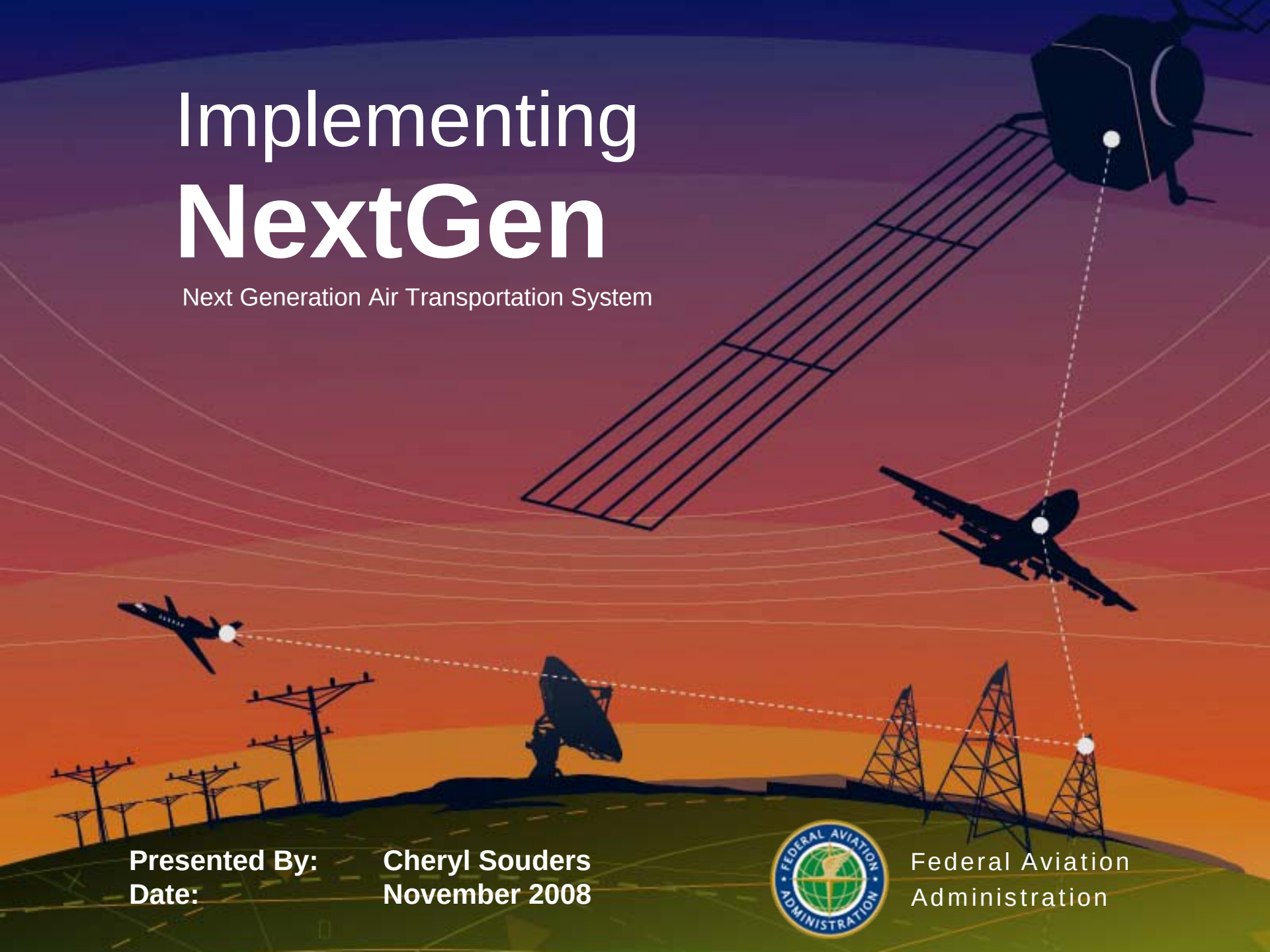
Implementing **NextGen**

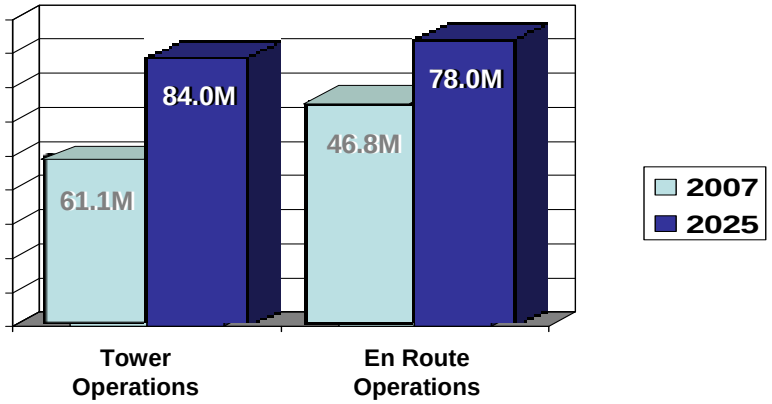
Next Generation Air Transportation System



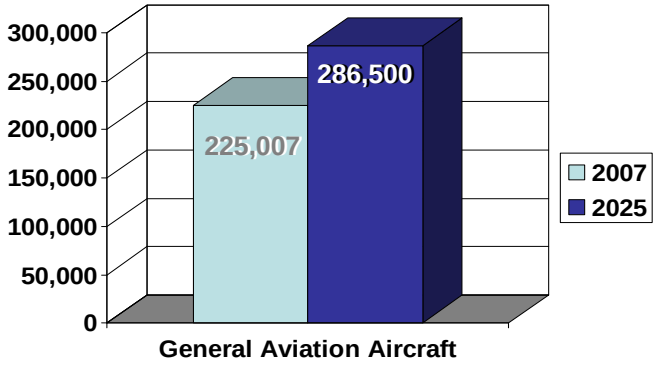
Presented By: Cheryl Souders
Date: November 2008

Federal Aviation Administration

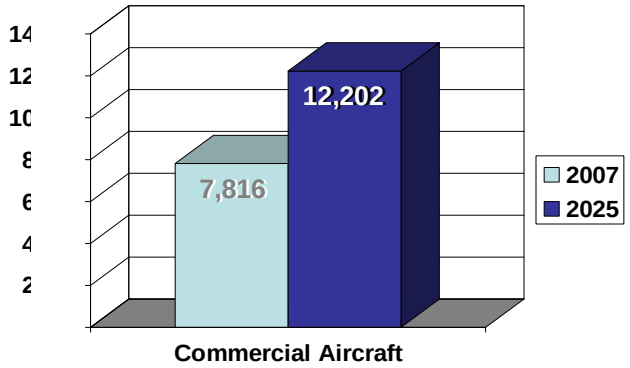
The Need for NextGen…Growing Demand



Operations



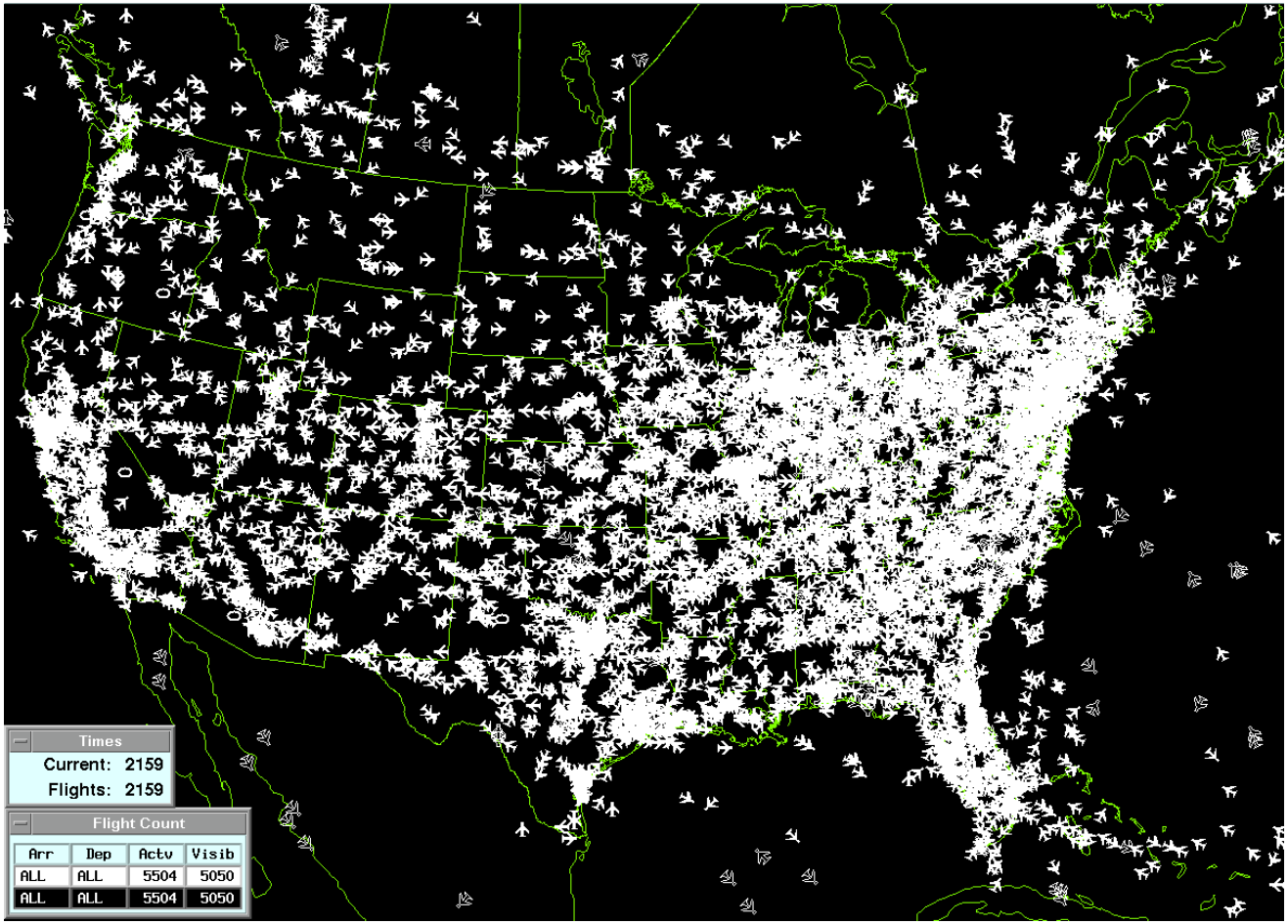
General Aviation



Commercial Aviation

*** FAA 2008-2025 Forecast**

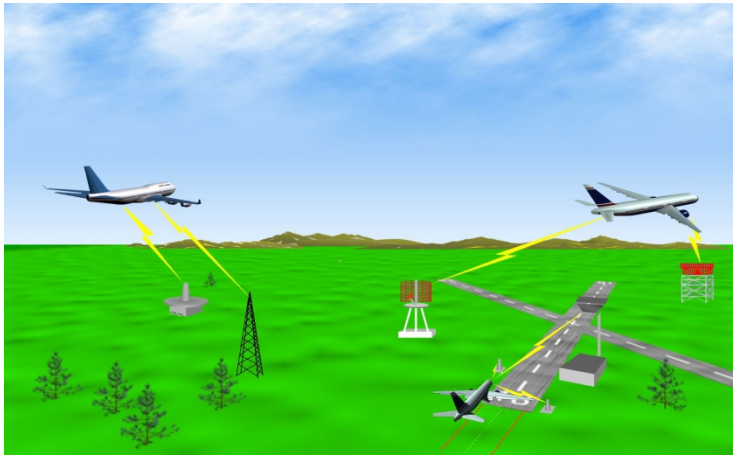
Our National Airspace System in the Air

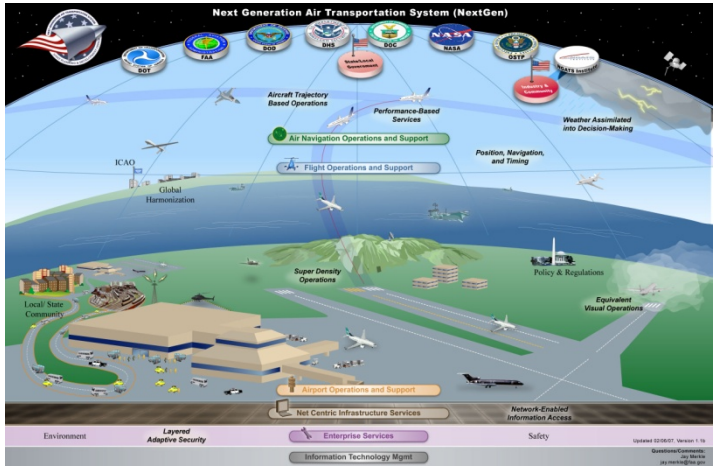


Peak aircraft traffic over the US

NextGen: Improving Service Delivery

Today's NAS		NextGen
Ground-based Navigation and Surveillance	→	Satellite-based Navigation and Surveillance
Air Traffic Control Communications By Voice	→	Clearance Trajectories and Routine Information Sent Digitally
Disconnected Information Systems	→	Information More Readily Accessible
Air Traffic "Control"	→	Air Traffic "Management"
Fragmented Weather Forecasting	→	Forecasts Embedded into Decisions
Airport Operations Limited By Visibility Conditions	→	Operations Continue Into Lower Visibility Conditions
Forensic Safety Systems	→	Prognostic Safety Systems





