AIRSPACE SYSTEMS PROGRAM

2005 NASA ACAST/SBT Workshop

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Deputy Program Manager

August 16, 2005

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FY 07 Aeronautics Research Priorities and Programs

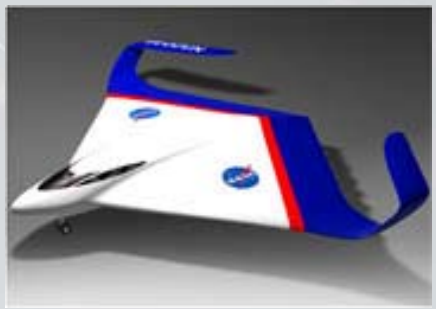
Programmatic Priorities

- Ensure NASA contribution to Joint Planning & Development Office (JPDO)
- Emphasize public good research
- Enhance uninhabited aerial vehicles (UAV) research
- Assess possibilities for supersonics
- Increase planetary aircraft research
- Define high-risk innovative technology to maintain U.S. leadership in aerospace

Programs

Aviation Safety & Security

Airspace Systems



Vehicle Systems

Foundational Technology

Airspace Systems Program

Goal:

Enable major increases in the capacity and mobility of the air transportation system through development of revolutionary concepts for operations and vehicle systems

Approach:

- Improve throughput, predictability, flexibility, collaboration, efficiency, and access of the NAS
  - Enable general aviation and runway-independent aircraft operations
- Maintain system safety, security and environmental protection
- Enable modeling and simulation of air transportation operations
- Enable high altitude, long endurance unmanned aircraft systems operations

Benefits:

- Enable more people and goods to travel faster and farther with fewer delays
- In alliance with the FAA, increase air traffic management effectiveness, flexibility and efficiency, while maintaining safety
- Enable use of small aircraft at under-utilized, rural/suburban airports to offload congestion at large, urban airports
- Develop capability to perform trade-off assessments of future air transportation systems concepts and technologies

Airspace Systems Projects

Small Aircraft Transportation System
Technologies for Small Aircraft/Airport Operations

Efficient Flight Path Management
Integrated Traffic Management Tools

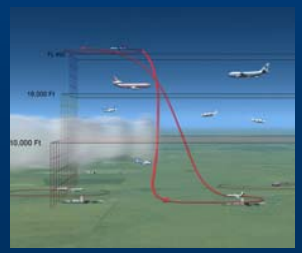
Virtual Airspace Modeling & Simulation
NAS Modeling/Simulation Capability & Next-Generation ATM/ ATC Concepts

Strategic Airspace Usage
Strategic Traffic Flow Management

Human Measures and Performance
Human/Computer Technologies

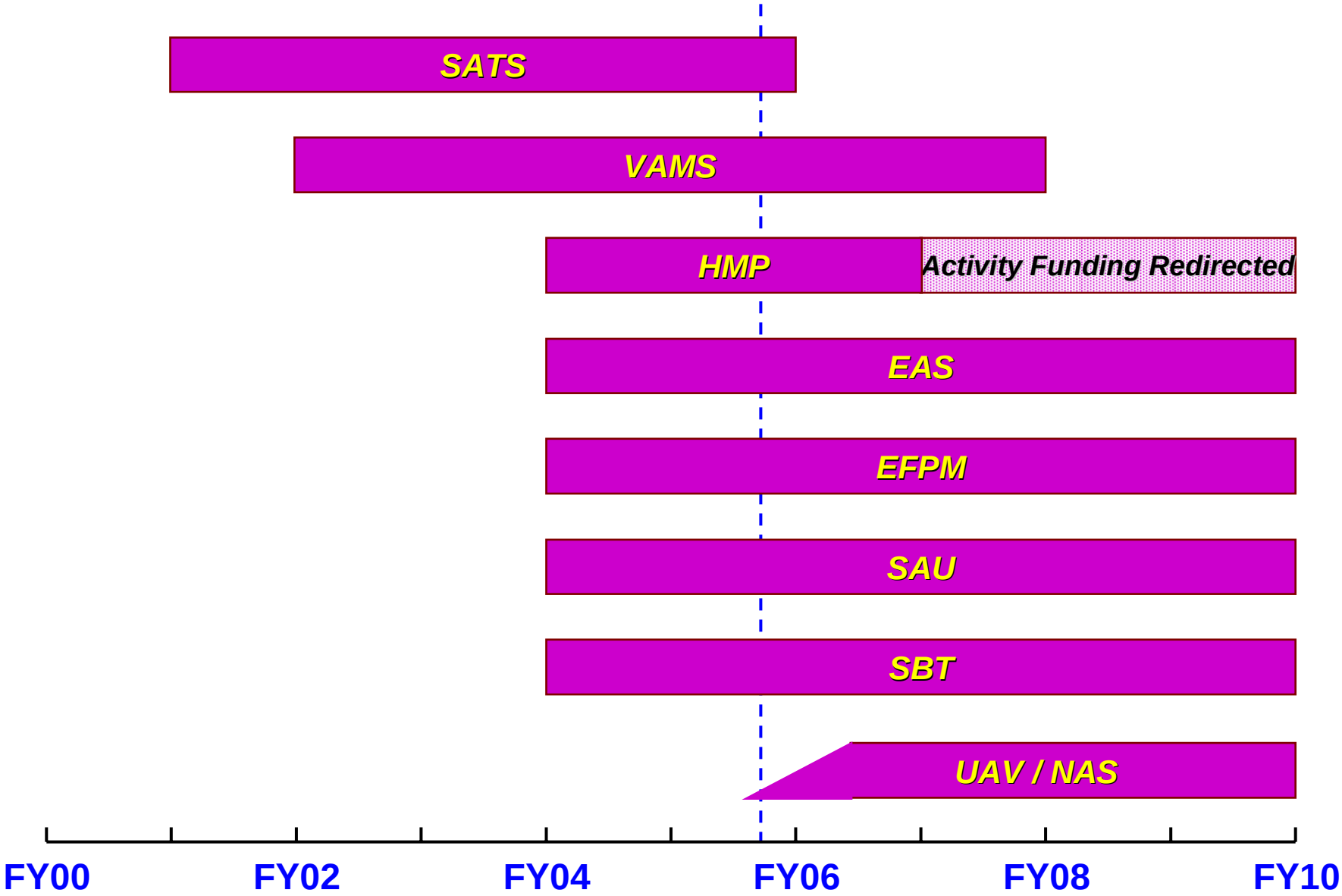
Space-Based Technologies
CNS Technologies and Architectures

