

Metron Aviation

**ICAO ATFM
SEMINAR**

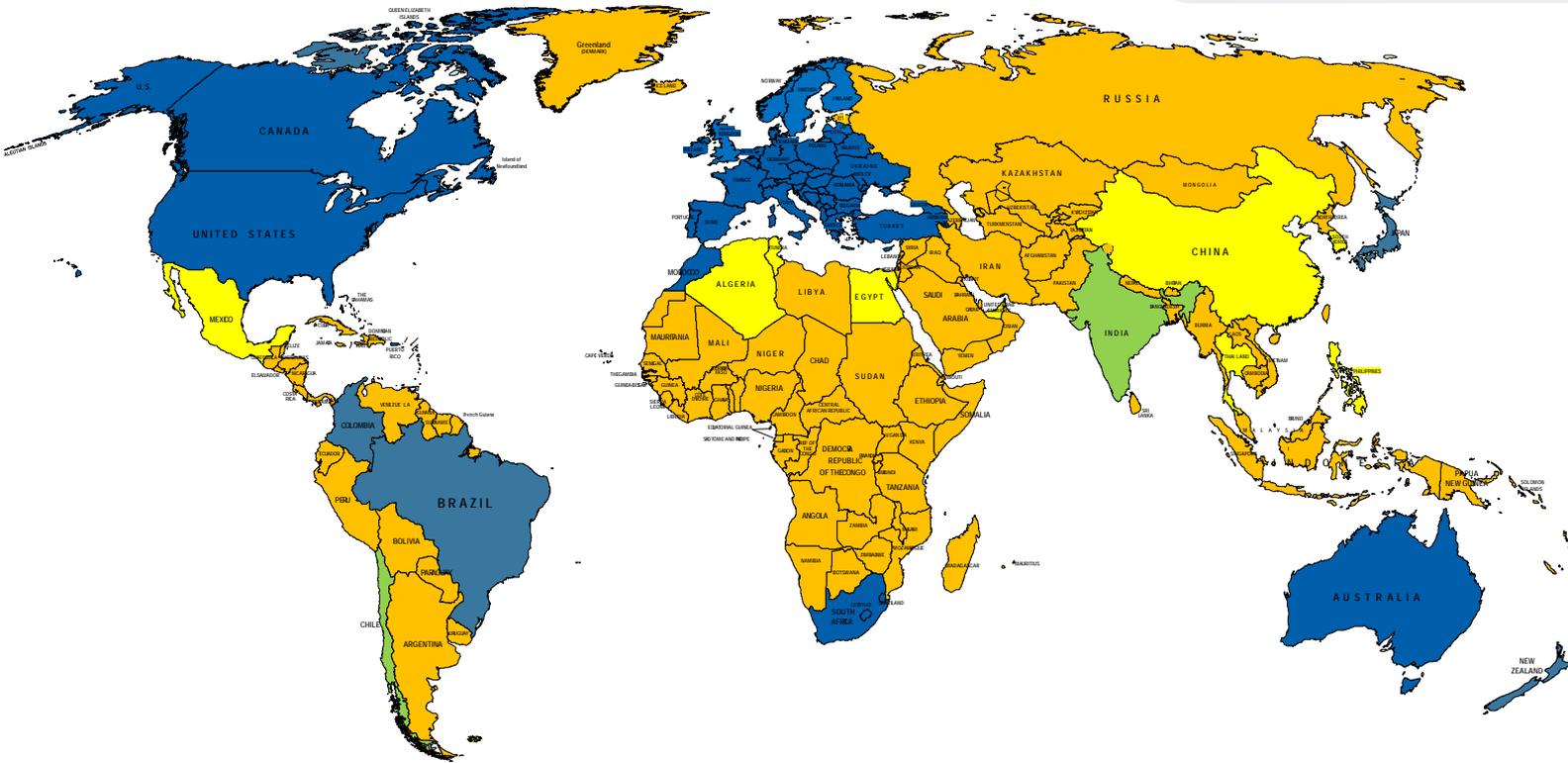
13-15 December 2016

Dubai, UAE

Stuart Ratcliffe



ATFM Global Implementation



ATFM Level

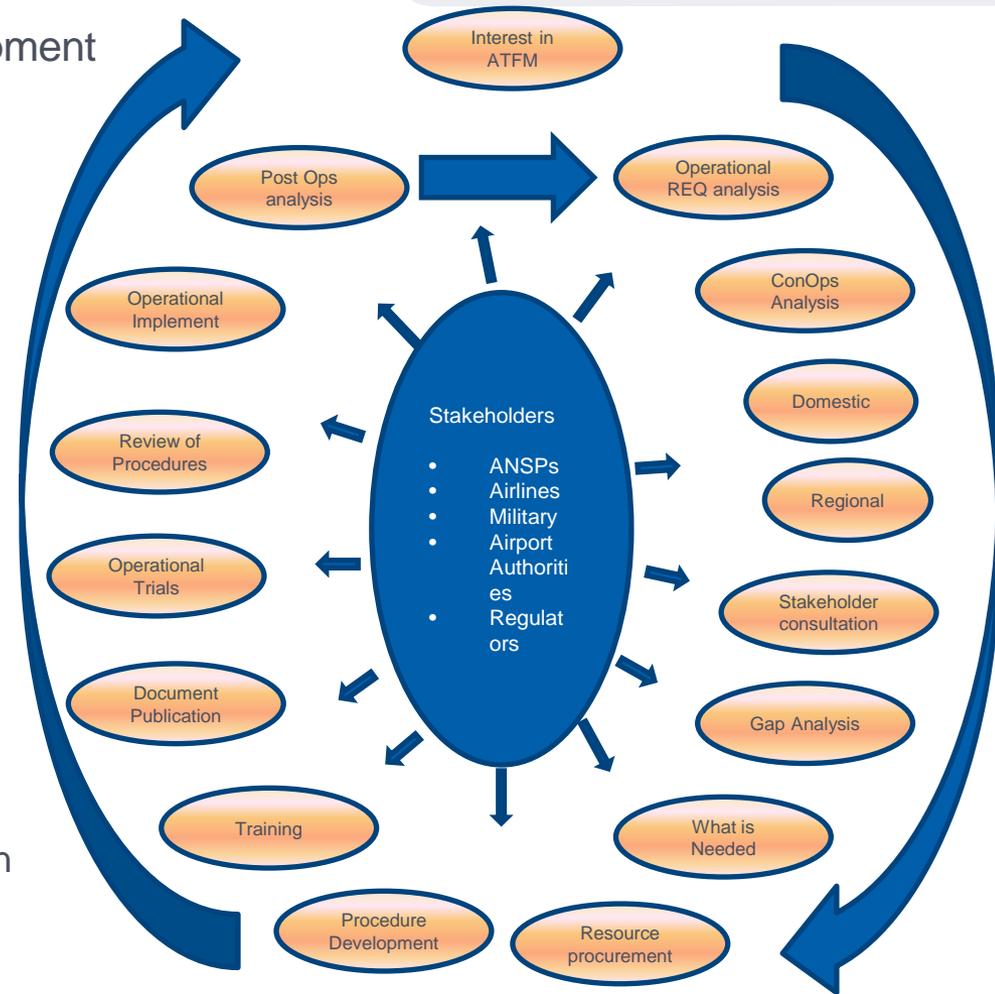
Characteristics



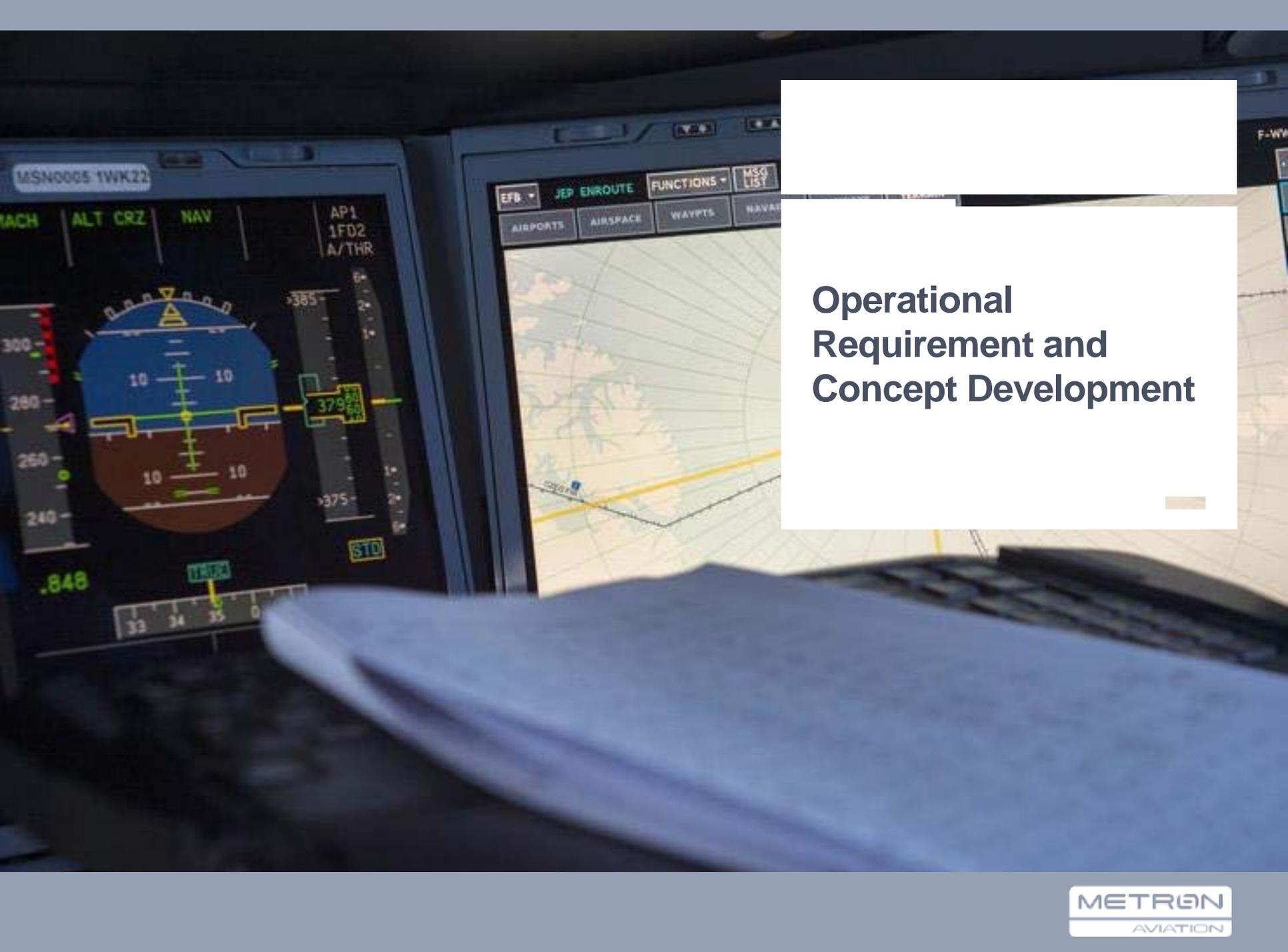
- 1 Advanced National/Regional, Integrated-ATFM/CDM Procedures and System Deployed
- 2 Mature ATFM/CDM Procedures and Initial System Deployed
- 3 Initial ATFM/CDM Procedures but No System Deployed
- 4 No ATFM/CDM Procedures or System Deployed

ATFM Implementation Process

- ATFM/CDM Operational Concept Development
 - Operational Environment Analysis
 - Gap Analysis
 - Needs Analysis
- Operational and Technical Specification development
- System Integration
- ATFM/CDM Implementation
 - Operating Procedures and Processes
 - Stakeholder facilitation, education and training
 - Document preparation and publication
 - Change management
 - Operational Subject Matter Expertise support
 - Technical support
- Operational data analysis
 - Post operational analyses and report generation
- Benefits analysis
 - Qualitative benefit analysis
 - Quantitative benefit Analysis