NextGen Integration and Implementation

Joint Planning and Development Office (JPDO)

Seven US Government Departments and Agencies

System users and manufacturers included

Nine Government and Industry working groups

Defined the *NextGen Vision* and Concept of Operations for 2025

Addresses cross-agency needs, issues, and concerns

FAA's Integration & Implementation Office

Integrates and *manages* the work required to implement each operational capability, including:

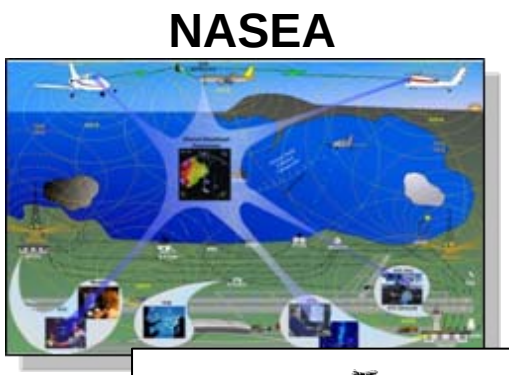
- Research
- Technical requirements
- ATC equipment
- Aircraft avionics
- Airspace redesign
- Procedures
- Rulemaking
- Certification

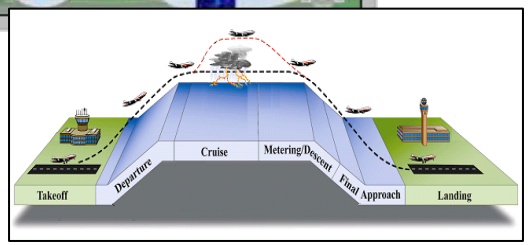
Operational Capabilities

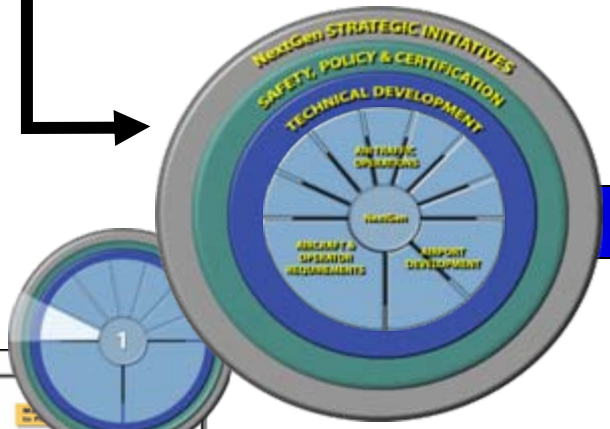

Next Generation Air Transportation System (NextGen)
DOT
FAA
DOD
DHS
DOC
NASA
OSTP
NGATS Institute
State/Local Government
Industry & Community
Aircraft Trajectory Based Operations
Performance-Based Services
Weather Assimilated into Decision-Making
Air Navigation Operations and Support
Position, Navigation, and Timing
Flight Operations and Support
ICAO
Global Harmonization
Super Density Operations
Policy & Regulations
Local/ State Community
Equivalent Visual Operations
Airport Operations and Support
Net Centric Infrastructure Services
Network-Enabled Information Access
Environment
Layered Adaptive Security
Enterprise Services
Safety
Information Technology Mgmt
Updated 02/06/07, Version 1.1b
Questions/Comments:
Jay Merkle
jay.merkle@faa.gov

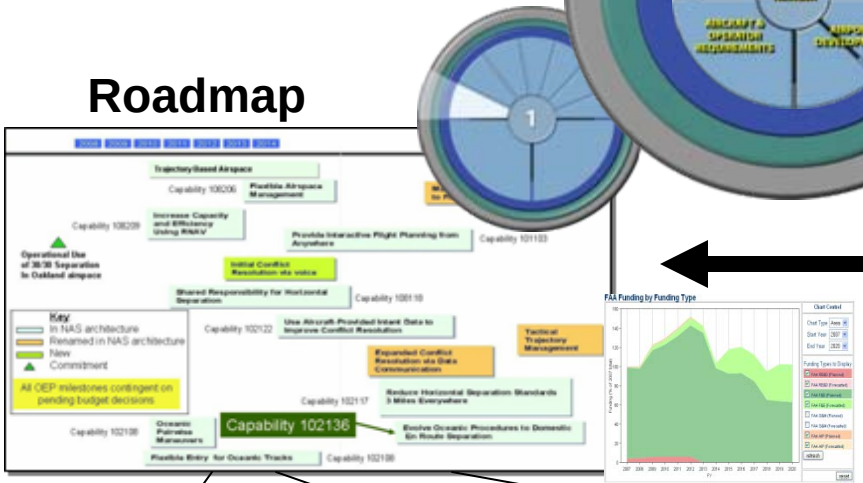
NextGen Key Capabilities

- Initiate Trajectory Based Ops
- Increase Arrivals/Departures at High Density Airports
- Increase Flexibility in the Terminal Environment
- Improve Collaborative Air Traffic Management (ATM)
- Reduce Wx Impact
- Increase Security and Safety Performance
- Increase Environmental Performance
- Transform Facilities







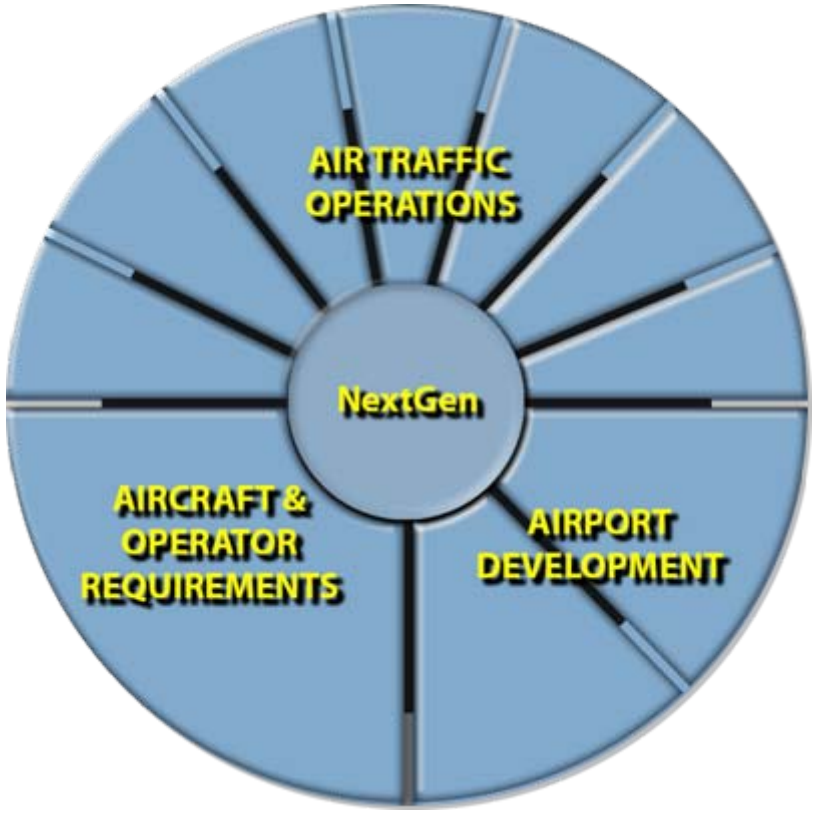


Programs

En Route Automation Modernization (ERAM)	*NextGen Collision Avoidance System*	*NextGen Traffic Flow Management*	*SWIM*	*Aeronautical Data Link*

FAA's NextGen Implementation Plan

Our focus is on integration and execution



Airport Development

- OEP Airports
- OEP Metro Areas

Air Traffic Operations

- Initiate Trajectory-based Operations
- Increase Arrivals and Departures at High Density Airports
- Increase Flexibility in the Terminal Environment
- Improve Collaborative Air Traffic Management
- Reduce Weather Impact
- Improve Safety, Security and Environmental Performance
- Transform Facilities

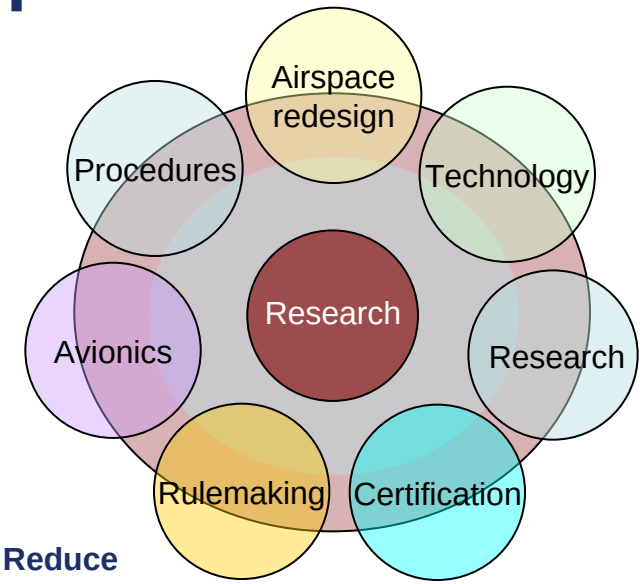
Aircraft & Operator Requirements

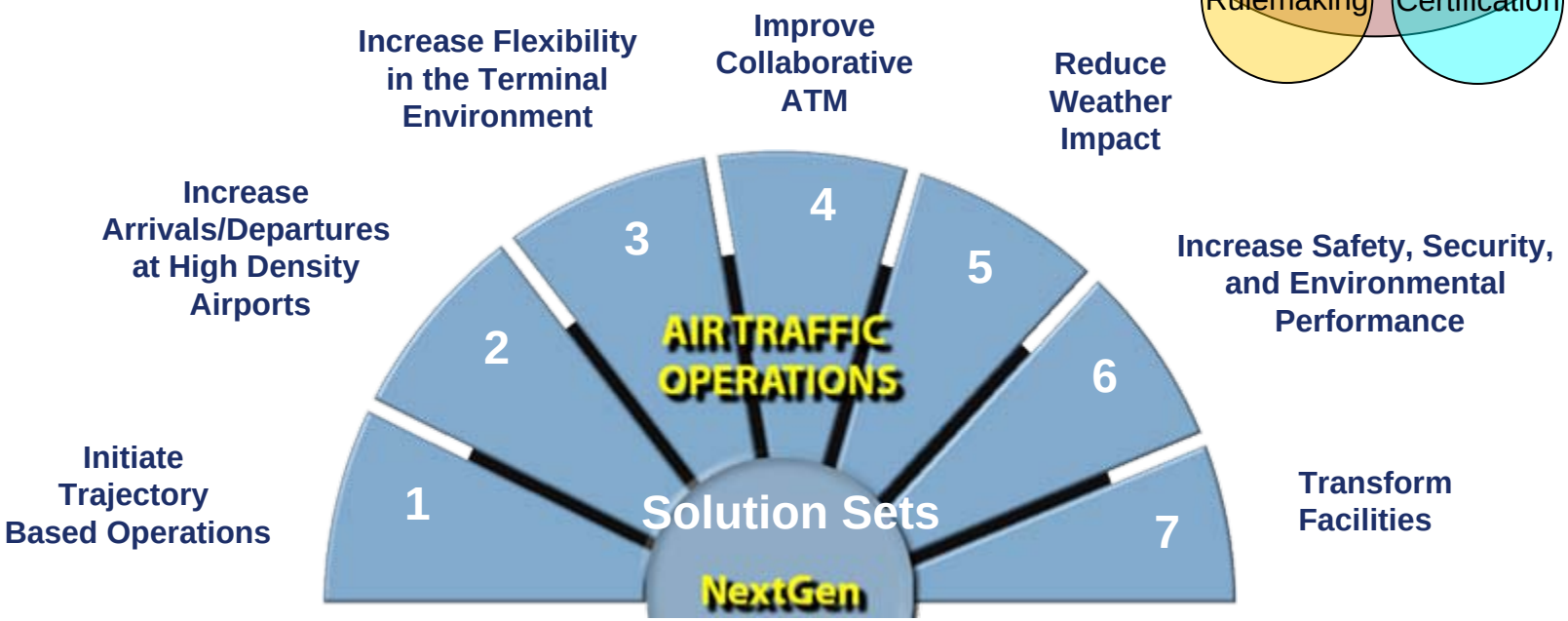
- Avionics

Air Traffic Operations Domain

A solution set is a portfolio of *capabilities*

Implementation of a *capability* depends on a variety of activities carried out across FAA's lines of business





FY 08 Accomplishments

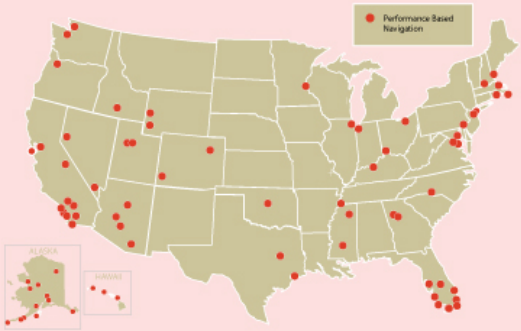
Aircraft Performance Based Mechanisms

Area Navigation (RNAV) & Required Navigation Performance (RNP). RNAV enables aircraft with specified operational performance requirements to fly more cost-effective automated trajectories. RNP introduces the requirement for onboard performance monitoring and alerting. Aircraft and controller performance increases are being realized. In Atlanta, for example, RNAV/RNP procedures have helped increase ATC productivity by 20-30%, which leads to as many as 10 additional departures per hour. Delta has estimated $36M savings annually at that location.

