPHL	EGLL	06:55	T ➢ S	06:06	20,041	1092
BAW40F	KJFK	EGLL	06:30	V ➢ W	06:08	29,271	(321)
BAW6W	KIAD	EGLL	06:24	U ➢ T	06:10	29,599	1812
BAW11J	KJFK	EGLL	06:43	V ➢ V	06:12	28,056	150

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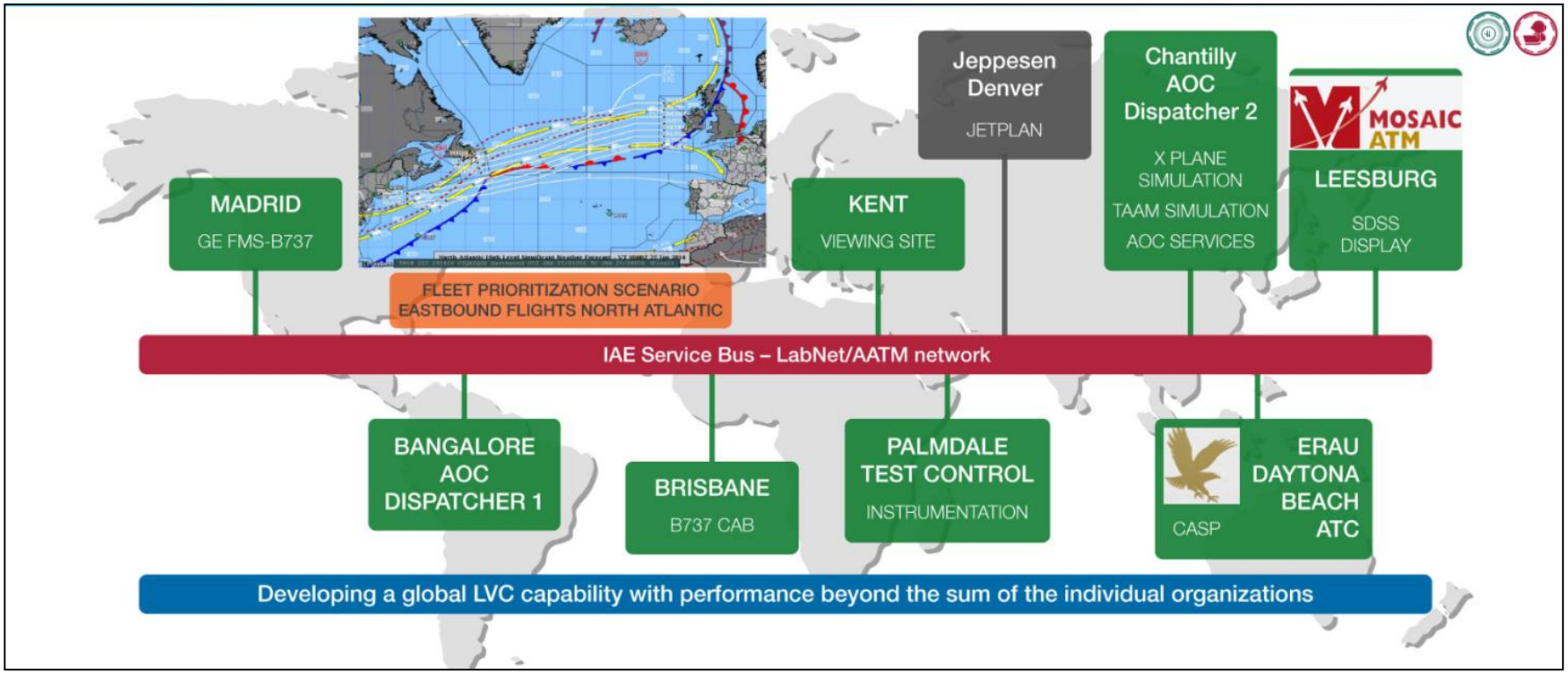
IAE Architecture



Acronyms:
AOC – Airline Operations Center
TAAM – Total Airspace & Airport Modeler
FMS-Flight Management System
AATM-Advanced Air Traffic Management
CASP-Common Air Surveillance Picture
SDSS- Surface Decision Support System