ATFM Implementation is a process



Operational Requirement and Concept Development

ATFM – What is required for the region

Operational REQ
analysis

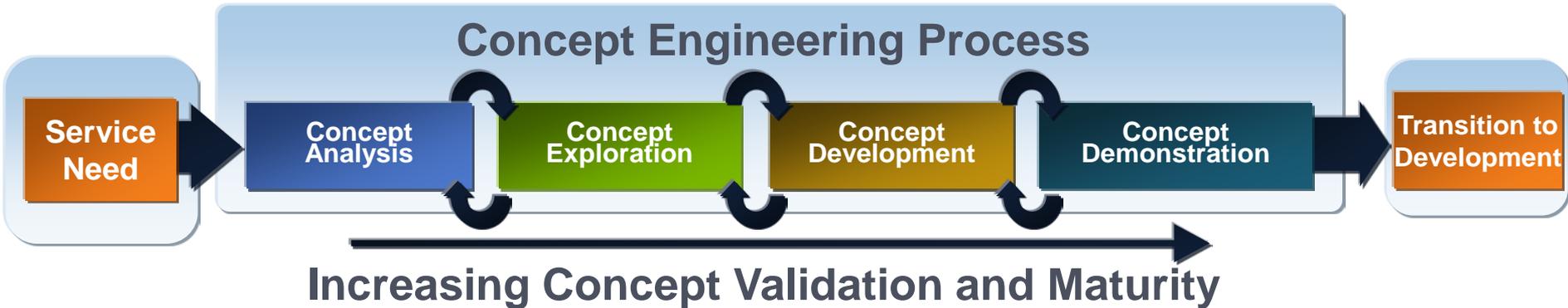
An ATFM Assessment

- **What** is required to balance demand against capacity?
 - Increase in Capacity/Efficiency
 - Demand Monitoring – Common Situational Awareness
 - Simple ATFM Solutions/Measures (Sectorization, MIT, MINIT, Level Capping)
 - Complex ATFM Measures GDPs
- **How (ConOps)**
 - Domestic ATFM
 - Regional
 - Central/Multi-Nodal
- **Who**
 - Which Stakeholders do you need to include
- **When**
 - Timeline for Implementation

Each ANSP/Region will have
unique requirements

Concept Engineering Process

ConOps Analysis



- Assess current operations and technology
- Stakeholder collaboration
- Data collection
- Baseline analysis
- Forecasting
- Research planning

- Develop alternative concepts of operation
- Assess feasibility/ benefits/ risks/ concept gaps
- Fast-Time simulation
- Stakeholder coordination

- Rapid prototype development
- Prototype integration
- Conduct HITLs
- Stakeholder evaluation
- Analyze HITL results
- Analyze feasibility, including safety, human factors, mixed equipment

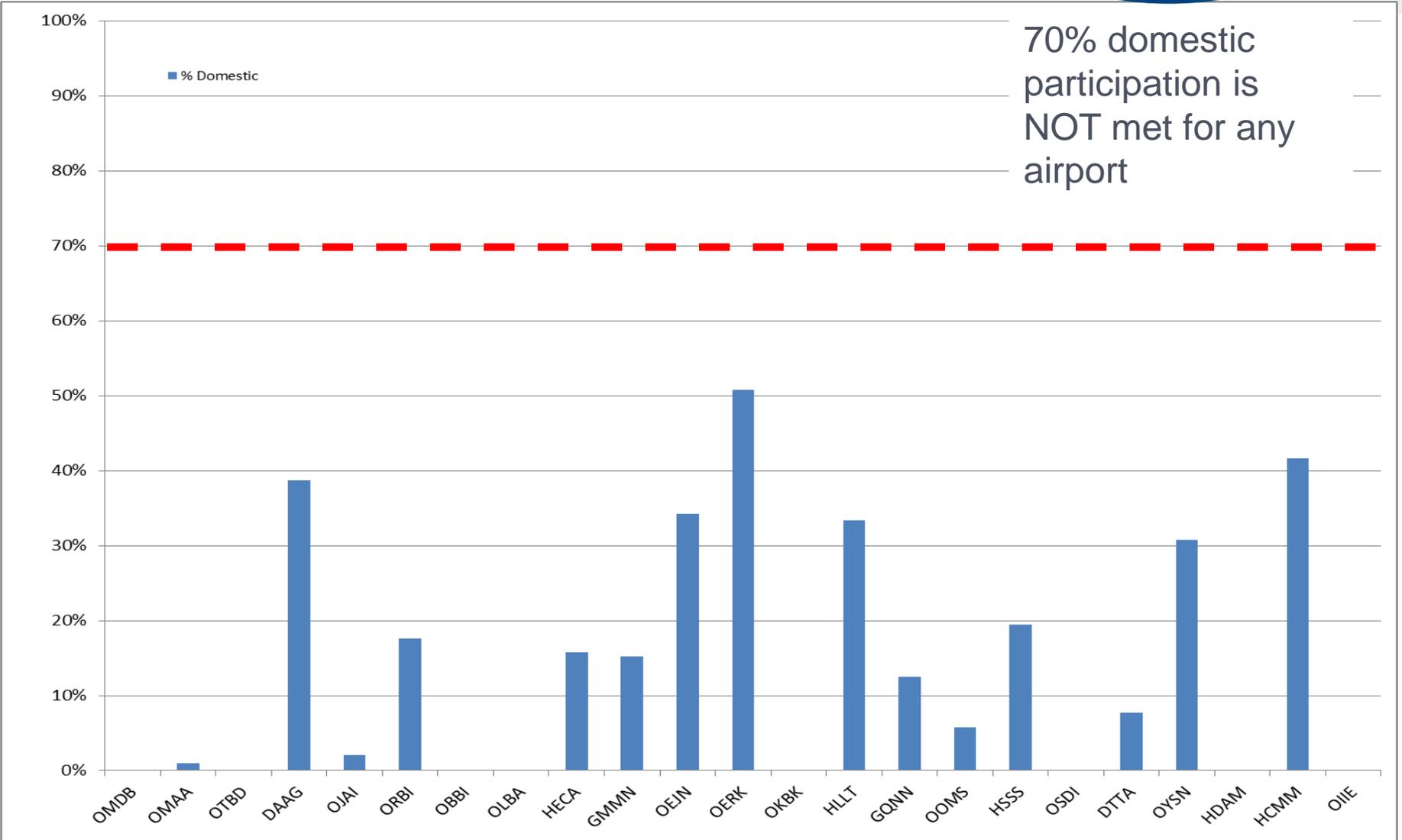
- Laboratory demonstrations
- Standards development
- Integrate and assess interoperability
- Conduct operational trials
- Promote stakeholder involvement

Concept Engineering ATFM Case Studies

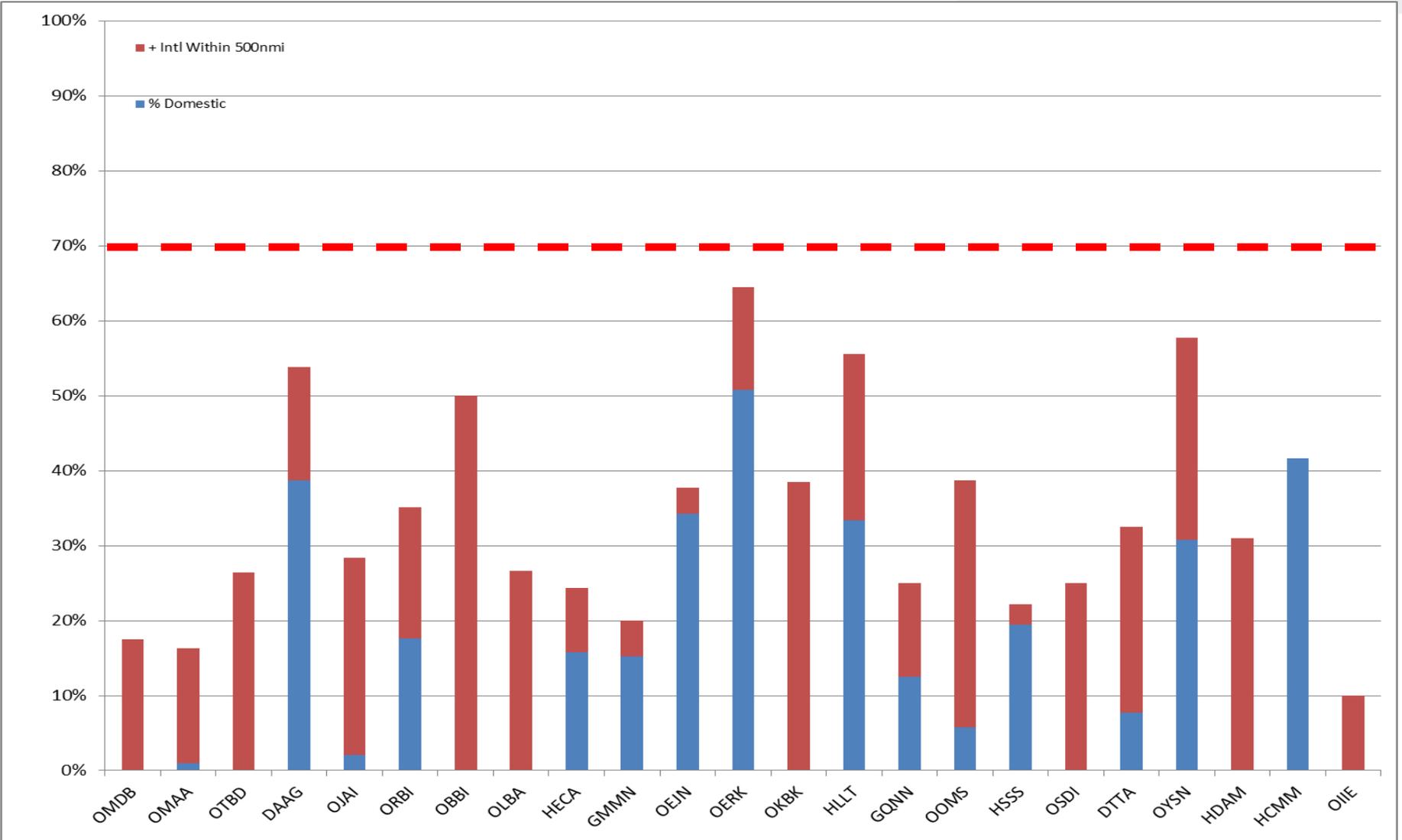
- FAA
 - Departure Flow Management (DFM)
 - Improved APREQ process to better manage departures into the overhead stream and coordinate departures from multiple airports with shared departure resources
 - Airspace Flow Program (AFP)
 - Application of airport ground delay program concepts to en route airspace congestion
 - Accomplished release of major new functionality in 18 months to beat the TFMS new functionality freeze
 - System Enhancements for Versatile Electronic Negotiation (SEVEN)
 - Provides electronic negotiation of user preferred trajectory options integrated into a significantly more dynamic, flexible, and effective TFM capability. A stepping stone towards Trajectory Based Operations
 - Major change in NAS operations recently transitioned to TFMS development as the Collaborative Trajectory Options Program (CTOP)
- CAAS
 - Regional ATFM
- Airservices Australia
 - Long Range ATFM
- China
 - Integration of ATFM with Regional ATMB systems

ACAC ATFM Participation (Domestic)