- Introduced 64 published routes and procedures.
- Accelerated implementation at four high priority airports: Dallas-Ft.Worth, Chicago O'Hare, Houston's Bush Intercontinental, and New York's John F. Kennedy.

Wide Area Augmentation System (WAAS) Localizer Performance with Vertical Guidance (LPV) approaches give equipped aircraft a lower cost space-based, ILS-like approach option to runways with published LPV minimums.

- Integrated nine international reference stations.
- Deployed two new geostationary satellites.



- Published over 325 LPV approaches.
- Aug 08 – the number of LPV approaches expected to surpass the number of ILS approaches.

Optimized Profile Descent (OPD). These arrivals (also known as Continuous Descent Arrivals, or CDAs) provide the operator the ability to fly the aircraft's optimal vertical profile with a continuous descent. The FAA is currently designing, modeling, evaluating, and demonstrating procedures that accommodate OPD at several facilities in an effort to reduce noise and emissions, as well as increase fuel efficiency (estimated to be 100M gallons annually if implemented nationwide).

- Implemented one Standard Terminal Arrival Procedure (STAR) at Los Angeles that accommodates OPD (used by 25% of LAX traffic). Expected to implement two more STARs in July 2008 that will increase OPD availability to 50% of LAX traffic.
- Designed one STAR OPD procedure for San Diego, expected to be published in Nov 2008, that will be available to 50% of the traffic.
- RNAV STAR procedures designed for optimum profiles are available at six OEP airports.

Airspace Capacity

Airspace Design and Improvement. Refining airspace design and procedures that increase use of air traffic management automation are part of our efforts to enhance system capacity, user efficiency and safety.

- Time-based Metering Procedures – four En Route centers.
- Initial Traffic Flow Management – Modernization (TFM-M).
- Airspace Redesign – Chicago.
- Airspace Redesign – New York New Jersey.
- Airspace Redesign – Houston.
- Adaptive Compression tool for the Airspace Flow Program (AFP).
- Advanced Technologies and Oceanic Procedures (ATOP) for the West Atlantic Route System, the Atlantic portion of Miami Oceanic, and the San Juan flight information region.

New York Initiatives. The FAA instituted a special office to focus attention on the airspace around New York. Partnering with industry, the FAA convened an Aviation Rulemaking Committee (ARC) that resulted in more than 70 recommended initiatives aimed at reducing delays here.

- De-conflict Newark arrivals over SHAFF intersection.

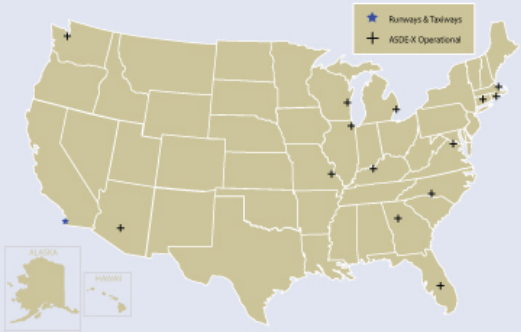
- Simultaneous Visual Approaches to Runway 4L/R at Newark.
- Enhanced procedures for Caribbean arrivals.
- New procedures to allow arrivals to Runway 29, while landing Runway 4R at Newark.
- Simultaneous Approaches to Runways 31L/R at JFK.
- Accessing J134/J149 from ELIOT Intersection.

Improved ILS Runway Visual Range (RVR) Landing Capabilities. Due to advances in aircraft equipage and improvements in ILS ground system performance, the FAA was able to safely reduce landing visibility minimums, enhancing capacity and reducing the number of aircraft diversions.

- Reduced the required approach RVR from 2400 to 1800 feet for properly equipped aircraft (271 approaches at 190 airports).
- Authorized Category (CAT) II approach minimums to runways with CAT I ILSs that meet CAT II ILS performance criteria for properly equipped aircraft (three complete and 37 in progress).
- Reduced the minimum RVR required for takeoff on runways without centerline lighting from 1600 to 1000 feet (370 runways at 99 airports).
- Harmonized FAA takeoff minimums with European Joint Aviation Authority standards, reducing the RVR minimums required for takeoff from 600 to 500 feet.

Airport Capacity

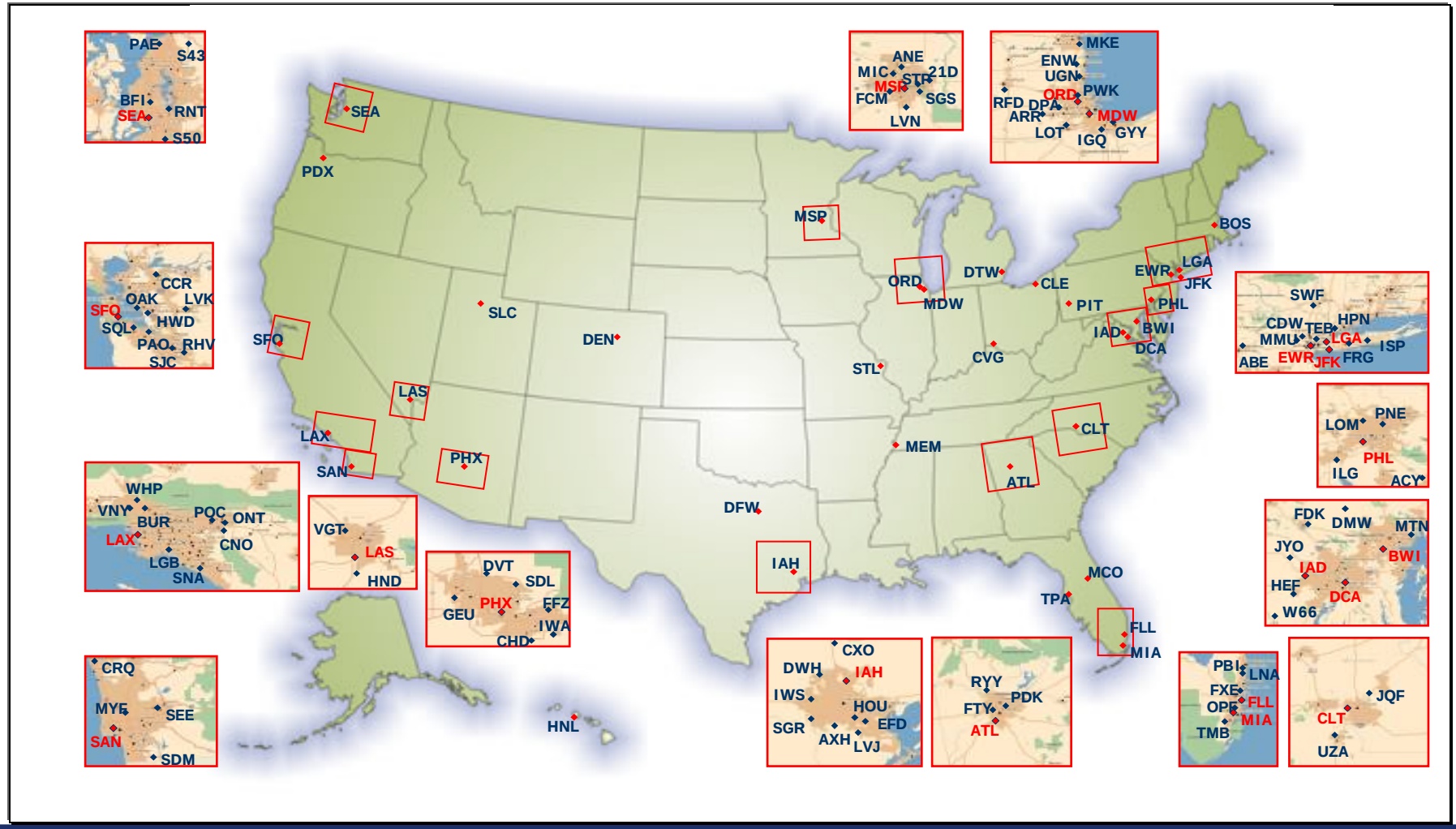
The largest capacity improvements for airports, building new runways and taxiways, require significant lead time (10-15 years) and substantial investment. NextGen technologies will allow greater design flexibility with closer simultaneous landing separations. Surface automation technology will improve situational awareness for all operators as well as lead to greater surface movement efficiencies.



- New Center Taxiway at Los Angeles, completing the airport's south airfield reconfiguration project that increases safety
- Airport Surface Detection Equipment – Model X (ASDE-X) declared operational at four sites this year to date. This enhanced surface surveillance provided by the 12 total deployed ASDE-X systems has reduced airport delays by one million minutes nationwide.

FAA's NextGen Implementation Plan

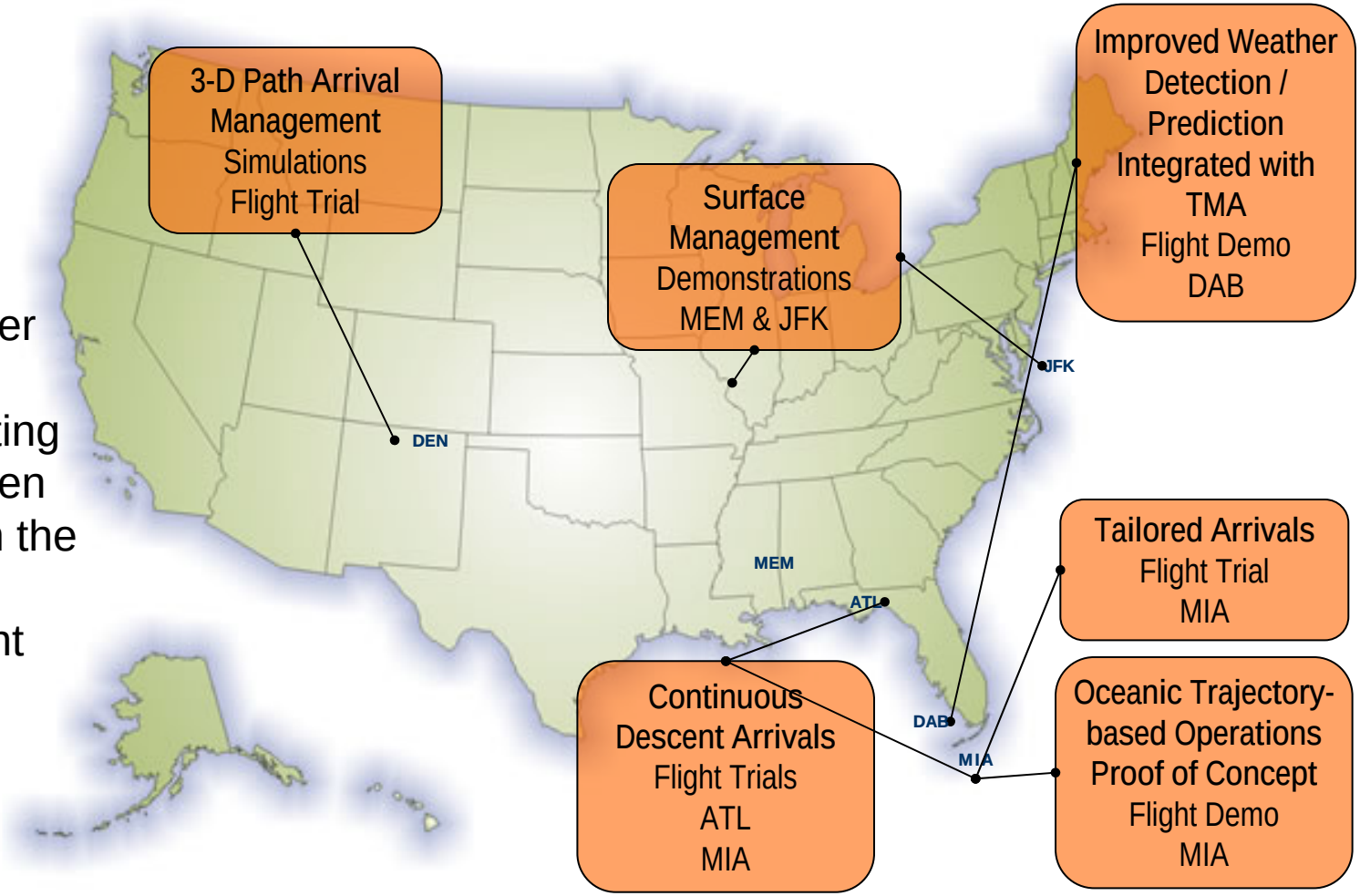
Identifying solutions for tomorrow's trouble spots



