2025 Concept for “Airport Curb-to-Airport Curb”

- System-Wide Transformation
- Network-Enabled Information Access
- Performance-Based Services
- Weather Assimilated into Decisions
- Layered, Adaptive Security
- Broad-Area Precision Navigation
- Aircraft Trajectory-Based Operations
- “Equivalent Visual” Operations
- “Super Density” Operations
**Capability:**

**Network-Enabled Information Access**

*Global secure access, information handled according to “communities of interest”*

- **“Shared Situation Awareness”**
  - Real-time free-flow of info from private, commercial, & government sources
  - Push/pull processes, secured according to needs and priorities
  - Common awareness of day-to-day ops, events, crises

- Aircraft are additional “nodes” in network

- Integrated surveillance system across government
NGATS Information Sharing

2025 Assumptions
- Sufficient bandwidth exists
- Sufficient infrastructure
- Total Security Integration
- Broad-Area Precision navigation
- Tailored, secured according to needs of users
- “Push/Pull” information sharing via NEO
**Capability: Performance-Based Services**

*Service levels designed to capability performance*

- **Multiple service levels aligned with specified user performance thresholds**
  - Provides choice to users depending on needs
  - Required Communication, Navigation and Surveillance performance
  - Other categories of performance -- environment, security, etc

- **Services flexible to varying situations/needs**
  - Varies from area to area, in terms of airspace and “air portal” surfaces
  - Varies with time as needs dictate
  - Preference established based on user capability/equipage/training/security etc.

- **Performance levels used to analyze risks (safety, security, environment, etc)**

- **Service guarantees let users align performance with needs**
  - Developed cooperatively by service providers and their users
Capability: Weather Assimilated into Decisions

Common weather picture across NGATS

- Fuse multiple weather observations and forecasts into single national database, dynamically update as needed
  - 1000’s of sensors (airborne & ground) feed 10’s of forecast models
- Learning automation accounts for weather and its uncertainties in managing aircraft trajectories
- Identify hazardous weather real-time
- Assimilated into NGATS “decision loops”
  - Total integration via machine-to-machine
  - Critical decision system time scales using both probabilistic and deterministic weather info
  - Optimized to maximize available weather-favorable airspace
  - Terminal weather impacts including ground/ramp ops
Capability: Layered, Adaptive Security

Move people/goods expeditiously from “curb-to-curb” while enhancing security

- Adaptive Security for People, Cargo, Airports and Aircraft
- Risk Assessment-Driven Evaluation and Response
- Positive Identification for People and Cargo
- Preventive Threat Detection and Mitigation
**Capability: Broad-Area Precision Navigation**

*Large area precision enables flexibility*

- **Navigation performance sufficient to enable precision approaches (CAT-I/II/III)**
  - Minimal/zero ground-based aids at any “air portal”
  - CAT-II without local augmentation, CAT-III with low-cost local augmentation
  - “Air portal”-specific, vice runway-specific

- **Broad-Area to Global Availability of Nav Services**
  - Meeting appropriate requirements for accuracy, integrity and continuity

- **Reduction/elimination of legacy systems & procedures**
Capability: Aircraft Trajectory-Based Operations

Adjust airspace configuration to meet user needs

- Airspace configuration driven by: User needs, DoD/DHS requirements, safety, environment, overall efficiency
- 4D trajectories are basis for planning and execution
- Machine-based trajectory analysis and separation assurance
- Users “contract” for airspace access and service
- Airspace reconfigurable during day of operations
Aircraft Trajectory-Based Operations: Management-by-Trajectory

Key Issues are functional allocation between:
- Automation and humans
- Aircraft operators and service provider
Aircraft Trajectory-Based Operations: National Dynamic Airspace

• Freedom from static geospatial constraints
• Allocate airspace as a resource to meet “demand”
  – Temporal implementation of high-density, high demand corridors, etc
  – Creates options for service provider operations
• Single mechanism for implementing Special Use Airspace, TFR’s, etc
  – Maximizes airspace access to all
  – Defense and Homeland Security needs prioritized
“Evaluator”

- Integrates/communicates weather, security, defense, environmental, safety & other information
- Users “post”/update desired 4D trajectories in common system that continuously evaluates mutual compatibility
- Predicts potential “over demand” situations
- Works across all time horizons from days/weeks/months prior to flight up to separation management (20 minutes or less)
- Supports distributed decision-making environment where players have clear, agreed-to roles and rules of engagement
**Capability: “Equivalent Visual” Operations**

*Increasing capacity from today’s non-visual conditions*

- Aircraft perform "*equivalent visual*" operations in non-visual conditions (achieve “VFR capacity” under these conditions)

- ATM provider delegates “*maintain separation*” responsibility to aircraft operators
  - Requires timely, high fidelity information on nearby aircraft, weather, etc

- **System-wide availability** at all “air portals”
  - With appropriately capable “landside” (including security)

- **More predictable operations** at busy airports
Capability: “Super Density” Operations

