

# Air Traffic System Concept Development & Validation

## Role in Transitioning to NextGen

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Development & Validation Group

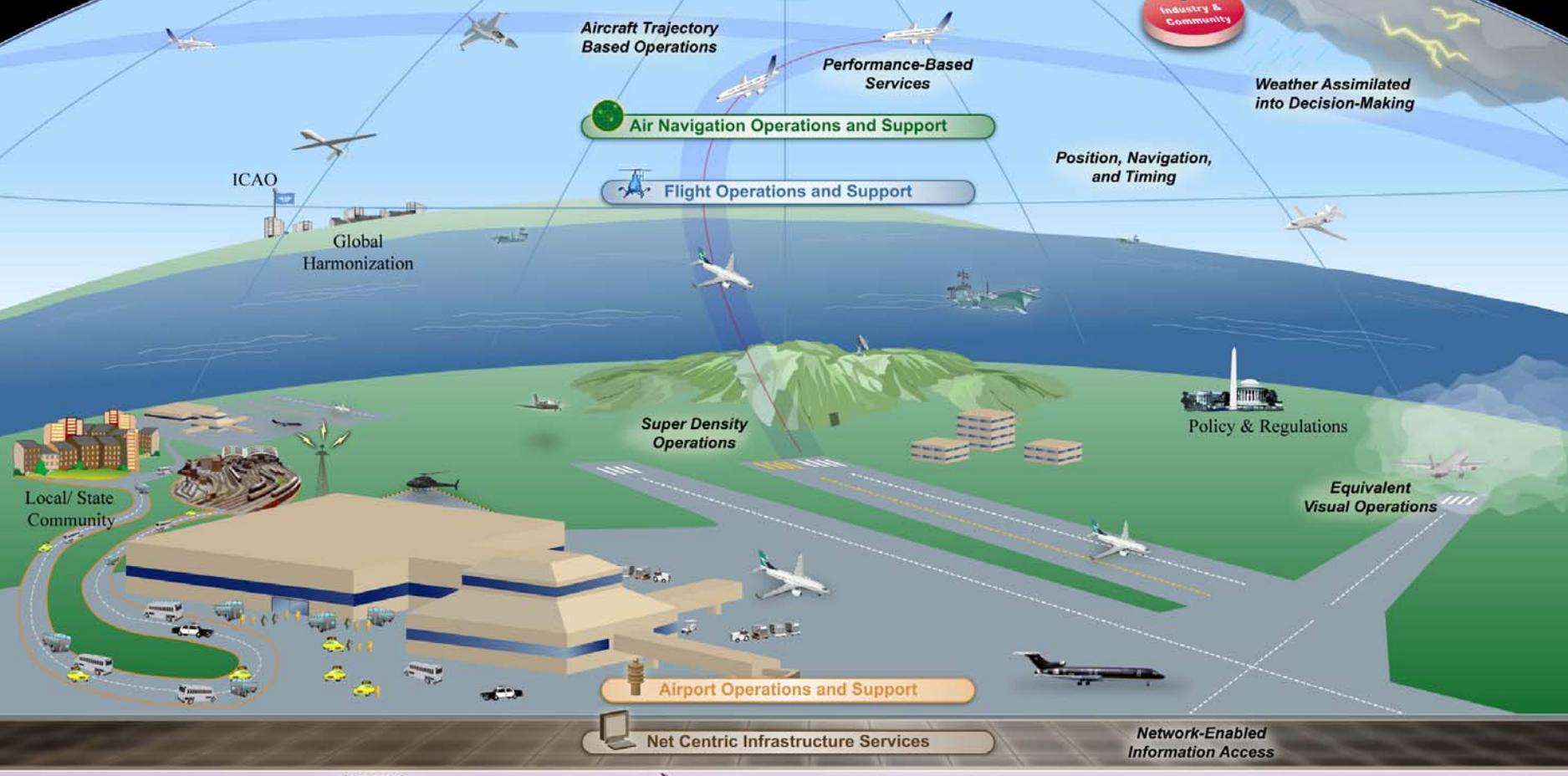
Date: June 25, 2009



Federal Aviation  
Administration



# Next Generation Air Transportation System (NextGen)



Environment

**Layered Adaptive Security**

**Enterprise Services**

Safety

**Information Technology Mgmt**

Updated 02/06/07, Version 1.1b

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# NextGen Objectives

**INCREASE SAFETY**

**EXPAND CAPACITY**

**PROTECT THE ENVIRONMENT**

**INCREASE PRODUCTIVITY**

**INCREASE EFFICIENCY**

**SECURE THE NATION**

**ENSURE OUR NATIONAL DEFENSE**



Wake Turbulence Separation

4DTs

Optimized Descent Profiles

Flexible Airspace

Delegated Separation

Network Enabled Information

CSPRs