FAA's NextGen Implementation Plan

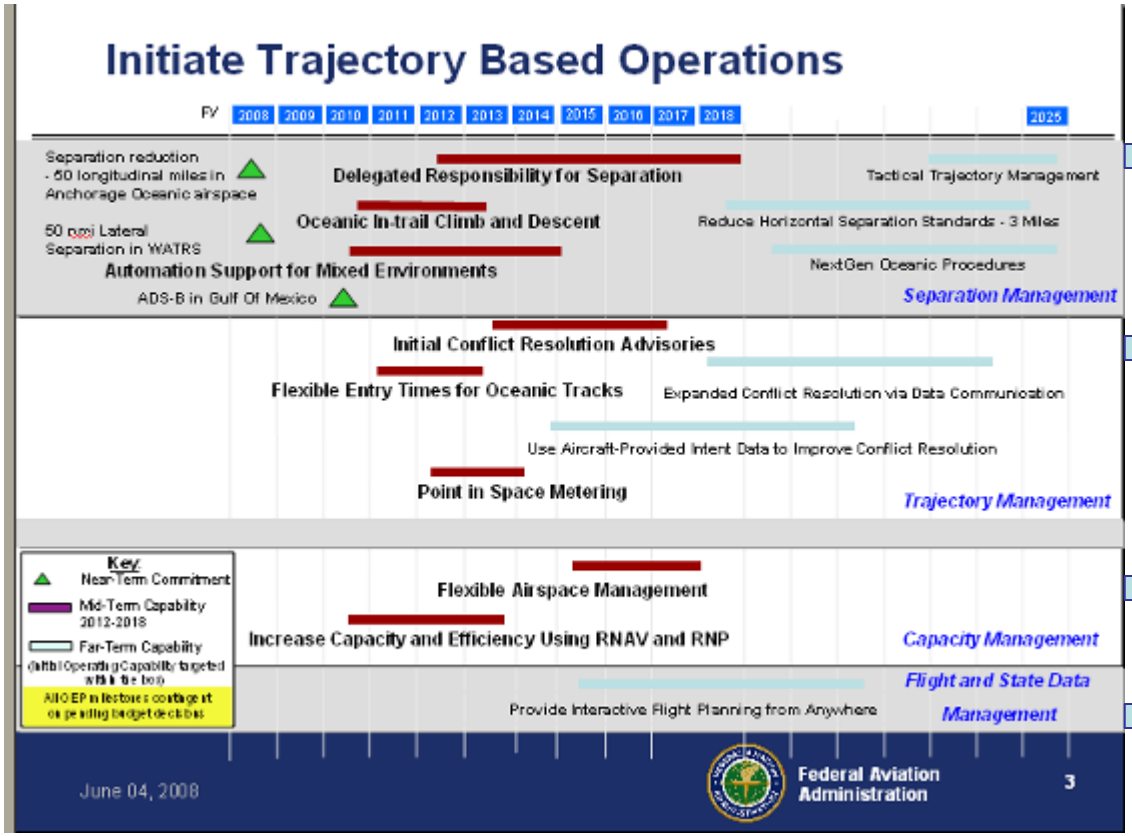
Flight trials

This summer FAA is demonstrating vital NextGen concepts in the operational environment



NextGen Implementation Timelines

Portfolio – *Operational Level Descriptions*



Separation Management

Separation between aircraft, airspace and terrain

Conflict Management

Trajectory Management

Provide the most efficient "flow" of aircraft

Traffic Synchronization

Flow Contingency Management

Manage demand with flow exceed capacity *(Strategic Flow)*

Demand Capacity Balancing

Capacity Management

Airspace Design and Management

Airspace Organization and Management

Flight and State Data

Safe and Efficient Flight Planning and Execution

Information Management

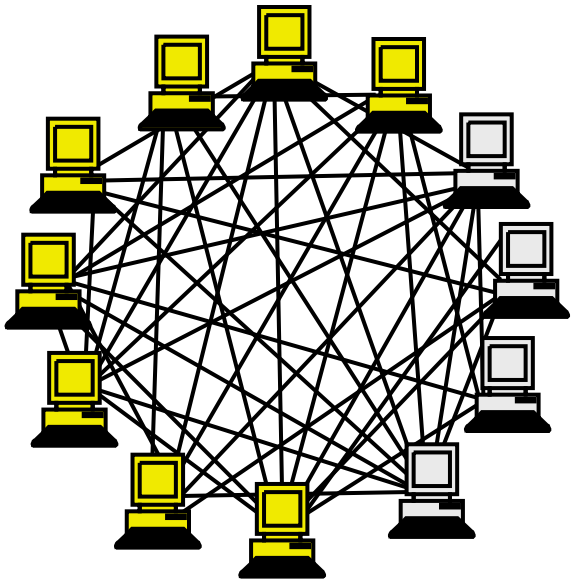
Automatic Dependent Surveillance Broadcast (ADS-B)

- **A**utomatic
  - Periodically transmits information with no pilot or operator input required
- **D**ependent
  - Position and velocity vector are derived from the Global Positioning System (GPS)
- **S**urveillance
  - A method of determining position of aircraft, vehicles, or other asset
- **B**roadcast
  - Transmitted information available to anyone with the appropriate receiving equipment

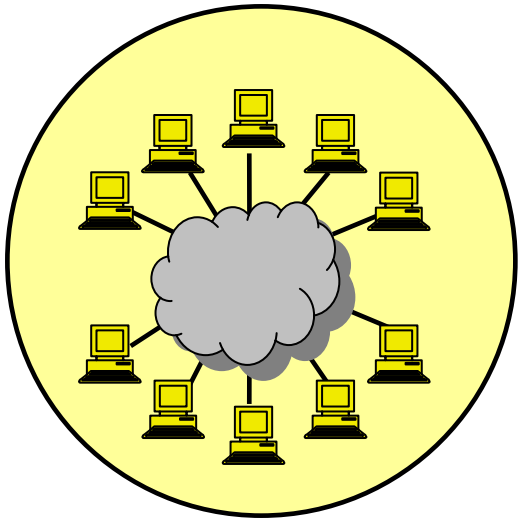
System Wide Information Management (SWIM)

Today: Point to Point Information Management

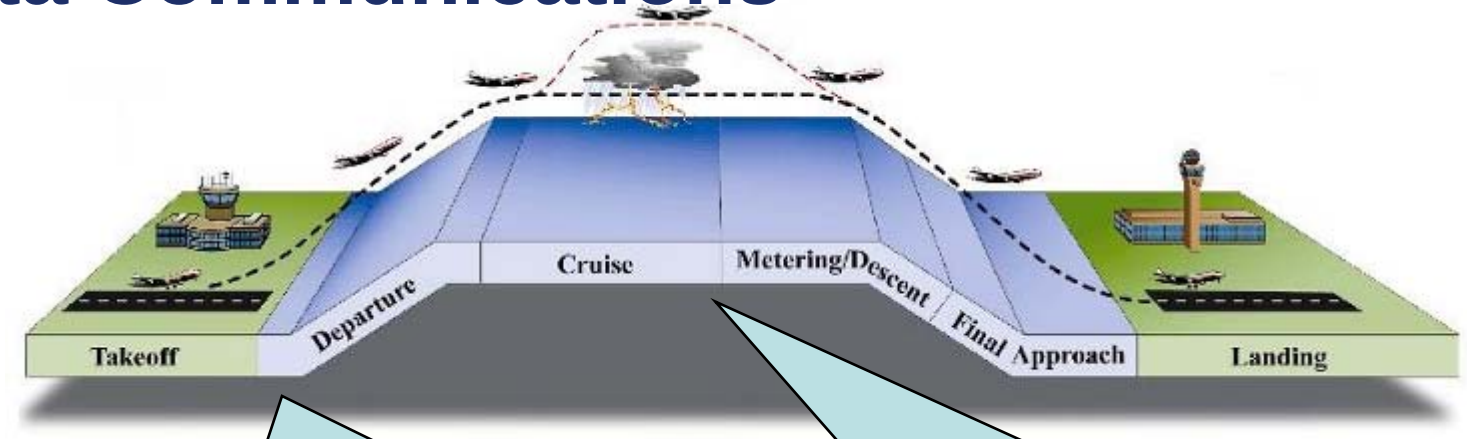
NextGen: System Wide Information Management



Business as Usual
(NextGen without SWIM)



Data Communications



•Revised Departure Clearance
•Taxi Clearances
•Airport Information
•Flow Initiatives

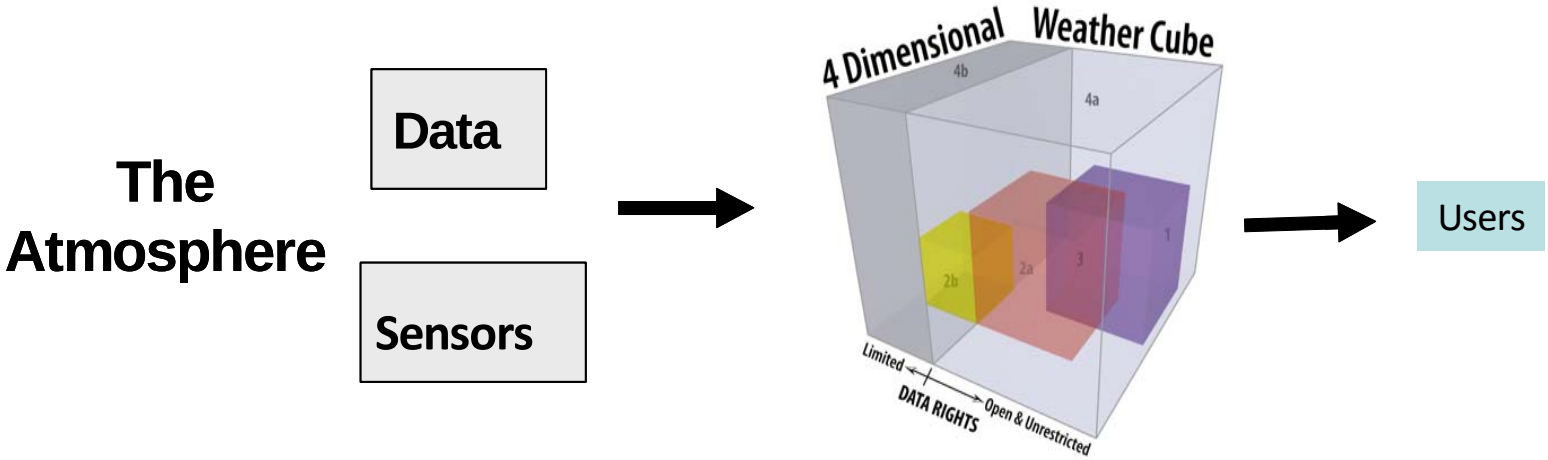
•Enroute Clearances
- Heading, Speed, Altitude, Routes, Flow Initiatives, Crossing Restraints
•Enroute Notifications

Data Communications Provides

- Two-way data between controllers, automation and flight crews
- Safety-of-flight air traffic control clearances, instructions, traffic flow management, flight crew requests and reports
- Automation enhancements for ATC message generation and exchange
- Communications link carrying data between aircraft and air traffic managers