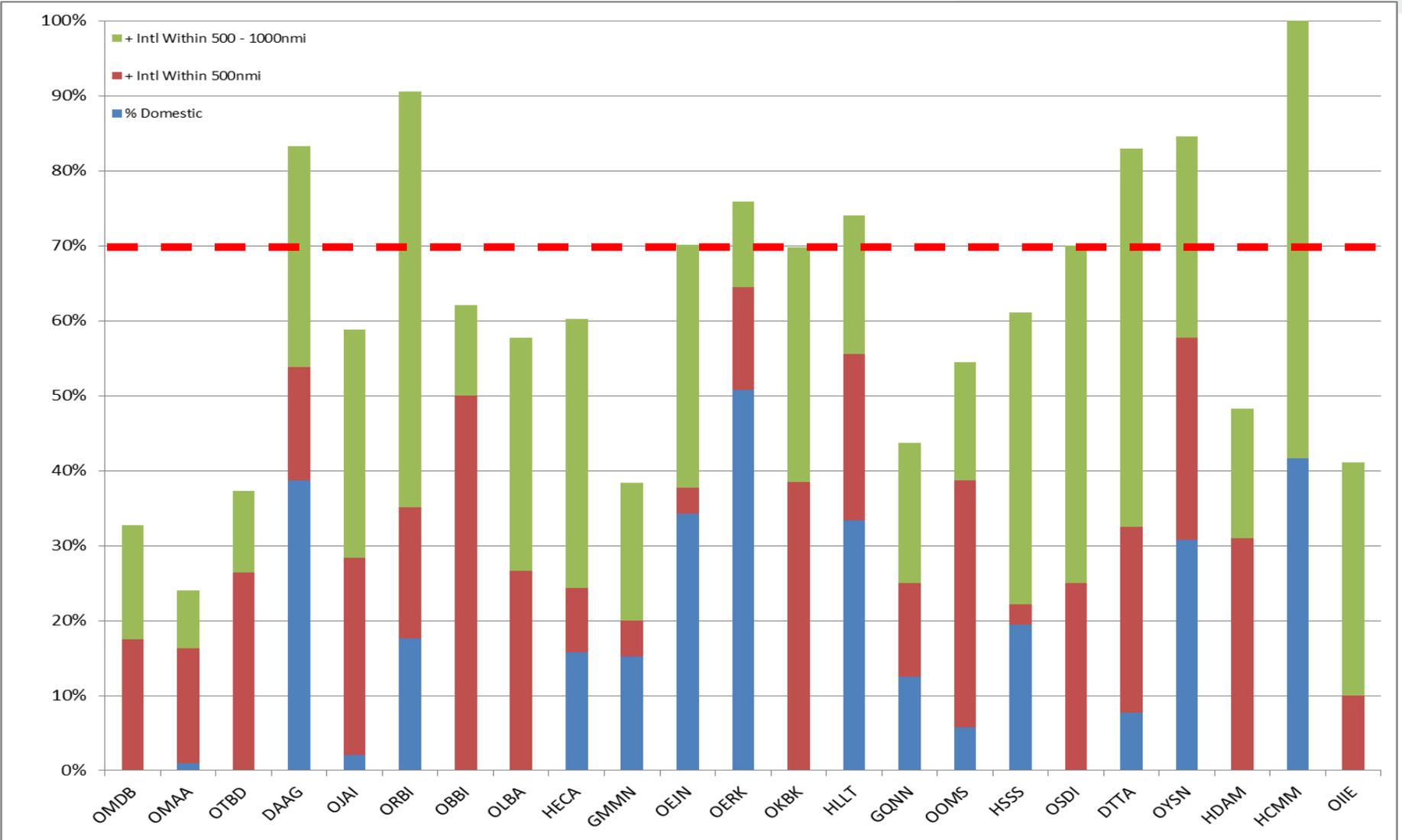
Domestic ATFM?



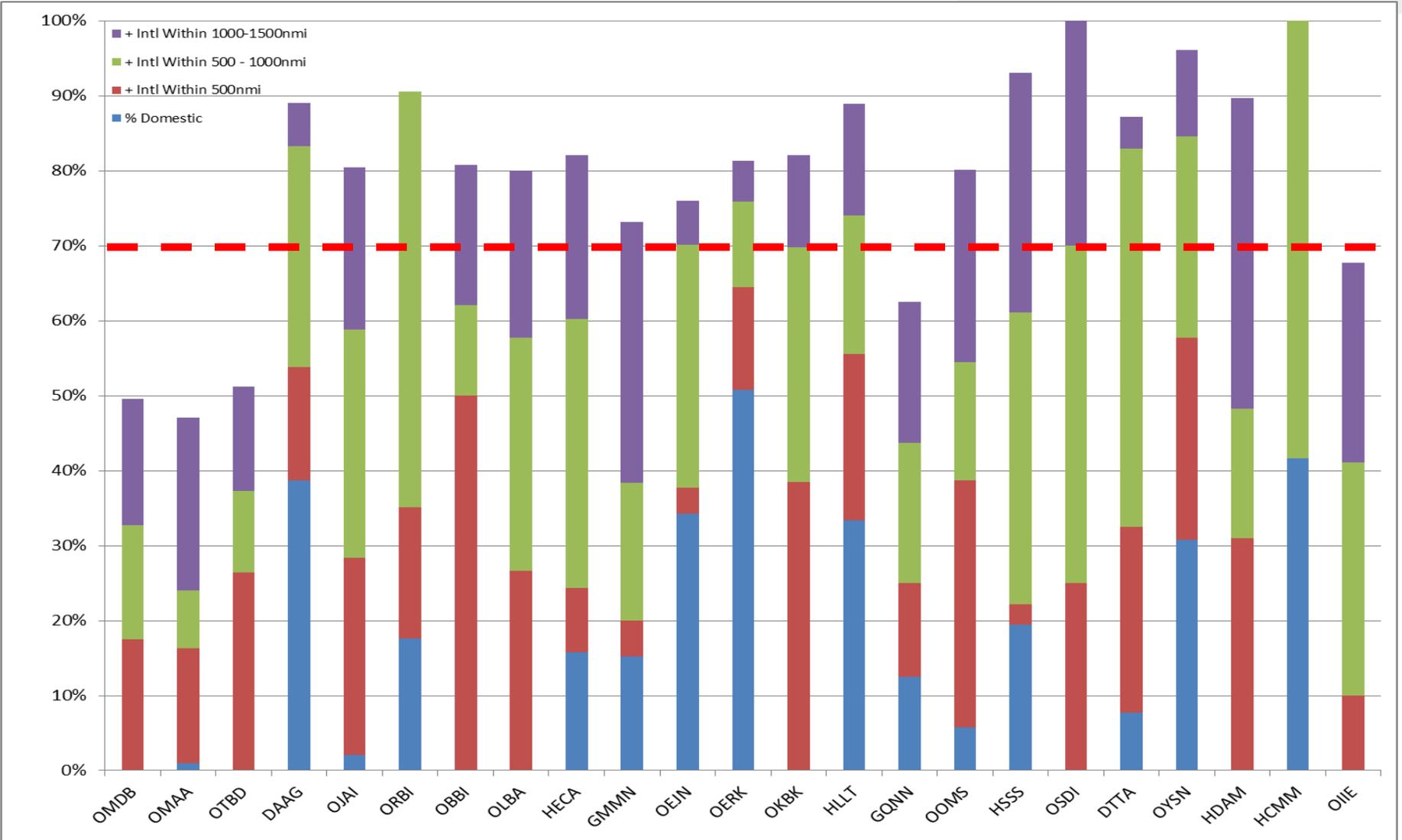
ACAC ATFM Participation (Domestic + International)



ACAC ATFM Participation (Domestic + International)

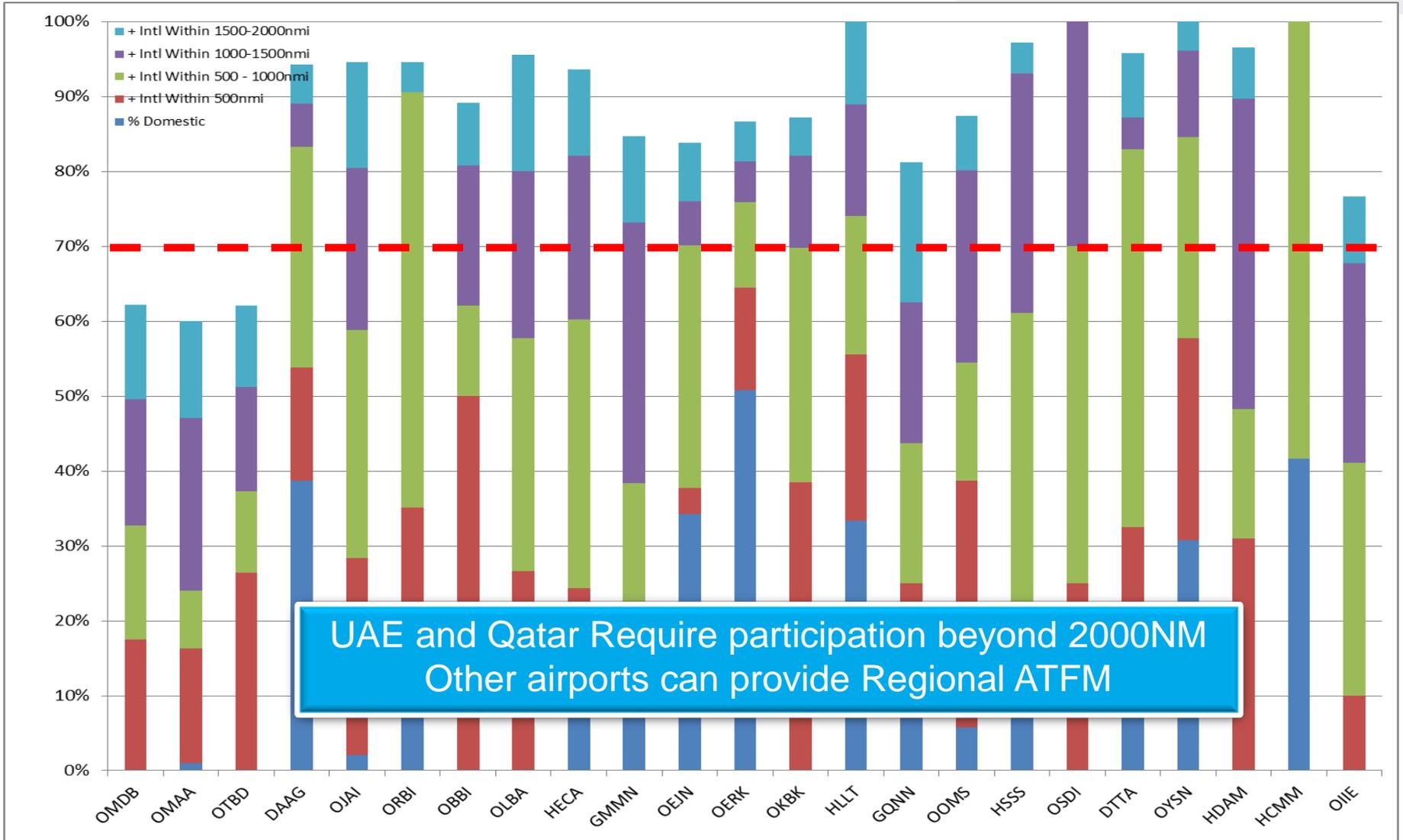


ACAC ATFM Participation (Domestic + International)



