

The Role of ADS-B in NGATS

Presentation to ADS-B Industry Day

June 19, 2006



NGATS Evolution

ATM Research

FY05 & Earlier

- 4DT & “Flight Object”
- Space Based NAV
- RNP/RNAV
- ADS-B/CDTI
- Decision Support Tools

FY06 – FY11

- 4DT Management
- RTSP & Levels of Service
- Equivalent Visual Ops (CDTI)
- Roles of Pilots & Controllers

FY12 – FY17

- Safety Case for Super Density Operations
- 4DT on Surface
- Right Sizing of Facilities

FY18 & Later

- Research for Beyond NGATS

Building NGATS

Establish NGATS Infrastructure

Segments: 0, 1, & 2

Develop: 06-11

Implement: 08-13

- Deploy NGATS Infrastructure
 - ATM (ADS-B, DL, RNP), NEO, Wx, Security
- Policy: Establish aircraft equipage rules
 - NAS wide (ADS-B “OUT”, NAV)
 - Airspace/Route access based on RTSP (CDTI, DL, Lower RNP)
- Establish and implement Safety Management System and Integrated Environmental Management
- Commercial fleet equips for NGATS
- Capacity benefits realized by those equipped and the system

Primary NGATS Operations

Segments: 3, 4, & 5

Develop: 12-17

Implement: 14-19

- Equipage of all aircraft completed for NGATS
- Airspace/Route access and Level of Service based on RTSP
- Most of NGATS capacity gains realized
 - 4DT Management (Runway-to-Runway)
 - VMC rates achieved in IMC
 - Delegation to flight deck for self-separation, merging, and passing