WX Integrated into DSTs

Self Separation

TBO

Performance Based Airspace

Enhanced Departure Flows

Metroplex Merging & Spacing

Automated Conflict Resolution

Remotely Staffed Towers

NEO



# Which are the right concepts?

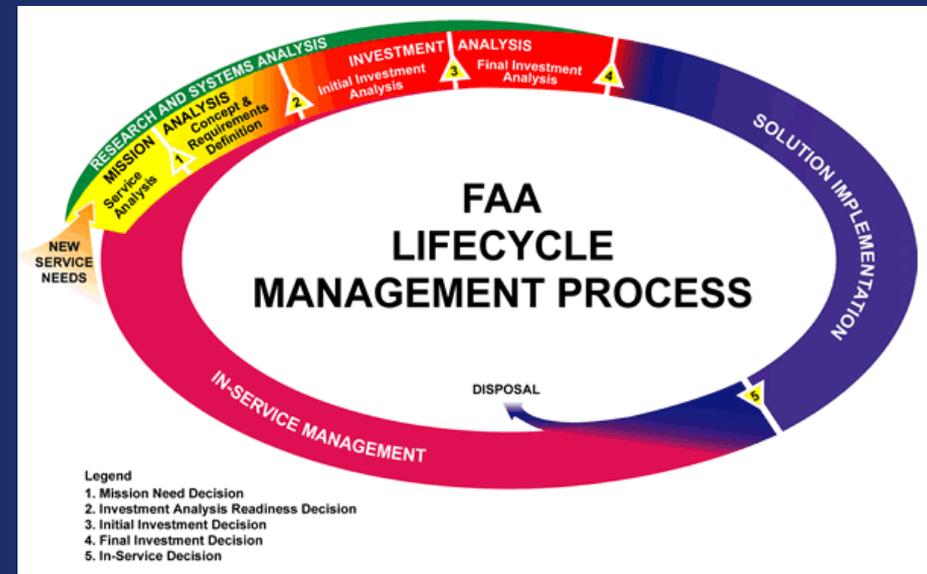
## Only research will tell



# CD&V Group Role in Research & Systems Analysis

- **Develop & evaluate Concepts of Operations**
  - Assess operational feasibility
  - Validate benefits
  - Identify safety risks, human factors issues, procedural, training & airspace implications
- **Develop requirements and business cases**
- **Develop NAS EA Products**
- **Transition concepts and requirements to service units for implementation**

ATS CD&V



# Concept Hierarchy

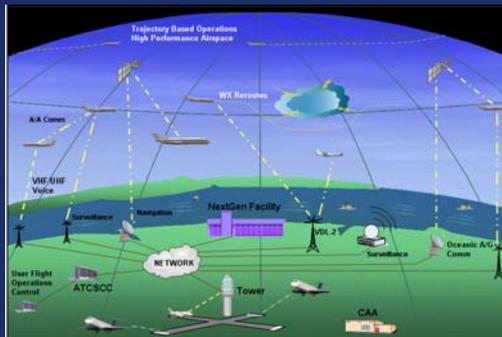
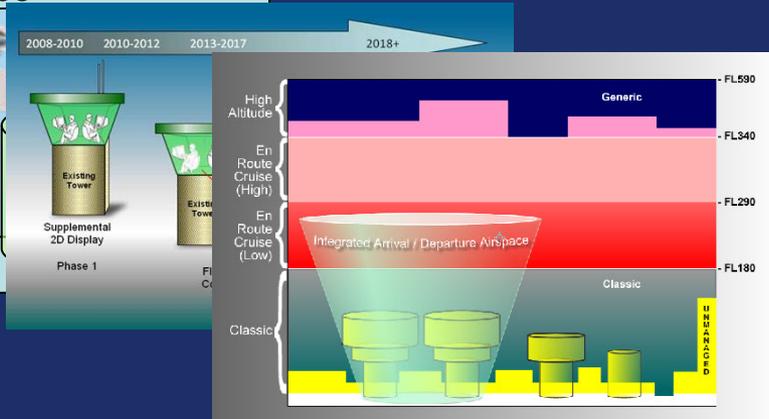
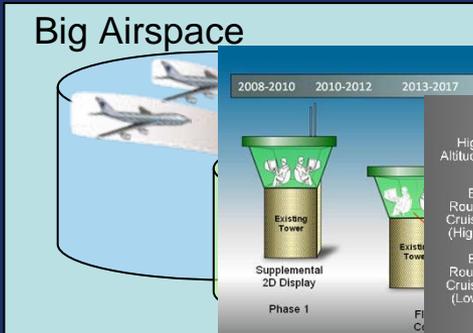
Enterprise Level