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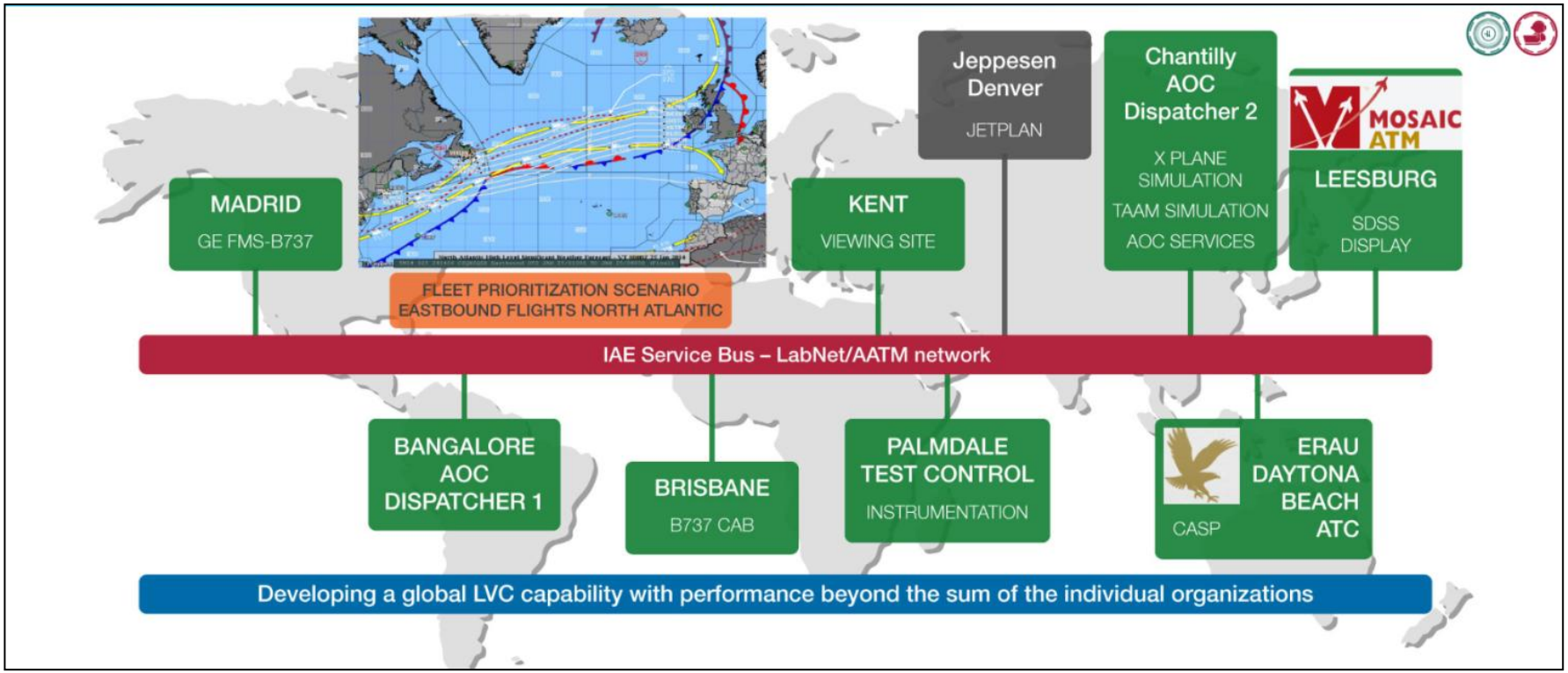
IAE Instrumentation



2014 Instrumentation Recap

- ✓Video distribution – 5 sources to 8 sites – recorded at one site
- ✓ Audio distribution – 8 sources – Voice over DIS bridged to Telecon – recorded at one site
- ✓ Voice DIS recording
- ✓ Cyber Monitoring
- ✓Network Monitoring
- •Raw data capture
- •Logger/Parser – SOA Pub/Sub Messaging Service

