NextGen Weather
NextGen Weather Overview

- Background
- Assumptions
- Key themes
- Policy/Research
- Status
NextGen Scope

Next Generation Air Transportation System (NextGen)

- Aircraft Trajectory Based Operations
- Performance-Based Services
- Air Navigation Operations and Support
- Flight Operations and Support
- Global Harmonization

- DOT
- FAA
- DOD
- BHS
- DOC
- NASA
- OSFP
- Industry & Community
- NATS Institute

- ICAO

- Local/State Community
- Equivalent Visual Operations
- Policy & Regulations

- Flight Planning
- Flight Data
- Aeronautical Information
- Layered Adaptive Security
- Surveillance

- Airport Operations and Support

- Geospatial Information
- Position, Navigation, and Timing
- Communication
- Safety
- Weather

- Enterprise Services

- Performance Metrics

Net Centric Infrastructure Services

Network-Enabled Information Access

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NextGen Goals

NextGen Weather Supports

- Trajectory Based Operations
- Collaborative Air Traffic Management
- High Density Departure/Arrival Operations
- Equivalent Visual Operations
- Performance Based Services
NextGen Plan

**“What”**
The NextGen transformed state will be
- Narrative
- System Documentation

**“Who, When and How”**
The NextGen capabilities will be researched, developed and implemented

**“Why”**
The NextGen investments make sense

<table>
<thead>
<tr>
<th>June 2007</th>
<th>Enterprise Architecture</th>
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<td>July 2007</td>
<td>Integrated Work Plan</td>
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<td>Sept 2007</td>
<td>OMB Business Case Exhibit 300</td>
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NextGen Weather

- Weather significantly impacts the national airspace system
- NextGen goals are not achievable without improving integration of weather information into decision support systems
- NextGen weather vision (a major paradigm shift) is focused on:
  - Providing a multiple user common weather picture
  - Consistent and reliable weather information
  - An improved weather information data storage approach containing observation and forecast data (i.e., the “4 Dimension* Weather Cube”) enabling NextGen dissemination capabilities
  - Leveraging JPDO agency 4D Weather Cube capabilities from:
    - NOAA
    - DOD
    - FAA
- Weather Working Group has made significant progress

* 4 dimensions are 3D space and time
## Today/NextGen Weather Information Attributes

### Today
- Not integrated into aviation decision support systems (DSS)
- Inconsistent/conflicting on a national scale
- Low temporal resolution (for aviation decision making purposes)
- Disseminated in minutes
- Updated by schedule
- Fixed product formats (graphic or text)

### NextGen (new requirements)
- Totally integrated into DSS
- Nationally consistent
- High temporal resolution
- Disseminated in seconds
- Updated by events
- Flexible formats
NextGen Weather
Key Themes

• An integrated and nationally consistent weather common operational picture for observational and forecast data is available to all system users
  – NextGen operational systems are supported by a “single authoritative source”
  – Weather common operational picture fully utilizes envisioned NEO capabilities
    • Data Latency (seconds)
    • Data Refresh (seconds)
    • Data Sharing Standards/Protocols
  – Weather information sharing is two-way
  – Unlimited end-user product formats are made possible
NextGen Weather
Key Themes

• NextGen proactively adjusts on multiple strategic and tactical time scales to probabilistic weather information
  – Operational decision making utilizing uncertainty based information
    • Weather-influenced 4D trajectory updates “on the fly”
  – New operational weather paradigms (business models) are required
    • Strategic adjustments to departure/arrival planning
  – Areas (volumes) of weather constrained airspace are reduced
NextGen Weather
Key Themes

- Direct integration of weather information into operational decision making processes
  - Reduced requirement for government provided weather “products”
    - Weather information sets become the government provided product in most cases
    - Opportunity for tailoring of private sector provided products significantly increase
  - Weather information is translated into operational decision options for human/automated systems
  - Standalone Weather “Systems” become obsolete
Benefit/Cost

• Annual benefits of Improved Weather Capability
  – Reduces $1.2 Billion in economic loss due to delay
  – Increased overall system safety

