

NextGen

Next Generation Air Transportation System



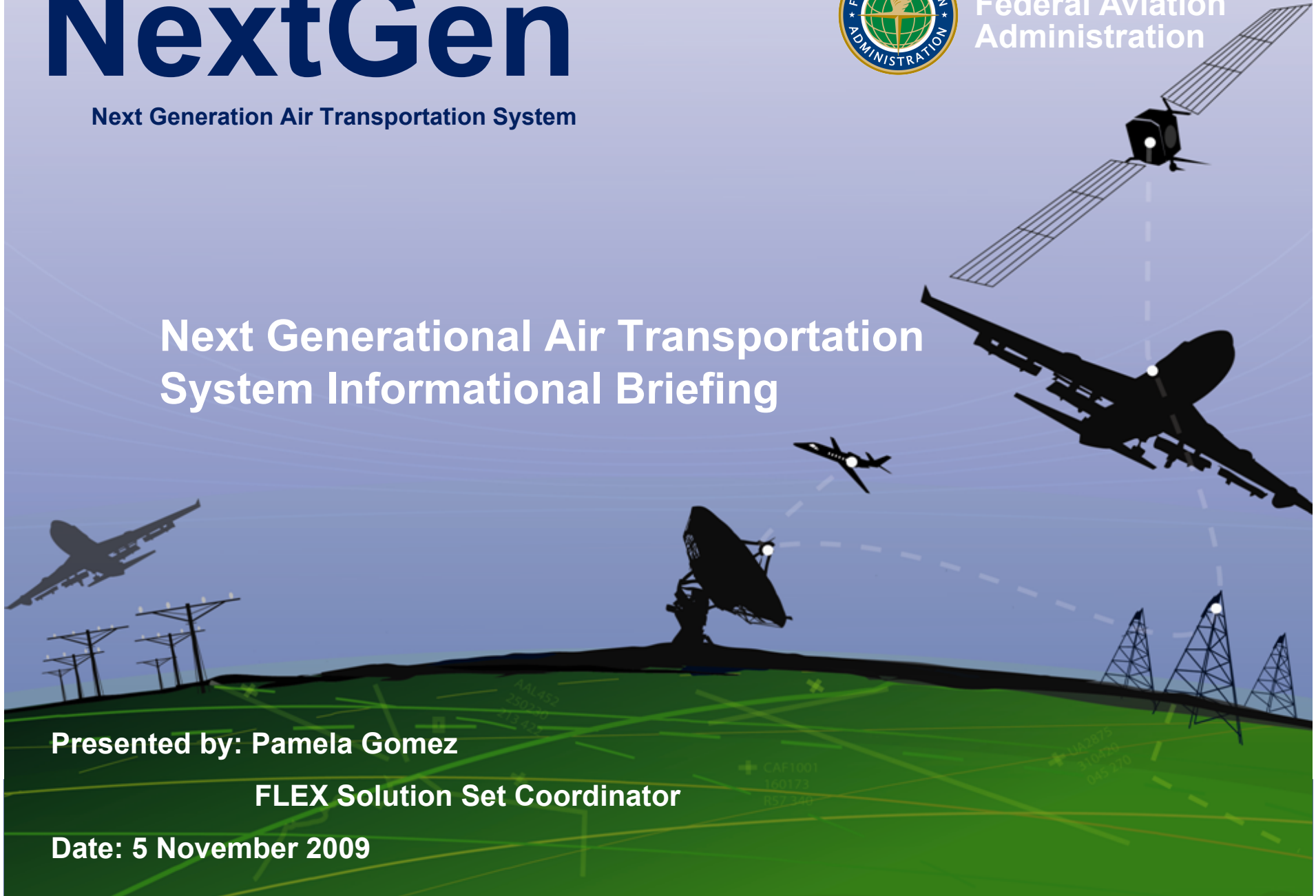
Federal Aviation
Administration

Next Generational Air Transportation System Informational Briefing

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FLEX Solution Set Coordinator

Date: 5 November 2009



OBJECTIVE

- **Why NextGen?**
- **What is NextGen?**
- **How NextGen will be Implemented**
 - Challenge
 - Management Structure
 - Integrated Management – Portfolio Approach
 - Solution Sets & Operational Improvements

Solution Sets

- CATM
- RWI
- TBO
- High Density
- Terminal
- SSE
- FLEX



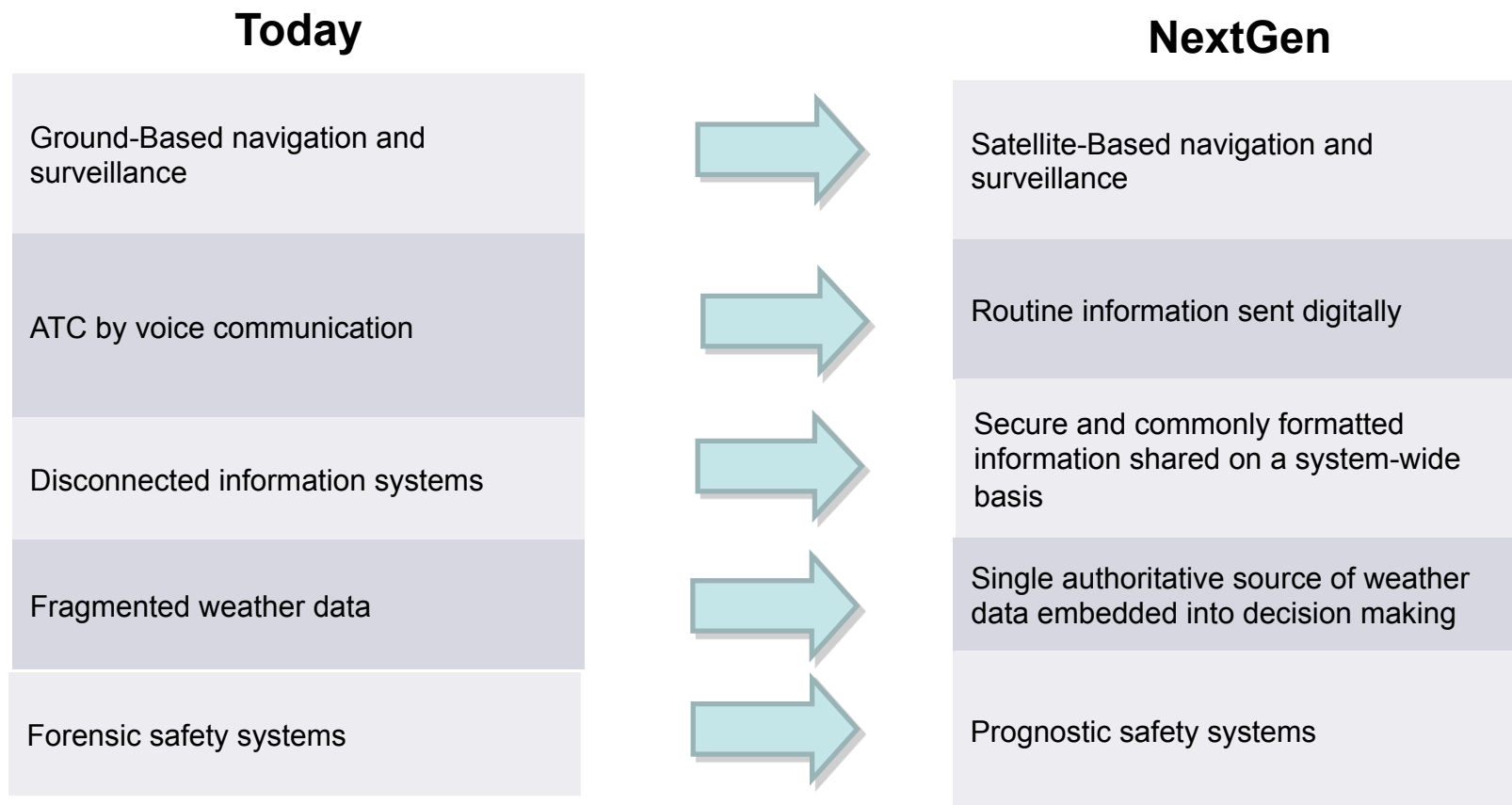
Why NextGen?

