

NGATS Block-to-Block CONOPS Overview

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Agenda

- Background
- Concept of Operations
- Independent Assessment
- Stakeholder Review
- Operational Improvement Roadmaps
- Additional Questions



NGATS CONOPS Purpose

- Common view of how the NGATS will operate in the 2025 timeframe,
- Highlight key differences from today's operations,
- Identify key research and policy issues that need to be resolved in achieving national goals for air transportation

... baseline to initiate a dialog with the stakeholder community in order to prioritize and synchronize investments



Background

- **Scope: Block to Block**
 - Air Navigation Service Provider (ANSP) and Flight Operator focus
- **Next Version completes the NGATS story with:**
 - Airports, Security, Safety, Weather and Environment
- **Developed jointly by NGATS Institute and Federal members of IPTS**
- **Single set of concepts - range of advanced operations**
 - Selected for ability to meet the goals in the national plan
 - Selected “most transformational”
 - Concept refinement and evolution through:
 - Stakeholder review, research results, and policy decisions

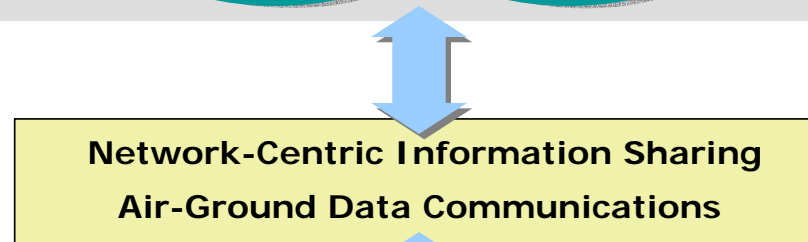
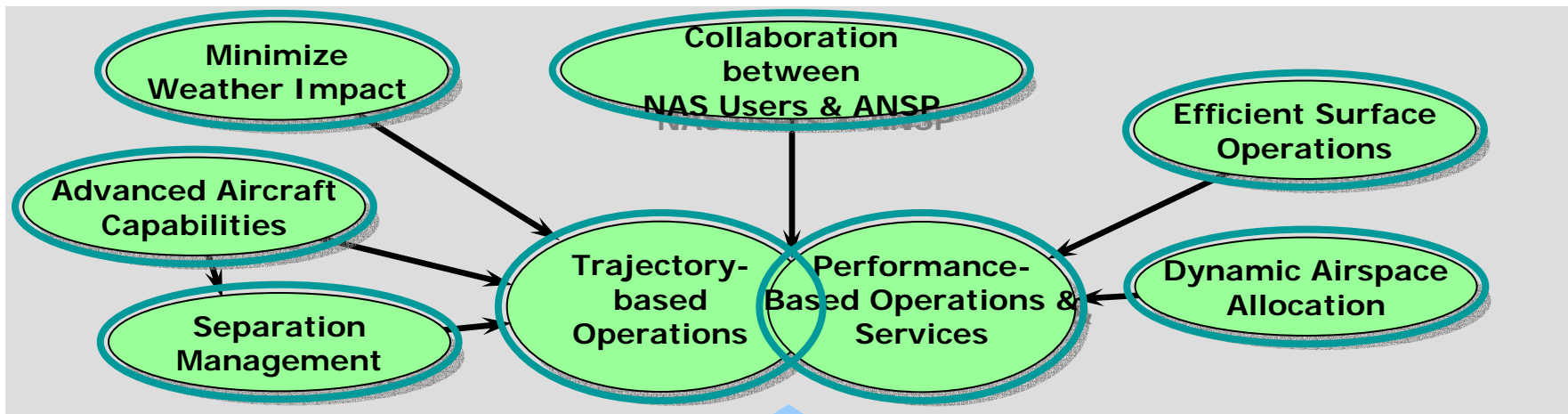


CONOPS “To-Do” Items

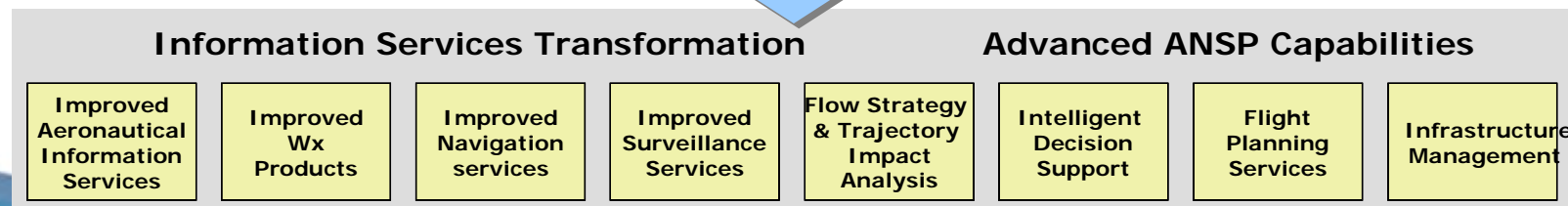
- Synchronize CONOPS with other JPDO products
 - Enterprise Architecture
 - NGATS Business Case
 - Operational Improvement Roadmaps
- Complete the Story
- Add “flight threads” and ANSP Mission Support
- Address Independent Review Comments
 - Discussed later



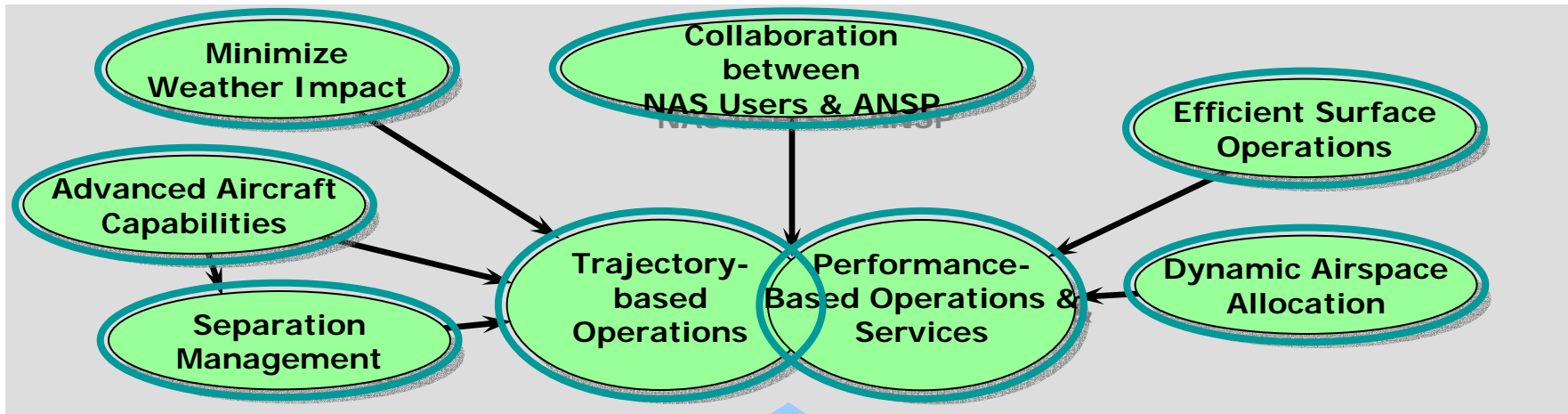
Key Transformational Elements for ATM Operations