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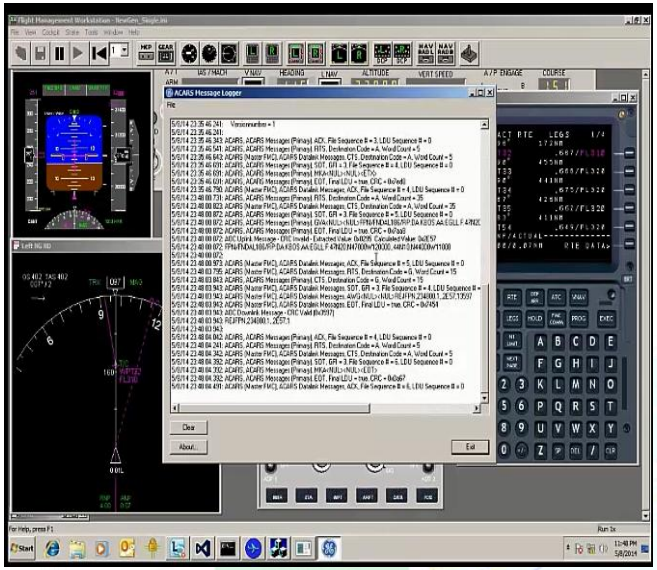
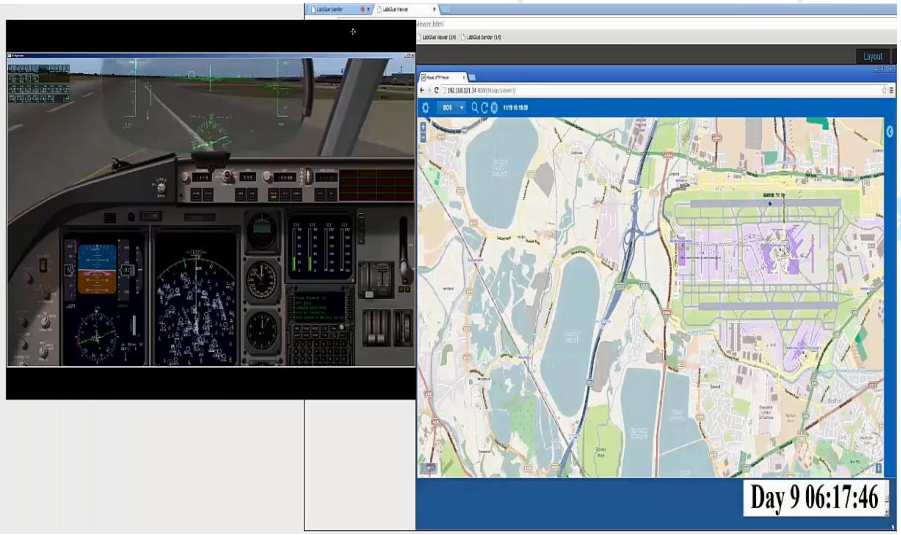
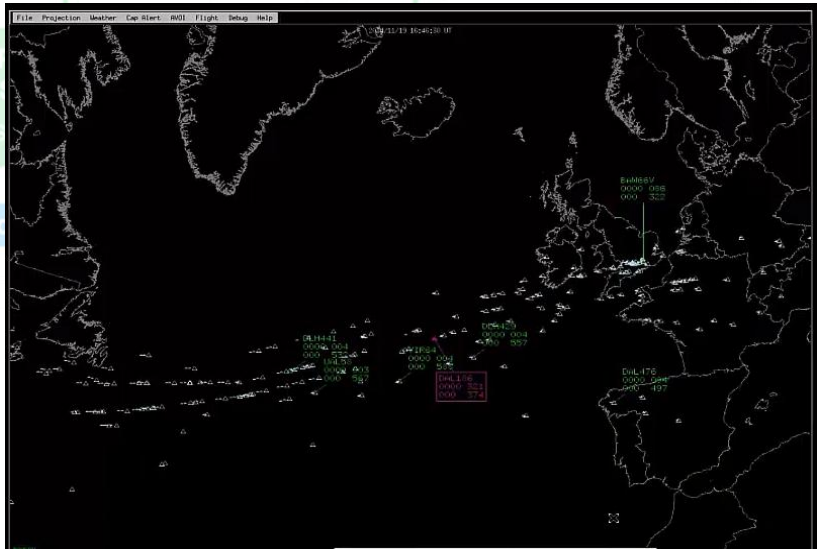