- **Today – Delays repeatedly impact passenger travel**
- **Future – Forecast for demand remain extremely high**
- **Our current ATC system is not scalable or flexible to handle this future demand**
- **NextGen will:**
 - **Improve efficiency**
 - **Create additional capacity**
 - **Provide enhancements to safety and environmental performance**

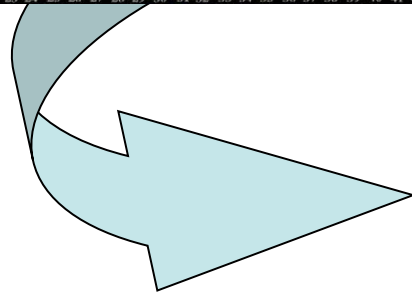
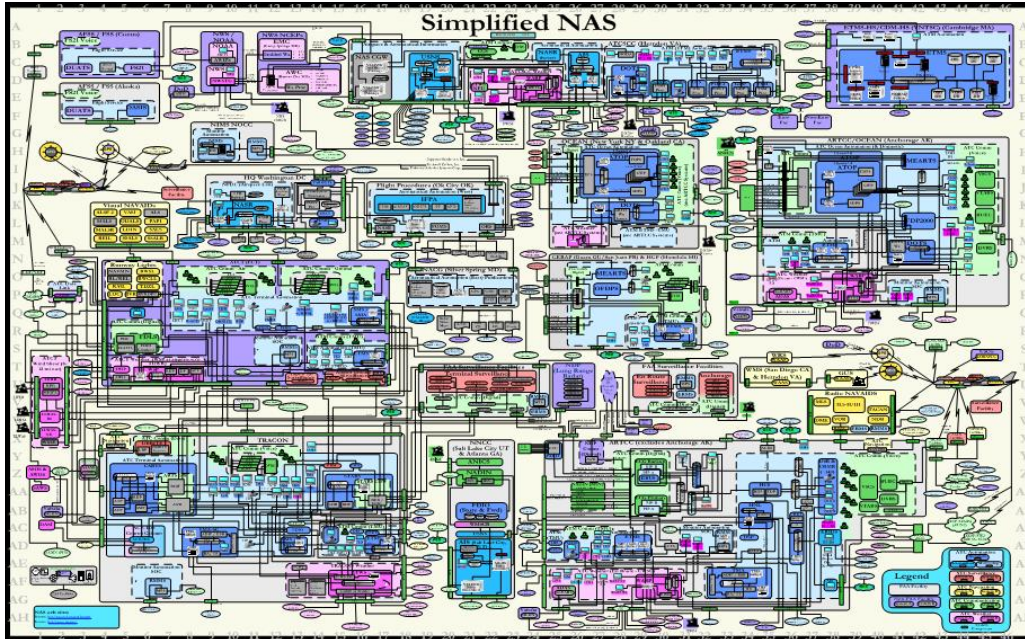


What is NextGen?

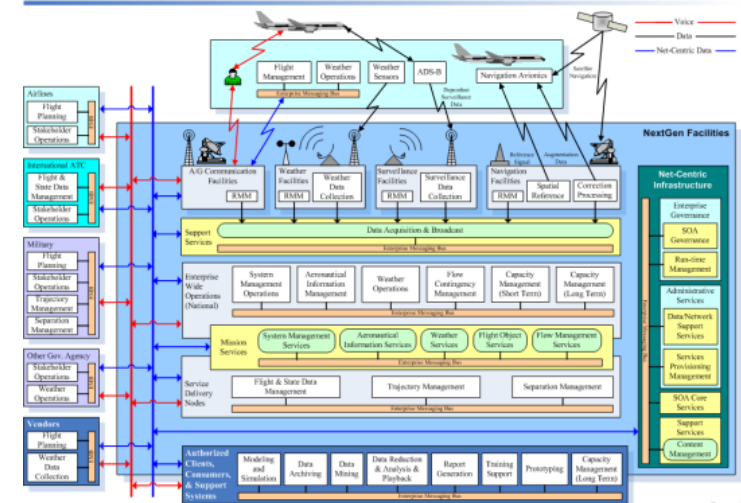
It is an umbrella term for a wide-ranging transformation of the NAS