Enablers



Key Transformational Elements for ATM Operations



- User meet
- Performance capabilities
- 4DT
- Different performance
- Performance benefits
- New minimums
- Achieving procedures
- Start on private
- Collaborative systems
- Trajectory flow
- Information negative
- Problem integration
- Separation capabilities
- Reduced capacity
- Greater separation
- Allocation of crew for some
- Dynamic performance
- Airspace groups
- Digital operations efficiency
- Cooperation aerodynamic
- Integrated traffic and war
- Eliminate rest equipment
- Surface operations highly integrated with other ATM functions, including depts, arrs, and collaborative traffic management
- Automatic analysis
- Agile algorithms
- Capacity visibility
- Wake management
- A large percentage of aircraft flying in trajectory-based ops airspace can
 - Exchange and execute 4DTs
 - Meet CTAs
 - Achieve RNP-0.3
- Some aircraft have delegated separation capability

Information Services

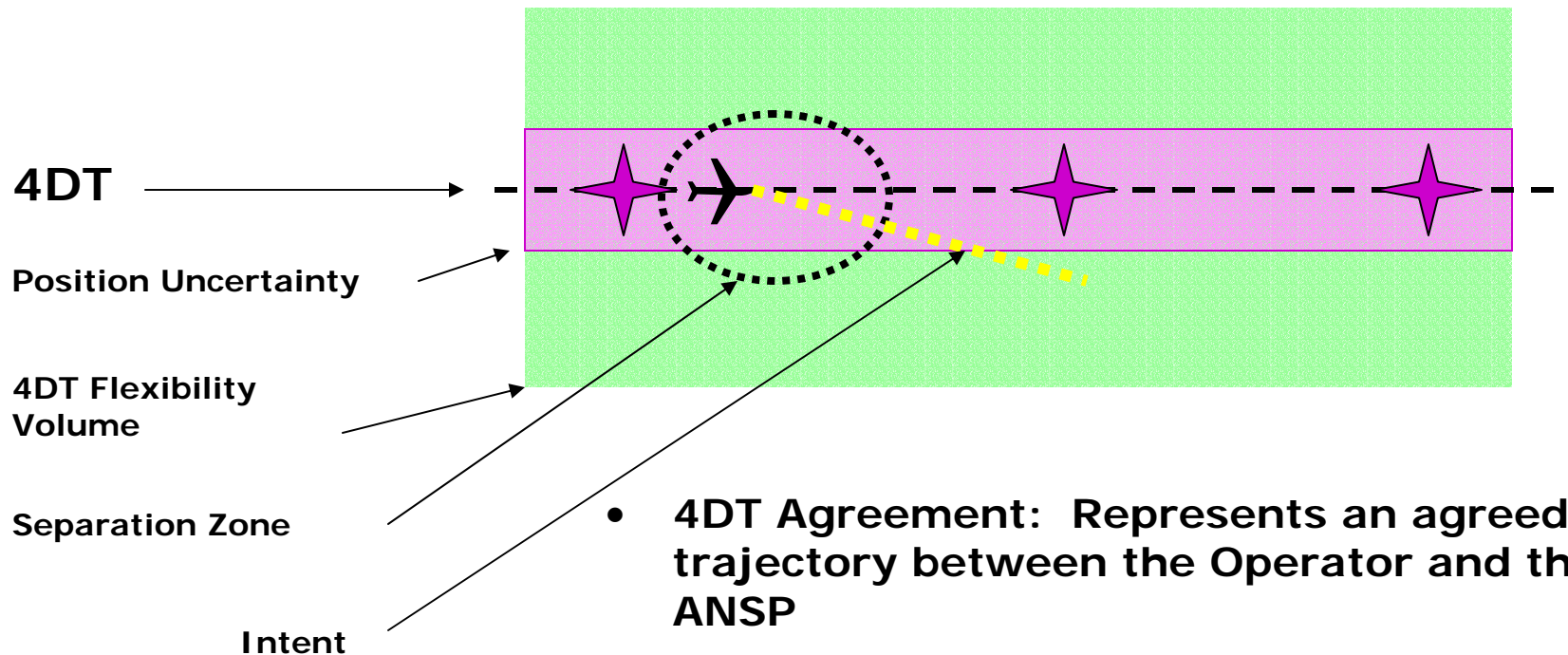
Infrastructure Management

Air Navigation Service Operations

- Major Themes
 - Performance Based Services/Trajectory Based Operations are key mechanisms
 - Enables reduced complexity in increased capacity
 - Enables scaling of NAS to predicted demand
 - ANSP and flight crew become more strategic
 - ANSP manage flows and trajectories
 - decision support tools to provide context-sensitive ATM information
 - automation performs routine tasks
 - Systems monitor separation in most trajectory based operations
 - Flexible Airspace/Operations
 - low demand – low requirements
 - high demand – high requirements
 - Higher performance used to manage capacity when needed