ACAC ATFM Participation

Regional



Stakeholder Consultation

Stakeholder consultation

Technology Testbed

Server and Storage Array HITL Software Workstations



Manager Position

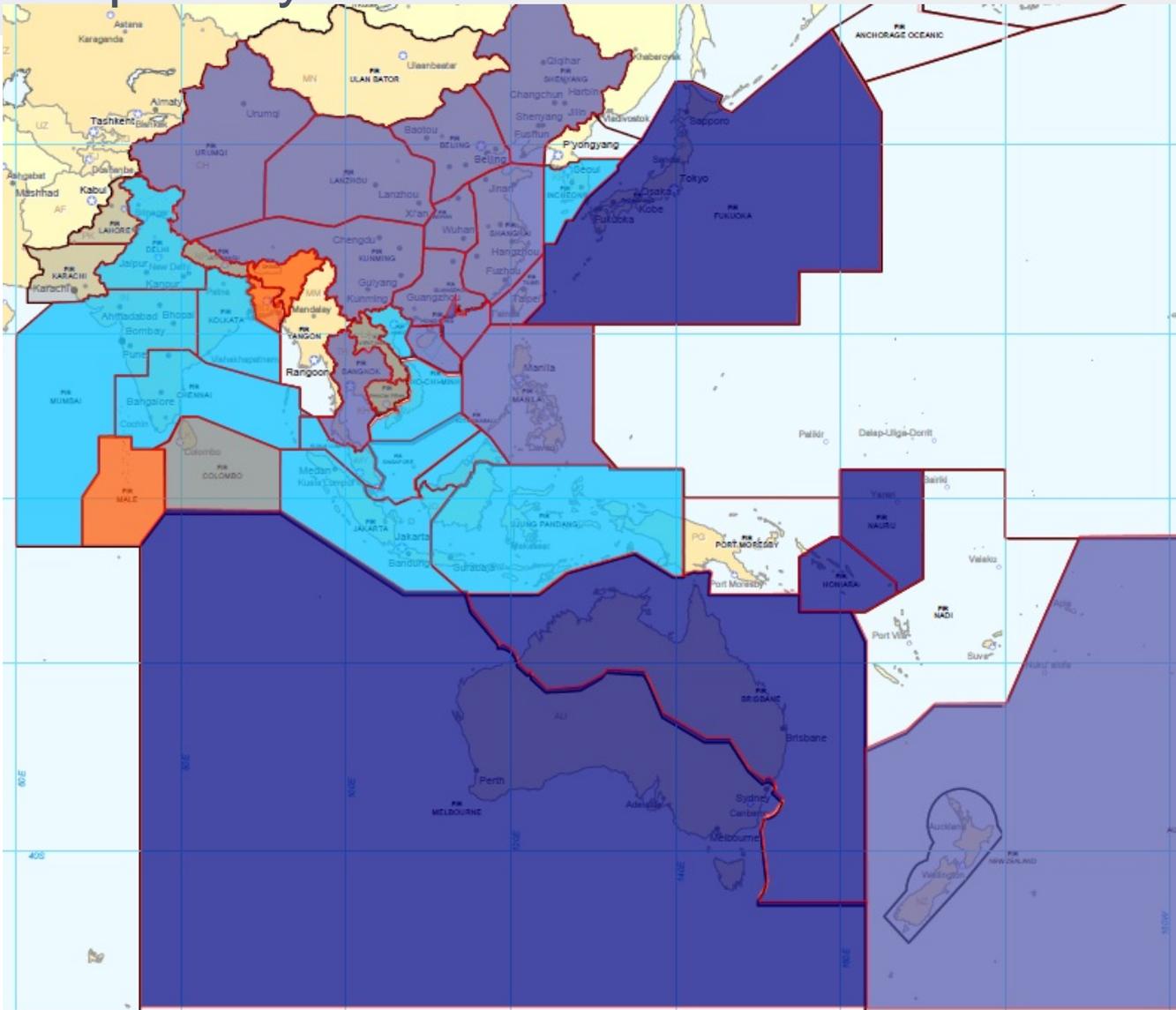
Airline

Airport Operator

Departure Tower



Gap Analysis - ATFM Infrastructure



ATFM Infrastructure

Australia **Advanced**

Japan

Philippines

Thailand

New Zealand

Hong Kong

China

Taiwan

India

Korea

Malaysia

Singapore

Indonesia

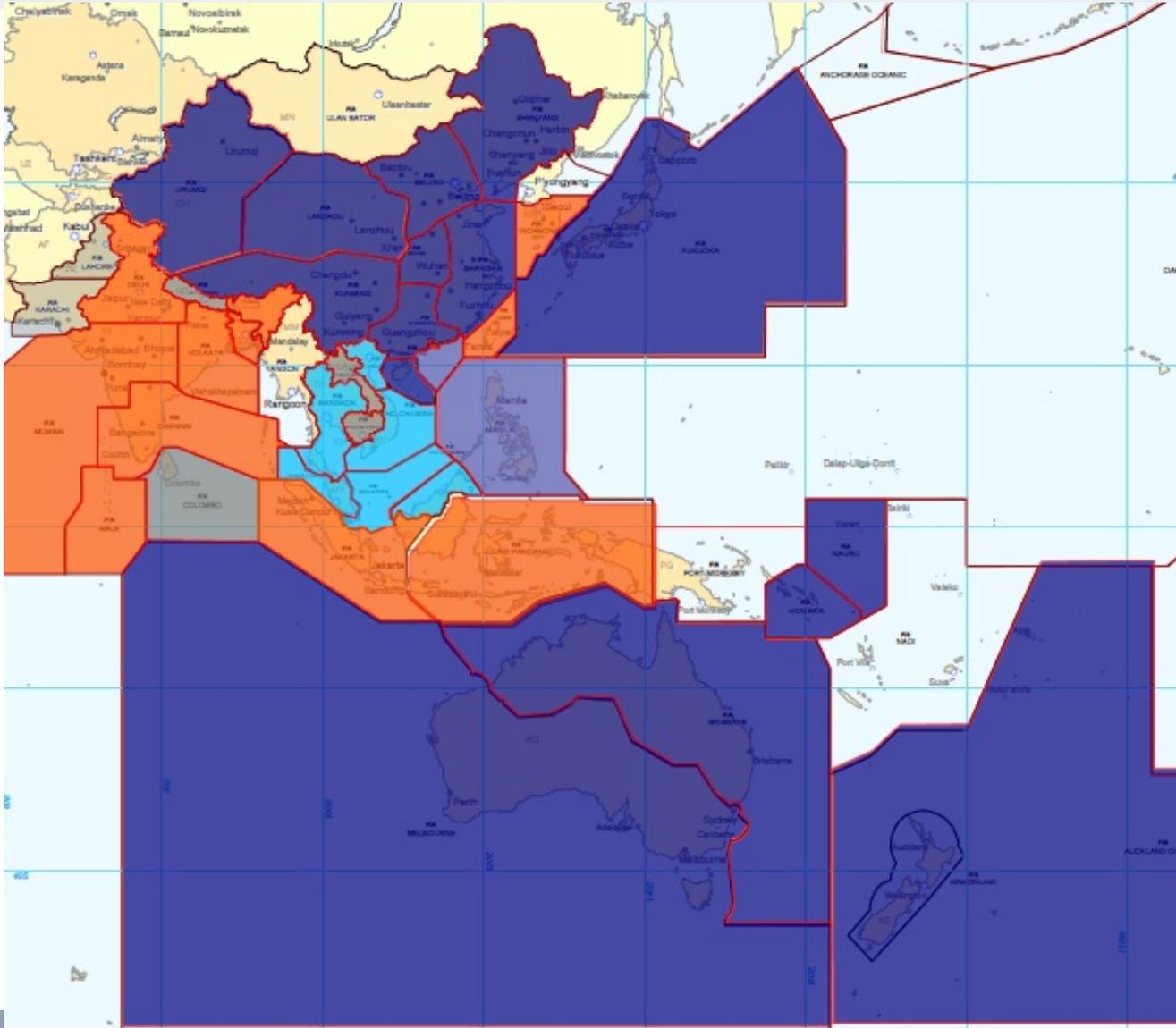
Vietnam

Bangladesh

Maldives



Gap Analysis CDM Processes – Situational Awareness



*Situational Awareness/
Telecon/Web based*

Australia
Advanced

China
Japan
New Zealand

Hong Kong
Philippines

Malaysia
Thailand
Singapore
Vietnam

Maldives
Taiwan
Korea
Indonesia
India
Bangladesh





ATFM Tools

What is required to do ATFM

Demand and Prediction Tool

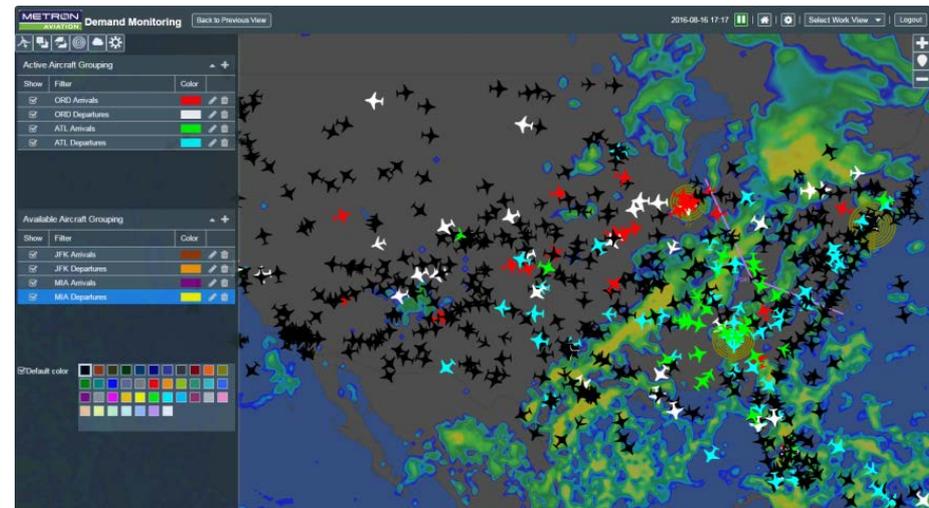
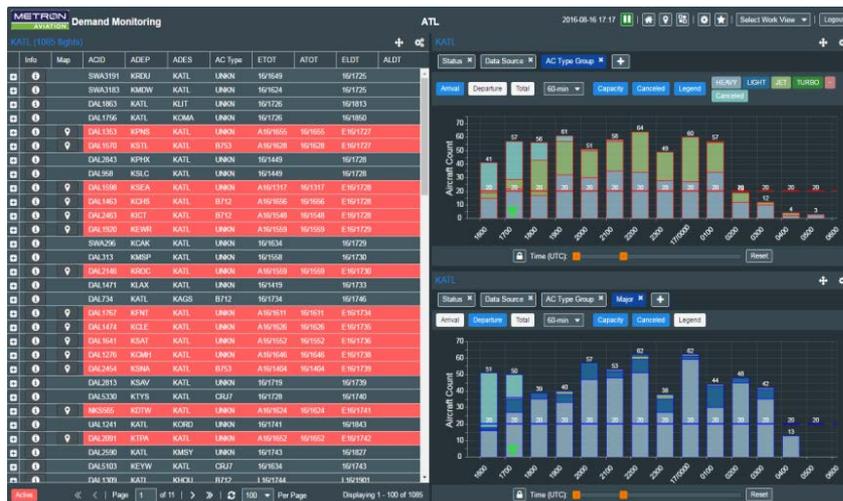
What is Needed

Horizon

- Provides common situational awareness and Demand Monitoring of aviation resources (e.g., airports, airspaces)
- Provides post-operations analysis

Demand Monitoring

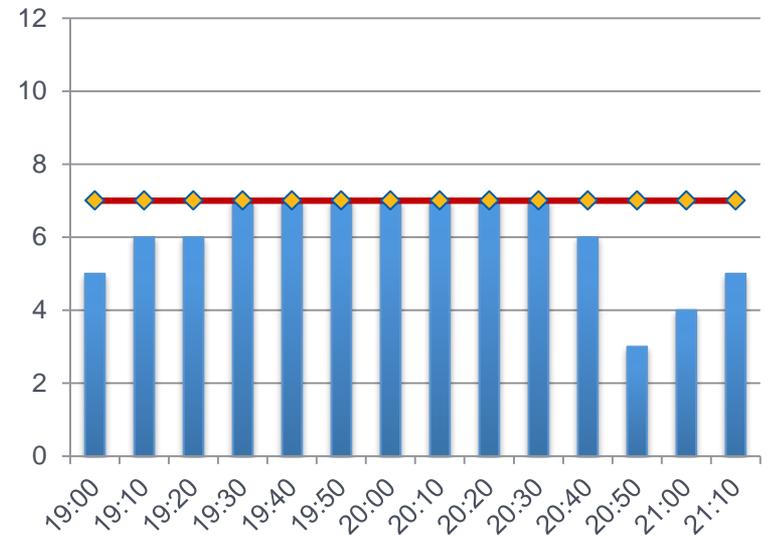
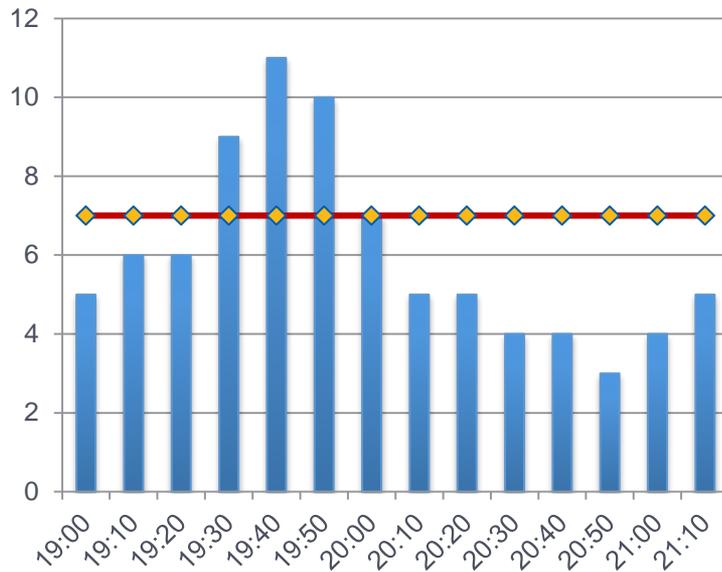
Traffic Situation