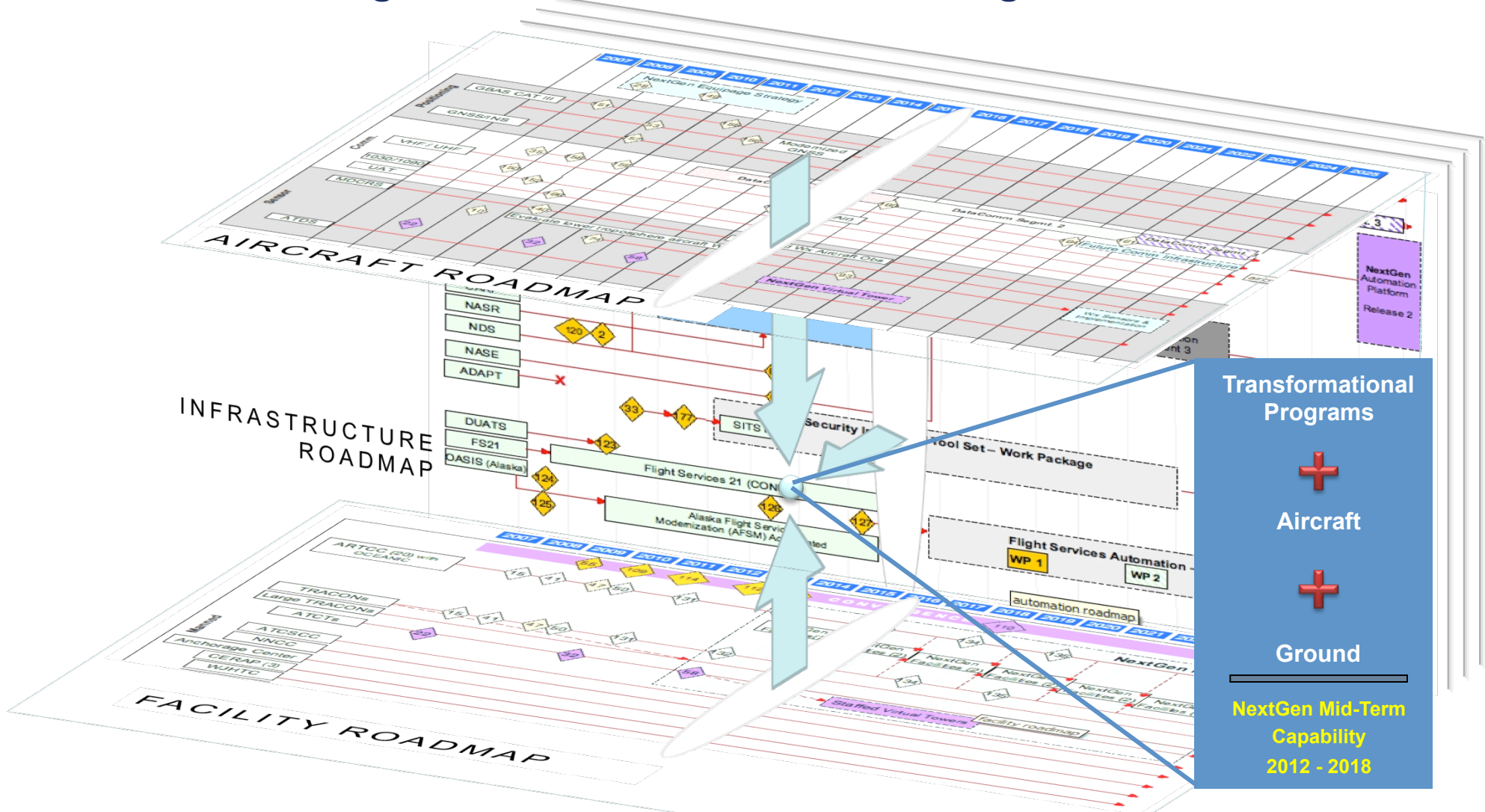
The transition path is very challenging



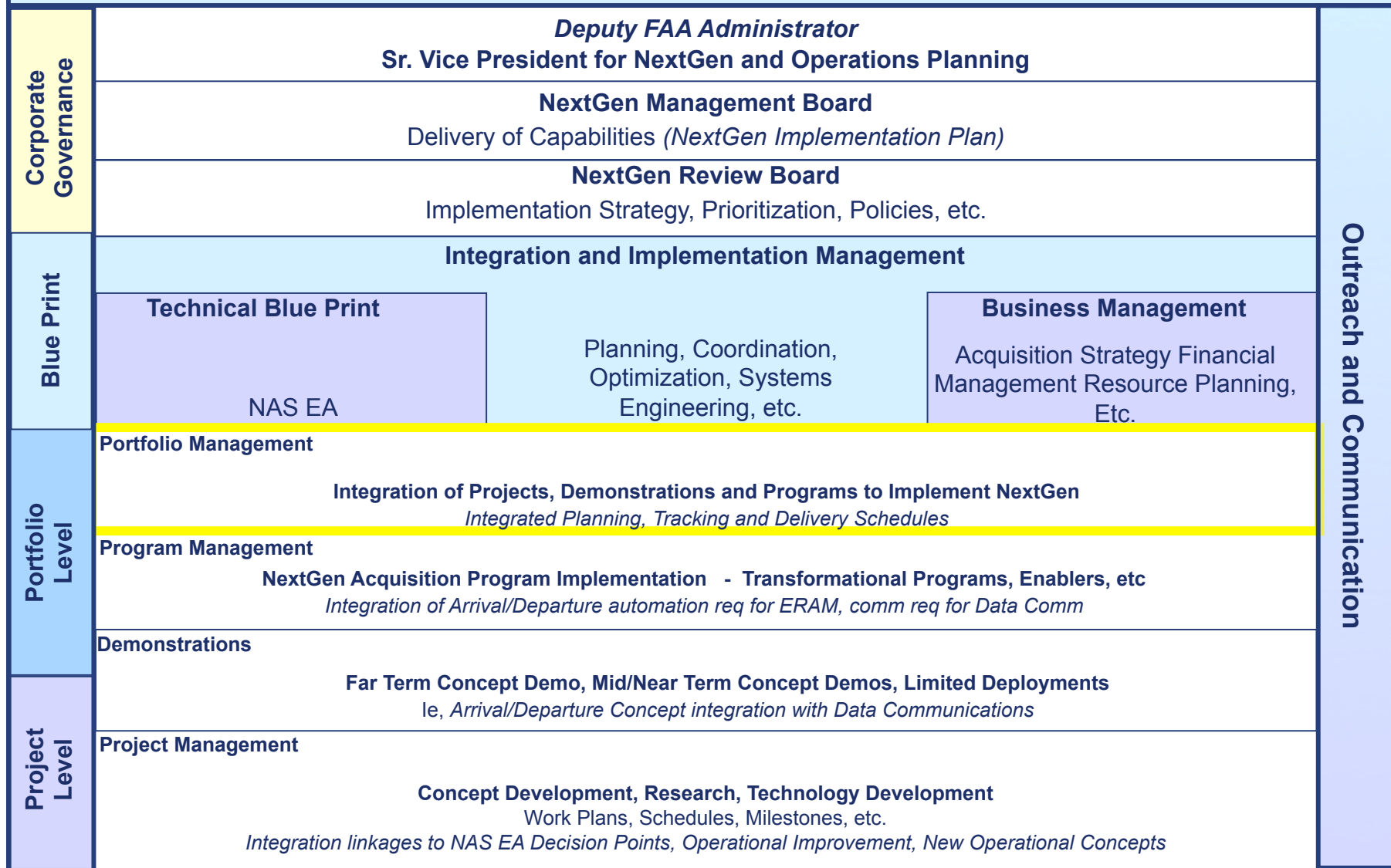
NextGen 2025 – SV-1p 2/5/09



NextGen Complexity Presents a Significant Communication Challenge



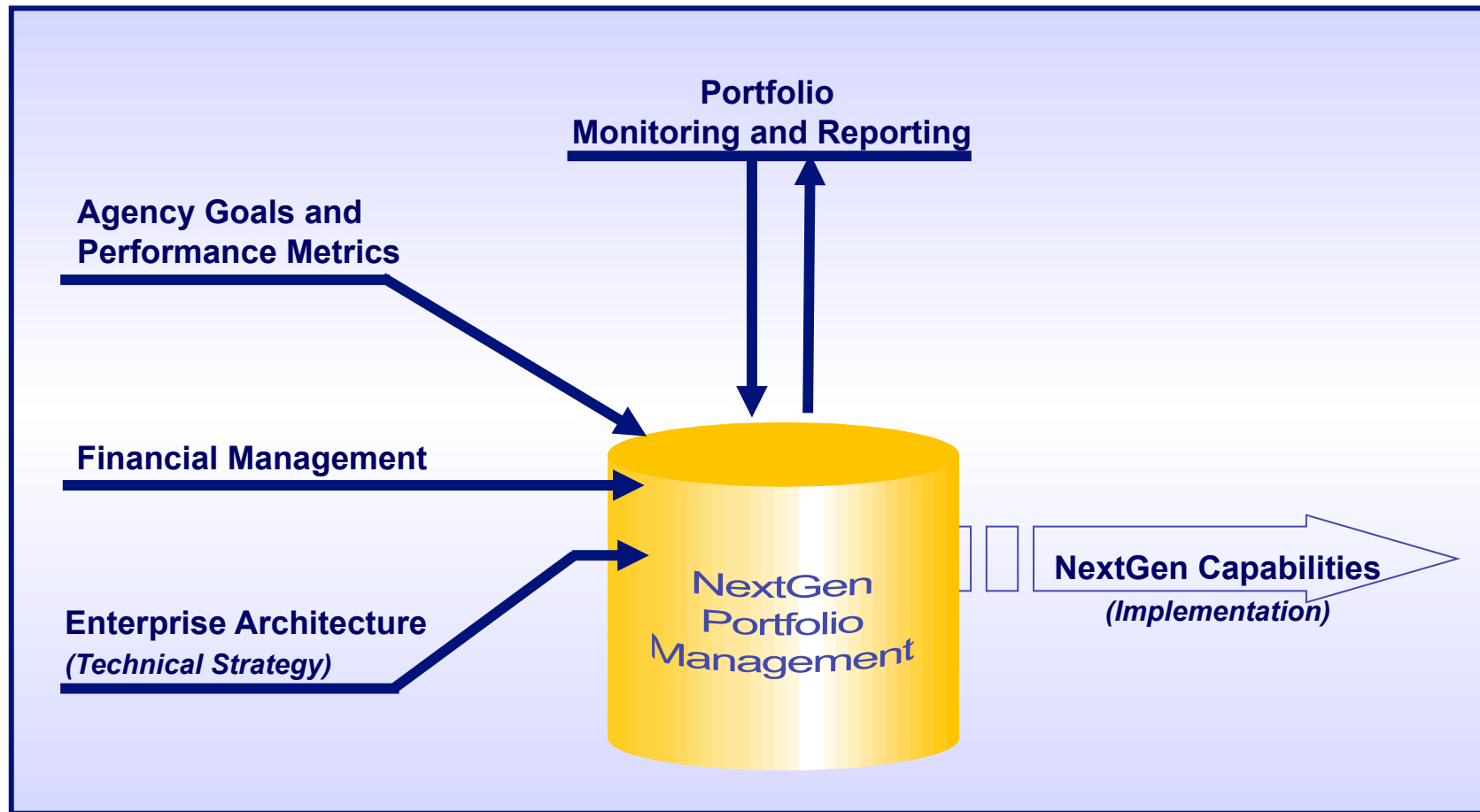
NextGen Implementation



Outreach and Communication



NextGen ...Portfolio Management



NextGen Integration & Implementation