Service or Sub-service Level



System Level



# CD & V Process

JPDO Concept of Operations for NextGen

NAS EA Operational Improvements



JPDO Operational Improvements

NextGen Mid-Term CONOPS for the NAS

NextGen CONOPS for the NAS

2<sup>nd</sup> Level Concepts

2<sup>nd</sup> Level Concepts



Concept Validation and Refinement Activities

- Analysis of related CONOPS
- Analysis of EA
- Stakeholder feedback
- Cognitive Walkthroughs
- Part Task Studies
- Fast Time Simulations
- Human in the Loop Simulations (HITLs)
- Field Testing

Concept Requirements Transition

Operational Service Units

Implementation

# Concept Exploration & Development

- **Concept Development Iterative Process**
- **Initial Concepts developed based on:**
  - Literature / Research Review
  - Analysis of related (higher/lower level) CONOPS
    - JPDO, CAASD, Operational Svc Units, NASA, etc.
  - Analysis of EA OIs and Roadmaps
- **Draft Concepts produced and vetted to obtain Stakeholder Feedback**
- **Concepts Revised based on stakeholder feedback and results of concept validation activities**

# Concept Validation

- **Conducted to assess operational feasibility, benefits, and operational and technical requirements associated with concepts**
- **Concept Validation Process**
  - Scenario Development – Vet the Scenarios
  - Develop & Vet Concept Validation Plan
  - Conduct Validation Studies
    - Part Task Simulations
    - Fast Time Simulations
    - Human In The Loop (HITL) Simulations
    - Field Testing / Demonstrations
- **Revise the CONOPS and Develop Concept Level Requirements based on results**



# Role of Scenarios in CD&V

- **Initially generated in concept development process to put the concept description into an operational context**
- **Form the top level basis of traffic scenarios generated for concept validation activities**
- **Goal is to develop a set of mid term and far term scenarios that will be used for all concept validation activities for a given concept/Operational Improvement**