• Airport & Airspace DCB

- Airports
- Terminal sectors
- En-route sectors
- Arrival/departure fixes

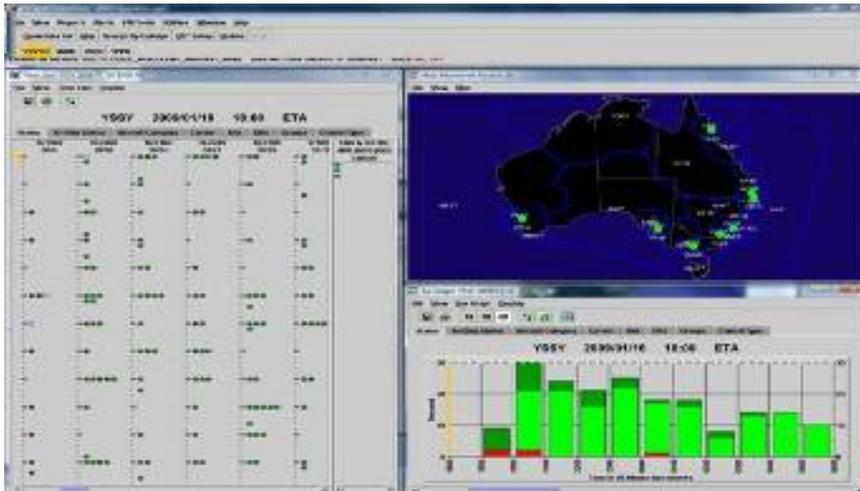




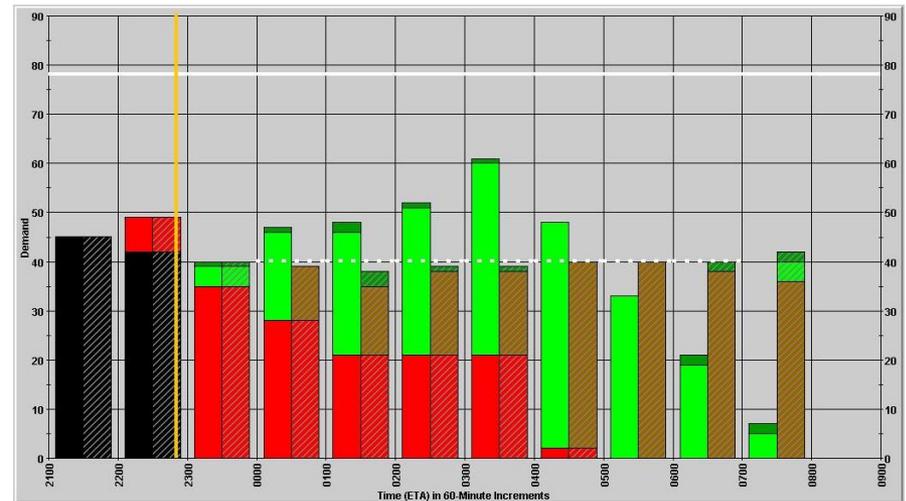
- Strategic, Pre-Tactical, and Tactical **Demand Monitoring**
- **Demand Capacity Balancing** for airports and airspaces
- Supports stakeholder Collaborative Decision Making including including automated slot substitutions
- Supports **Post Operations performance metrics** and operational analysis

Metron Harmony

Demand Monitoring



Demand Capacity Balancing



CDM Platform – CTOT and Slot Substitution Capability

Selecting a GDP displays its slot list and cancelled flights in the right panes

Updated 14/2123 Slot Substitution

Traffic Management Initiatives Retrieved substitution data of all controlled flights for airport named WSSS. Major: SIA

Ground Delay Programs (GDPs)
WSSS - SUBS: ALL ON

WSSS Slots List

	Slot	ARwy	Slot Hold	ACID	ADEP	ADES	ETD	ETA	COBT	CTOT	Program Delay
4	15/0442			SIA973	VTBS	WSSS	15/0245	15/0442	15/0240	15/0245	0
5	15/0512			SIA931	WARR	WSSS	15/0315	15/0512	15/0310	15/0315	0
6	15/0526										
7	15/0530										
8	15/0542										
9	15/0548			SIA212	YSSY	WSSS	14/2200	15/0548	14/2155	14/2200	0
10	15/0603			SIA607	RKSI	WSSS	15/0007	15/0603	15/0002	15/0007	2
11	15/0612			SIA957	WIII	WSSS	15/0449	15/0612	15/0444	15/0449	14
12	15/0639			SIA939	WADD	WSSS	15/0416	15/0639	15/0411	15/0416	16
13	15/0648			SIA278	YPAD	WSSS	14/2350	15/0648	14/2345	14/2350	0

Page 1 of 1 Display: Up to 50 Results

WSSS Cancelled Flights List

Slot	ARwy	Slot Hold	ACID	ADEP	ADES	ETD
------	------	-----------	------	------	------	-----

Page 1 of 1 Display: Up to 50 Results

- Active - Pop-Up - Active, Pop-Up **ACID** - Controlled by Another TMI

Undo Cancel Flight Reinstate Flight Swap

Review your flights Calculated Off Block Times (COBT), Calculated Time of Take Off (CTOT), and Program Delay. These times will reflect any delay assigned by the GDP.

Tower View

YSCB Flight List : [ADES =

Tools ▾ Alerts ▾ Reports ▾ Window ▾ Help ▾



Search for Airport: YSCB



Display: Departures Only

Tower View

Updated 2012-10-07 22:40:51

	ACID	ETD	COBT	ADES	ATOT
1	QLK466D	07/2228	07/2215	YSSY	07/2228
2	VOZ639A	07/2245	07/2239	YSSY	
3	QFA704	07/2259	07/2254	YSSY	
4	QLK468D	07/2336	07/2331	YSSY	
5	EVY78	08/0016	08/0011	YSSY	
6	QLK472D	08/0026	08/0021	YSSY	
7	QLK474D	08/0103	08/0058	YSSY	
8	VOZ647A	08/0206	08/0201	YSSY	
9	QLK478D	08/0216	08/0211	YSSY	
10	QLK422	08/0258	08/0253	YSSY	
11	VOZ651	08/0310	08/0305	YSSY	
12	QLK480D	08/0318	08/0313	YSSY	
13	QLK476D	08/0402	08/0357	YSSY	
14	VOZ657A	08/0505	08/0500	YSSY	
15	QFA878	08/0506	08/0501	YSSY	
16	QFA562	08/0603	08/0558	YSSY	

Page 1 of 1 | Display: Up to 50 Results

Displaying 1 - 34 of 34

Is a Operational Information System (OIS) Required

- OIS system required for Situational awareness
 - ATFM Solutions/Measures
 - Resource Capacity
 - CDM Teleconference Schedule
 - ATFM Daily plans
 - CNS Serviceability

The screenshot displays a dashboard with several data tables:

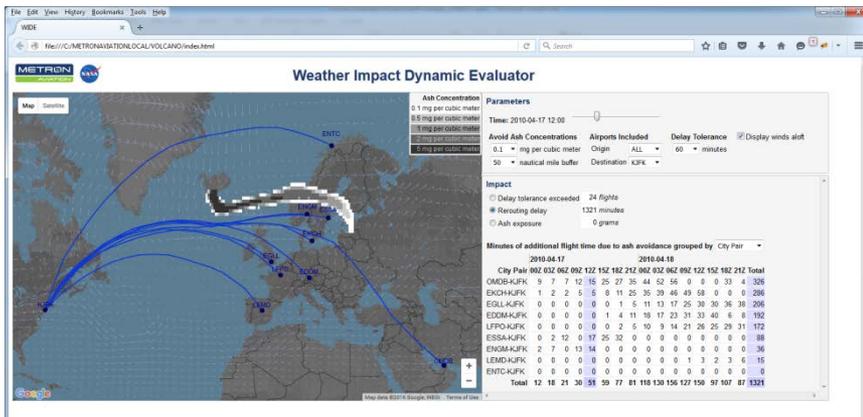
- ATFM Solutions/Measures:** A table with columns: ANSP, Resource, Active, Start Time (UTC), End Time (UTC), Type, Description, NOTAM.
- NOTAMs, METARs, TAFs:** A section with sub-tables for NOTAMs (Time (UTC), ANSP, Identifier), METARs, and TAFs.
- Resource Capacity:** A table with columns: ANSP, Resource, Capacity Remarks.
- CDM Teleconference:** A table with columns: Info, Hosting ANSP, Start Time (UTC).
- ATFM Daily Plans:** A table with columns: Info, ANSP, Last Updated (UTC).
- Reference Material:** A list of links: + Weather, + ANSP Documentation, + IDAC, + DC-ANSP, - AIP, - LOA.
- CNS Service Items:** A table with columns: ANSP, Resource, Active, Start Time (UTC), End Time (UTC), Type, Description, NOTAM.

(Name of Unit)		(UTC Date) (Applicable Time)	
Capacity and Constraints			
Location (AD or SECT)	Applicable Period	AAR (Landing/Hour)	Constraint/Remark
ATFM Measures			
Location (AD or SECT)	Applicable Period	AAR (Landing/Hour)	Constraint/Remark
POSSIBLE/DEVELOPING ISSUES			
Location (AD or SECT)	Applicable Period	AAR (Landing/Hour)	Constraint/Remark

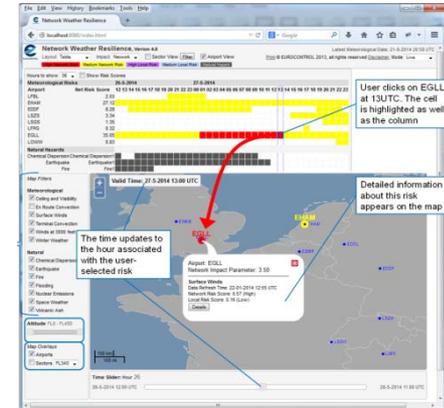
Weather Integration into ATFM

- Provides weather translation capabilities for FMP decision support
- Identifies predicted capacity (e.g. Sector, AAR, ADR)
- Analyzes weather impacts on air traffic and ATM performance evaluation through post-ops analyses
- Improves Route Efficiency

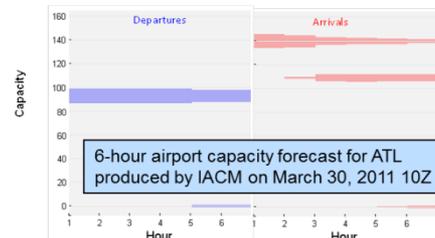
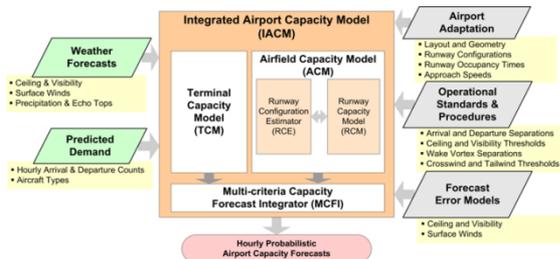
Weather Impact Dynamic Evaluator