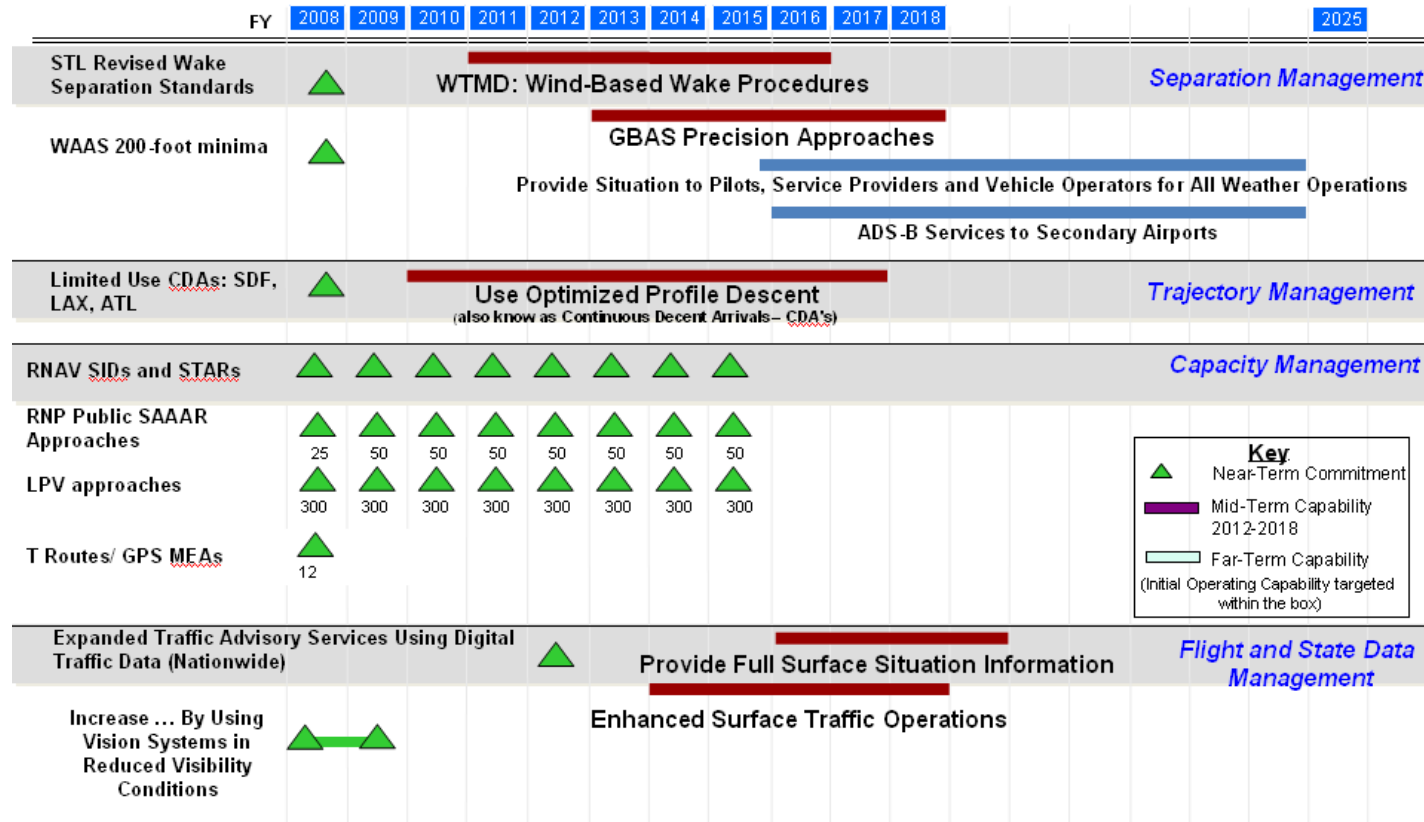
- **Ensure effective and efficient application, planning, programming, budgeting and execution of FAA's NextGen portfolio**
 - Focus on near & mid-term (now – 2018) NextGen implementation
- **Manage NextGen portfolio across FAA lines of business**
 - Service-level agreements
 - Program-level agreements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