NGATS Super Density Operations

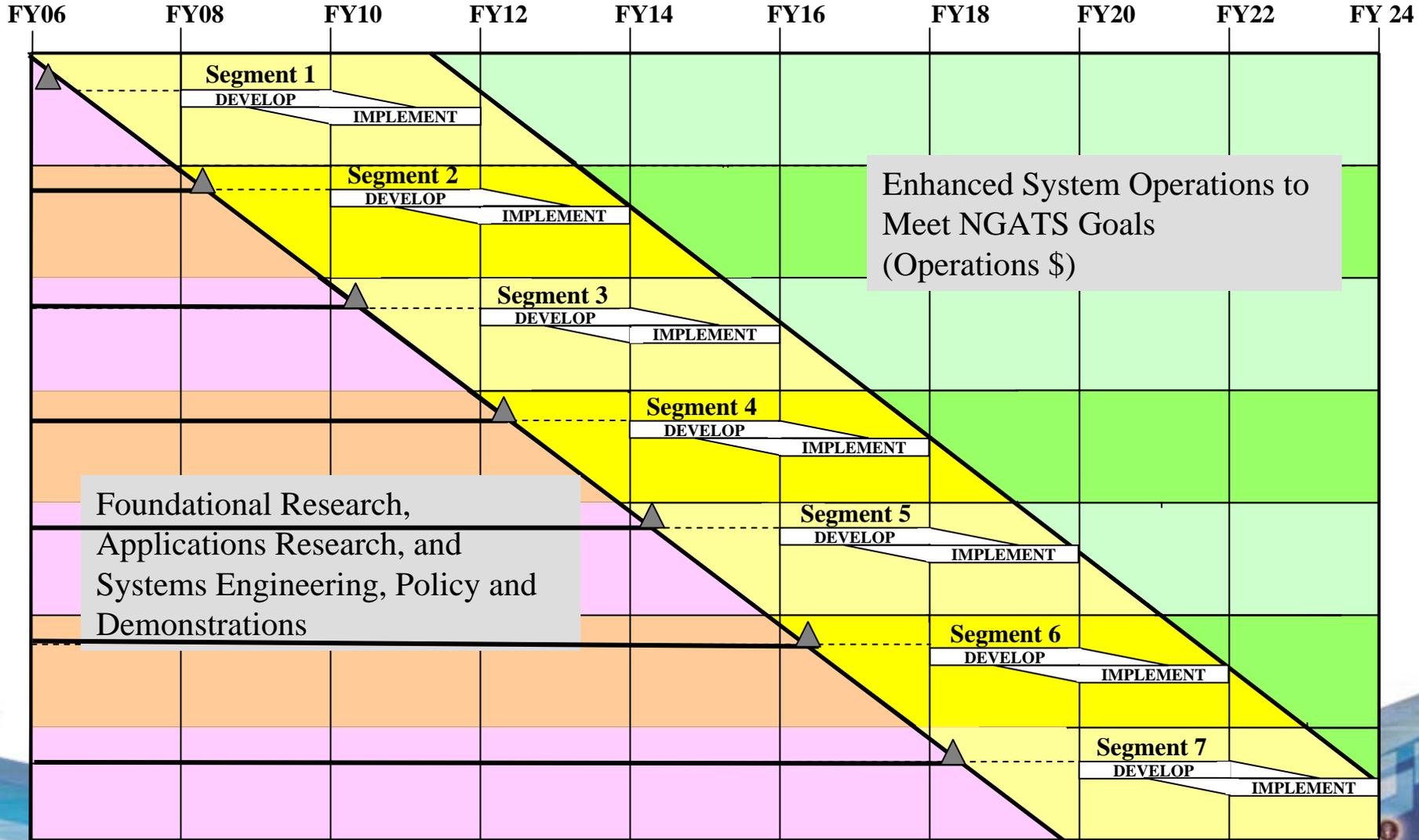
Segments: 6 & 7

Develop: 18-21

Implement: 20-23

- Airports network expanded
- Capacities of congested airports further increased
 - 4DT Management (Gate-to-Gate)
 - Reduced Runway Lateral Spacing
- Complete reduction of facilities and NAV & surveillance infrastructure

Transition to NGATS



Enhanced System Operations to Meet NGATS Goals (Operations \$)

Foundational Research, Applications Research, and Systems Engineering, Policy and Demonstrations

NGATS Operational Improvements and Benefits

1. Broad Area and Precision Navigation ► Access and capacity
2. Airspace Access and Management ► Capacity
3. 4D Trajectory Based ATM ► Capacity and efficiency
4. Reduced Separation between Aircraft ► Capacity
5. Flight Deck Situational Awareness and Delegation ► Capacity and safety
6. ATM Decision Support ► Capacity
7. Improved Weather Data and Dissemination ► Capacity and safety
8. Reduced Cost to Deliver ATM services ► Cost
9. Greatly Expanded Airport Network and Improved Terminals ► Capacity
10. Layered, Adaptive Security ► Security
11. Integrated Environmental Management ► Environment



Broad Area and Precision Navigation

Segment	Operational Improvement
1	<ul style="list-style-type: none"> ● RNAV is made available for general aviation by certifying portable GPS/WAAS units for VFR use
2	<ul style="list-style-type: none"> ● RNP routes are available to/from all runways at OEP airports
3	<ul style="list-style-type: none"> ● CAT I/II approaches are available at all runway ends throughout the NAS without ground augmentation ● Area navigation routes with lower RNP are available NAS-wide
5	<ul style="list-style-type: none"> ● RNP routes are available to/from all runways at top 100 airports ● CAT III approaches are available where needed, with augmentation
6	<ul style="list-style-type: none"> ● RNP routes are available to/from all desired airports



Airspace Access and Management

Segment	Operational Improvement
1	<ul style="list-style-type: none"> ● RTSP serves as the basis for airspace and route access and level of service ● General aviation corridors are established in Class B airspace to ensure efficient and safe movement of aircraft
2	<ul style="list-style-type: none"> ● Systems and airspace policies are in place that increase civilian access to SUA and flow restricted airspace
4	<ul style="list-style-type: none"> ● Arrival/departure terminal airspace boundaries in large metro-area are dynamically configured to meet flow requirements
5	<ul style="list-style-type: none"> ● Air-ground data communication (addressable and broadcast) is used to support improved access to SUA and flow restricted airspace ● All airspace is dynamically configured to meet flow requirements