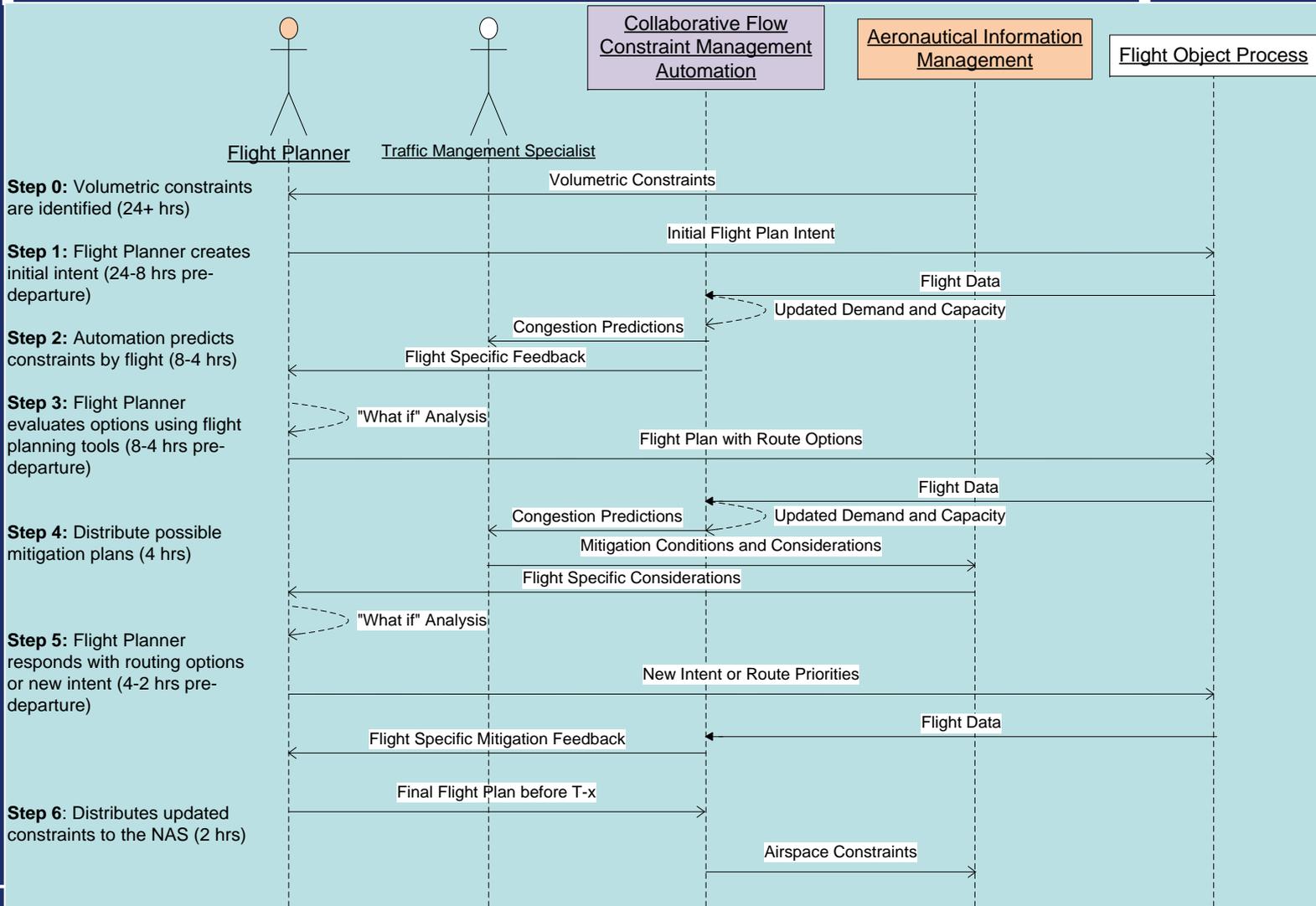


# Scenario Example

- NextGen Context
- Assumptions
- Highlighted Operational Improvements (OIs)
- Operational Change
- OV-1s
- High-Level Activity Overview
- Detailed Scenario Activity Walk-Through
- OV-6c
- Issues and Gaps



# Sample OV-6c: Operational Event Trace Description



# Backup Slides



# Enterprise Level CONOPS



# Developing the Midterm CONOPS

## Trajectory Based Operations

- Delegated Responsibility of Separation
- Ocean in Trail Climb & Decent
- Automation Support for Mixed Environment
- ADS-B Separation
- Initial Conflict Resolution Advisories

## Increased Arrival & Departure at High Density Airports

- Improved Parallel Runway Operations
- Initial Surface Traffic Management
- Time Based Metering using RNP and RNAV route assignments

## Increased Flexibility in Terminal Environment

- Wake Turbulence Mitigation for Departures (WTMD): Wind based wake procedures
- Ground Based Augmentation System (GBAS) Precision Approaches
- Wake Turbulence Mitigation for Arrivals: CSPRs
- Use optimized profile decent
- Low Visibility Surface Operations
- Low Visibility/Ceiling Approach Operations

## Improved Collaboration ATM

- Continuous Flight Day Evaluation
- Traffic Management Initiatives with Flight Specific Trajectories
- Improved Management of Airspace for Special Use

## Reduce Weather Impact

- Initial Integration of Weather Information into NAS Automation and Decision Making
- Initial Improved Weather Information from Non-Ground Based Sensors
- Deploy FIS-B Nationally