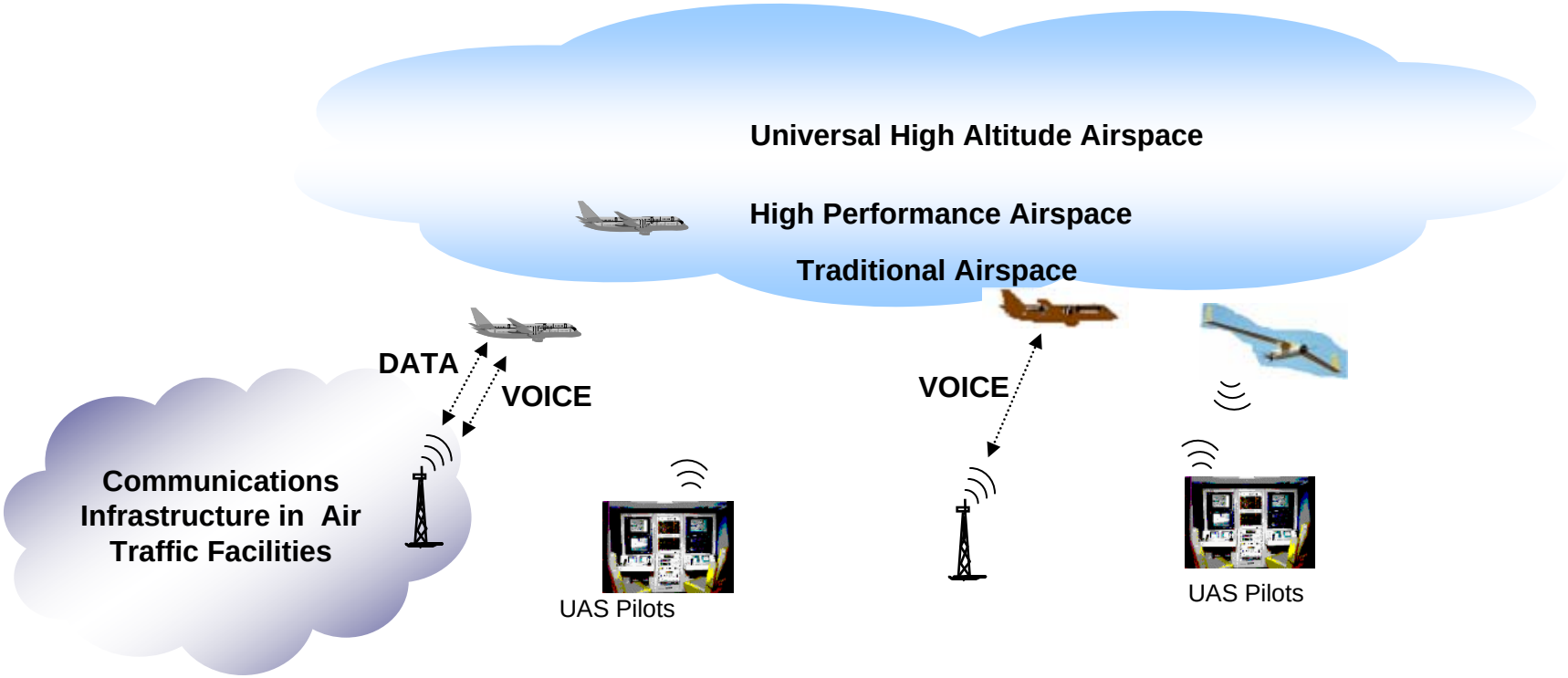
NextGen Network Enabled Weather (NNEW)

- **A net-enabled distribution of weather information to enhance collaborative and dynamic NAS decision making.**
- **It is a 4-Dimensional Weather Data Cube that draws information from multi-agency sources into a consolidated virtual data cube for aviation users**



NAS Voice Switch (NVS)

Current voice architecture is limiting, inflexible and does not support sharing communication within and across facility boundaries. NVS replaces existing voice switches at En Route, Terminal and support facilities with network-capable switches to enable flexible voice communications.



NextGen is…

- **Reduction of delays and system gridlock**
- **Integration of weather information into decision support tools to reduce weather-related delays**
- **Reduced adverse impacts to environment**
- **Reduced fuel consumption**
- **Precise trajectory-based operations**
- **Network-enabled real-time information access by air traffic control and system users**
- Moving more and varied air vehicles through the National Airspace System.
- Moving more and happy passengers from gate to gate!

NextGen… "What It Isn't…"

- **NextGen is not a single project…** **It is the integration of many projects, concepts, and technologies.**

- **NextGen is not a program plan…** **It is the integration of <u>many</u> program plans to deliver new service capabilities to meet increasing demand.**

- **NextGen is not simply a new system…** **It is the integration of new systems, new procedures, new aircraft performance capabilities, new supporting infrastructure and a new way to do business as the Air Transportation System.**

References

- **JPDO's Concept of Operations and Enterprise Architecture**

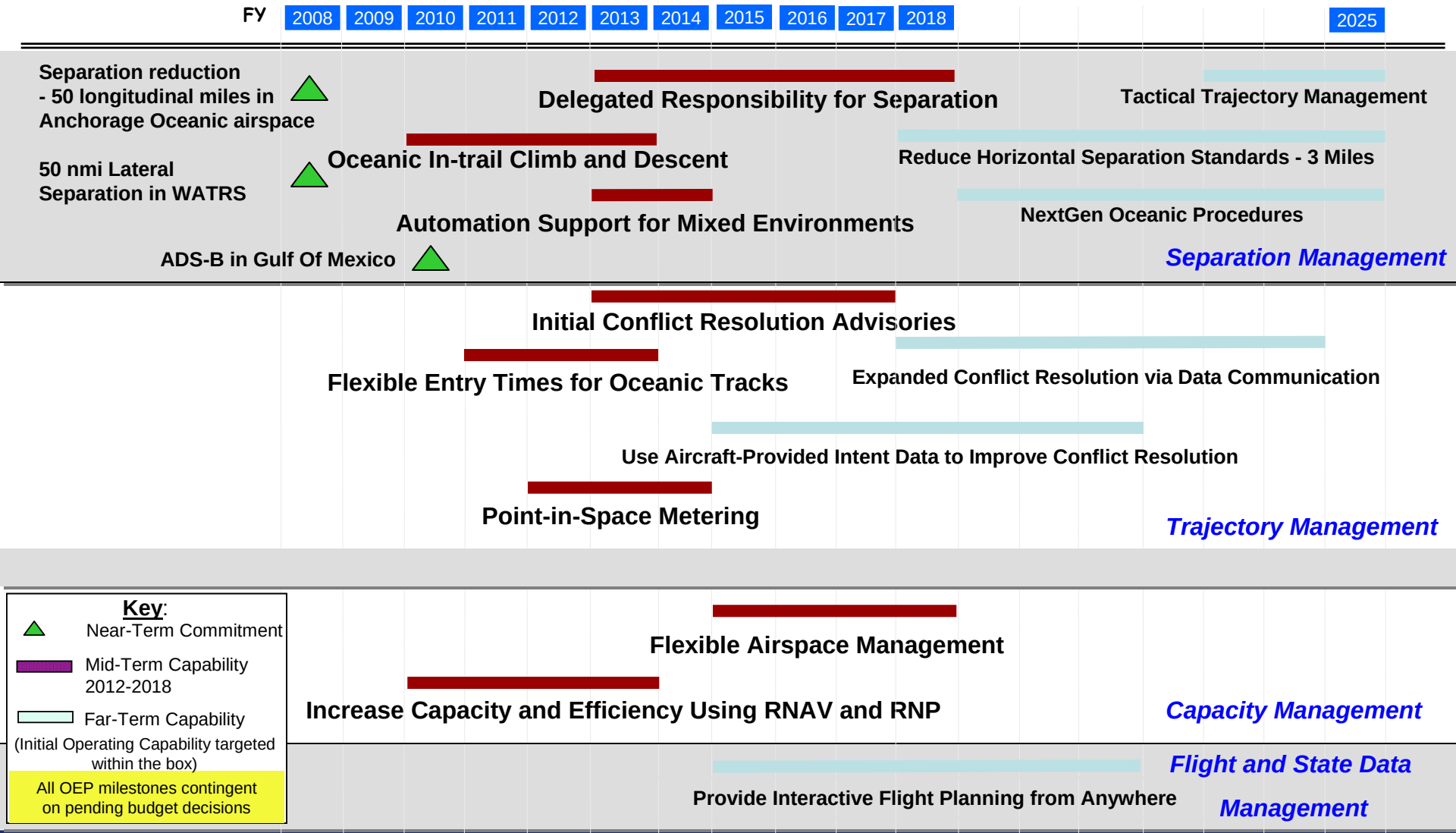
  http://www.jpdo.gov/
- **FAA's NextGen Implementation Plan**

  http://www.faa.gov/nextgen
- **FAA's Enterprise Architecture**

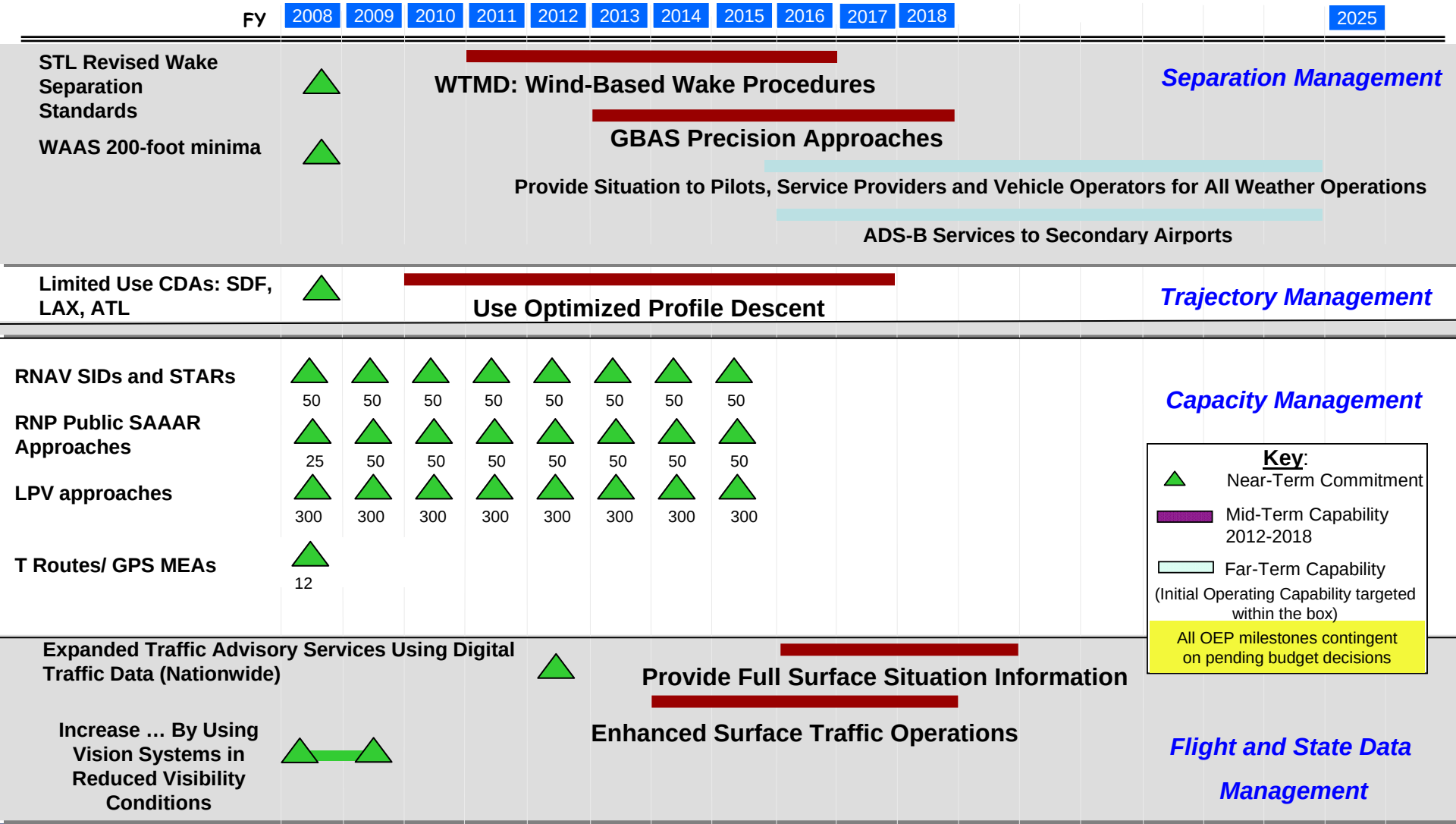
  http://www.nas-architecture.faa.gov/nas/