4D Trajectory Management

Segment	Operational Improvement
1	<ul style="list-style-type: none"> • Flight planning is based on 4D trajectories for commercial aircraft that fly in high altitude airspace • Trajectories are available with variable separation to accommodate special classes of aircraft (e.g., UAS, A380)
2	<ul style="list-style-type: none"> • Flight planning is based on 4D trajectories for all aircraft that fly in high altitude airspace
3	<ul style="list-style-type: none"> • All aircraft in high altitude airspace are managed by 4D trajectories, with trajectories exchanged via data communications
4	<ul style="list-style-type: none"> • Management by 4D trajectories is expanded to additional airspace, with trajectories exchanged via data communications
5	<ul style="list-style-type: none"> • All aircraft departing from or arriving at OEP airports file 4D runway-to-runway trajectories • Trajectory management is enhanced by auto negotiation with properly equipped aircraft
6	<ul style="list-style-type: none"> • All aircraft departing from or arriving at OEP airports will file 4D gate-to-gate trajectories



Reduced Separation between Aircraft

Segment	Operational Improvement
1	<ul style="list-style-type: none"> • 3-mile and 5-mile separation procedures are applied to new airspace based on RSP • RSP standards are established for surface operations (control off glass)
2	<ul style="list-style-type: none"> • Oceanic longitudinal and lateral spacing is reduced to 15 X 15 nm by use of RNP, ADS and data communications
3	<ul style="list-style-type: none"> • Lateral separation requirements are reduced for converging and parallel runway operations based on use of RTSP, CDTI and ADS-B
4	<ul style="list-style-type: none"> • Procedures based on RTSP for less than 3 mile separation are implemented • Longitudinal arrival and departure spacing are dynamically adjusted at OEP airports, based on ground-based wake vortex detection and prediction
5	<ul style="list-style-type: none"> • 5 mile separation procedures are used in some oceanic airspace via enhanced CNS and CDTI (lower RTSP) • Multiple runway occupancy procedures for single runway arrivals are available at all OEP airports
6	<ul style="list-style-type: none"> • Reduced arrival spacing (with altitude offset) is allowed for very closely spaced parallel runways at OEP airports • Multiple runway occupancy procedures for single runway departures are available at all OEP airports
7	<ul style="list-style-type: none"> • Reduced arrival spacing (co-altitude) is allowed for very closely spaced parallel runways at appropriate OEP airports



Flight Deck Situational Awareness and Delegation

Segment	Operational Improvement
1	<ul style="list-style-type: none"> ● Oceanic pair-wise maneuvers (in-trail climbs, descents and passing maneuvers) are enabled through the use of ADS-B, CDTI and satellite-based communications ● Increased use of visual approaches is supported by ADS-B and CDTI-aided visual separation (CAVS) ● Self-spacing at near VFR levels on single runway approaches is enabled by CDTI, ADS-B ● Departures rates in reduced visibility/ceilings are increased by use of ADS-B and CAVS
2	<ul style="list-style-type: none"> ● Self spacing, merging and passing in en route airspace is allowed under certain conditions in certain airspace via CDTI, ADS-B
3	<ul style="list-style-type: none"> ● Aircraft and ground vehicle movement on the airport surface in low visibility conditions is guided by moving map displays, CDTI, and ADS-B at OEP airports.
5	<ul style="list-style-type: none"> ● Aircraft-to-aircraft separation is delegated to the flight deck in some oceanic airspace via CDTI and improved CNS and oceanic automation ● High density en route corridors (tubes) are in use and are characterized by parallel tracks and delegation of separation responsibility to the flight deck via CDTI and ADS-B ● Self-spacing with CDTI/ADS-B coupled with sequencing automation is in use at non-towered airports ● Aircraft and ground vehicle movement on the airport surface in zero/zero visibility conditions is guided by moving map displays, CDTI, and ADS-B at OEP airports.
6	<ul style="list-style-type: none"> ● Aircraft and ground vehicle movement on the airport surface in low visibility conditions is guided by moving map displays, CDTI, and ADS-B at all desired airports
7	<ul style="list-style-type: none"> ● Aircraft and ground vehicle movement on the airport surface in zero/zero visibility conditions is guided by moving map displays, CDTI, and ADS-B at all desired airports