## Increase Safety

- Enhance Emergency Alerting
- Aviation Safety Information Analysis & Sharing

## Increase Security

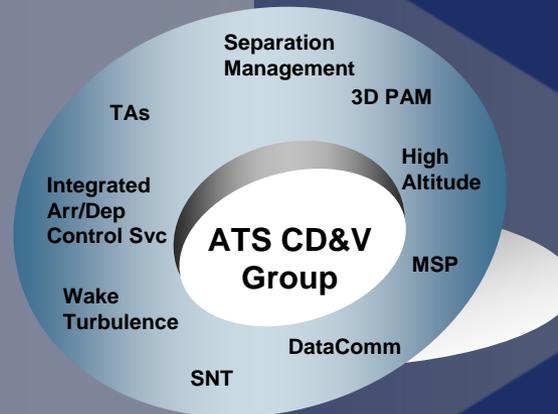
- Operational Security Capability for Threat Detection and Tracking, NAS Impact Analysis and Risk-Based Assessment

## Increase Environmental Performance

- NEXTGEN Operational Initiatives Implemented that Reduce Environmental Impacts

## Transform Facilities

- Remotely Staffed Tower Services

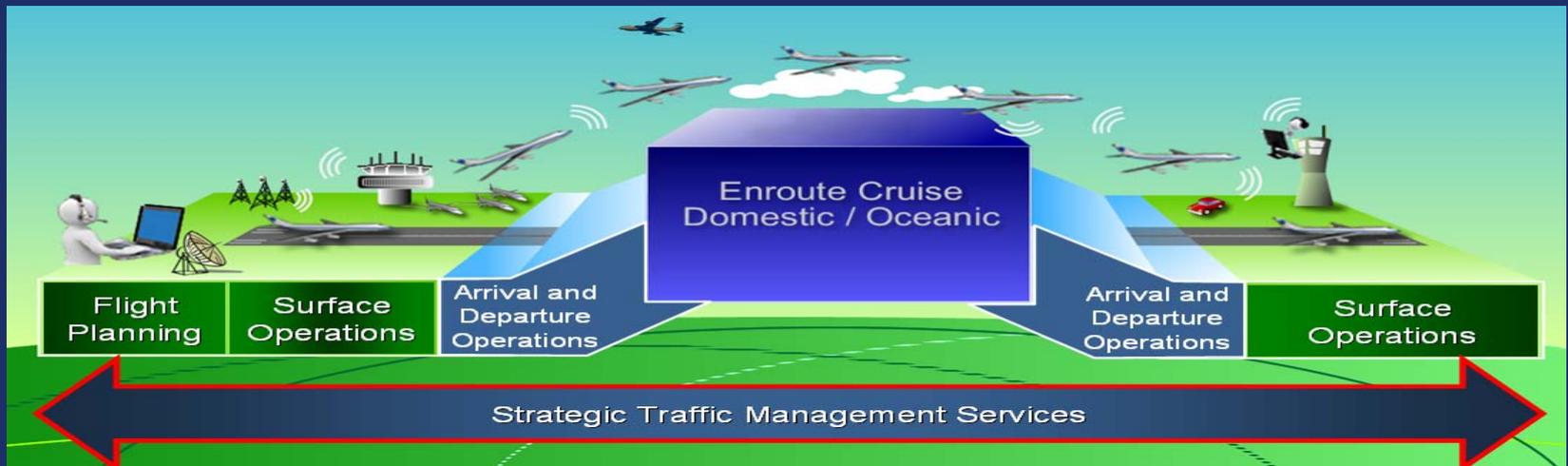


**NextGen Mid-Term Concept of Operations for the National Airspace System**

**Narrative Detailed Operational Scenarios**

# NextGen Midterm NAS CONOPS

- **An architecture level concept of operations description of the NAS in the 2018 timeframe.**
  - Describes operations and ATC services in all phases of flight
  - Pre-flight and strategic traffic management services
- **Trajectory-Based Operations in Context**
  - Flight plans become trajectories aggregated into the ATM system
  - Level of performance required (RNAV + RNP) driven by demand vs. capacity
  - User access determined through “best equipped” = “best served”
  - Some airspace may be exclusionary to trajectory based operations