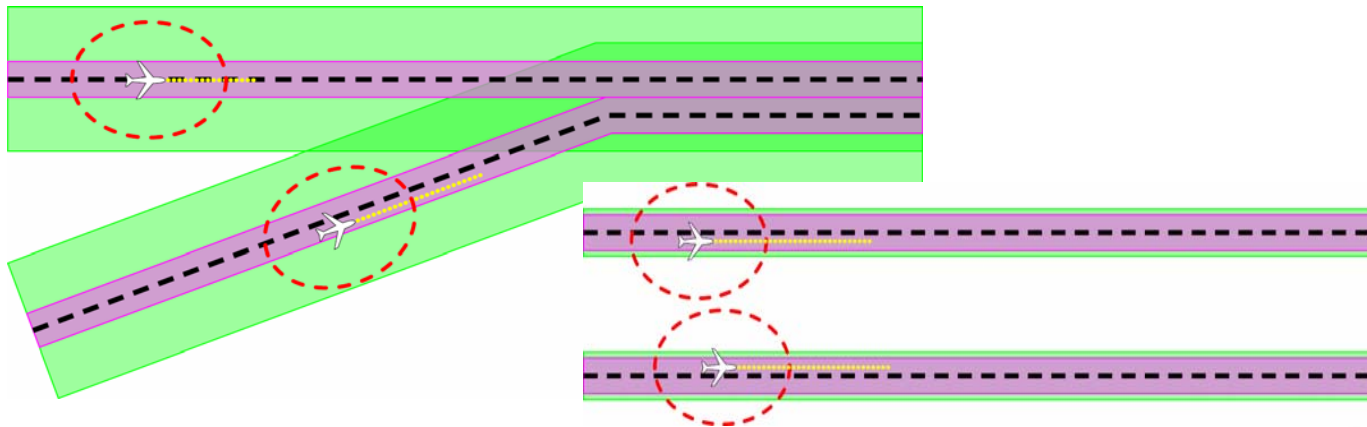
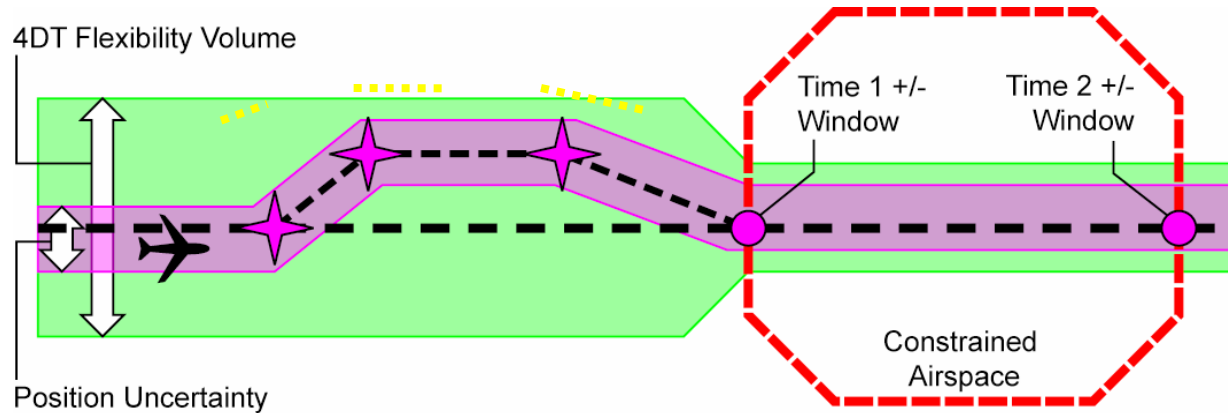
Four Dimensional Trajectory (4DT)



- **4DT Agreement:** Represents an agreed-to trajectory between the Operator and the ANSP
- **4DT Proposal:** Represents a potential change suggested by the Operator or the ANSP



Examples of 4DTs



Trajectory Based Operations

- Major Themes
 - 4 dimensional trajectories (4DT)
 - Used for information exchange, planning, analysis, agreements
 - Controlled Time of Arrive (CTA)
 - Flexible volumes
 - Flexibility to maneuver within volume
 - Used to predict demand
 - Limit impact of self separating a/c in dense airspace
 - Airspace & A/C Trajectory Management
 - Capacity Management (CM)
 - Flow Contingency Management (FCM)
 - Tactical Trajectory Management (TTM)
 - Tactical Separation Management (TSM)

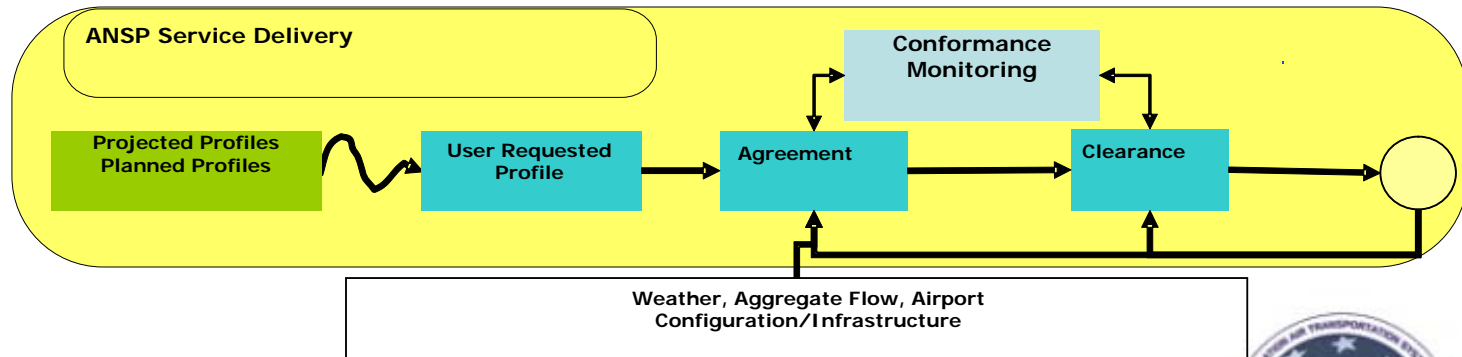
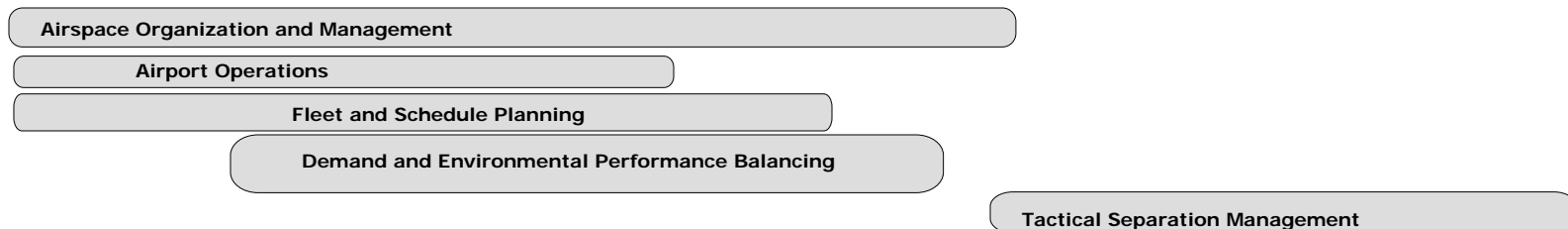


Trajectory Based Operations, cont.