Back-Up Slides

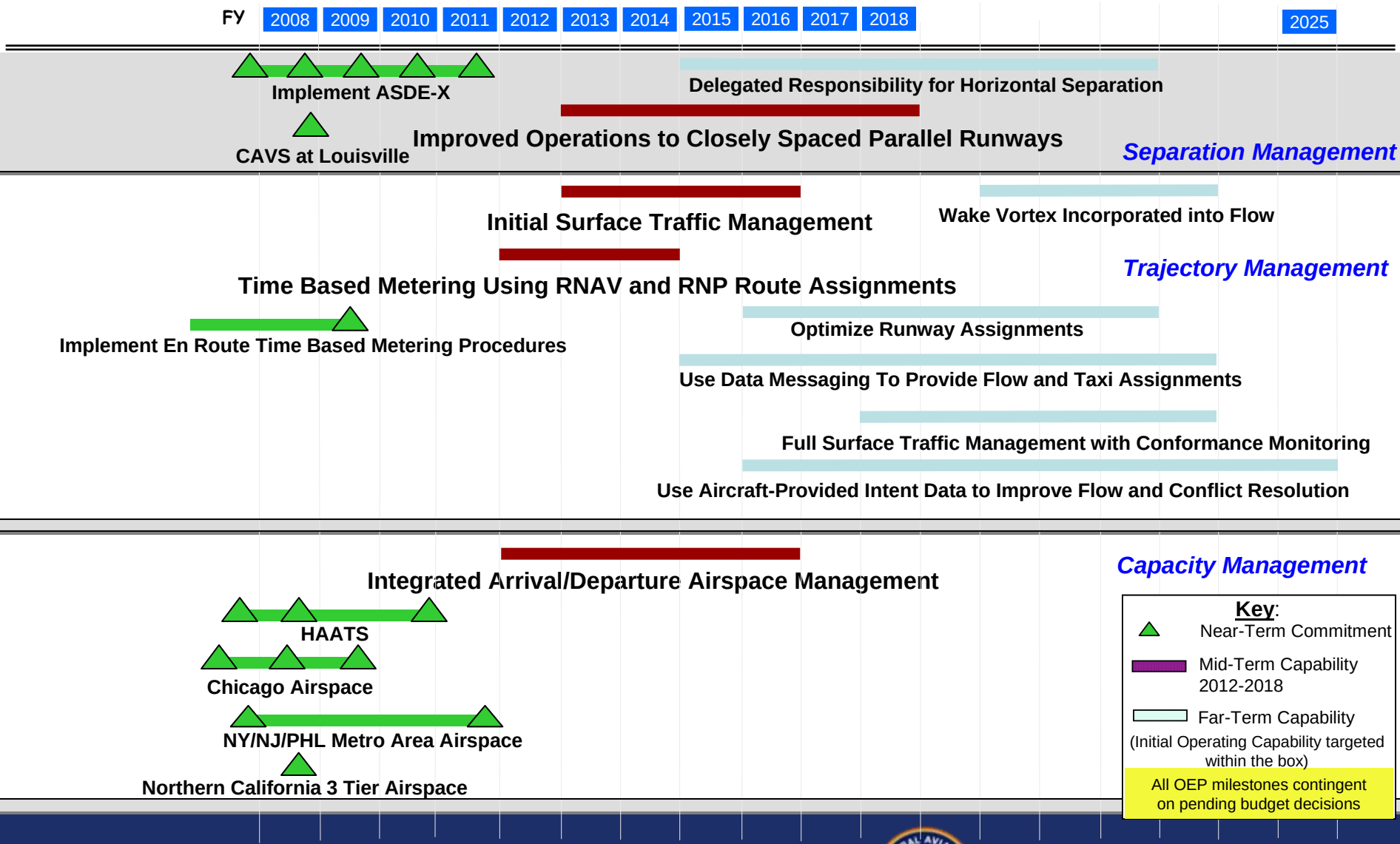
Initiate Trajectory Based Operations



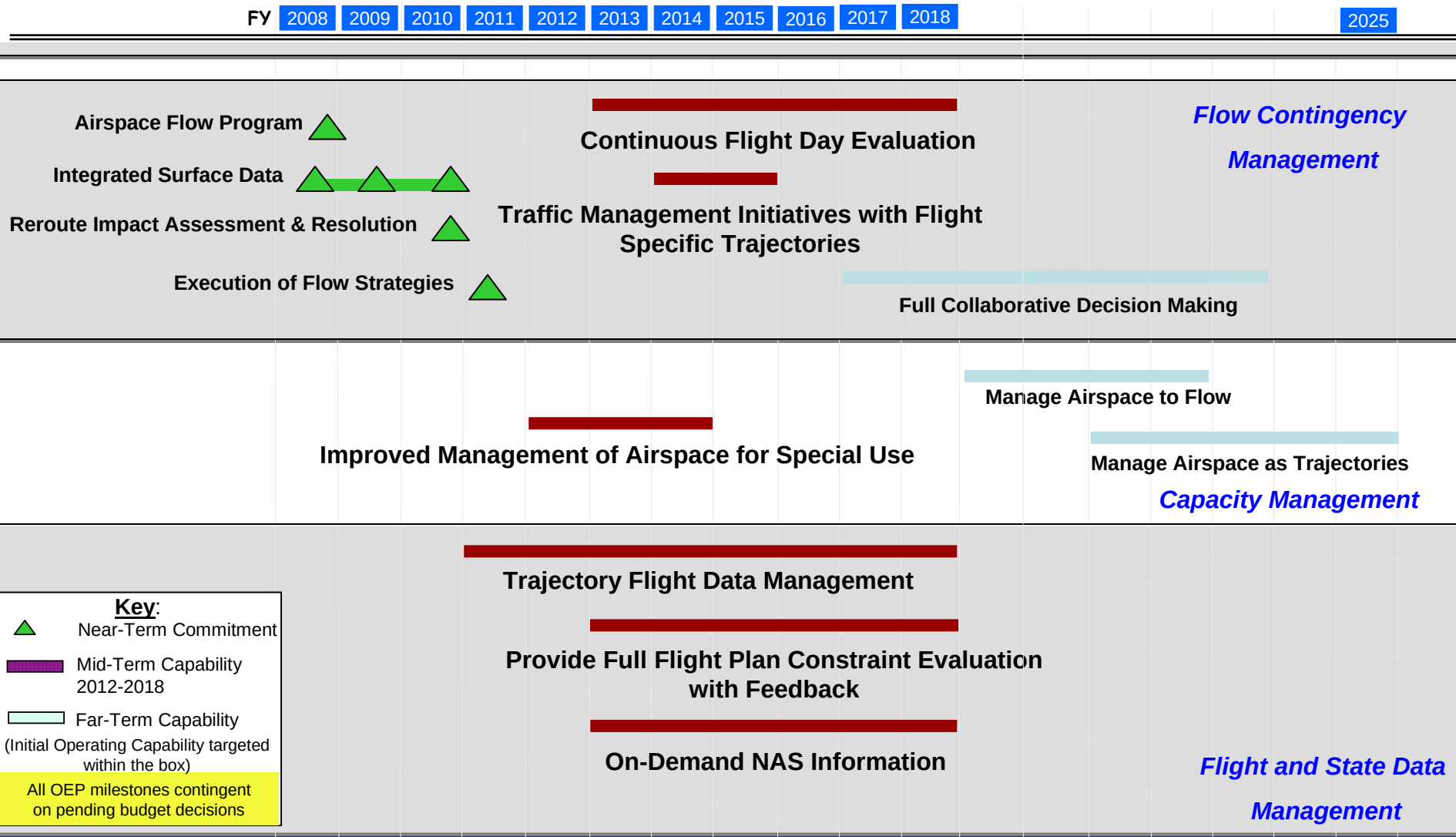
Increase Flexibility in the Terminal Environment



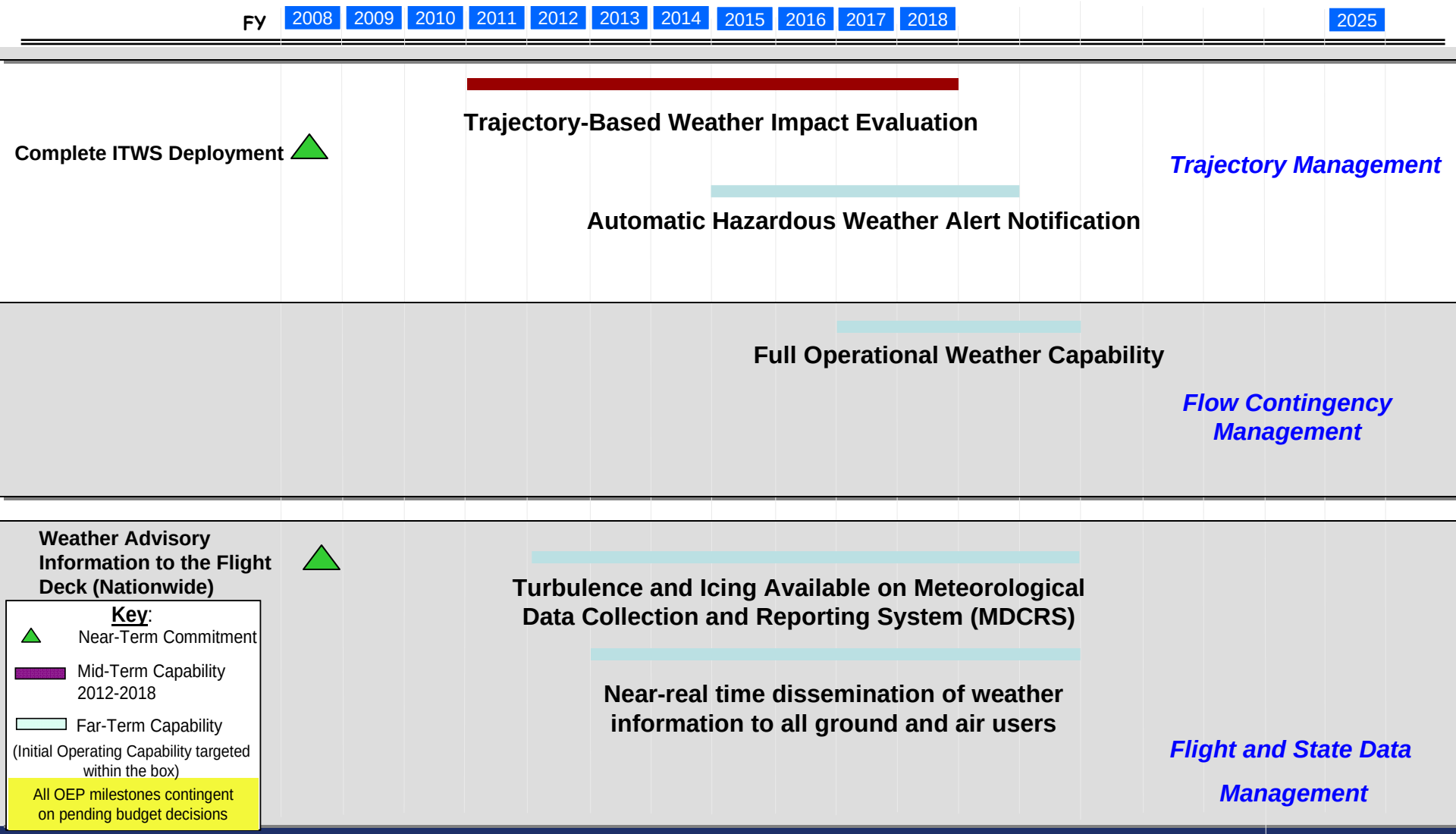
Increase Arrivals/Departures at High Density Airports



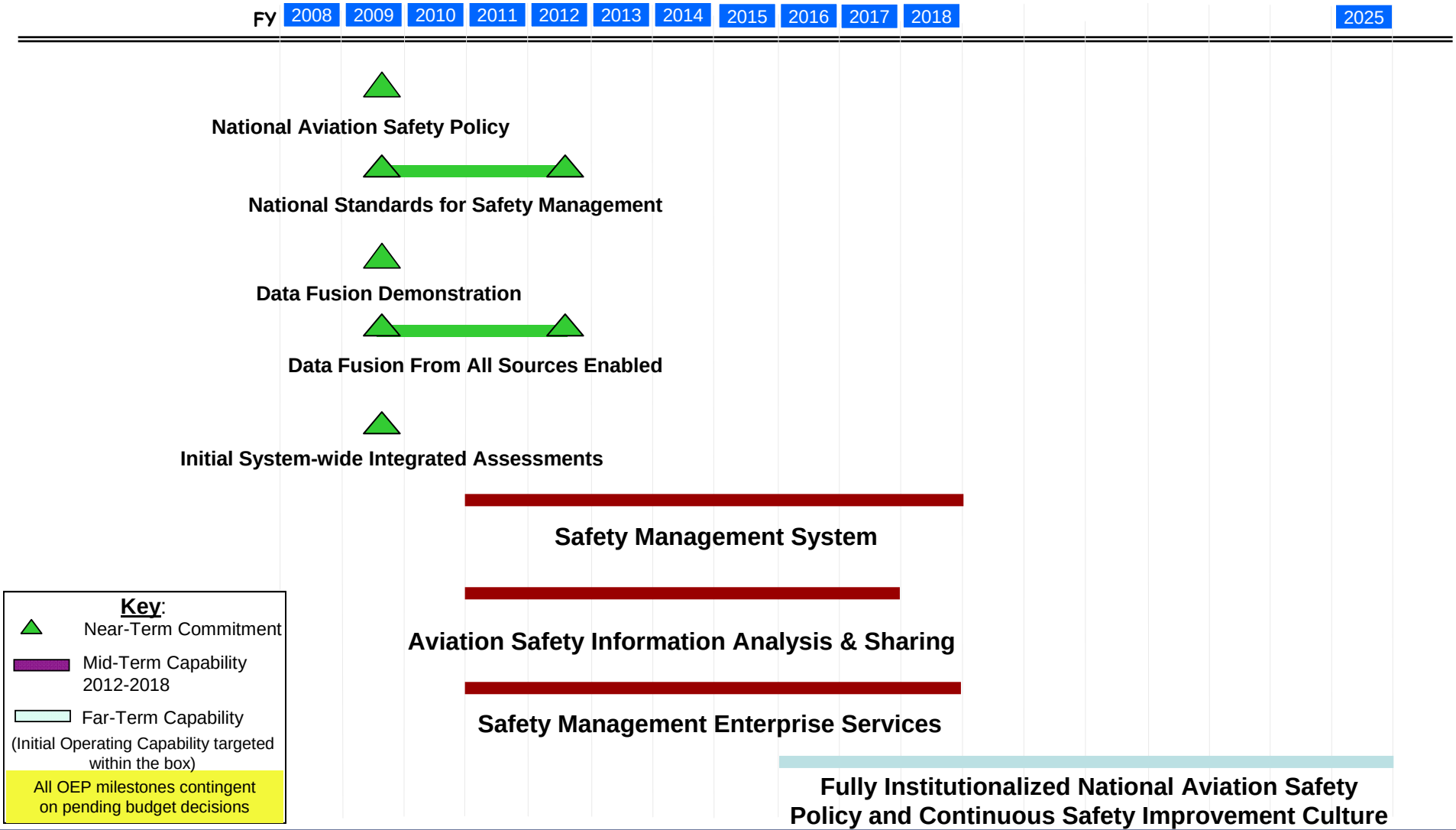
Improve Collaborative Air Traffic Management