ATM Decision Support

Segment	Operational Improvement
2	<ul style="list-style-type: none"> • Departure Management incorporates surface traffic information reduces the time to develop and execute Traffic Management Initiatives (TMIs) and increases the predictability of departure times • Probabilistic weather information is incorporated into 4D trajectory flight planning decision support tools
3	<ul style="list-style-type: none"> • Timely and accurate weather information is available to all automated decision support tools • Arrival scheduling and sequencing tools are used to flow aircraft from en route airspace to individual arrival runways at all OEP airports • A Surface Management System is available at all OEP airports that uses automation, ADS-B, CDTI/aircraft moving map displays, and data linked taxi instruction prior to pushback • RTSP-based TMI allow "multiple TMI what-if analysis" and are incorporated into TFM automation
4	<ul style="list-style-type: none"> • Time-based and metered RNP routes are assigned by Decision Support Tools (DSTs) for aircraft arriving/departing at all OEP airports • A Surface Management System is available at all OEP airports that is used to generate data linked taxi instructions prior to final approach • Flight Operations Center (FOC) automation and net-centric data-sharing mechanisms are implemented with service providers to allow flight planning feedback and negotiation mechanism
5	<ul style="list-style-type: none"> • Integrated Arrival/Surface/Departure Manager improves decision making and flow management • Time-based surface traffic management is used at all OEP airports
6	<ul style="list-style-type: none"> • Time-based and metered RNP routes are assigned by DSTs for aircraft arriving/departing at the top 100 airports



Improved Weather Data and Dissemination

Segment	Operational Improvement
1	<ul style="list-style-type: none"> ● Improved and automated upper-air wind and weather observations allow more accurate flight planning ● In-flight icing and turbulence forecasts are improved due to additional data from aircraft-based weather sensors ● New transoceanic weather products (e.g., convection, volcanic ash, in-flight icing, clear air turbulence, and convection-induced turbulence) are available ● Improved airport weather sensors support improved airport operations
2	<ul style="list-style-type: none"> ● A single national weather virtual database ensures a common aviation weather picture. This common picture enables improved NGATS decision making and leads to improved recovery from disruption ● Digital weather information are broadcast to the flight deck via UAT FIS-B
3	<ul style="list-style-type: none"> ● Robust network-centric disseminates weather information to users ● Enhanced Echo Top mosaic and forecast are available that facilitate over-the-top routing ● Improved weather forecasts are provided to minimize the predicted volume of airspace impacted by weather
4	<ul style="list-style-type: none"> ● Runway reconfiguration forecasts are improved through new sensors and improved forecast products ● Advisories, in-flight weather information, and alerts are immediately available to all system users (controller, pilots, airline operation centers, and airport operations managers) via net-centric architecture
5	<ul style="list-style-type: none"> ● A depiction of hazardous weather impacting the NAS is available to all users ● Hazardous weather information and alerts (particularly wind shear and microbursts) are provided to pilots and controllers by an Automatic Hazardous Weather Alert Notification System using voice circuits, ground based transceivers, and air-ground data communication



Reduced Cost to Deliver ATM Services

Segment	Operational Improvement
1	<ul style="list-style-type: none"> • A decision is made regarding backup systems for surveillance and navigation • NDB ground-based navigation aids are shut down
2	<ul style="list-style-type: none"> • NAS-wide transition to ADS-B for air/ground surveillance is completed
3	<ul style="list-style-type: none"> • VOR/DME ground-based navigation network is reduced to minimize sustainment costs and to reduce reliance on terrestrial-based systems
4	<ul style="list-style-type: none"> • Arrival/departure terminal airspace boundaries and sectors in large metro-area are dynamically configured to increase resource efficiency and balance capacity with demand
5	<ul style="list-style-type: none"> • En route airspace is dynamically reconfigured during the day within a facility to increase resource efficiency and balance capacity with demand • Tower functions at all but high capacity airports are remoted (virtual towers) • Terminal facilities are combined and reduced to 30-55 facilities
7	<ul style="list-style-type: none"> • En route and terminal facilities are combined and reduced to 15 ground service delivery facilities • ILS is shut down at all but CAT III approach locations



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For more detail see Operational Improvement Roadmap in the Tech Hanger section of JPDO Website www.jpdo.aero