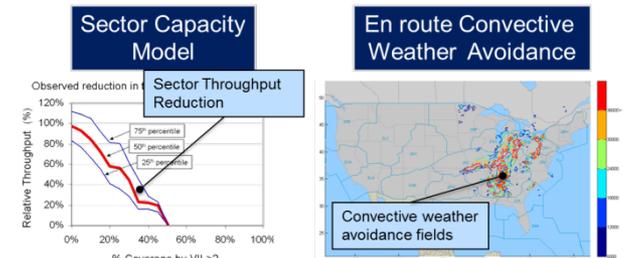
Weather Resilience Tool

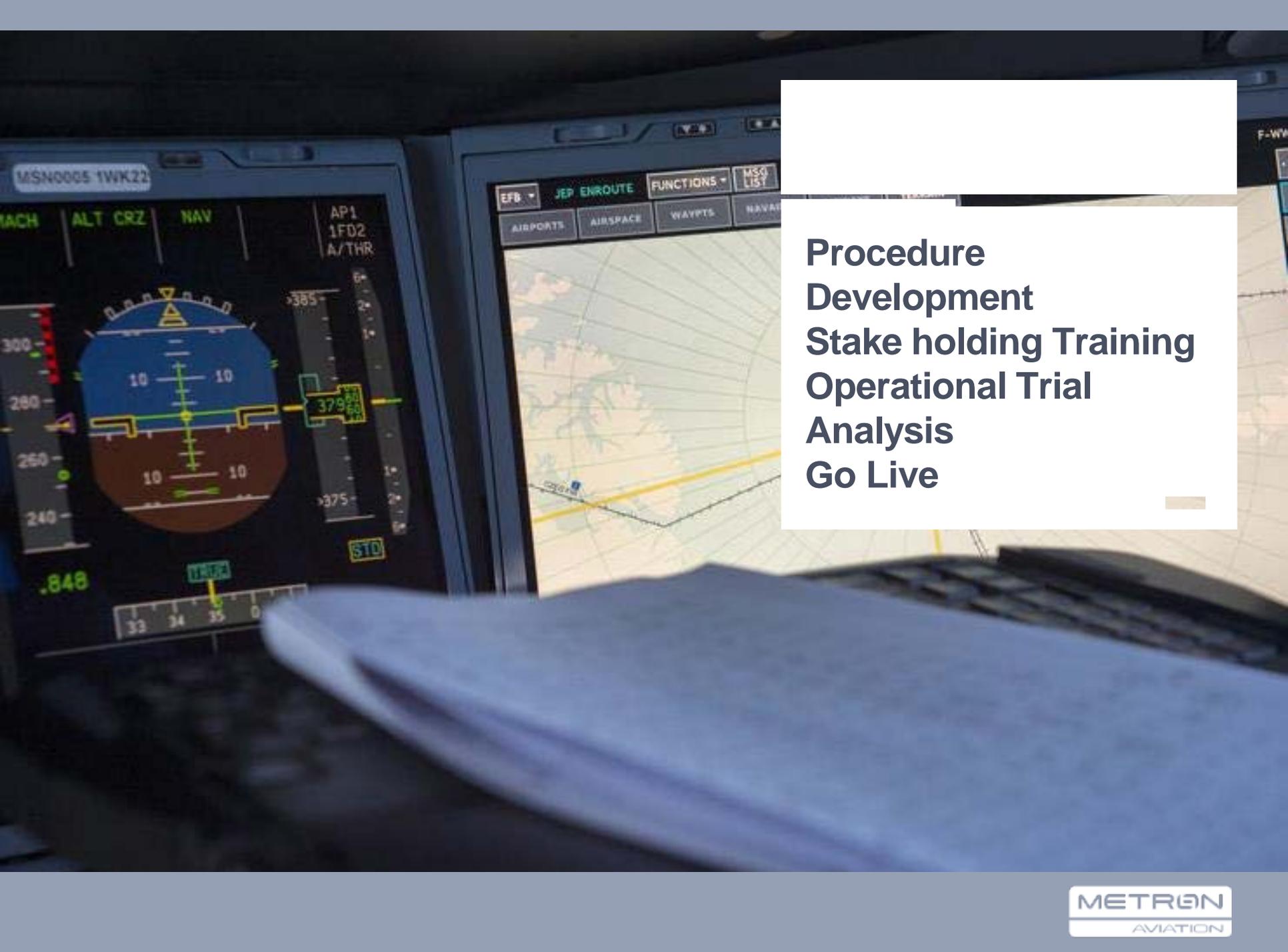


Integrated Airport Capacity Model (IACM)



Integrated Airport Capacity Model





**Procedure
Development
Stake holding Training
Operational Trial
Analysis
Go Live**

Regional Air Traffic Flow Management Concept of Operations

Application of Regional ATFM in Singapore Airspace and Asia Pacific

7 February, 2014



Civil Aviation Authority of Singapore



INTERNATIONAL CIVIL AVIATION ORGANIZATION



ASIA/PACIFIC REGIONAL
AIR TRAFFIC FLOW MANAGEMENT
CONCEPT OF OPERATIONS

Version 1.0 September 2015

This document was developed by the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG)

Approved by APANPIRG/26 and published by the ICAO Asia and Pacific Office, Bangkok

Asia/Pacific Framework for Collaborative ATFM

INTERNATIONAL CIVIL AVIATION ORGANIZATION



ASIA/PACIFIC FRAMEWORK
FOR
COLLABORATIVE AIR TRAFFIC FLOW MANAGEMENT

Version 2.0 September, 2016

This Plan was developed by the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG)

Approved by APANPIRG/26 and published by the ICAO Asia and Pacific Office, Bangkok

ATFM Training - Who needs to be trained in ATFM

- Introduction to ATFM for Management
- ATFM for ATC
- ATFM for Stakeholders
- Specialized ATFM Training

Harmony Sim ATFM Simulation Tool



Phased Approach to the Operational Trial

Phase 1 2015 - 2016

- Distributed Ground Delay Program
- Airport Arrival Constraints (short-term & medium-term) e.g. weather, runway outage

Phase 2

- Ground Delay Program supporting Airspace Congestion & Capacity Planning
- Explore interconnectivity among ATFM systems

Phase X Vision

- Fully interconnected Global ATFM Service
- Integration with SWIM and 4D-Trajectory Management

Go Operational

Big Bang

Phased



Post Operational Analysis

Post Ops analysis

FAA's challenge

- World's largest ANSP responsible for more than 30 million sq. miles of U.S. airspace and approximately 80,000 flights/day
- In 1990, huge traffic increase brought unprecedented delays
- Limited common situational awareness and no access to delay information



The Solution

- For more than 15 years, the FAA partners with Metron Aviation on systematic approach to ATFM/CDM strategies & deployment

Benefits

- Since commissioning the Collaborative ATFM system in 1998, stakeholders have saved more than:
 - 70 million minutes of delays
 - 191 million liters of fuel
 - 590 thousand metric tons of CO2 emissions
 - Over US\$7.0 Billion in operating costs

Stakeholders



Conclusion

- ATFM implementation is not an event it is a process
- ATFM Solutions are unique to an ANSP or a Region
- An ATFM Assessment must be carried
- A Concept of Operations must developed.
- Ensure all stakeholders are included from outset
- Procure appropriate tools
- After implementation carry out post operations review



AN  **AIRBUS** COMPANY

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Metron Aviation Overview

Core Competencies

- Air Traffic Flow Management (ATFM) and Collaborative Decision Making (CDM)
- Environmental and Energy Analysis
- Weather Impacts to Aviation
- Airspace Design
- Operational Concept Development and Validation

Metron Aviation fuses advanced science and mathematics with unparalleled air traffic management expertise to provide ground-breaking optimization and collaborative decision making solutions for the world's leading Air Navigation Service Providers, Airspace Users and Airports

Impressive Track Record

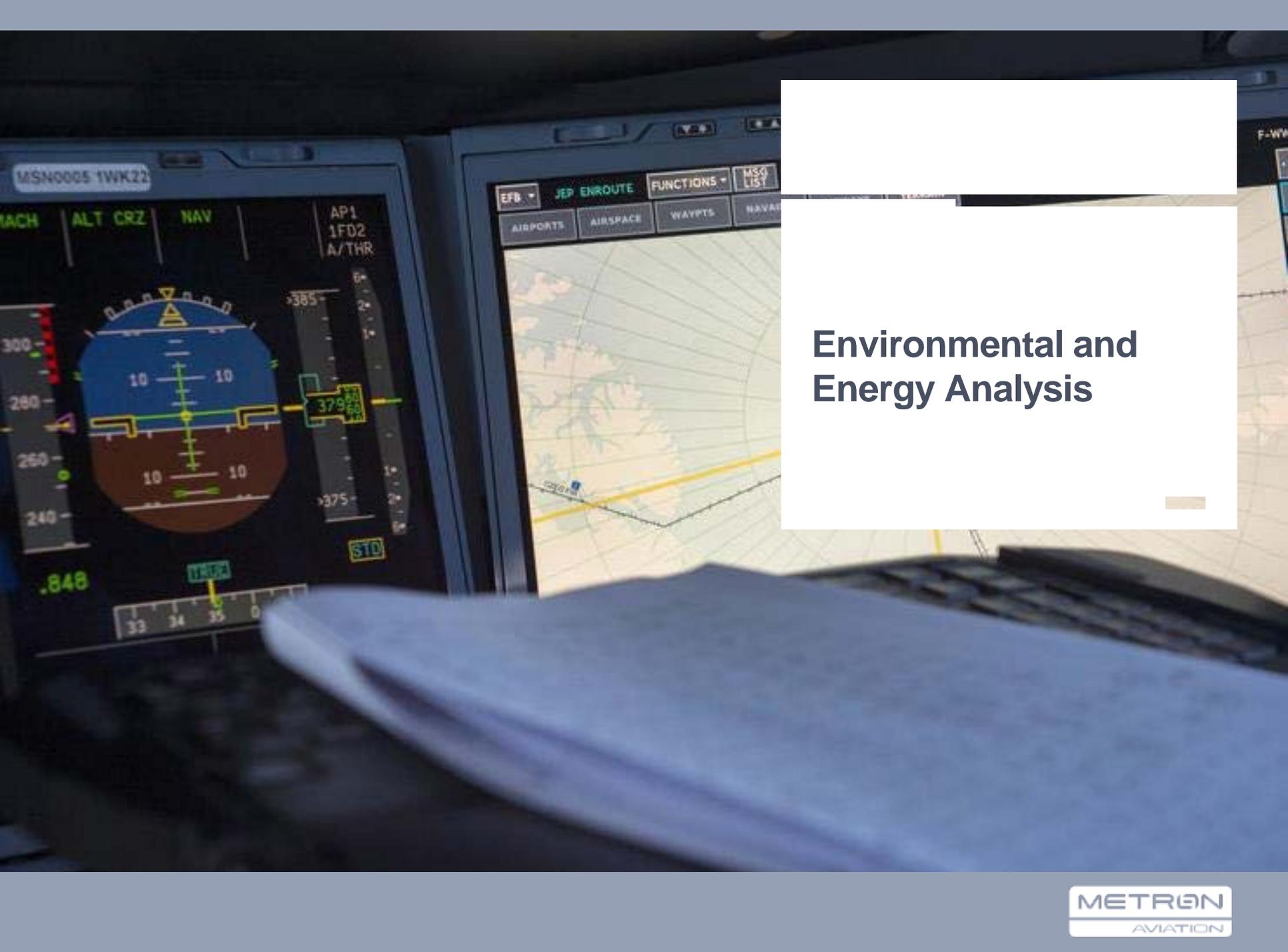
- Innovation: Industry's first ATFM platform and CDM solution
- Customer Value: Significant, measurable, economic and environmental benefits
- Excellence: Numerous awards from FAA, NASA, ATCA, Jane's ATC Global

ATFM/CDM International Involvement

- Contributing Authors to ICAO Doc 9971 (ATFM/CDM)
- CANSO Co-Chair for the ATFM Work Group
- Support CANSO and IATA in the Asia Pacific Multi-Nodal ATFM Activity
- Support for CANSO at CADENA (Caribbean, Latin America ATFM Implementation)

Metron Aviation ATFM/CDM Customer Base



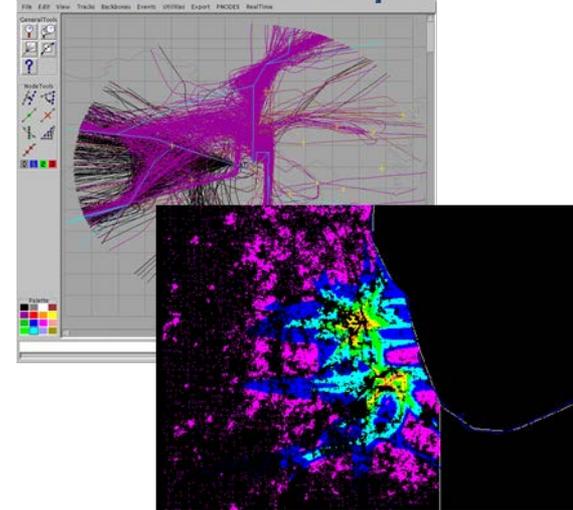


Environmental and Energy Analysis

Environmental and Energy Analysis (1 of 2)

