Implementing NextGen
Next Generation Air Transportation System

Presented By: Cheryl Souders
Date: November 2008

Federal Aviation Administration
The Need for NextGen...Growing Demand

**Operations**

- **Tower Operations:**
  - 2007: 61.1M
  - 2025: 84.0M

- **En Route Operations:**
  - 2007: 46.8M
  - 2025: 78.0M

**General Aviation**

- **General Aviation Aircraft:**
  - 2007: 225,007
  - 2025: 286,500

**Commercial Aviation**

- **Commercial Aircraft:**
  - 2007: 7,816
  - 2025: 12,202

*FAA 2008-2025 Forecast*
Our National Airspace System in the Air

Peak aircraft traffic over the US

Implementing NextGen
November 2008
NextGen: Improving Service Delivery

Today’s NAS

- Ground-based Navigation and Surveillance
- Air Traffic Control Communications By Voice
-Disconnected Information Systems
- Air Traffic “Control”
- Fragmented Weather Forecasting
- Airport Operations Limited By Visibility Conditions
- Forensic Safety Systems

NextGen

- Satellite-based Navigation and Surveillance
- Clearance Trajectories and Routine Information Sent Digitally
- Information More Readily Accessible
- Air Traffic “Management”
- Forecasts Embedded into Decisions
- Operations Continue Into Lower Visibility Conditions
- 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
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

Roadmap

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
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 23-30%, which leads to as many as 10 additional departures per hour. Delta has estimated $234M savings annually at that location.
- Introduced 14 published routes and procedures.
- Accelerated implementation at four high priority airports (Dallas F-L, Winst, Chicago O’Hare, Houston, 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.

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 - 90% fit for Route centers.
- Interface Traffic Flow Management - Nationalization (TFM-6).
- Airspace Redesign - Chicago.
- Airspace Redesign - New York/New Jersey.
- Airspace Redesign - Houston.
- Adaptive Composition Tool for the Airspace Flow Program (AFTP).
- Advanced Technologies and Operations Practices (ATOP) for the West Atlantic Route System, the Atlantic portion of Miami-Cancun, and the San Juan Flight Information Region.

New York Initiatives. The FAA established 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 revisions aimed at reducing delays here.
- Due to the New York initiative, FAA reduced the STAP intersection.

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 operational awareness for all operators as well as lead to increased surface movement efficiencies.
- New Center Taxiway at Los Angeles completing the airport’s southfield 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.

Optimized Profile Descent (OPD). These arrivals also known as Continuous Descent Approaches (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 locations in an effort to reduce noise and emissions, as well as increased fuel efficiency (estimated to be 10-20% annually if implemented nationwide).
- Implemented one Standard Terminal Arrival Procedure (STARP) at Los Angeles that accommodates OPD (used by 25% of LAX traffic). Expected to implement two more STAPs in July 2008 that will increase OPD availability to 30% of LAX traffic.
- Designed one STAR OPD procedure for San Diego, expected to be published in November 2008, that will be available to 10% of the traffic.
- RNAV STAR procedures designed for OPD are available at six OGP airports.

- Simultaneous Visual Approaches to Runway 4R at Newark.
- Enhanced procedures for Caribbean arrivals.
- New procedures to allow arrivals to Runway 25, while landing Runway 4R at Newark.
- Simultaneous Approaches to Runways 31L/R at JFK.
- Accessing 3140149 from ELOV intersection.

Improved ILS Runway Visual Range (RVR) Landing Capabilities. Due to advances in aircraft equipage and improvements in ATC ground system performance, the FAA was able to safely reduce visibility requirements, enhancing capacity and reducing the number of traffic diversions.
- Relaxed the required approach RVR from 2000 to 1800 feet for properly equipped aircraft (717 approaches at 93 airports).
- Authorized Category (CAT) II approach minimums to runways with CAT I ILS that meet CAT II ILS performance criteria for properly equipped aircraft (these complete in 2007).
- Redefine the minimum RVR required for takeoff on runways with hazy conditions, extended from 1600 to 1600 feet at 317 runways at 99 airports.
- Harmonized RNAV takeoff minimums with European Joint Aviation Authority standards, reducing the RVR minimums required for takeoff from 600 to 360 feet.
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

Initiate Trajectory Based Operations

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June 04, 2008
Automatic Dependent Surveillance Broadcast (ADS-B)

- **Automatic**
  - Periodically transmits information with no pilot or operator input required
- **Dependent**
  - Position and velocity vector are derived from the Global Positioning System (GPS)
- **Surveillance**
  - A method of determining position of aircraft, vehicles, or other asset
- **Broadcast**
  - 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 SWMM)
Data Communications

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 many 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