- Success!!! at the mission level
- Post event processing showed gaps in data collection





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Challenges of data capture in a SOA

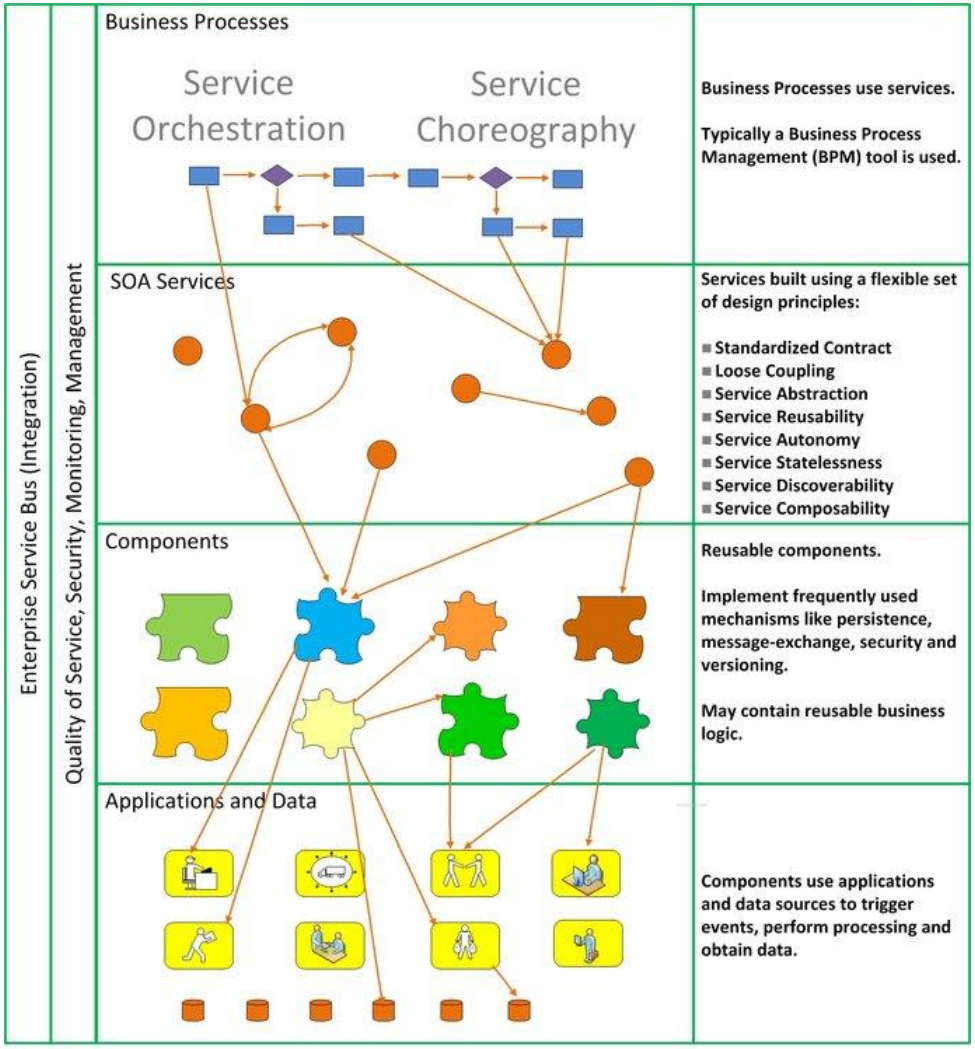
Server – multiple Operating Systems, multiple versions, multiple web packages

Client – multiple Operating Systems, multiple web browsers, multiple client side programs

SOA - contents and interactions can be dynamic

Clients may also use different connections (AATM/ LabNet)