- Extensive Metroplex and Large TRACON airspace redesign and environmental analysis experience
 - New York, New Jersey and Philadelphia Metroplex Redesign
 - Potomac Consolidated TRACON (PCT) Metroplex Project (Washington DC Metroplex)
 - Las Vegas (LAS) RNAV/RNP Airspace Optimization Environmental Analysis
 - Chicago Terminal Airspace Plan (CTAP)
- Metron leverages extensive environmental analysis capabilities to deliver cost effective environmental screening and detailed regulatory environmental analysis
 - Targeted analysis to deliver the appropriate level of analytical detail to determine the potential for significant environmental impacts (noise, emissions, GHG etc.)
 - Extensive experience in translating operational ATC procedure change intent into the requisite level of environmental analysis for impact assessment that supports analysis of options

Data Integration and Model Development

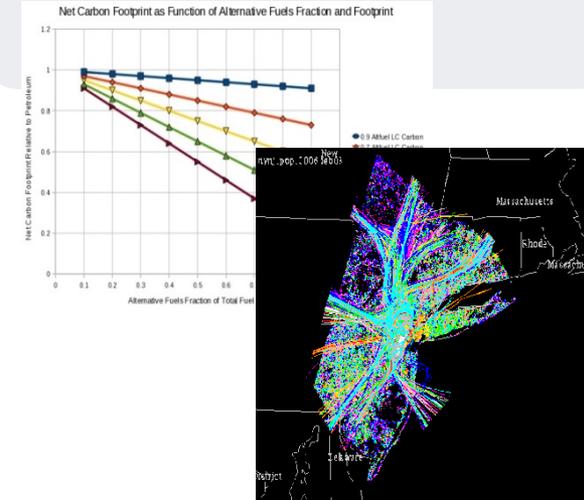


- **Noise Integrated Routing System (NIRS)**
- **Airspace Design/Screening Tool (ADST)**
- **Aviation Environmental Design Tool (AEDT)**
- **Aviation Environmental Screening Tool (AEST)**
- **NAS-wide Environmental Impact Model (NASEIM)**
- **Alternative Fuels Production Analysis Tool (AFPAT; in collaboration with MIT)**

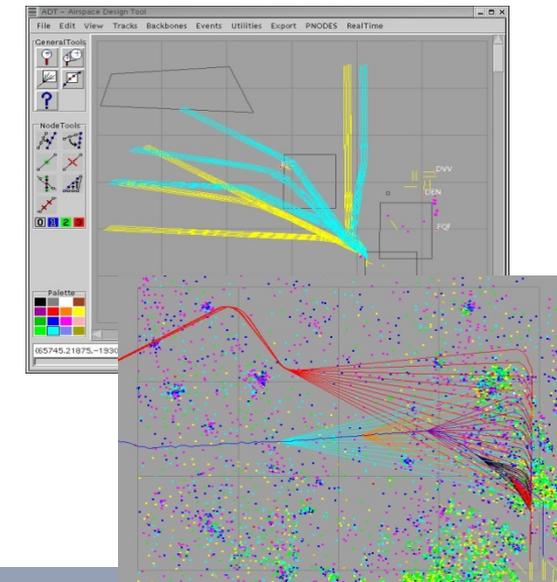
Environmental (2 of 2)

- Focus on key drivers of environmental impacts:
 - Engine/airframe technology and insertion into fleet
 - Operational improvements (PBN, RNAV-RNP etc.)
 - Demand structure and how fleet services demand
 - Alternative fuels (direct use & life-cycle GHG impact changes)
- Experienced in NextGen and SESAR Analysis Support
 - NextGen JPDO Interagency Portfolio & Systems Analysis
 - FAA Environmental Target Analysis for Policy Support
 - SESAR environmental impacts (Project 16.06.03 w/ Thales)
 - Alternative fuels availability, cost, and benefits assessment, as well as business-case analysis (FAA, TRB-ACRP, Airlines)
- Environmental Impact & Decision Support Tool Development
 - Developed NIRS for FAA and supporting FAA AEST evolution
 - Development of Numerous Other DSTs and processes including;
 - Route Optimization for Mitigation Analysis (ROMA)
 - Dynamic Noise Avoidance Planner (DNAP)
 - Emissions/Noise Total Impact REduction (ENTIRE)
 - Modeling Environmental Factors in Surface and Terminal Optimization (MEFISTO)

Environmental Impact Analysis



Decision Support

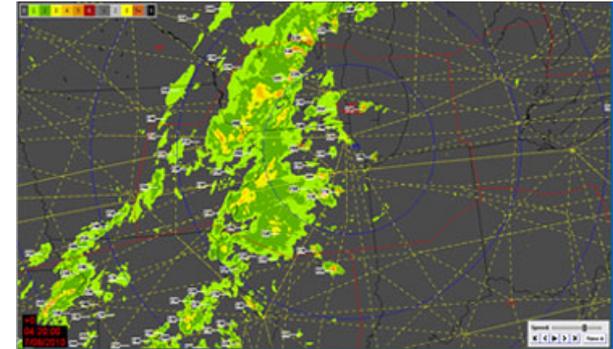




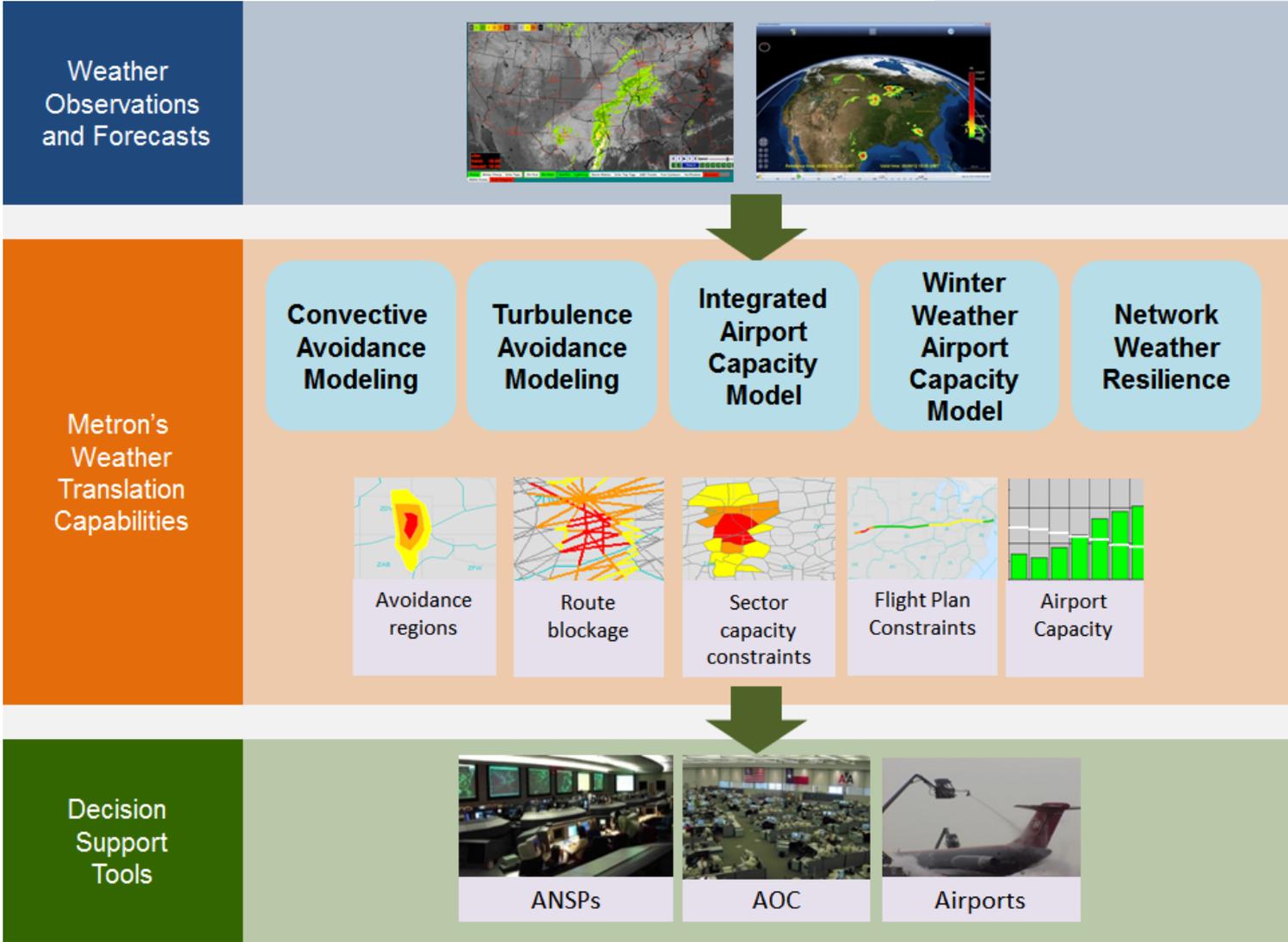
Weather Impacts to Aviation

Weather Impacts

- Weather impacts both safety and efficiency of operations
 - Leading cause of delays in the US (67%)
 - Leading cause of fatal accidents
- Large portion of weather impact is avoidable
 - Improved integration of weather information can significantly reduce avoidable delays and reduce number of accidents and injuries
- But there are challenges
 - Sharing the same operational depiction of constraints among all stakeholders (pilots, dispatchers, air traffic controllers, etc.)
 - Integration into decision support tools



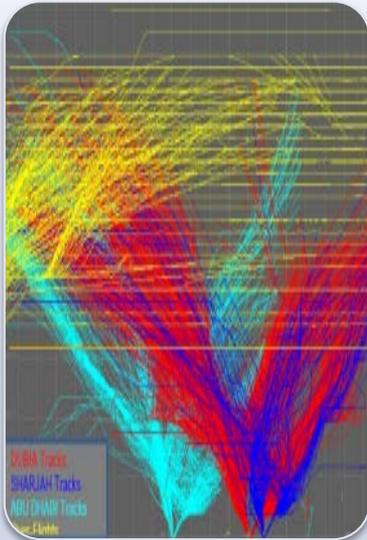
Weather Translation





Airspace Design

Capabilities



- Upper and Lower Airspace Simulation and Analysis
- En route, Arrivals, and Departures (RNAV & RNP – including RNP AR)TMA Airspace Redesign
- Sectorization, Air Traffic Forecast and Impact Analysis
- ATM Study and Planning
- Workshops, Training, Design and Projects