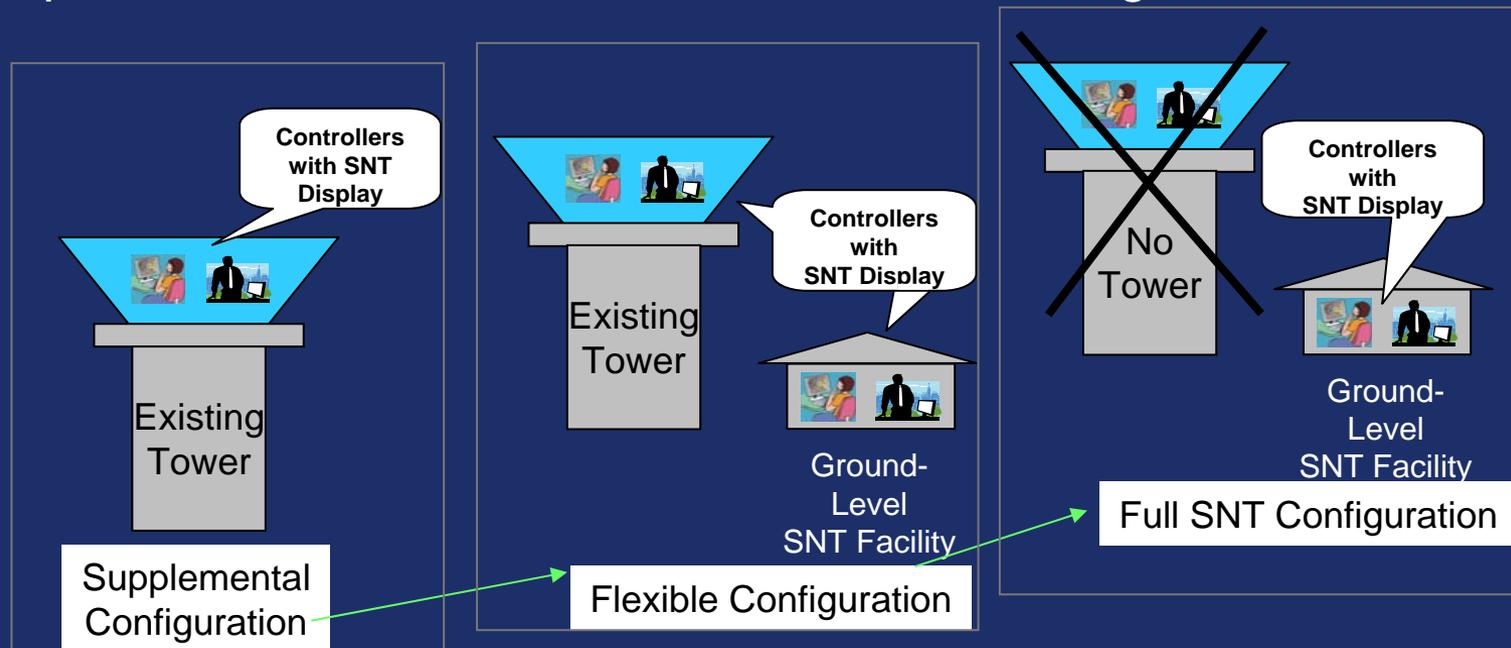


# Second Level Concepts

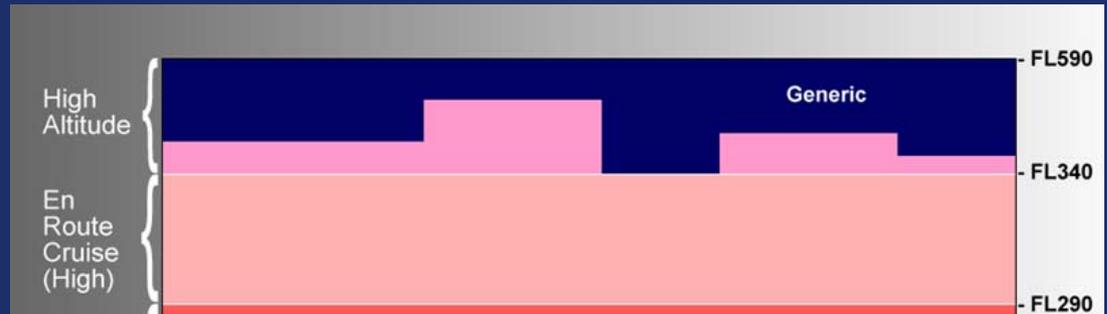


# Staffed NextGen Towers (SNT)

- Provides surface and tower services without the requirement for direct visual observation by ANSP personnel from an airport tower cab
- Cost effective expansion of tower services
- Extended ATM service when tower closes
- Ability to 'see' new runways obstructed from view of tower cab
- Improved service in inclement weather and at night