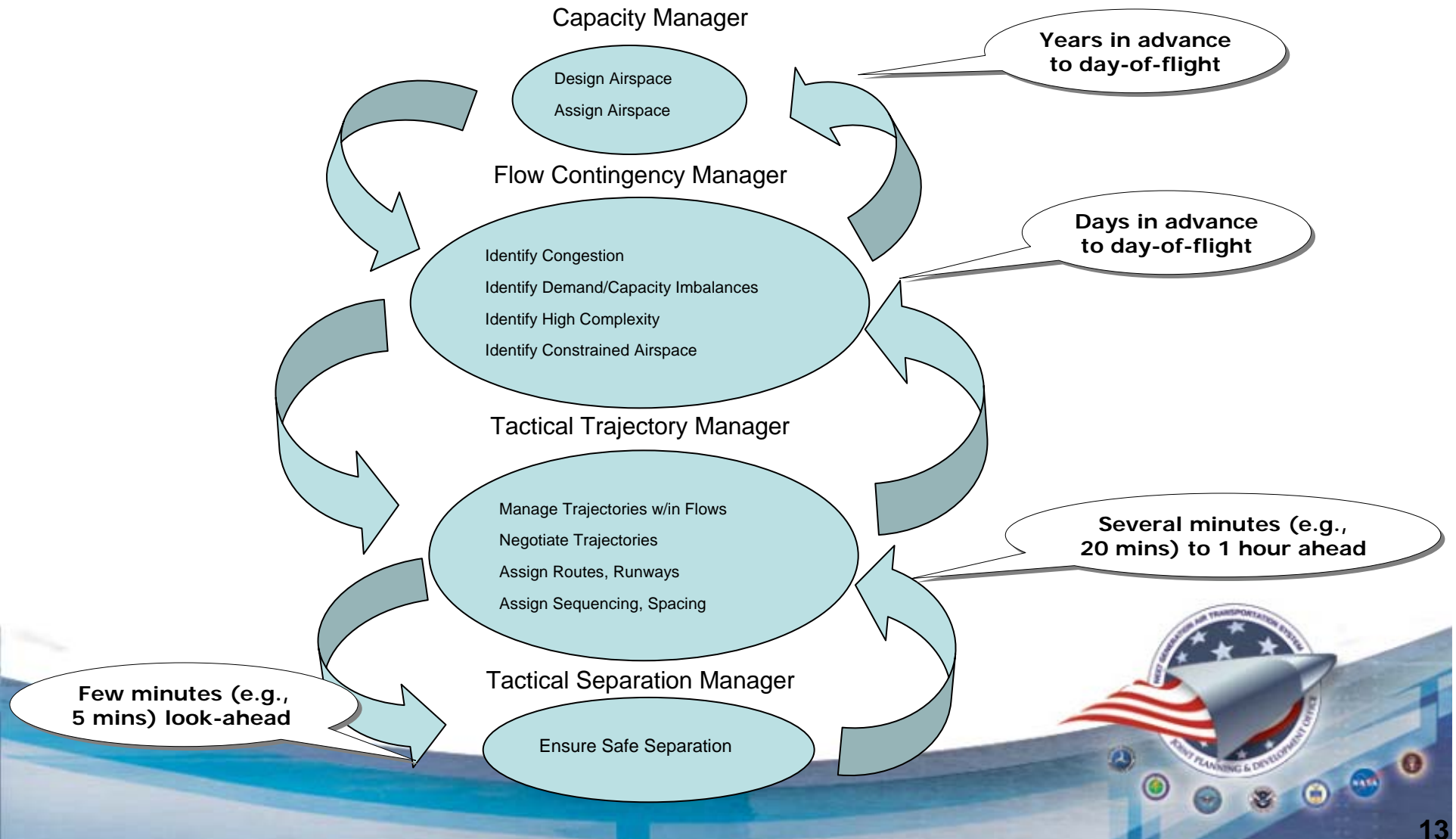
Strategic

Tactical

Separation Mgmt



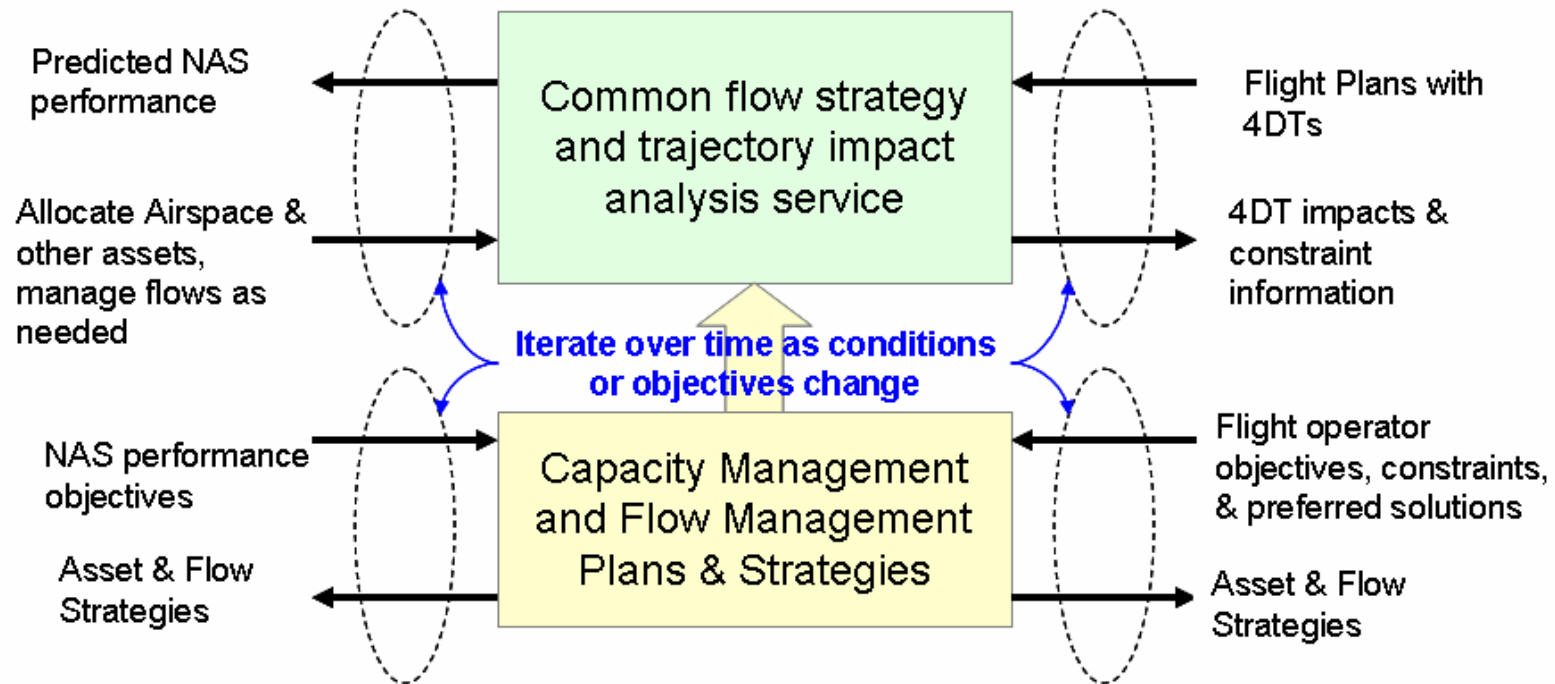
Interactive Airspace and Trajectory Management Process