NextGen Implementation Timelines

Portfolio – Operational Level Descriptions

Increase Flexibility in the Terminal Environment

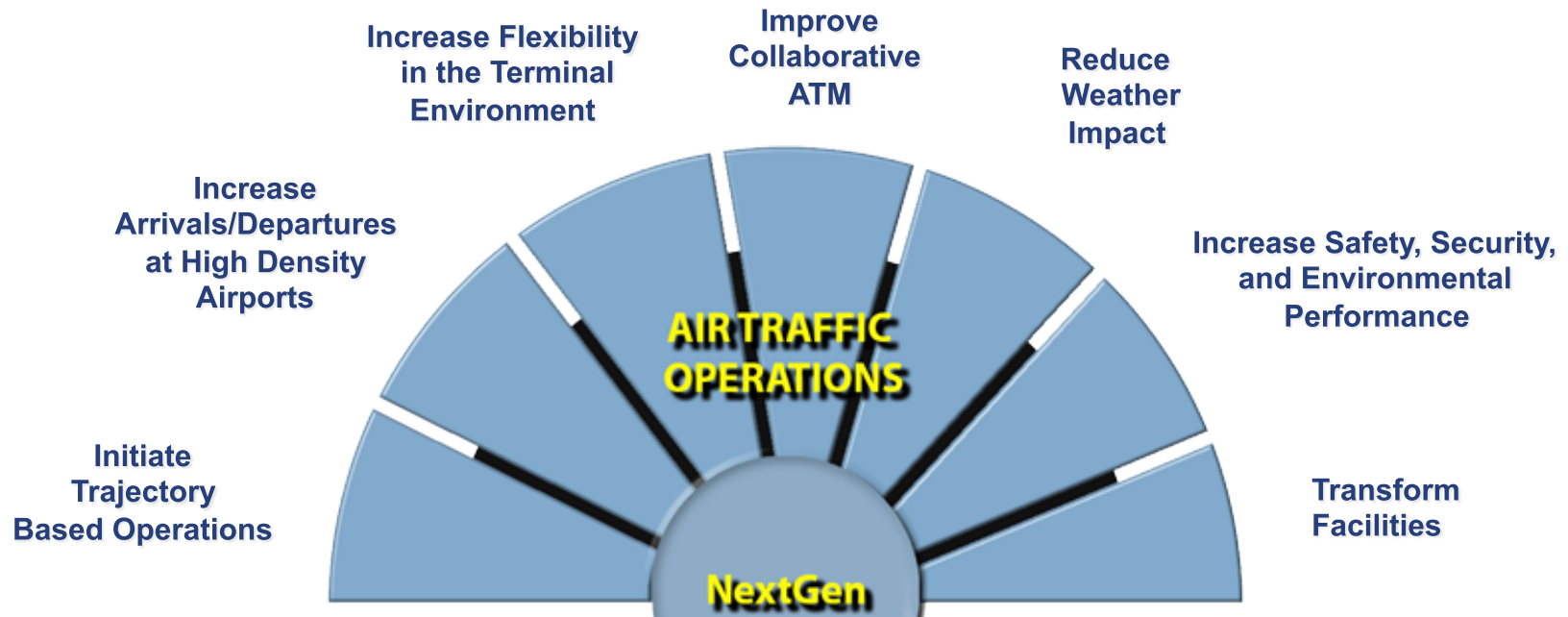


NextGen Integration and Implementation Office



NextGen

Air Traffic Operations Solution Sets

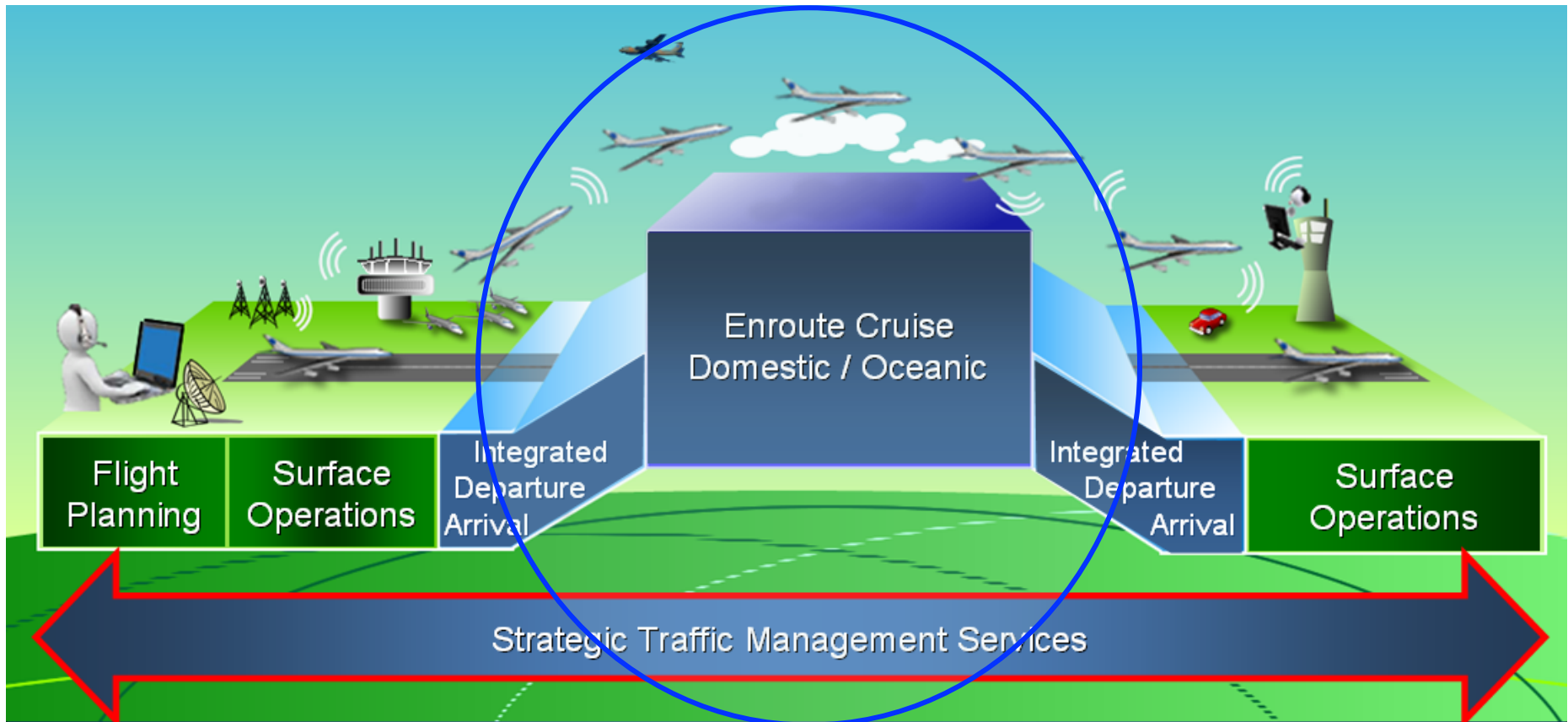


Separation Management
Trajectory Management

Data Management
Capacity Management

Trajectory-based Operations (TBO)

Trajectory-based Operations (TBO) represent a shift from clearance-based to trajectory-based control. This solution set focuses primarily on en route cruise operations, although the effects of the trajectory-based operations will be felt in all phases of flight.



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***



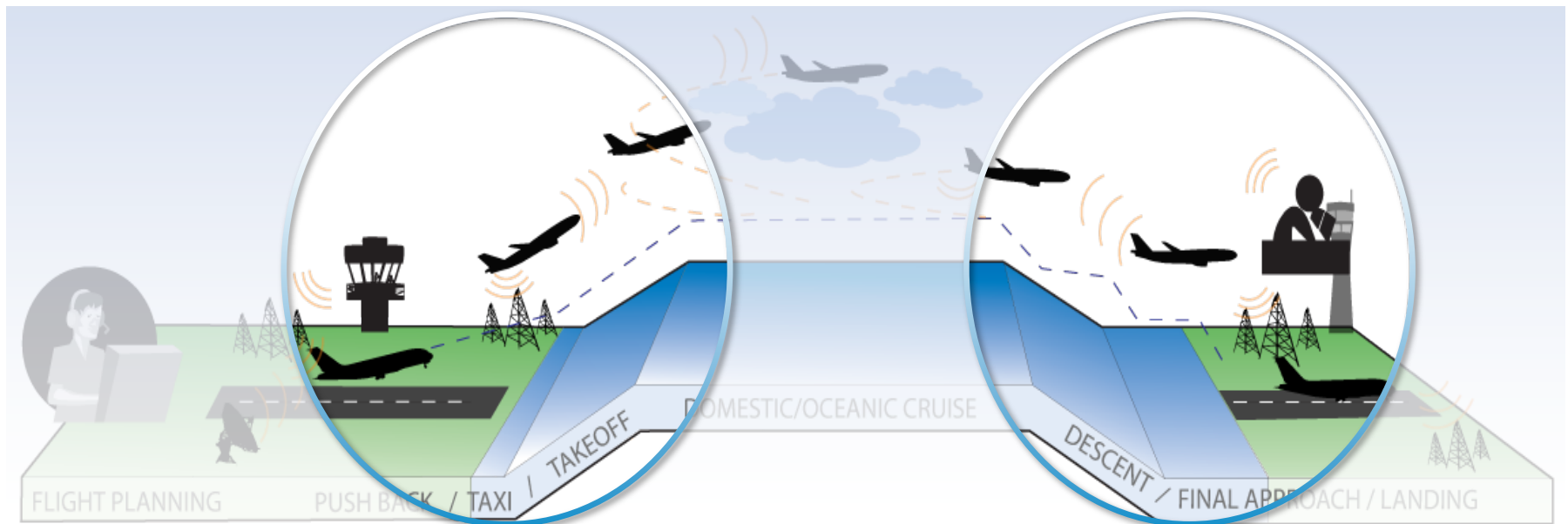
Benefits

- 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

High Density Solution Set

The Increase Arrivals/Departures at High-Density Airports solution set involves airports (and the airspaces that access those airports) in which:

- Demand for runway capacity is high
- There are multiple runways with both airspace and taxiing interactions, or
- There are close-proximity airports with the potential for airspace or approach interference.