• 4D Cube 10 year implementation costs (early estimates in the hundreds of $M)

• Integration of weather into NextGen decision support systems (2-3 X cost of implementing the cube) over 10 years
NextGen Weather Assumptions

• Network Enabled Operations concept is in place with robust communication capability
• Identified policy issues resolved (discussion later today)
• Agency and industrial based aviation weather research synchronized (discussion later today)
• NextGen transforms the national system with respect to the utilization of weather information
• Technology continues to advance the state of the art in observing and forecasting weather
  – Ability to define uncertainty as important as accuracy
Virtual 4D Weather Cube

Aviation weather information in 3 dimensions (latitude/longitude/height)

Observation

Hazard

Virtual 4D Weather Cube

4th dimension: time

0 – 15 mins

15-60 mins

1 – 24 hrs

Aviation weather information in 3 dimensions (latitude/longitude/height)
# NextGen Implementation Status

## Funded Commitments

<table>
<thead>
<tr>
<th>FY07</th>
<th>FY08</th>
<th>FY09</th>
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<tr>
<td><strong>ADS-B</strong> - Implement 1st segment of advanced surveillance &amp; broadcast services to deliver en-route, terminal, &amp; surface surveillance data from key sites via broadcast comm. link</td>
<td><strong>SWIM</strong> - Implement 1st set of data exchange services using net-centric technology and architecture to support increase shared situational awareness</td>
<td><strong>NNEW</strong> – Demonstrate inter-agency Wx Dissemination Mgmt capabilities to Integrate effective Wx info into Operational decision-making</td>
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<td><strong>DataComm</strong> – Develop architecture to transform from a voice-only comm. to an air-ground data comm. capability</td>
<td><strong>Demos &amp; Infrastructure</strong> - Perform formal demos that advance R&amp;D, operational concepts and key infrastructure</td>
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## Mid-Term Capabilities 2012 - 2018

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

## NASA programs 2019-2025

- Aviation Safety
- Airspace Systems
- Fundamental Aeronautics
BACKUP Charts
Recommended Action

- JPDO Weather Working Group proposes a study team be created for a period of six months, made up of JPDO agency SME’s (those involved in agency 4D cube efforts), with the following deliverables due Jan 1, 2008 to support a Spring 2008 SPC decision on implementation:
  
  - A set of common NextGen 4D Cube functional requirements [defined for short (2012), mid (2015), and long (2018+) time frames] -- 2012 requirements highest team priority
  
  - Document containing higher-level 4D Cube definition (including cost/schedule/performance information) than proposed for the initial baseline of the JPDO Integrated Work Plan
  
  - Working jointly with the JPDO System Evaluations and Analysis Division, deliver improved cost-benefit analyses
Inter-agency Policy Opportunities

• Three early inter-agency opportunities identified during the planning process
  – Interagency Net Enabled Information Sharing
  – National Safety Management System
  – NextGen Net Enabled Weather

• Common attributes
  – Critical to NextGen
  – Cross-agency impact (cost and benefit)
  – No single agency has within its mission the integration role among all impacted groups
  – Requirements must be brought together to mature the Integrated Work Plan and Enterprise Architecture
Problem Statement: Why a National Aviation Information Sharing Agreement?

• Net Centric Operations (NEO) & Information Sharing (NEIS) are at the core of the NextGen vision for NAS transformation

• NextGen IWP Linkages: Net-enabled information sharing is a key enabler to NextGen’s envisioned core capabilities, including:
  – 4-D Trajectory Management
  – Integrated Weather and Safety systems;
  – Integrated surveillance;
  – Curb-to-curb system security;
  – Dynamic airspace management

• Considerable investment already exists among JPDO Partner Agencies in information technology and net-centric operations:
  – DoD – GiG
  – FAA – SWIM
  – DHS – One-Net

• Opportunity exists now, with appropriate Partner Agency direction, to synchronize key efforts in the areas of data interoperability and compatible network-to-network interface mechanisms