Collaborative Traffic Flow Management

ANSP

Aircraft Operators

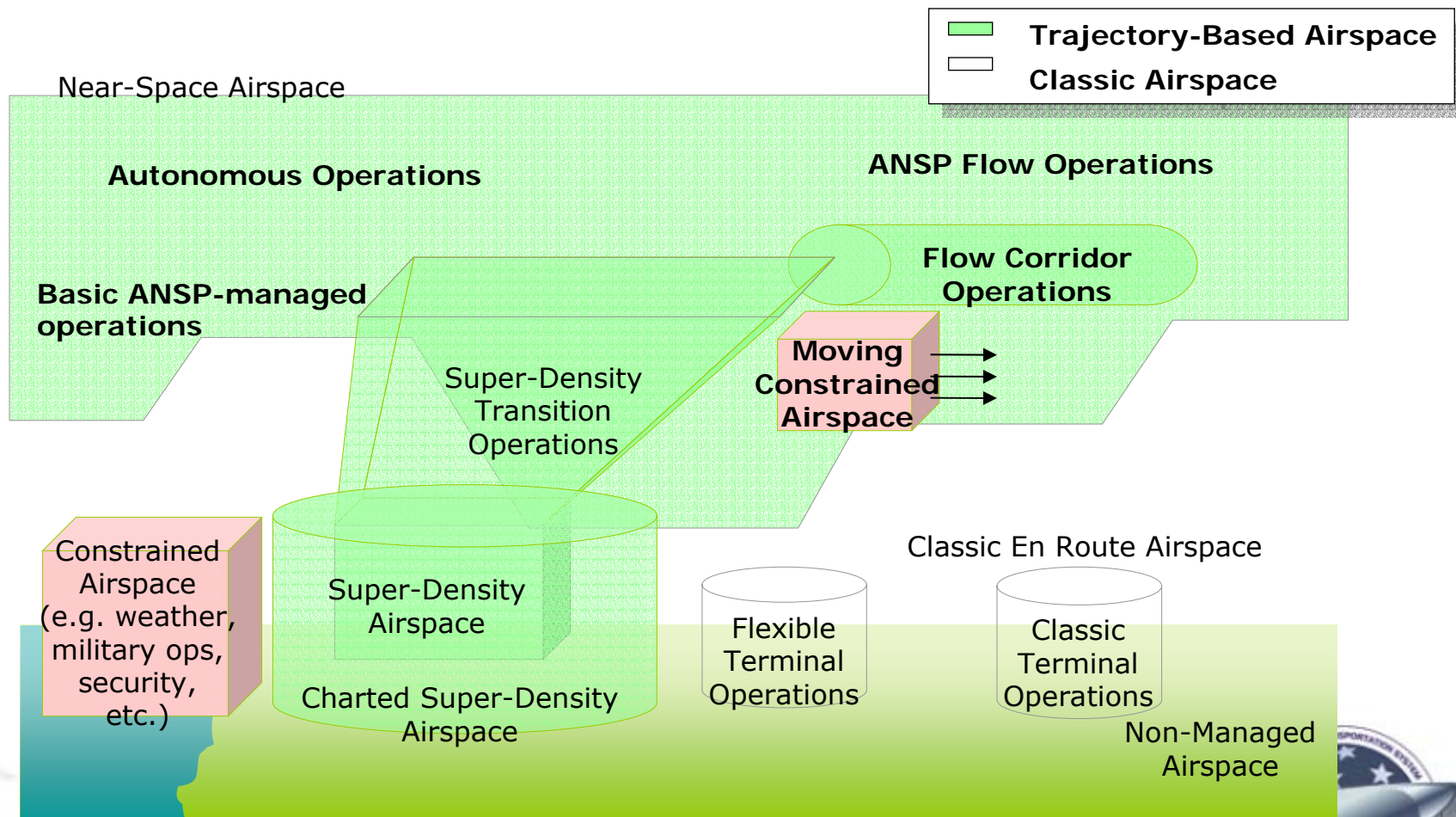


Integrated Airspace Operations

- Classic Airspace
 - Just like today
- Trajectory Based Airspace
 - En Route
 - ANSP Flow Airspace
 - Flow Corridors
 - Autonomous Operations
 - Super Density Terminal
 - Flexible Terminal
- Tower and Surface
 - Staffed Virtual Towers
 - Automated Virtual Towers



Integrated Airspace Operations Examples



En Route - TBO

Operation	Benefit	ANSP Capability	Aircraft Capability	Provision of Tactical Separation
En-Route Trajectory-Based Operations				
<ul style="list-style-type: none"> ANSP flow operations 	High traffic density	4DT exchange, including updates for TSM, TTM	Exchange & execute 4DT, CTA, RNP, some aircraft have delegated separation capability	ANSP, may be automated and may be delegated by exception
<ul style="list-style-type: none"> Flow corridors 	Very high traffic density Preferred routing ANSP productivity	4DT exchange, with reduced requirement for updates, TTM	Exchange & execute 4DT, CTA, RNP, delegated separation capability	Procedural separation of corridor from other airspace, aircraft within corridor separate themselves
<ul style="list-style-type: none"> Basic ANSP-managed operations 	Accommodate wider range of aircraft capabilities	4DT exchange, TTM, TSM	Exchange & execute basic 4DT	ANSP, supported by automation and may be delegated by exception
<ul style="list-style-type: none"> Autonomous Operations 	Preferred routing ANSP productivity	Reduced 4DT exchange	Exchange & execute 4DT, CTA, RNP, full self-separation	Aircraft