# High Altitude



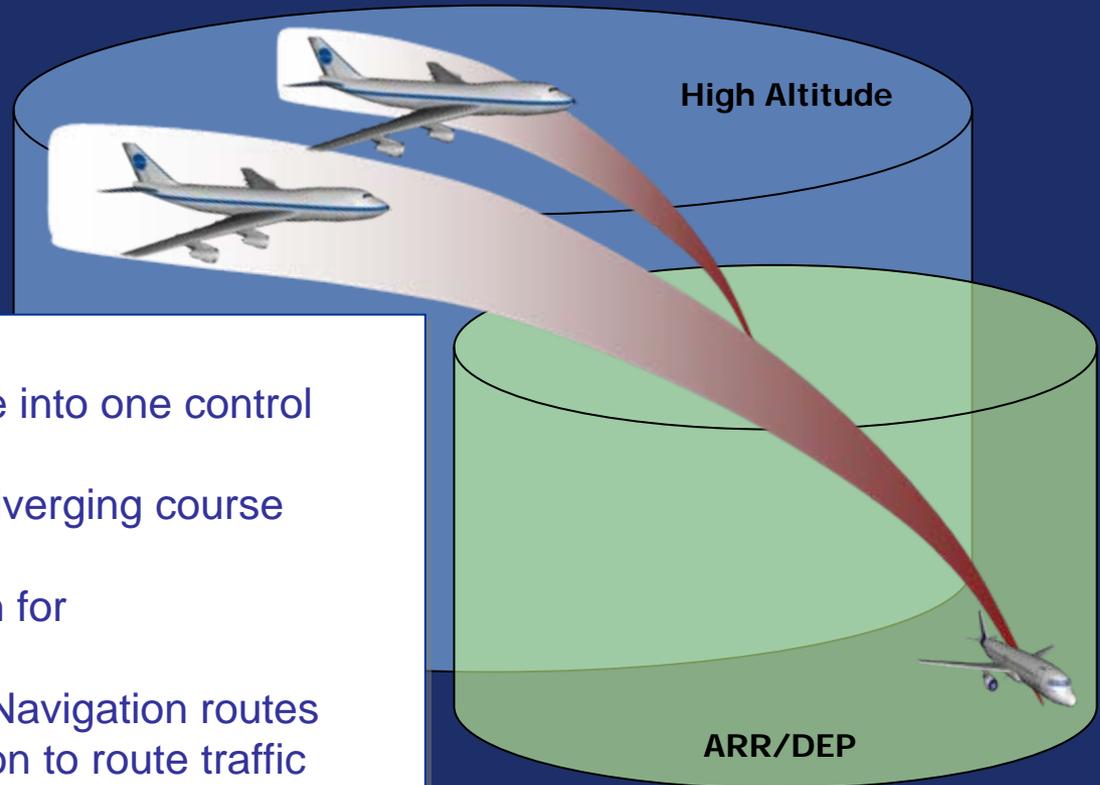
- Blends the principles of Ultra High Altitude (generic sector) Airspace with Trajectory Based Operations
- Airspace exclusive to aircraft that are TBO capable
- TBO aircraft are RNAV capable and Data Comm equipped
- Designed to more effectively respond to daily events (e.g., weather, SUA activation), as well as seasonal changes in traffic demand
- **Generic Sectors**
  - Increased staffing efficiencies
  - Reduced controller training time
  - Improved options to allocate resources in response to traffic demand
- **Adaptable Airspace**
  - Improved management of demand-capacity imbalances
  - More efficient use of airspace
  - Better distribution of ANSP workload
- **Trajectory Based Operations**
  - Increased User-preferred routing
  - Reduced coordination between ANSP and Users
  - Improved traffic management (within sectors and at merge points)
  - Improved fuel efficiency