Peak performance for the busiest airports

- Maximized runway capacity
  - Reduced arrival/departure spacing
  - Equivalent Visual capability
  - Predictable detection/integration of wake vortex hazards

- Reduce Runway Occupancy Time
  - Aircraft energy management during rollout coupled with optimum turnoff selection
  - Situational awareness of “nearby” surface traffic and intent for high-speed turnoff

- Simultaneous operations on single runway
  - Multiple aircraft operate on a single runway when sufficient “separation” exists
  - High-update rate surveillance info available to all aircraft

- Airport “landside” (including security) sized accordingly
## Capability Migration Roadmap

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<td>Federal sharing standards</td>
<td>Surveillance network</td>
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<td>Third-party tools</td>
<td>Net-Enabled Info Access</td>
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<td>Proactive risk-based safety</td>
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<td>Common weather picture</td>
<td>Probabilistic weather tools</td>
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<td>Primary means satellite navigation</td>
<td>Precision approaches to all air portals</td>
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<td>Broad-Area Precision Nav</td>
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<td>Time-based metering</td>
<td>Initial air/ground traj automation</td>
<td>Dynamic airspace design</td>
<td>4D contracts for airspace</td>
<td>Delegated separation</td>
<td>Aircraft Trajectory-Based Operations</td>
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<td>Equivalent Visual Operations</td>
<td>Expanded airport network</td>
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<td>Modified landside flow</td>
<td>Reduced separation stds</td>
<td>Multiple aircraft per runway</td>
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**Weather Assimilated into Decisions**

**Broad-Area Precision Nav**

**Aircraft Trajectory-Based Operations**

**“Super Density” Operations**
<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
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<td>Non-ground based nodes for data exchange</td>
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<td>Timely &amp; accurate probabilistic WX info for improved decision making</td>
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<td>Wake vortex info-based dynamic Separation minimization</td>
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| Network-Enabled Information Access | • Policy changes and standards adoption  
• Research technology alternatives, explore COTS  
• Non-ground based info sharing constellation |
| Performance-Based Services         | • Continue current RNP activities  
• R&D to complete definition of RTSP, aligned service levels, potential preference framework |
| Layered, Adaptive Security         | • Adaptive Security Envelopes, positive people & cargo ID  
• Improved threat detection, aircraft & facility hardening |
| Weather Assimilated Into Decisions | • Modify current weather models to produce common formatted output  
• Synchronize common weather information network development efforts |
| Broad-Area Precision Navigation    | • Engage GPS JPO around Block III requirements  
• Research requirements and system alternatives |
| Aircraft Trajectory-Based Operations| • Modernization activities (Time-Based Metering, ERAM, Common 4D Geospatial Information, Airspace design toolset for ERAM, etc)  
• Research “design issues” and requirements |
| “Equivalent Visual” Operations     | • Initiate ADS-B implementation  
• Research leading to Wake Vortex prediction |
| “Super Density” Operations         | • No major activities required in FY06-07 |

NGATS 2025: Initial Needed Activities

23-Jun-05

Version 4.3 - JPDO Working Document
System-Wide Transformation Requires Innovation Across All Lines of Development
Airborne Information Web

- Broad-area broadband
- Data & Voice
- Surveillance
- Secured
- Responsive
- User-tailored

Broadband communications over 1000 times as fast as standard 64K satellite service, operating at a small fraction of the cost.

Range: 300 Miles at 30,000 ft
45 Mbps

• Broad-area broadband
• Data & Voice
• Surveillance
• Secured
• Responsive
• User-tailored

4D Trajectory Mgt

Surveillance, Security & Defense Assessments

Wake Vortex knowledge

Curb-to-Curb ATM

45 Mbps
Layered, Adaptive Security: Secure People and Cargo

- Adaptive Security Envelopes
  - Passengers, crew & employees
  - Secure Passenger Programs
  - Known and Unknown Shipper Processes

- Positive Identification
  - Check Points
  - Credentialing
  - Cargo Integrity

- Detect Threats
  - No-Impact Screening
  - Checked Bags
  - Cargo Screening
Layered, Adaptive Security: Secure Airports & Aircraft

- **Facility Hardening**
  - Airport Access
  - Facility Surveillance
  - Perimeter Awareness
  - Airport Design

- **Aircraft Hardening**
  - Internal and External
  - Cabin/Cargo Chem/Bio, Rad/Nuc Sensors
  - Cabin/Cargo Surveillance

- **Mitigate Effects**
  - USNORTHCOM
  - Trained Cabin Attendants
  - Federal Air Marshals
  - Federal Flight Deck Officers
  - MANPAD Mitigation
Net-Centric Operations

“It’s about the Users”

From
- Info supplier dominated
- Owner pushes controlled info
- Sequential info flow

Gather, Process, Use, Disseminate

To
- User (consumer) dominates
- Owner posts info for appropriate classes of users
- Parallel information flow

Gather, Post, Process, Use

Net Centricity Payoffs
- Faster Decision Making
- Increased Collaboration
- Better Decisions based on access to more information