Classic Airspace

Operation	Benefit	ANSP Capability	Aircraft Capability	Provision of Tactical Separation
Classic Airspace Operations				
<ul style="list-style-type: none"> Classic Operations 	Accommodate all aircraft capabilities, preferred routing sometimes available for more capable aircraft	TTM, TSM	RNAV (most aircraft), some aircraft more capable	ANSP and may be delegated for some aircraft
<ul style="list-style-type: none"> CDA, Other RNP trajectories (equipped aircraft only) 	Reduced environmental impact, high throughput	4DT exchange, TTM, TSM	Exchange & execute 4DT, CTA, RNP	ANSP and may be delegated for some aircraft



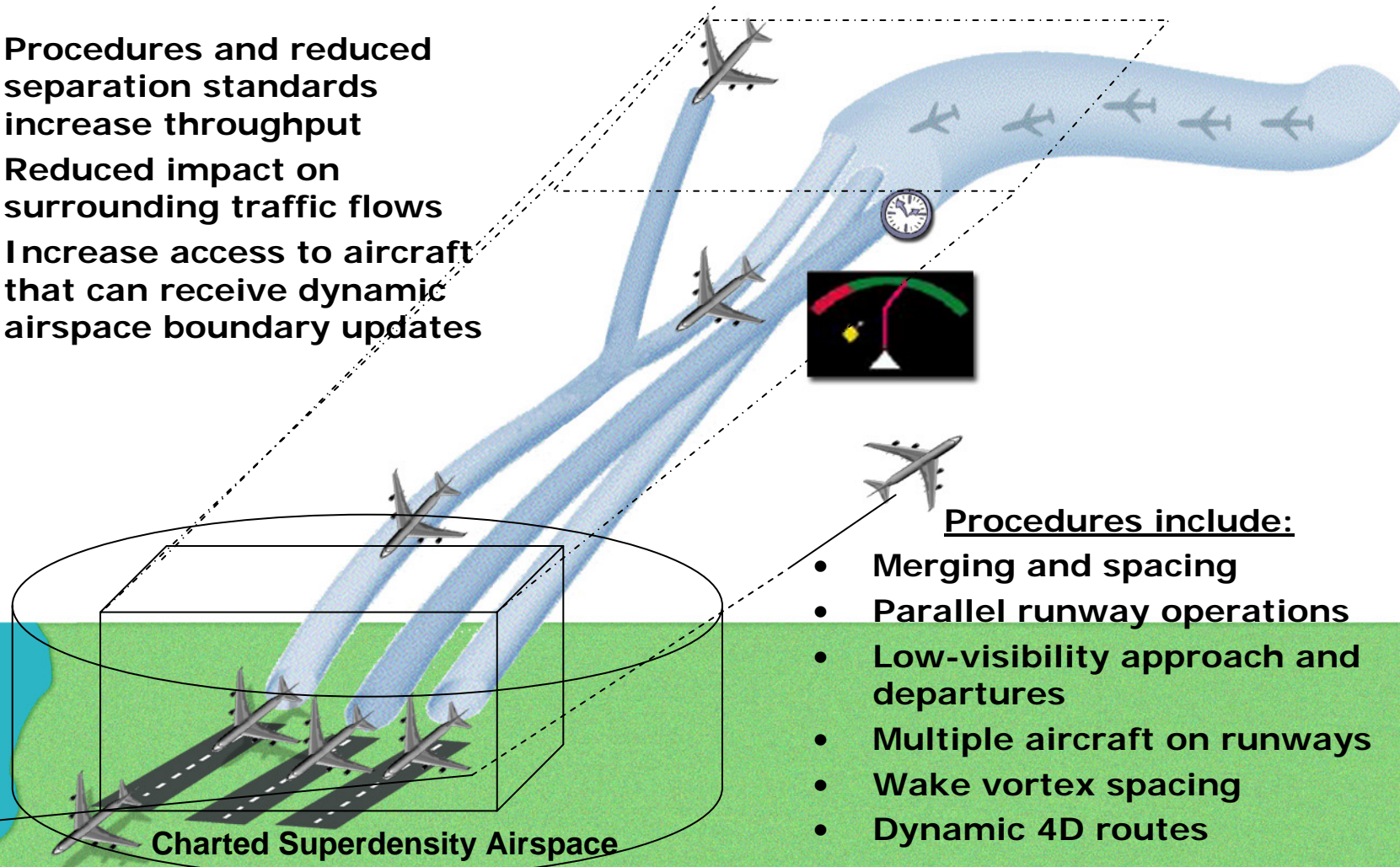
Super Density Terminal

Operation	Benefit	ANSP Capability	Aircraft Capability	Provision of Tactical Separation
Super Density Terminal Operations				
<ul style="list-style-type: none"> Merging & spacing 	Arrival throughput match to runway capacity ANSP productivity	4DT exchange, TTM, TSM	Exchange & execute 4DT, CTA, RNP, airborne spacing	ANSP, supported by automation and may be delegated for some aircraft
<ul style="list-style-type: none"> CSPA, paired approaches 	Closely spaced runways maintain VMC capacity in all visibility conditions	4DT exchange to establish aircraft on approach, TTM, TSM	Exchange & execute 4DT, CTA, RNP, parallel runway procedures	ANSP, except between aircraft conducting approach
<ul style="list-style-type: none"> CDA, Other RNP trajectories 	Reduced environmental impact, high throughput	4DT exchange, TTM, TSM	Exchange & execute 4DT, CTA, RNP	ANSP and may be delegated for some aircraft



Super Density Terminal Operations

- Procedures and reduced separation standards increase throughput
- Reduced impact on surrounding traffic flows
- Increase access to aircraft that can receive dynamic airspace boundary updates



Procedures include:

- Merging and spacing
- Parallel runway operations
- Low-visibility approach and departures
- Multiple aircraft on runways
- Wake vortex spacing
- Dynamic 4D routes