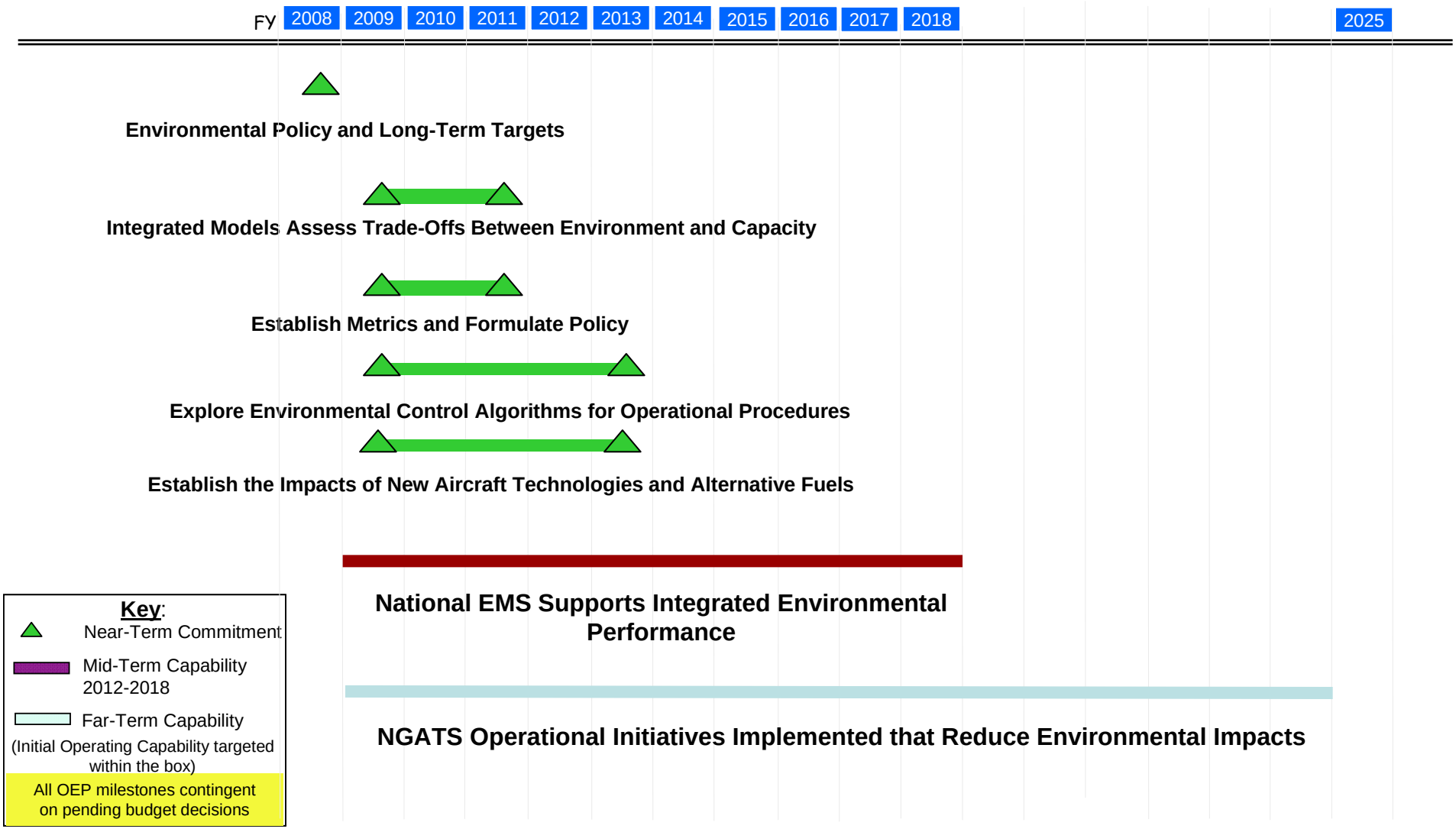
Reduce Weather Impact



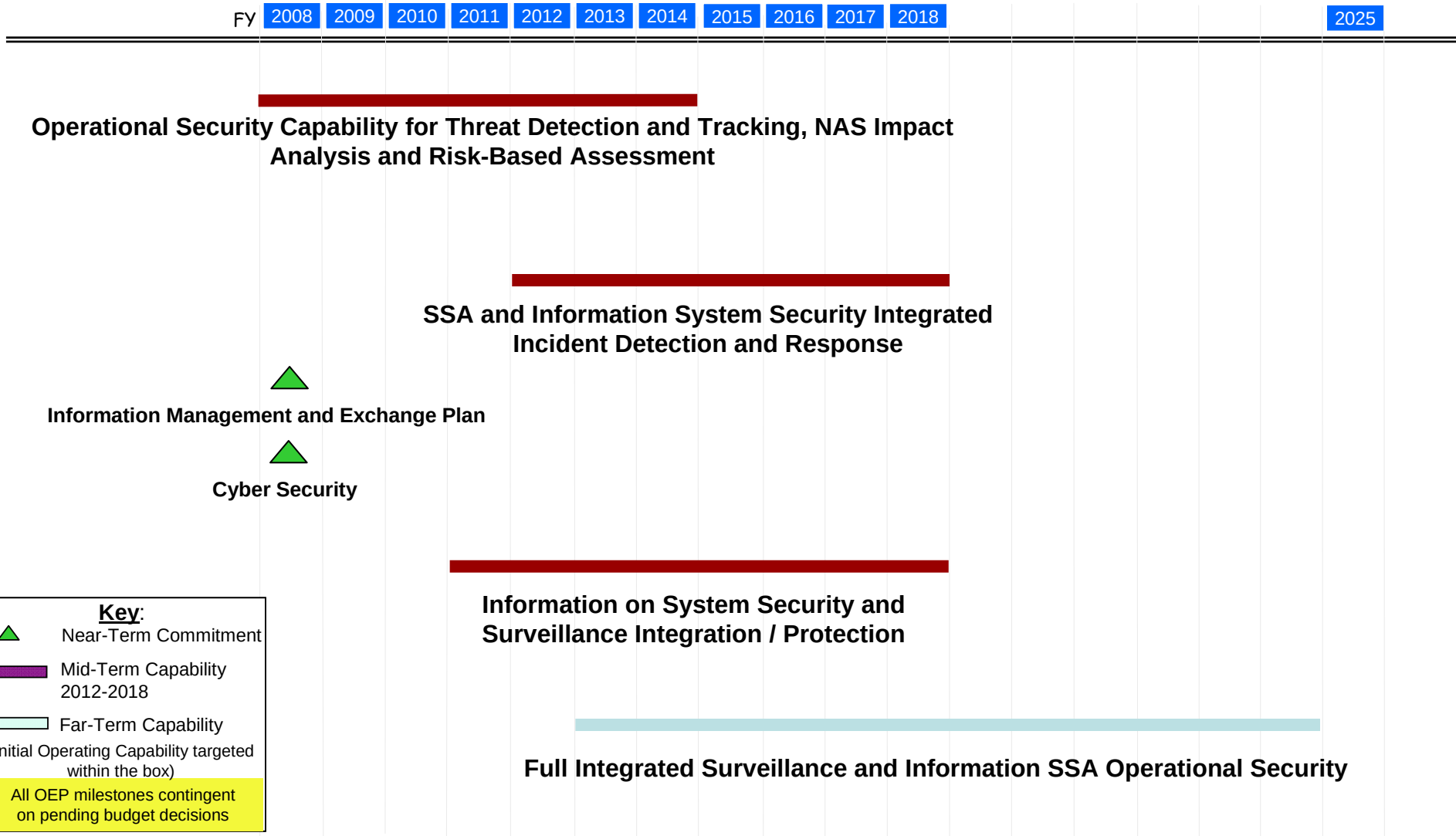
Safety


FY
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2025
National Aviation Safety Policy
National Standards for Safety Management
Data Fusion Demonstration
Data Fusion From All Sources Enabled
Initial System-wide Integrated Assessments
Safety Management System
Aviation Safety Information Analysis & Sharing
Safety Management Enterprise Services
Fully Institutionalized National Aviation Safety Policy and Continuous Safety Improvement Culture
Key:
Near-Term Commitment
Mid-Term Capability 2012-2018
Far-Term Capability
(Initial Operating Capability targeted within the box)
All OEP milestones contingent on pending budget decisions

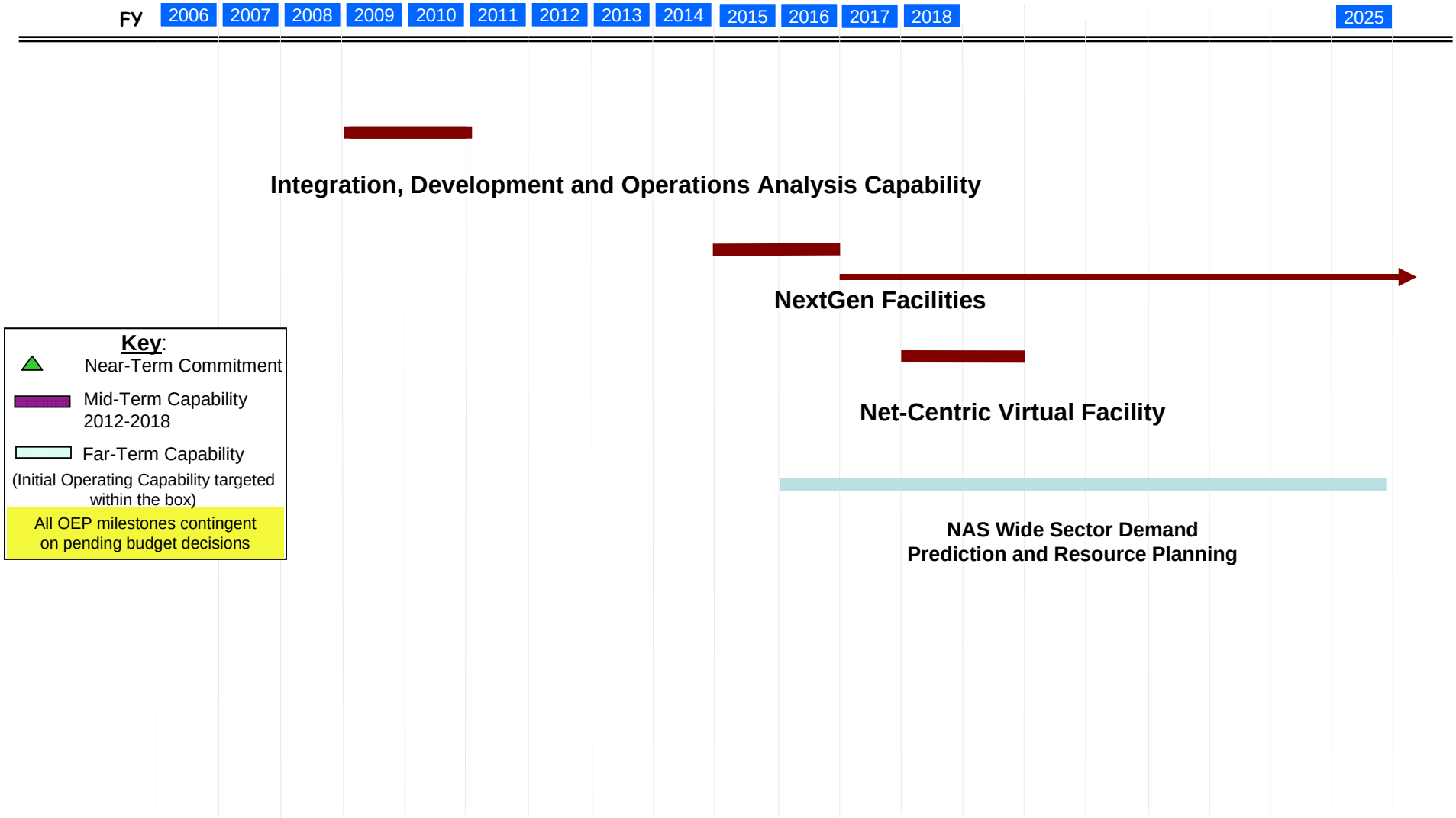
Environment



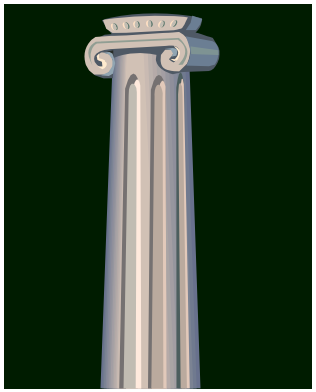
Security


FY
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2025
Operational Security Capability for Threat Detection and Tracking, NAS Impact Analysis and Risk-Based Assessment
SSA and Information System Security Integrated Incident Detection and Response
Information Management and Exchange Plan
Cyber Security
Information on System Security and Surveillance Integration / Protection
Full Integrated Surveillance and Information SSA Operational Security
Key:
Near-Term Commitment
Mid-Term Capability 2012-2018
Far-Term Capability
(Initial Operating Capability targeted within the box)
All OEP milestones contingent on pending budget decisions