Metron Services

ATFM/CDM Services

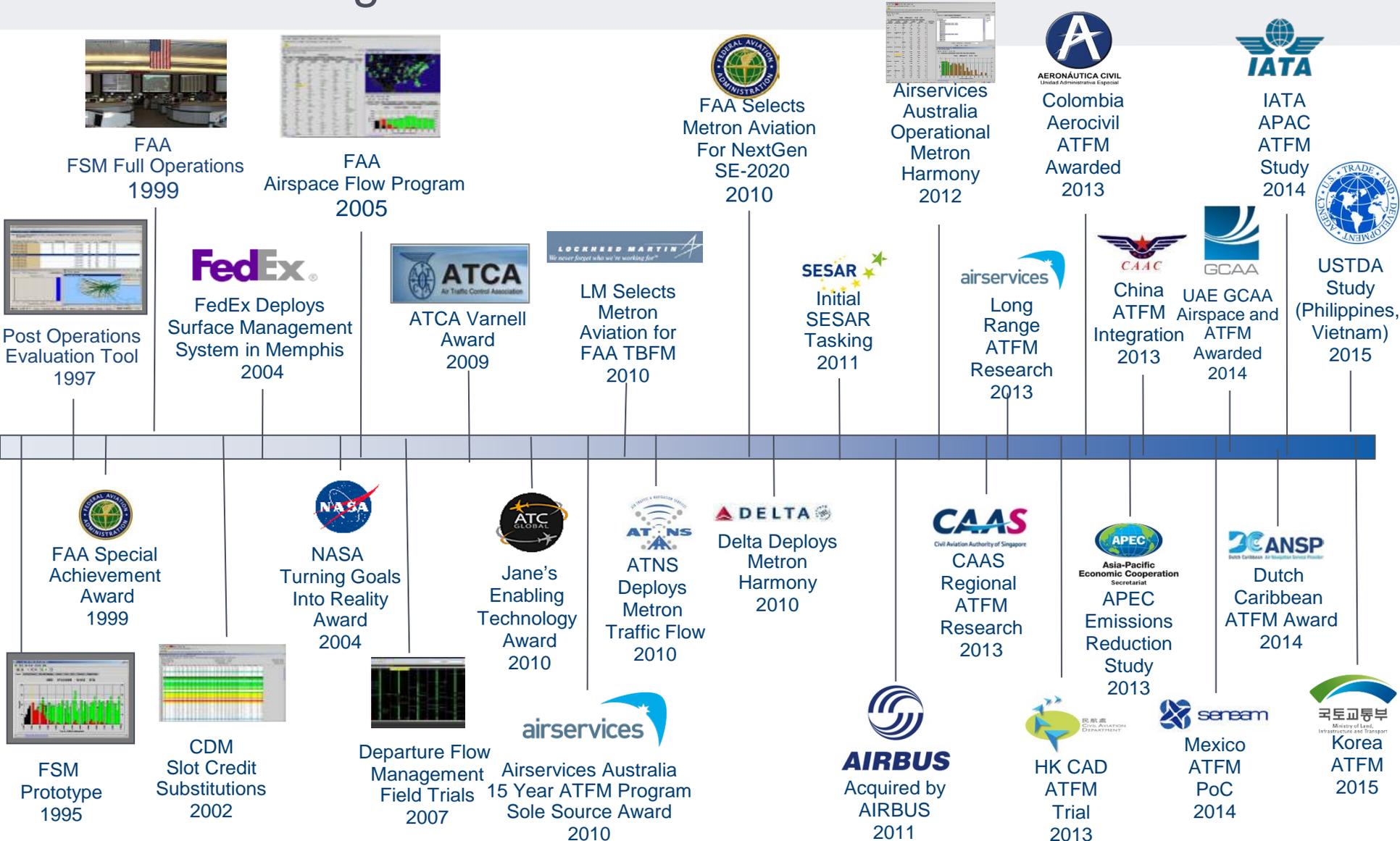
- ATFM Implementation is a process
- Complete an ATFM Assessment
- Develop a concept of operations
- Obtain appropriate Resources
- Decision Support Tools
 - Horizon – Harmony - OIS
- Education and Training
 - ATFM Simulator
- Operational Trial
- Implementation
- Post operational analysis

Additional Services

- Environmental/Energy Analysis
- Weather Impact Analysis
- Airspace Analysis and Design
- Weather Integration into ATFM

Metron delivers complete ATFM
Implementation Service

Metron's Heritage of Innovation and Success



Case Study: UAE Airspace Design Study

Phase 1 - Gather information:

- Current situation – Political, Operational, Economic, Technical
- Stakeholder needs, capabilities, perceptions and expectations

Phase 2 - Define vision and goals

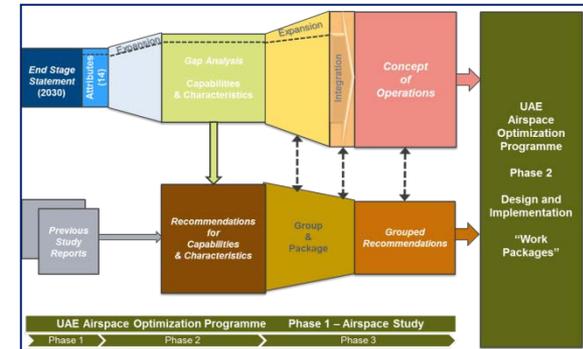
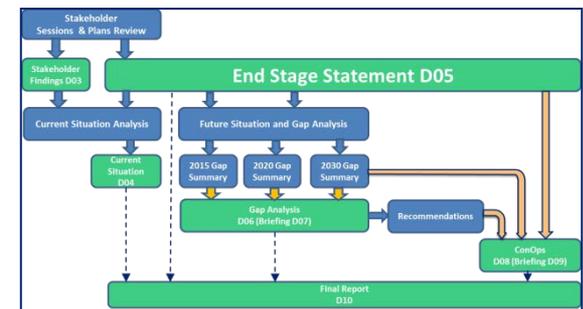
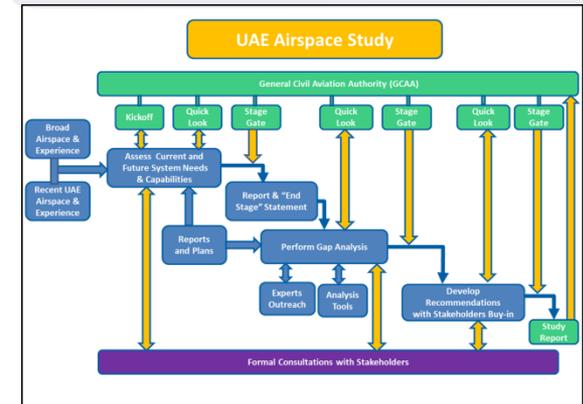
- Attributes and capabilities associated with defined vision and goals, including interim “snap shot” timeframes
- Foster stakeholder understanding and acceptance

Phase 3 - Gap analysis

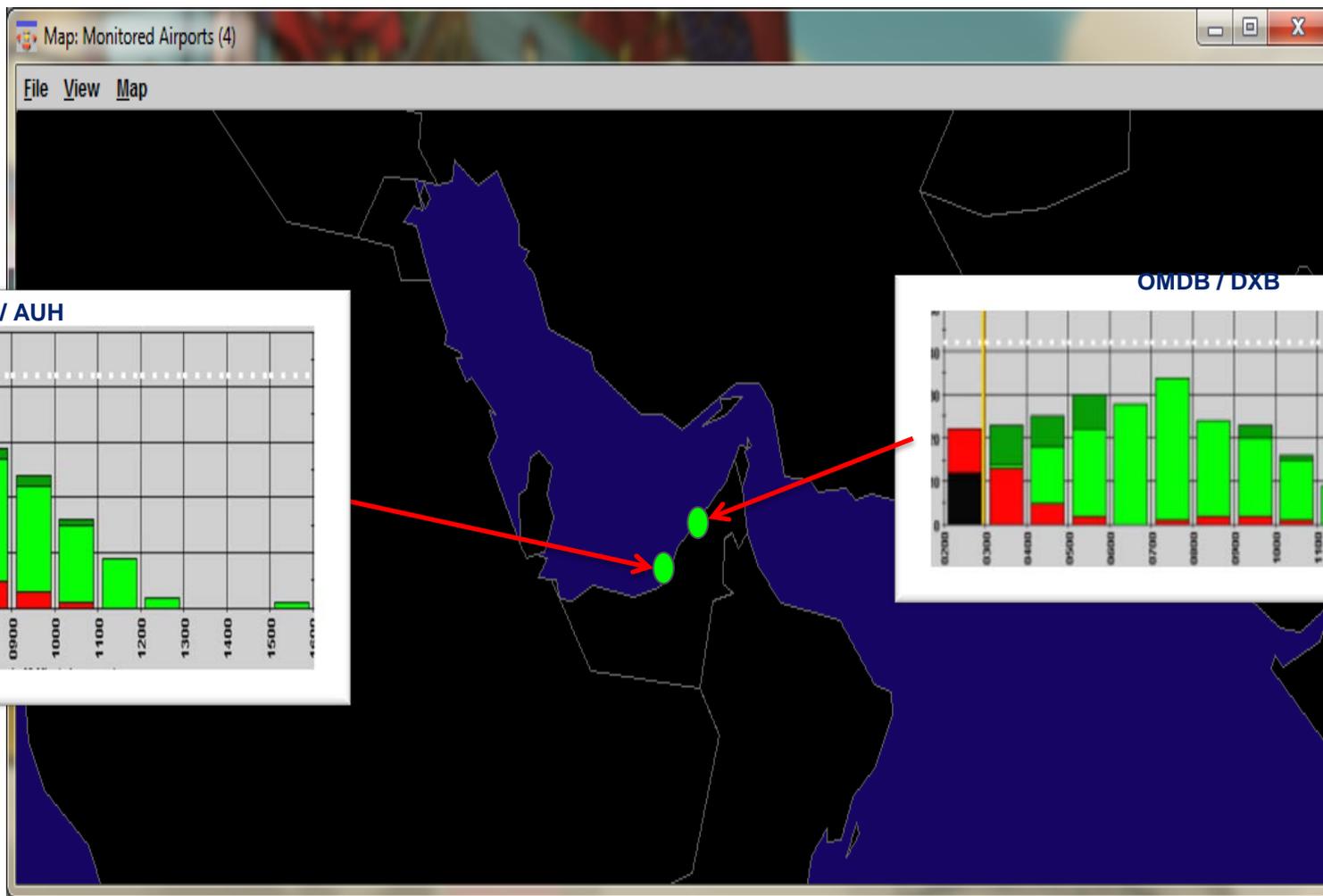
- Between defined vision/goals and:
 - Current situation
 - Each interim snap shot time frame

Phase 4 - Recommendations and path forward

- 53 Recommendations: Government – Policy Level, Operational & Procedural, Regulatory, and ATM Systems



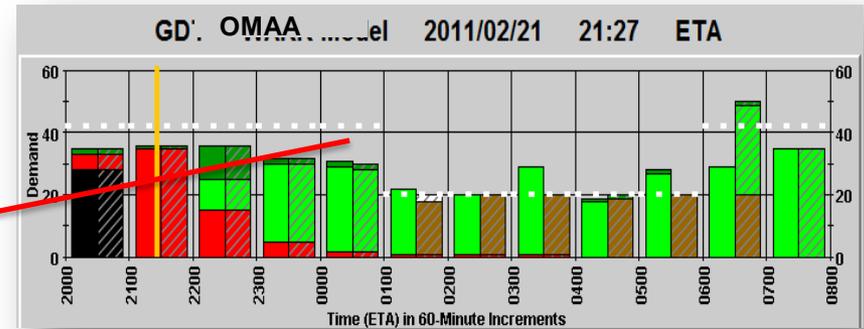
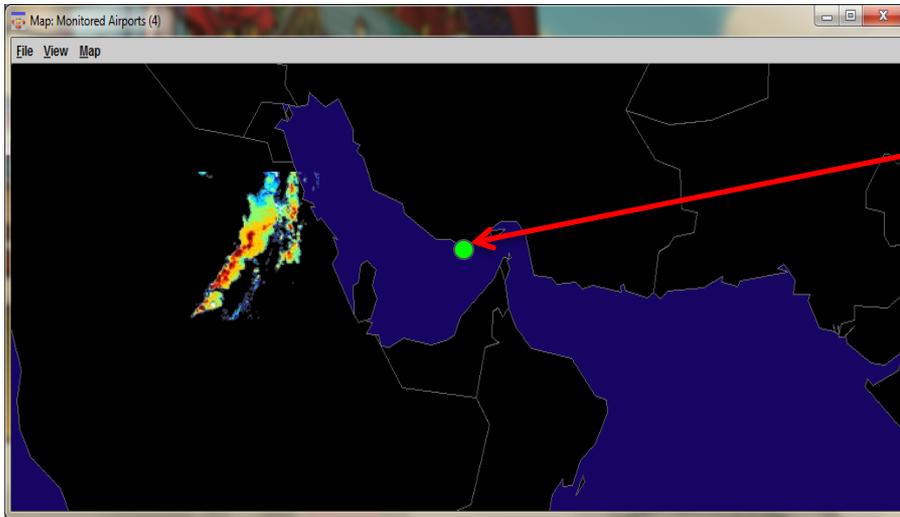
Monitoring Resource Capacity and Demand



Evaluating and Initiating ATFM Measures

Various capacity-reducing events can require an ATFM measure that will balance the demand with available capacity. Stakeholders can be involved in deciding the appropriate ATFM Measure with the least operational impact.

Assessing the conditions with enough anticipation



Evaluating the Impact of the ATFM Measure