Flexible Terminal Operations

Operation	Benefit	ANSP Capability	Aircraft Capability	Provision of Tactical Separation
Flexible Terminal Operations				
<ul style="list-style-type: none"> Basic arrival procedures 	Accommodate all aircraft capabilities	TTM, TSM	Precision Approach to Cat 1, voice communications	ANSP and may be delegated for some aircraft
<ul style="list-style-type: none"> Merging & Spacing (equipped aircraft only) 	Arrival throughput match to runway capacity ANSP productivity	4DT exchange, TTM, TSM	Exchange & execute 4DT, CTA, RNP, airborne spacing	ANSP and may be delegated for some aircraft
<ul style="list-style-type: none"> CDA, Other RNP trajectories (equipped aircraft only) 	Reduced environmental impact, high throughput	4DT exchange, TTM, TSM	Exchange & execute 4DT, CTA, RNP	ANSP and may be delegated for some aircraft



Tower and Surface

- Increased traffic levels at many airports
 - Increased use of smaller airports
 - More operations for non-fixed-wing aircraft
 - More integrated ATM operations and air service planning
- Improved surface traffic management and safety
 - Automation integrates departures and arrivals to increase throughput
 - Aircraft capabilities improve surface movement guidance
 - CTAs used to improve efficiency where needed
- Virtual towers
 - Provide increased service at reduced cost
 - Eliminate requirement for visual monitoring of airports
 - Enable continued operation at low- or zero- visibility
 - Staffed virtual towers provide “full service” operations
 - Automated virtual towers provide sequencing guidance



Flight Operations

- Introduction
 - How operators use capabilities to achieve objectives
 - Less driven by regulation – more capability based
- Operators
 - Scheduled Operators
 - On-Demand Operators
 - Personal Aircraft Operators
 - State Aircraft Operators



NGATS Principles for Operators

- Accommodates a range of operator goals and business models
- Resources are managed to maximize utility to operators
- Restrictions are imposed only for reasons of projected congestion, security or safety.
- Broad, active participation in the C-TFM process
- Access to airspace and aerodromes is capability driven
- C-TFM - a transparent policy, known by all operators and stakeholders, provides the resolution to prioritize access to NGATS resources
- National objectives for the NGATS are considered in addressing access to NAS resources



Flight Operators

- For many aircraft, role of the flight crew evolves to:
 - Supervisory override, aircraft system manager, C-TFM participant
- IFR Operations:
 - The 4DT basis for operation
 - If the Operator intends to leave the flexibility zone, or can not comply with the 4DT agreement, a new 4DT agreement needs to be made
 - Special accommodations to enable transit through trajectory-based airspace
- VFR flight operations are
 - Generally unrestricted, except when ANSP workload or other factors prohibit VFR access to certain airspace
 - VFR flights granted access to trajectory-based airspace, workload permitting
 - Electronic VFR operations are conducted like VFR flights, but with relaxed cloud clearance and visibility requirements



Operator Capabilities

- Most interactions between operator and ANSP are data communications.
 - service levels received depend on the sophistication of the systems that operators invest in.
- Service difference driven by:
 - ability to receive and request 4DT changes
 - ability to receive changes to airspace changes
- Aircraft/Airframe Capabilities
 - Area Nav
 - Air-to-ground Data Communications
 - Air-to-ground and air-to-air surveillance



Flight Management

- C-TFM
 - Revolutionized with machine-to-machine “negotiation” replacing the labor-intensive, telephone based process
 - Operator and ANSP automation fully integrated
 - Operators share information with ANSP via network enabled operations and common data
 - FOC provides ANSP with options and preferences for flights
- Collaborative Airspace Management
 - Dynamic Airspace status decreases reserved airspace
 - Lack of equipage for status reduces flexibility
 - Operators participate in the definition and selection of capacity and flow strategies
 - Segregated airspace managed collaboratively



UAS, Vertical Flight, and Space Operations

- Unmanned Aircraft Systems (UAS)
 - Includes remotely operated and “autonomous” operations
 - UAS interoperate among crewed aircraft when
 - Can comply with 4DT trajectory management requirements
 - Can “sense and avoid”, so other aircraft are not burdened with separation responsibility
- Vertical Flight Operations
 - Vertical flight capabilities incorporated into terminal departure and arrival trajectory planning
- Space operations have less impact on ATM operations
 - More precise geographic and time restrictions
 - More accurate allocation of airspace to match operations
 - Updates reduce disruption to affected traffic



What does this mean?

- Reliever to Reliever
 - Demand will dictate performance
- Small Airport to Reliever
 - Demand will dictate performance
- Small Airport to Small Airport
 - Automated Virtual Towers



Independent Assessment

- Recommendation of REDAC Subcommittee
- Members
 - Don Bateman, Honeywell
 - Dallas Denery, UCSC
 - R. John Hansman, MIT
 - Bob Peake, AirServices Australia
 - Dave Shaffer
 - Al Spain, JetBlue (ret)
- Charter
 - Assess Conops
 - Recommendations for improvement and risk reduction



General Observations

- Integration appears to be a challenge
 - Need JPDO to take system integration leadership
 - Buy-in from SPC members not sufficient
- Consensus approach will not get closure
 - Runs the same risk as Free Flight Task Force 3
 - Can't keep everyone happy
- Integrated Plan goal need updating
- Products generally too complex
 - Products need consolidation
 - Abstraction of key issues
- Rationale and assumptions need to be explicit



Stakeholder Review

- Dates
 - August 24, 2006 through September 14, 2006
- Individual & Specific Comments
 - Web based comment form
 - <http://techhanger.jpdo.aero>
 - Register and comment
- Strategic view points from JPDO Board Members
 - Collective views on direction and implementation
 - If the view points don't fit Web form
 - Contact Ed Waggoner or Jay Merkle
 - Phone: 202 220 3487
 - Email: Edgar.g.waggoner@nasa.gov or jay.merkle@faa.gov



NGATS Operational Improvement Roadmap

- NGATS Operational Improvement Roadmaps
 - Describe how the air transportation system will transform from the current system to the NGATS Concept described in the 2025 timeframe
 - Your input is essential
- NGATS OIs are on the web for stakeholder review
 - <http://techhanger.jpdo.aero>