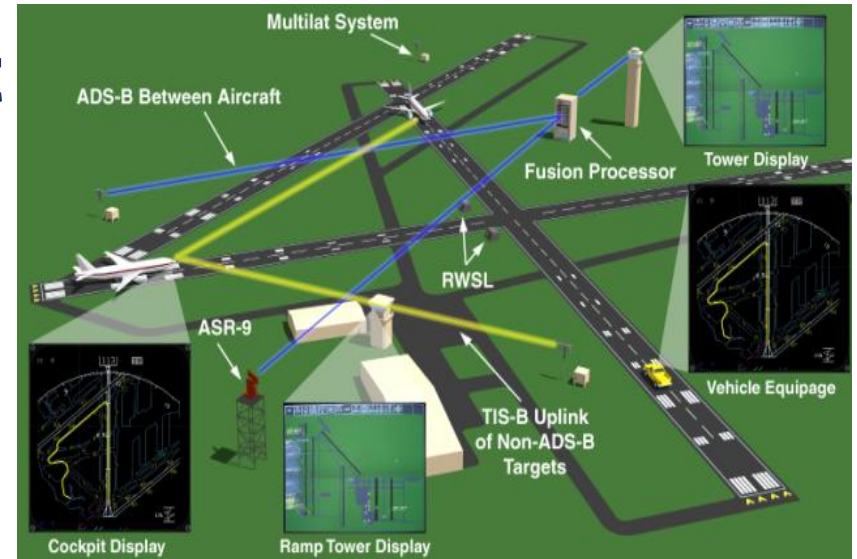


High Density Solution Set

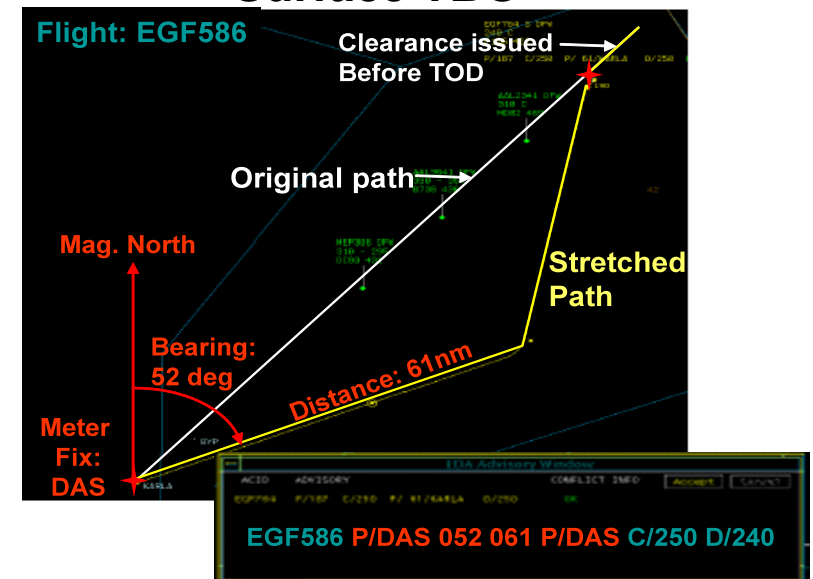
Benefits

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



Surface TBO



3D PAM

Collaborative Air Traffic Management Solution Set

- **Covers strategic and tactical flow management, including interactions with flight operators to mitigate situations when the desired use of capacity cannot be accommodated**
- **Includes flow programs and collaboration on procedures that shift demand to alternate resources (e.g., routings, altitudes and times)**
- **Manages National Airspace System (NAS) flights**
 - Development and management of aeronautical information
 - Management of airspace reservation
 - Management of flight information from pre-flight to post-analysis



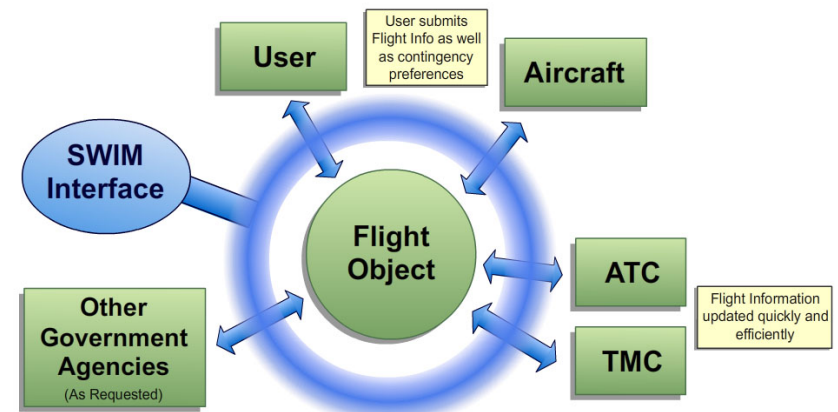
Collaborative Air Traffic Management Solution Set

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



NextGen Flight Object



The CATM Story
May 21, 2009



Federal Aviation
Administration



Reduce Weather Impact Solution Set

- 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

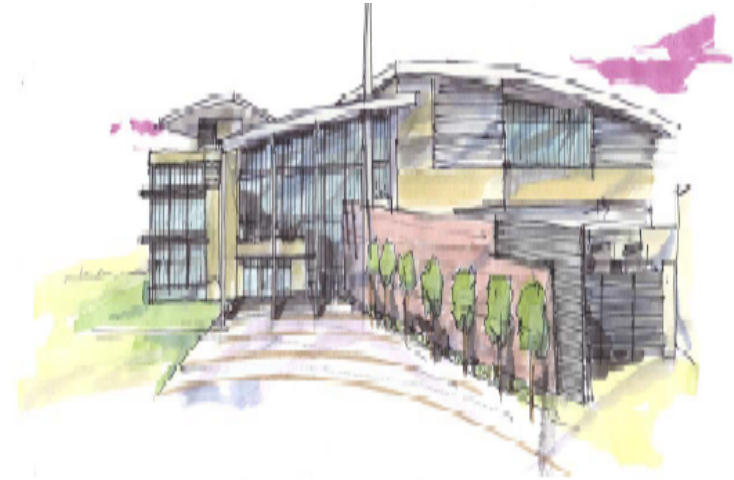


Benefits

- 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

Transform Facilities Solution Set

- **Flexible infrastructure to support service delivery and meet changing ATC and user needs**
- **NextGen facilities to enable new operational capabilities**
- **Support “Big Airspace” integrated ARR/DEP facilities, hi-lo altitude GSDPS, 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**