# Multi-Sector Planner

- Envisioned as a new staffed position in High Altitude Airspace (initially)
- First step toward trajectory and flow contingency management in mid-term
- 4D intent data helps MSP bridge the gap between traffic management strategic planning and sector team tactical operations
- Fine tunes traffic management initiatives to increase efficiency, reduce delays, and ensure sectors do not exceed complexity thresholds
  - Supports redistributed functions and flexible workforce management options
  - Adapts to work where the demand is expected
  - Minimizes impact of reroutes, manages complexity and maximizes capacity



# Big Airspace Concept

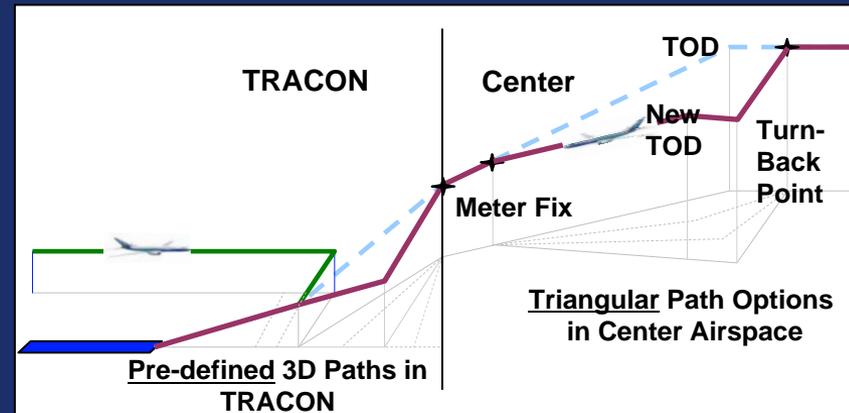


## Concept for Major Metro Areas

- Integrates ARR/DEP Air Service into one control service and one facility
- Applies 3 mile separation and diverging course procedures
- Reduce inter-facility coordination for arrivals/departures
- Additional Performance Based Navigation routes
- Dynamic airspace reconfiguration to route traffic around WX and manage controller workload
- Integrated flow management directives smooth transition
- Initial step to achieve NextGen High-Density Ops

# 3D Path Arrival Management (3D PAM)

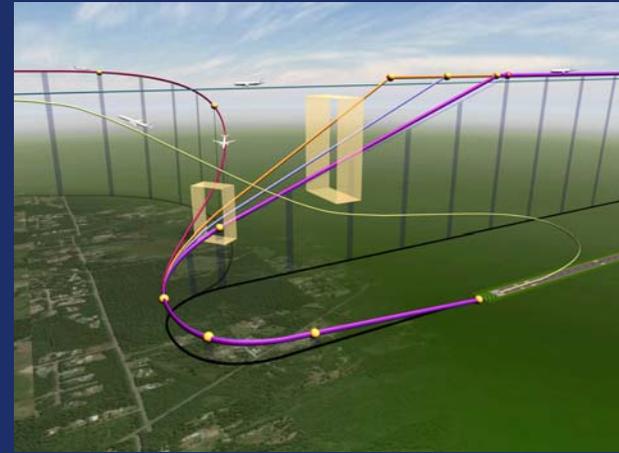
*Graphic courtesy of Boeing*



- An initial intervention in advance of NextGen 4D trajectory operations
  - Addresses congestion in arrival and departure streams for medium to large airports
- An efficient and predictable method to deliver aircraft from the Top of Descent to a metering fix
  - Optimum speed and altitude profiles
  - Reduced fuel burn, emissions and environmental impact
  - Increased flight path predictability and repeatability
  - Delay reduction
  - Reduced frequency and duration of voice communications
  - Increase controller productivity - reduced workload from trajectory clearances

# Tailored Arrivals

*Graphic  
courtesy of  
Boeing*



- Take advantage of under-utilized avionics in modern oceanic aircraft equipped with integrated Future Air Navigation System (FANS) 1/A equipment
- Pre-planned RNAV routes are data-linked to the aircraft well before TOD and the trajectory can be flown uninterrupted between multiple facilities and sectors
- Trajectory is optimized vertically and laterally for an efficient and predictable arrival
- Tailored Arrivals are an initial step toward 4D trajectory operations
  - Emissions and noise reduction (near idle descent)
  - Flight duration reduced by several minutes
  - ~880 lb (400 kg) less fuel burn per flight
  - Dramatically reduced VHF voice communication

# System Level (ConUse)



# Data Communications Segment 2