Transform Facilities

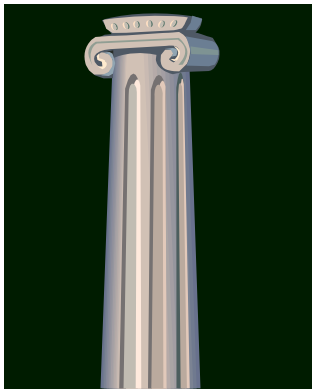


NextGen Integration & Implementation



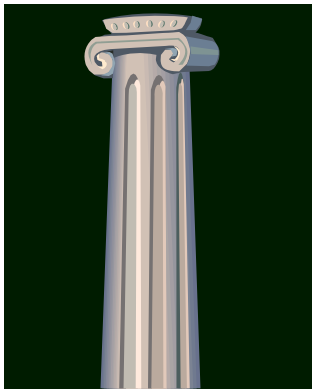
- **Ensures effective and efficient application, planning, programming, budgeting and execution of FAA's NextGen portfolio**
  - Focus on near & mid-term (now – 2018) NextGen implementation
- **Manages NextGen portfolio across FAA lines of business**
  - Service-level agreements
  - Program-level agreements
  - Cross-agency decision-making processes & accountability
- **Industry partnerships key to successful NextGen implementation**

NextGen Integration & Implementation



- **NextGen Planning Group**
  - Top-level integrated NextGen portfolio management
  - Supports governance framework for cross-agency decision making processes & accountability
    - NextGen Review Board
    - NextGen Management Board
  - Stakeholder engagement
  - Publishes & maintains NextGen Implementation Plan
- **Chief System Engineers Group**
  - NAS-wide system engineering for NextGen portfolio
    - NextGen critical path definition
    - Overarching NextGen risk matrix
    - Top-level requirements allocation
  - Top-level trade studies & business decision support

NextGen Integration & Implementation



- **Solution Set Integration Group**
  - Detailed portfolio management for integrated capabilities
    - Programs & enabling activities
  - Functional integration across Solution Sets

Initiate Trajectory-Based Operations

- **Air Traffic Control transitions to *traffic management by trajectory* and aircraft fly negotiated trajectories**
- ***Aircraft are equipped* to fully participate**
- **Pilot, controller and aircraft *roles and responsibilities & procedures changed* to support requirements**
- **System enhancements support traffic management *improvements in airspace with mixed equipage aircraft* operations**

Benefits

- **Accommodate the enroute demand growth by optimizing enroute capacity**
- **Reduce the impact of congestion and weather on system capacity**
- **Increase the efficiency for each flight reducing user cost and the flight's impact on the environment**

Increase Flexibility in the Terminal Environment

- **Provide *capabilities* to address the needs of airports with lower demand**
- **Supports *more efficient* use of airspace and ground assets**
- **Provides *increased situational awareness* to service provider and pilot**

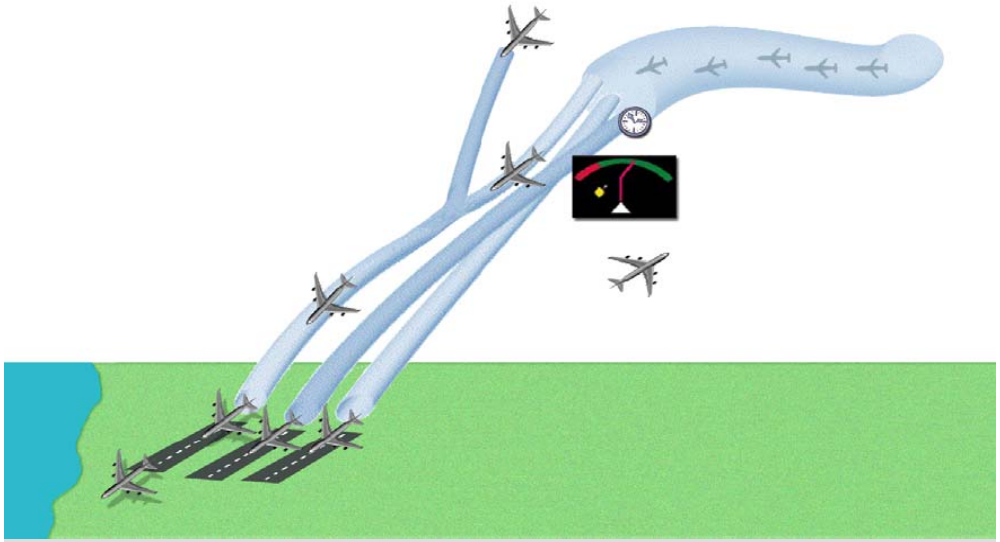
Benefits

- **Increase the use of secondary airports to meet growing demand in metro areas**
- **Improve safety through increased situational awareness for both pilot and controller**
  - Cockpit displays
  - Coded taxi-routes with conformance monitoring
- **Increase the environmental performance through lower emission procedures**
- **Maintain capacity in lower visibility operations**

Increase Arrivals/Departures at High Density Airports

- *Traffic flow management* **will improve to increase arrivals and departures at airports where:**
  - the demand for the runway capacity is high
  - Complex airspace and taxiing operations exist due to multiple runways, airport geometry, etc.
  - Airspace interference exists with airports in close proximity to each other

- **Operations will require** *higher performance navigation and communications* **capabilities**



Benefits

Maximum use of runway by:

- **Getting the right** *departure* **aircraft in the right order to maximize throughput**
- **Getting the right** *arrival* **aircraft through the airspace to the runway to fill every landing opportunity**
  - Expanding use of terminal procedures into transition airspace
  - Using 3-D RNAV/RNP criteria and procedures to “decouple” runways from shared flows
  - Improving the efficiency and delivery of aircraft in time-based metering by utilizing the aircraft’s capabilities

Improve Collaborative ATM

- **Accommodate *flight operator preferences* to the maximum extent possible**
- **Impose restrictions only when a real operational need exists**
- ***Adjust airspace* and other assets to satisfy forecasted demand, rather than constraining demand**
- **Maximize the operators' opportunities to resolve necessary constraints based on their own preferences**

Benefits

- **Increase the efficiency of flow actions by tailoring the impact on individual flight through integration of weather into the decision process**
- **Reducing delays by improving Airborne Flow Program prediction & execution by adding surface information**
- **Increase the available capacity when weather and congestion occur by flexibly moving airspace**
- **Improve the efficiency and reduce delays associated with a traffic flow program by providing all constraint data to all participants**

Reduced Weather Impact

- Improve *accuracy of weather* forecast
- Improve the scope & *use of weather information*
- Develop *improved products*
- Incorporate improved products into *decision support tools* to assess & manage the impact of both current and forecasted weather on individual flights and flows

Benefits

- Improved observation platforms with NAS-wide coverage
- Increased situational awareness by improving forecast of weather elements important to aviation (e.g., convection, icing, turbulence)
- Reduced impact of weather on capacity, efficiency and delay by provision of weather data into operational decision making – ATM, AOCs, and the flight deck

Increase Safety, Security & Environmental Performance

- Includes activities that enhance safety, security and environment

Benefits

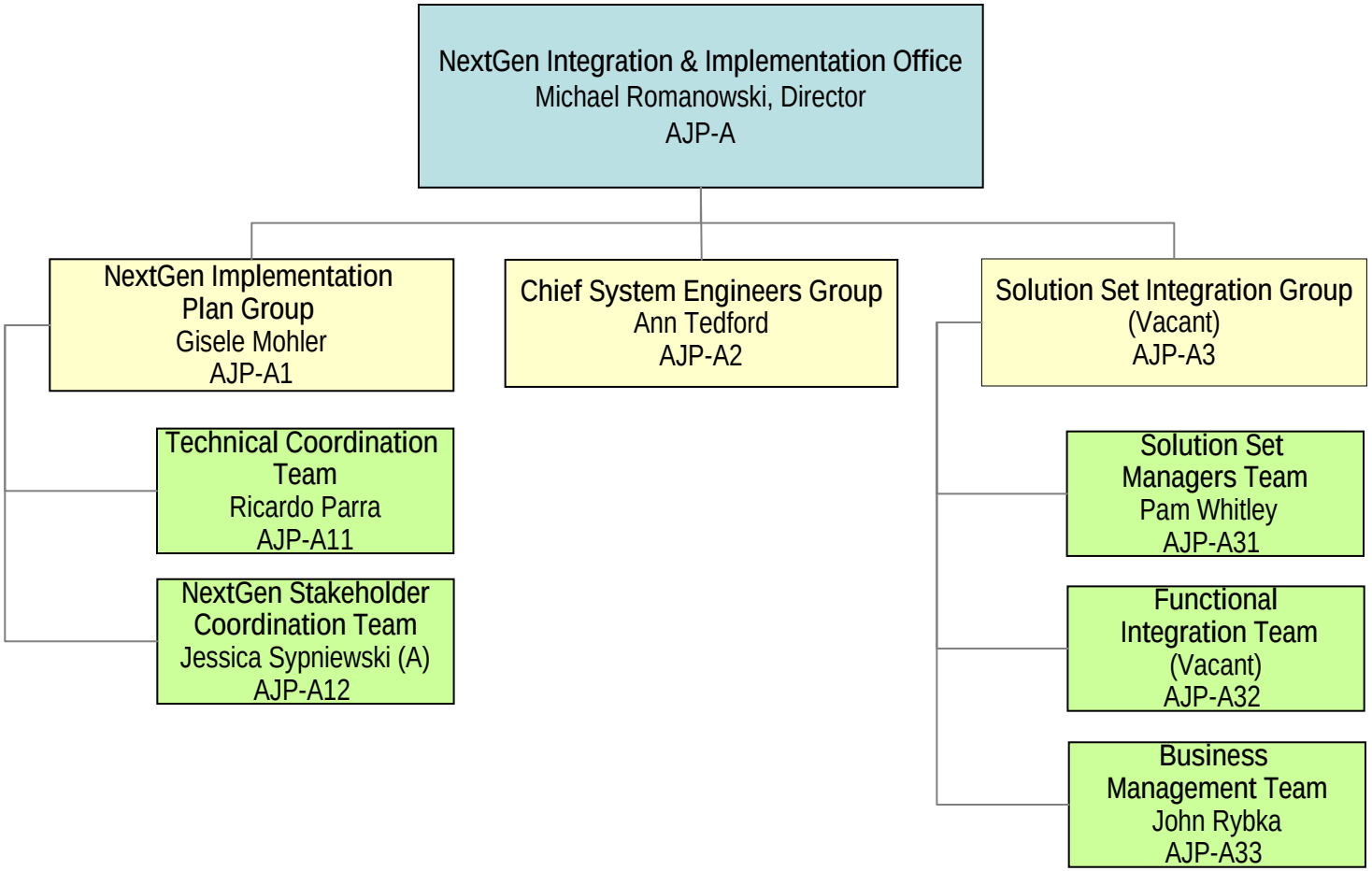
- Improves ATO's role in airspace security
- Address NextGen challenges for Information Security
- Meet Safety and SMS Mission
- Improve environmental performance

Transform Facilities

- **Flexible infrastructure to support service delivery and meet changing ATC and user needs**
- **NextGen facilities to enable new operational capabilities**
- **Support “Big Airspace” integrated Arrival/Departure facilities, hi-lo altitude General Service Delivery Points, and Staffed NextGen Facilities**

Benefits

- **Improvements in resource management, reduce overhead and gives service providers a greater career progression**
- **Provide continuity of operations in the event of a major facility outage**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