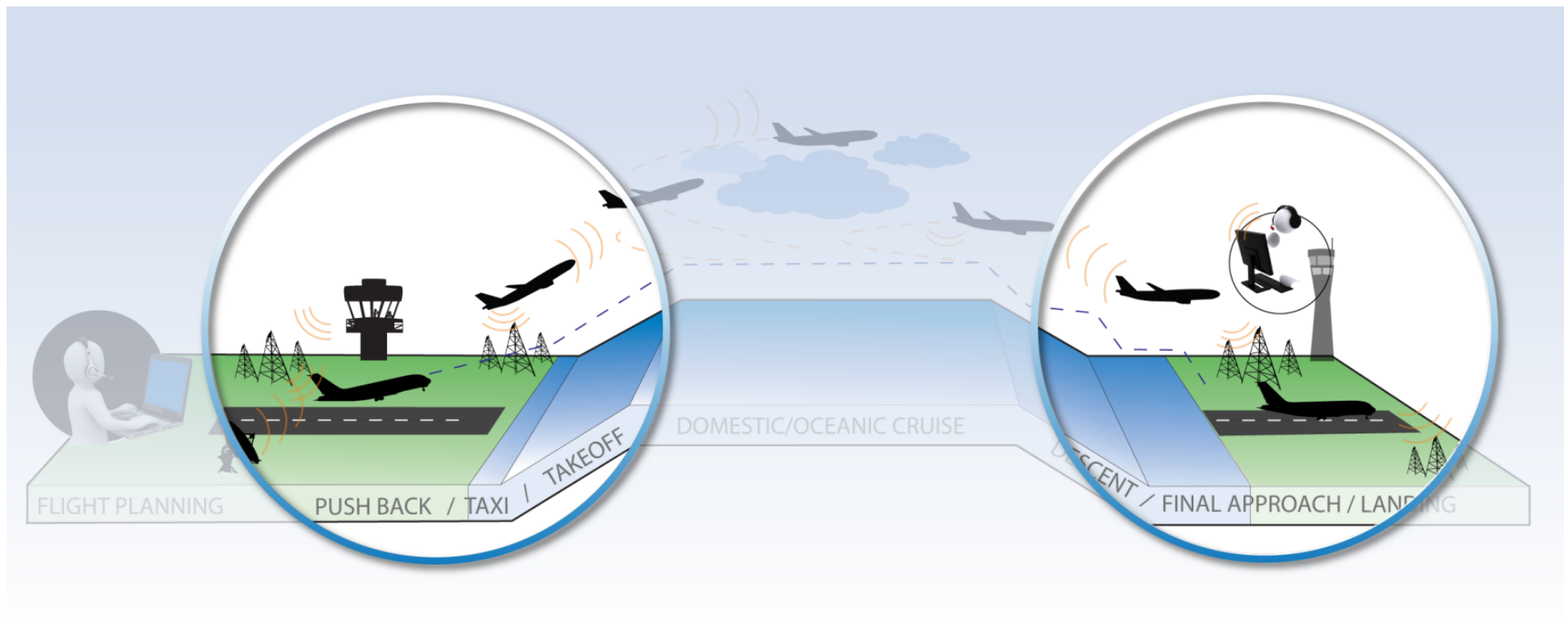
Increase Safety, Security, and Environmental Performance Solution Set

- **Safety involves activities directly related to ensuring that NextGen systems contribute to steadily reducing risks commensurate with increases in other system capacity.**
- **Security is inherent in all aspects of NAS Operations. Airspace security capabilities are specifically called out. Information security is already integral to the baseline of each NAS program.**
- **Environmental Performance involves activities directly related to energy production and use, as well as environmental considerations.**



Flexible Terminals and Airports

Increase Flexibility in the Terminal Environment solution set covers the terminal and airport operations ability to meet the need of both high-density terminals and other airports. Flexible terminal solutions focus on improvements to the management of separation at all airports. Such capabilities will improve safety, efficiency and maintain capacity in reduced visibility high-density terminal operations. Flexible terminal solutions will also improve trajectory management and advanced separation procedures employed when demand warrants.



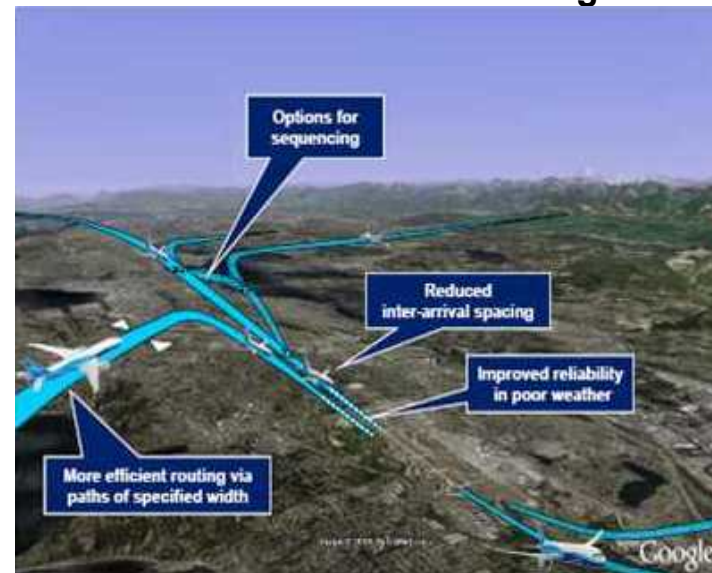
Flexible Airport and Terminal Solution Set

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



Wake Re-Categorization



GBAS Demo

FLEX

FY10 -- 11 Activities (Slide 1 of 3)

Activity

Separation Management – Wake Turbulence Mitigation for Departures

Award contract to install detectors that measure runway weather conditions to determine if wake turbulence (separation) delay can be reduced.

Separation Management – Wake Turbulence Mitigation for Arrivals

WTMA will allow controllers to reduce the required diagonal wake turbulence separation distance to a minimum of 1.5 NM when instrument arrival operations are being conducted on an airport's closely spaced parallel runways and there are favorable crosswinds. Implementation at potentially 12-to-17 candidate airports that have a significant number of Boeing 757 and heavier aircraft operations and use closely-spaced parallel runways for arrival operations would yield a higher airport arrival rate.

Flight and State Data Management – Surface/Tower/Terminal Systems Engineering

Identify requirements necessary to develop an engineering model for the Tower Flight Data Manager (TFDM) system; delivers Enhanced Surface Traffic Operations and Full Surface Situation Information capabilities.

Separation Management – Approaches, Ground Based Augmentation System (with Acceleration combined)

GBAS will support precision approaches to Category 1, and eventually Category 2 and 3 minimums for properly equipped runway and aircraft. GBAS can support approach minimums at airports with fewer restrictions to surface movement and offers the potential for curved precision approaches. GBAS also can support high-integrity surface movement requirements.

Separation Management – Closely Spaced Parallel Runway Operations (with Acceleration combined)

Identify requirements to provide enhanced procedures (including cockpit and ground improvements) that enable parallel runway improvements, reduce impact to airport/runway throughput in lower visibility conditions.



FLEX

FY10 -- 11 Activities (Slide 2 of 3)

Activity

Separation Management – Approaches, New Navigation Initiatives

Provide real-time data for system development and solution implementation for lower approach minima during periods of Instrument Meteorological Conditions (IMC). Support the use of Category I runways during runway visual range (RVR) conditions down to 1800 feet; allow use of DME area navigation (RNAV) down to 1000 feet AGL and enable more aircraft to achieve lower altitudes during IMC.

Separation Management – Approaches, Optimize Navigation Technology

Award contract services to conduct analyses of the physical, electrical (electronic) and economic evaluation to systems to determine what type of technology insertion or changes in the system would result in improved operating efficiency to increase flexibility in the terminal environment.

Separation Management – Enhancing Terminals & Airports – Relative Position Indicator (RPI) – Acceleration

Relative Position Indicator provides flight specific spacing information to support merging multiple RNAV routings in the terminal. It directly supports the more efficient and high demand use of RNAV/RNP procedures by enhancing the existing Converging Runway Display Aid (CRDA) function of the terminal automation platforms (STARS and CARTS)

Trajectory Management – Arrivals RNAV/RNP with Required Time of Arrival

Validate the concept, identify requirements and collect additional data to enhance efficiency and provide greater capacity and reduce fuel consumption. This increases aircraft flow and will introduce additional routes and flexibility to reduce delays and capability for enhanced surface traffic operations.