Measurement system design is difficult within this environment



SOA overview - simplicable.com

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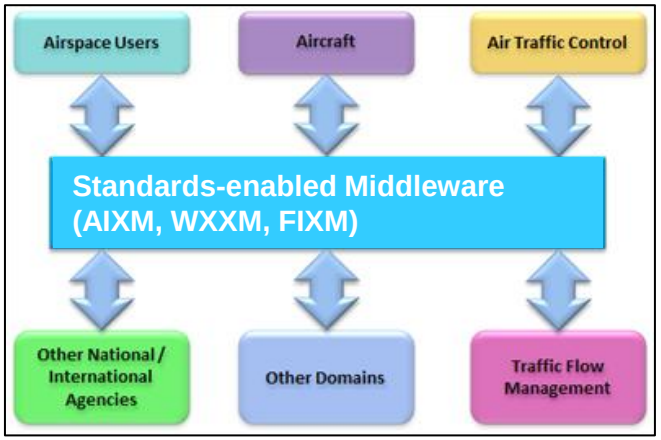
Logger/Parser – SOA Pub/Sub Messaging Service

Formatting issues varying levels of compliance of FIXM message types

- Chantilly Constructive Simulator
- Chantilly Virtual Simulator
- Madrid Virtual simulator
- FIXM mediator output
- ASDI Track Information
- ASDI Flight Plans
- Timestamp/Datestamp
- GUFI service



Source: fixm.aero

Procedural issues with start/stop of simulations and mediation services

- The order of services, track, and flight plan publishing

Standards issues

- Standards updates for other data types

Communication issues

- Time zone differences made communication difficult, more reliant on email

Acronyms:
ASDI-Aircraft Situation Display to Industry
sFMS- Simulated Flight Management System
FIXM-Flight Information eXchange Model
GUFI-Globally Unique Flight Identifier

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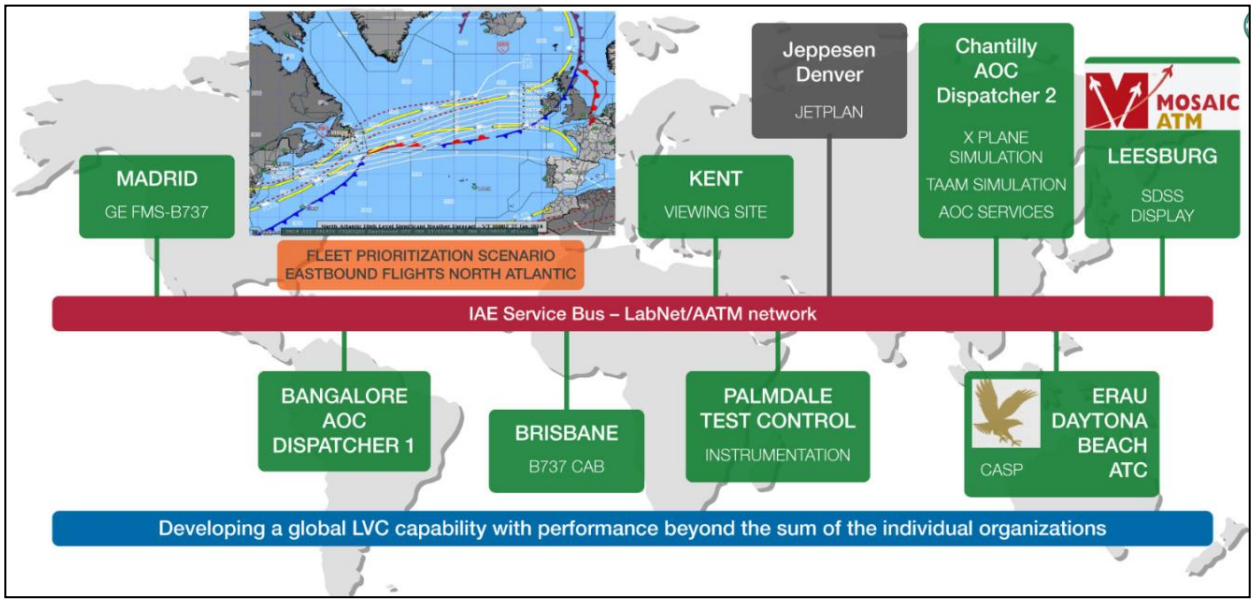
Going Forward Solving Challenges - IAE 2015