- Separation reduction - 50 longitudinal miles in Anchorage Oceanic airspace
- Delegated Responsibility for Separation
- Tactical Trajectory Management
- Oceanic In-trail Climb and Descent
- Reduce Horizontal Separation Standards - 3 Miles
- Automation Support for Mixed Environments
- NextGen Oceanic Procedures
- ADS-B in Gulf Of Mexico
- Separation Management
- Initial Conflict Resolution Advisories
- Flexible Entry Times for Oceanic Tracks
- Expanded Conflict Resolution via Data Communication
- Use Aircraft-Provided Intent Data to Improve Conflict Resolution
- Point-in-Space Metering
- Trajectory Management

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

Flexible Airspace Management
- Increase Capacity and Efficiency Using RNAV and RNP
- Capacity Management

Flexible Airspace Management
- Provide Interactive Flight Planning from Anywhere
- Flight and State Data Management

Implementing NextGen
November 2008
Increase Flexibility in the Terminal Environment

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Key:
- Green triangle: Near-Term Commitment
- Purple: Mid-Term Capability
- Blue: Far-Term Capability

All OEP milestones contingent on pending budget decisions.
Increase Arrivals/Departures at High Density Airports

**Key**: Near-Term Commitment, Mid-Term Capability 2012-2018, Far-Term Capability (Initial Operating Capability targeted within the box)

**Capacity Management**
- HAATS
- Chicago Airspace
- NY/NJ/PHL Metro Area Airspace
- Northern California 3 Tier Airspace

**Separation Management**
- Delegated Responsibility for Horizontal Separation
- Improved Operations to Closely Spaced Parallel Runways
- CAVS at Louisville
- Implement ASDE-X

**Trajectory Management**
- Wake Vortex Incorporated into Flow
- Time Based Metering Using RNAV and RNP Route Assignments
- Optimize Runway Assignments
- Use Data Messaging To Provide Flow and Taxi Assignments
- Full Surface Traffic Management with Conformance Monitoring
- Use Aircraft-Provided Intent Data to Improve Flow and Conflict Resolution

**Integrated Arrival/Departure Airspace Management**
- Implement En Route Time Based Metering Procedures

**Initial Surface Traffic Management**
- Time Based Metering Using RNAV and RNP Route Assignments
- Optimize Runway Assignments
- Use Data Messaging To Provide Flow and Taxi Assignments
- Full Surface Traffic Management with Conformance Monitoring
- Use Aircraft-Provided Intent Data to Improve Flow and Conflict Resolution

**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
Improve Collaborative Air Traffic Management

**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

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- Airspace Flow Program
- Integrated Surface Data
- Reroute Impact Assessment & Resolution
- Execution of Flow Strategies
- Continuous Flight Day Evaluation
- Traffic Management Initiatives with Flight Specific Trajectories
- Full Collaborative Decision Making
- On-Demand NAS Information
- Provide Full Flight Plan Constraint Evaluation with Feedback
- Trajectory Flight Data Management
- Manage Airspace to Flow
- Manage Airspace as Trajectories
- Capacity Management
- Flow Contingency Management

Improved Management of Airspace for Special Use

Federal Aviation Administration
November 2008
## Reduce Weather Impact

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### Trajectory-Based Weather Impact Evaluation

- **Complete ITWS Deployment**
- **Trajectory Management**

### Full Operational Weather Capability

- **Flow Contingency Management**

### Near-real time dissemination of weather information to all ground and air users

- **Turbulence and Icing Available on Meteorological Data Collection and Reporting System (MDCRS)**

### 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**

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**Implementing NextGen**

November 2008

**Federal Aviation Administration**
Safety

Key:
- Green triangle: Near-Term Commitment
- Purple line: Mid-Term Capability 2012-2018
- Blue line: Far-Term Capability
  (Initial Operating Capability targeted within the box)
- Yellow box: All OEP milestones contingent on pending budget decisions

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

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Environment

Integrated Models Assess Trade-Offs Between Environment and Capacity

Establish Metrics and Formulate Policy

Explore Environmental Control Algorithms for Operational Procedures

Establish the Impacts of New Aircraft Technologies and Alternative Fuels

Key:
- Green triangle: Near-Term Commitment
- Purple line: Mid-Term Capability 2012-2018
- White line: Far-Term Capability (Initial Operating Capability targeted within the box)
- Yellow box: All OEP milestones contingent on pending budget decisions

National EMS Supports Integrated Environmental Performance

NGATS Operational Initiatives Implemented that Reduce Environmental Impacts
# Security

### Operational Security Capability for Threat Detection and Tracking, NAS Impact Analysis and Risk-Based Assessment

- **Key:**
  - Green triangle: Near-Term Commitment
  - Purple rectangle: Mid-Term Capability 2012-2018
  - Light blue rectangle: Far-Term Capability (Initial Operating Capability targeted within the box)
  - Yellow rectangle: Full OEP milestones contingent on pending budget decisions

### 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

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Transform Facilities

Integration, Development and Operations Analysis Capability

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

NextGen Facilities

Net-Centric Virtual Facility

NAS Wide Sector Demand Prediction and Resource Planning
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