FLEX

FY10 -- 11 Activities (Slide 3 of 3)

Activity

Trajectory Management - Enhancing Terminals & Airports - Reduced Runway Visual Range (RVR) Minima – Acceleration

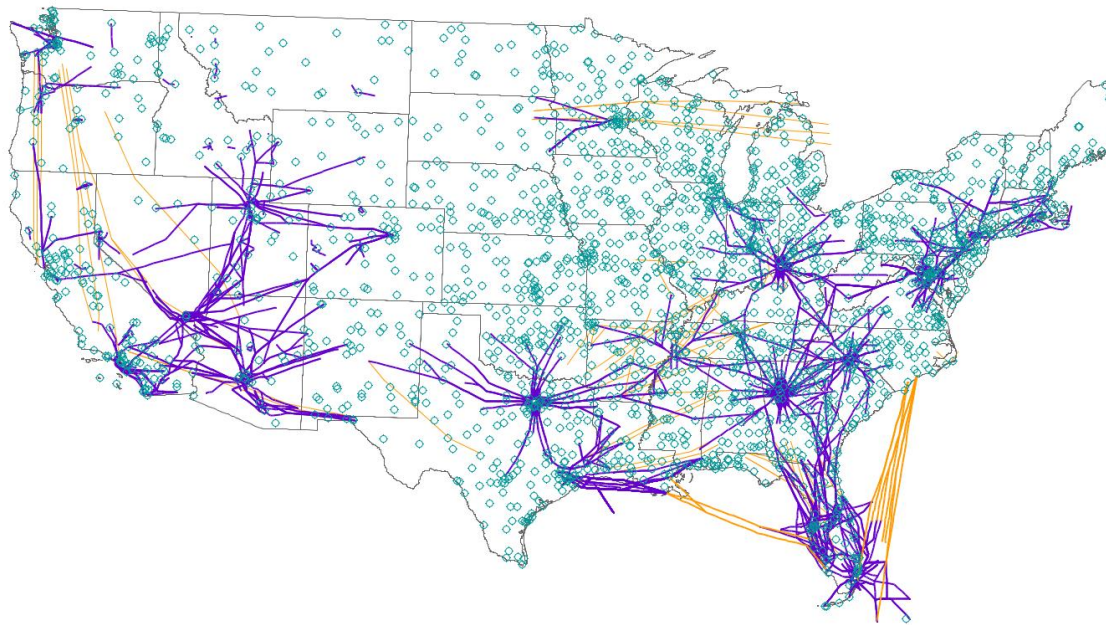
Acquisition, installation and commissioning of additional RVR sensors, additional dual-frequency ILS, threshold light bars, and localizer antenna modifications to increase flexibility in the terminal environment, increase airport access during periods of low visibility and increase arrivals and departures at airports.

Trajectory Management - Localizer Performance with Vertical (LPV) Procedures – Acceleration

Localizer Performance with Vertical (LPV) Procedures will accelerate the proliferation of LPV performance-based navigation procedures (PBN) by funding more LPV procedures at non-ILS non-OEP airports. Airports and runways without precision approach minimums will improve airport access, predictability, and efficiency for aircraft that operate in those locations.



Current PBN Implementation in U.S.



Purple – RNAV SIDs/STARs
Yellow – RNAV En Route
Green – Airports with RNAV or RNP approaches

RNAV

- Standard Instrument Departures (SIDs) & Standard Terminal Arrivals (STARs)
- Routes (Q, T, Global Positioning System Minimum Enroute Altitudes [GPS MEA])
- Optimized Profile Descent (OPD)

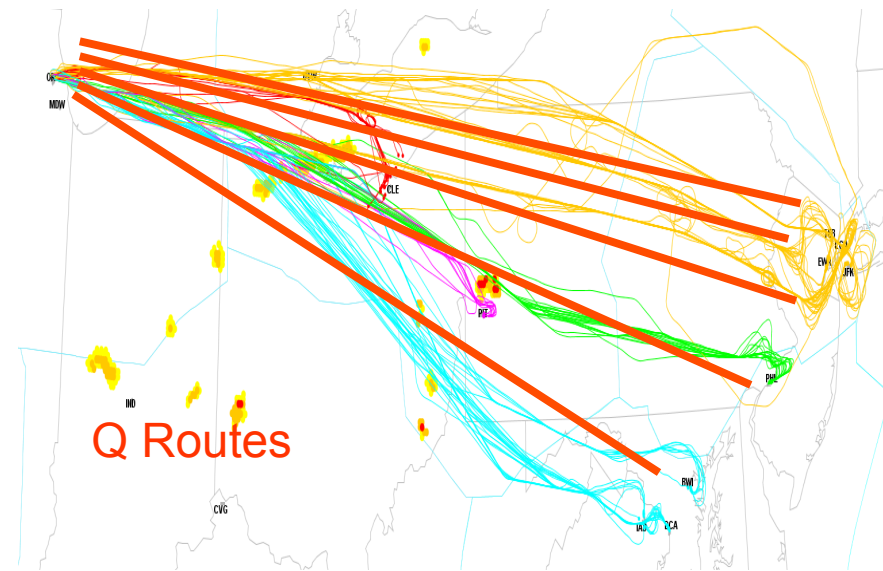
RNP

- RNP Authorization Required (AR)
- RNP Approaches with radius-to-fix (RF) legs, SIDs, STARs with new design and operational guidance
- From program inception to date, FAA has published more than 190 RNP approach procedures, more than 300 RNAV arrival and departure procedures, and more than 200 RNAV routes

Q-Routes – RNAV En Route

Focus Areas for High-Altitude Route Acceleration

- New York/Philadelphia/Newark
- DC Metro
- Atlanta/Charlotte
- Miami
- North Texas/Houston
- Denver
- San Francisco
- Los Angeles/Las Vegas/Phoenix
- Seattle
- Chicago/Midway



Note: These routes do not exist today and have been planned for development and deployment during the next 6-8 years. Acceleration would compress that time period to 3-4 years. While this is a definite challenge, acceleration is feasible if the dependencies are correctly and completely identified, implementation activities and timelines are programmed and receive stakeholder support, and an executable profile is provided. In this scenario, selected high-altitude routes would be implemented for operational use in the NAS beginning in FY 2014.

PBN RNAV RAIM Required Planning

- Requires RAIM for Pre-flight Planning Procedures
- Operator ensures RAIM availability exists
- Predicted, continuous loss of RAIM > 5 minutes for any part of the intended flight:
 - Delay, cancel, or re-route where RAIM requirements can be met.
- For multi-sensor equipment with operating GPS and DME/DME/IRU positioning, a RAIM check is not required as long as critical DME's are functioning normally



RNP – *performance based*

- Aircraft “system” performance
 - Horizontal alert limit may not depend on manufacturer implementation in meeting same RNP level
- “Business as usual” is changing
 - Ground infrastructure: nav aids, surveillance
 - Aircraft capability: New RNP procedures = greater capability, capacity, and fuel savings
 - AC 90-105 captures this *transition*



Summary

Nextgen Vulnerabilities in PNT

- What, Why, Where, When, and How
 - GPS Geometry more important than satellite count for RNAV/RNP
 - Enforcement for GPS RAIM began 28 Sept 2009

NOTE: Until September 27, 2009, a RAIM prediction does not need to be done for any RNAV route conducted where ATC provides radar monitoring or RNAV departure/arrival procedure that has an associated "RADAR REQUIRED" note charted. On September 28, 2009, operators filing RNAV 2 routes (Q and T), RNAV 1 STARs, and RNAV 1 DP's will need to perform a RAIM prediction as part of their preflight planning.

(Performance Based Flight Systems Branch, 7/22/09)

- Future work
 - **Assessing vulnerabilities and single-threaded dependency on GPS, both in system architecture and in Air Traffic Proficiency**
 - **Developing Integrated Navigation & Surveillance Backup Strategies in the Mid-Term will be key**



Closely Spaced High-level Objective