- Investigate Service Exchanges (Interactions)
  1. Link Transition
  2. Composite Transition
  3. Operational Transition

  a) State on the server
  b) Files
  c) Data bases
  d) Session data
  e) Beans

- Adding multiple data acquisition points (DAP) to the architecture
  - Parsers
  - Dissectors
  - Loggers

- Access to all services defined in the architecture



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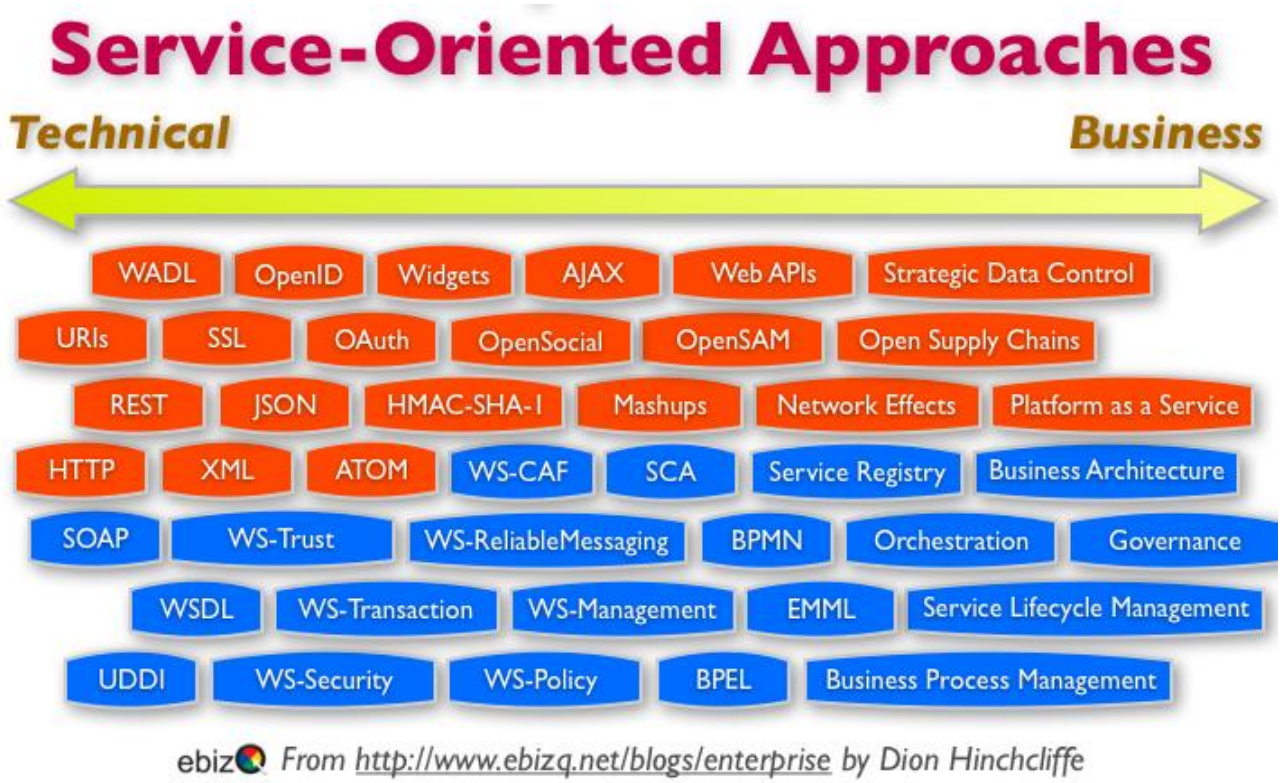
Summary



- Commercial Internet SOA vs. SWIM SOA
- Mission Accomplishment with verifiable data

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