NGATS CNS/ATM 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

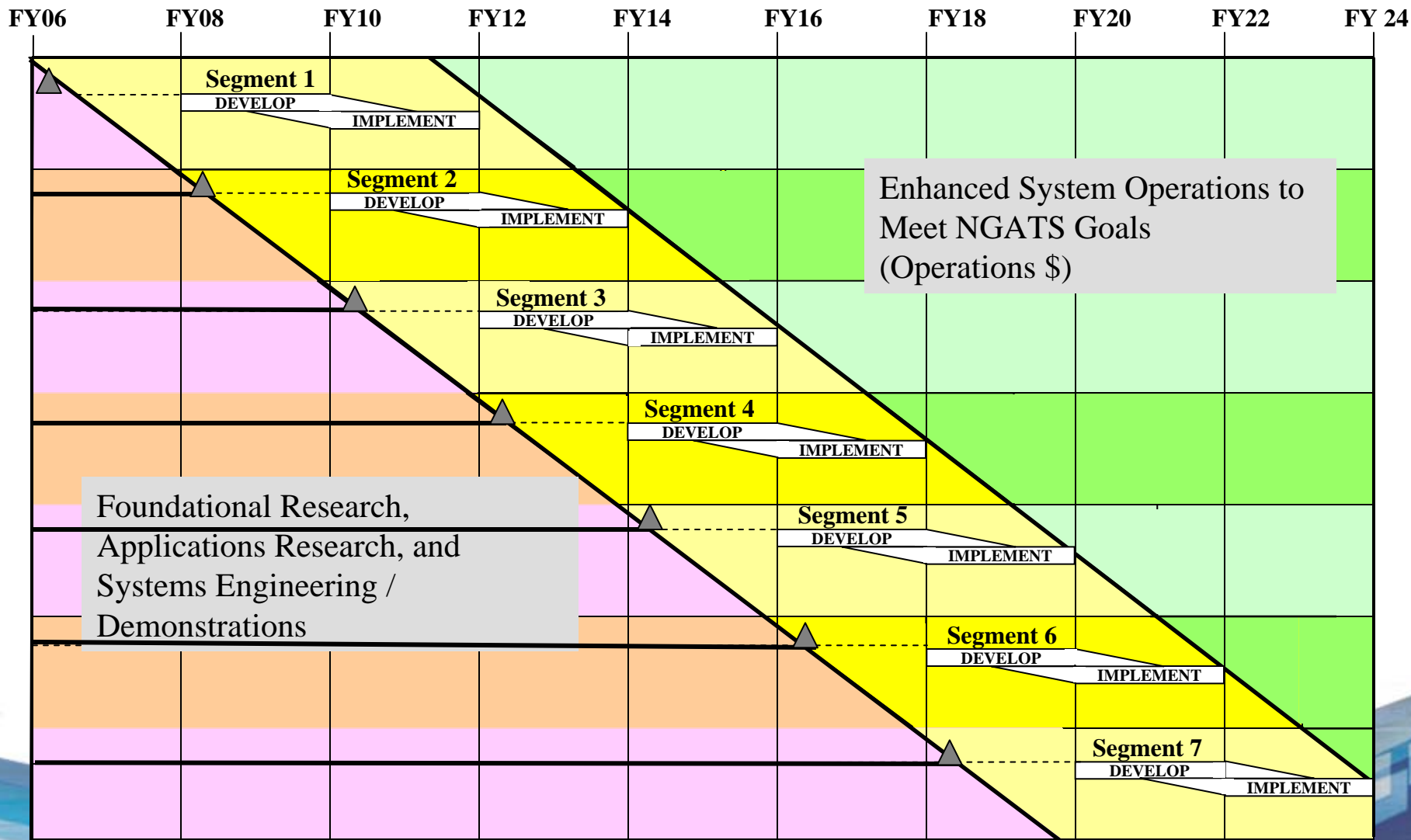
FY12 – FY17
Super Density Operations
4DT on Surface
Right Sizing of Facilities

FY18 & Later
Research for
Beyond NGATS

Building NGATS

Establish NGATS Infrastructure		
Segments: 0,1,&2	Develop: 0-6-11	Implement: 08-13
<ul style="list-style-type: none"> Deploy critical infrastructure for NGATS operations <ul style="list-style-type: none"> ADS-B, DL, RNP, NEO Policy: Establish aircraft equipage rules <ul style="list-style-type: none"> NAS wide (ADS-B "OUT", NAV) Airspace/Route access based on RTSP (CDTI, DL, Lower RNP) 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
<ul style="list-style-type: none"> Equipage of all aircraft completed for NGATS Airspace/Route access and Level of Service based on RTSP Most of NGATS capacity gains realized <ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> Airports network expanded Capacities of congested airports further increased <ul style="list-style-type: none"> 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 / Demonstrations

Broad Area and Precision Navigation

Segment Operational by	Operational Improvement
1 2012	<ul style="list-style-type: none"> • RNAV is available for all general aviation aircraft
2 2014	<ul style="list-style-type: none"> • RNP routes are available to/from all runways at OEP airports
3 2016	<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 2020	<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 2022	<ul style="list-style-type: none"> • RNP routes are available to/from all desired airports



Airspace Access and Management

Segment Operational By	Operational Improvement
1 2012	<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 2014	<ul style="list-style-type: none"> • Systems and airspace policies are in place that increase civilian access to SUA and flow restricted airspace
4 2018	<ul style="list-style-type: none"> • Arrival/departure terminal airspace boundaries in large metro-area are dynamically configured to meet flow requirements
5 2020	<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 • Airspace is dynamically configured to meet flow requirements



4D Trajectory Management

Segment Operational By	Operational Improvement
1 2012	<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 2014	<ul style="list-style-type: none"> • Flight planning is based on 4D trajectories for all aircraft that fly in high altitude airspace
3 2016	<ul style="list-style-type: none"> • All aircraft in high altitude airspace are managed by 4D trajectories, with trajectories exchanged via data communications
4 2018	<ul style="list-style-type: none"> • Management by 4D trajectories is expanded to additional airspace, with trajectories exchanged via data communications
5 2020	<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 2022	<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 By	Operational Improvement
1 2012	<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 2014	<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 2016	<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 2018	<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 2020	<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 2022	<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 2024	<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 By	Operational Improvement
1 2012	<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 2014	<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 2016	<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 2020	<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 2022	<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 2024	<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 By	Operational Improvement
2 2014	<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 2016	<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 2018	<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 2020	<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 2022	<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 By	Operational Improvement
1 2012	<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 2014	<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 2016	<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 2018	<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 2020	<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 By	Operational Improvement
1 2012	<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 2014	<ul style="list-style-type: none"> • NAS-wide transition to ADS-B for air/ground surveillance is completed
3 2016	<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 2018	<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 2020	<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 2024	<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



Additional Questions?