Efficient Aircraft Spacing
Airborne Separation and Wake Vortex



Uninhabited Aerial Vehicles in the NAS
Routine Operations of UAVs in the NAS

Airspace Systems Projects Timeline



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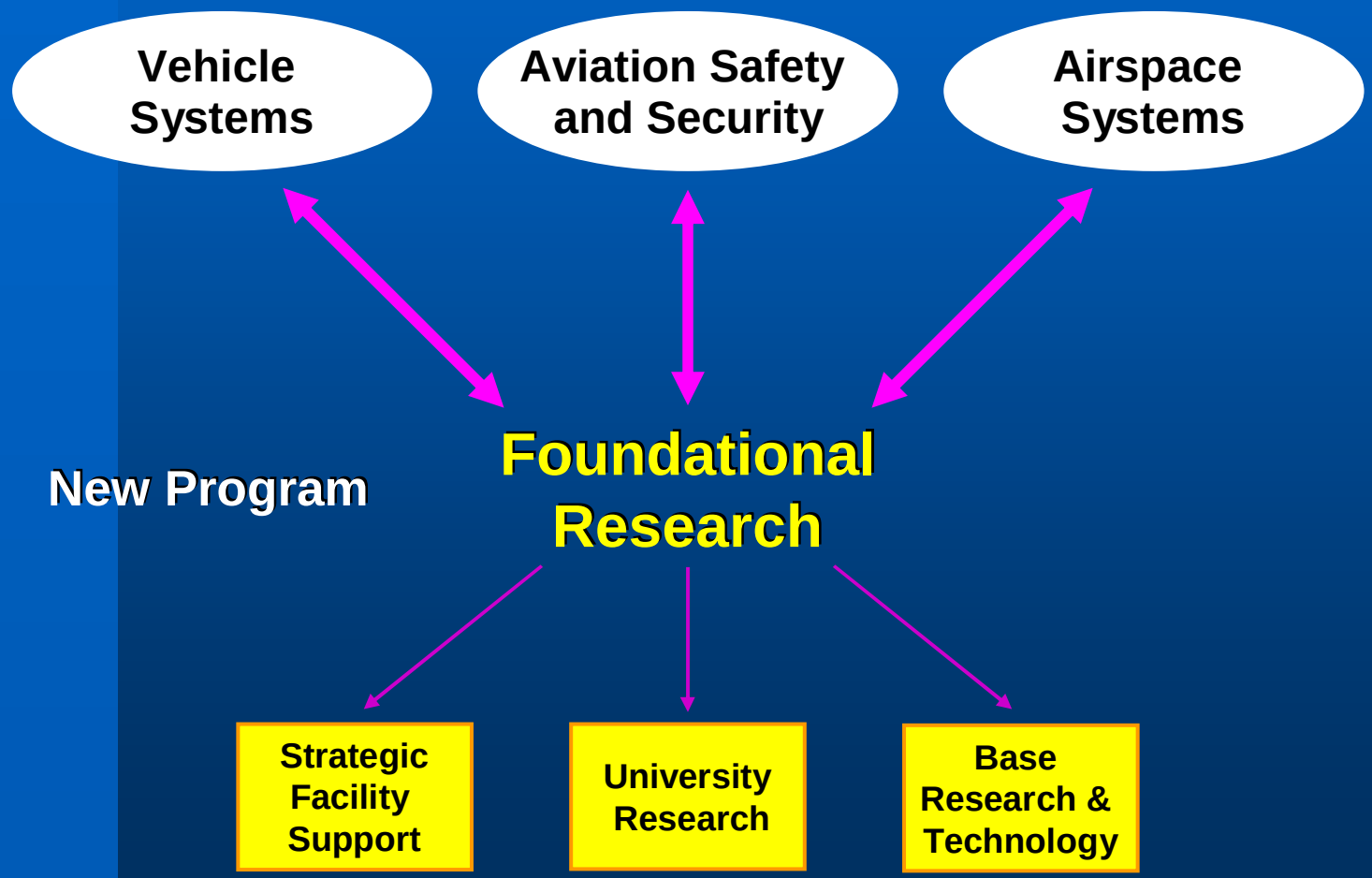
A Time of Change

- New Aeronautics Research Operating Model
  - Three Programs still in place



Transforming the NAS

The Path to the Next Generation Air Transportation System (NGATS 2025)

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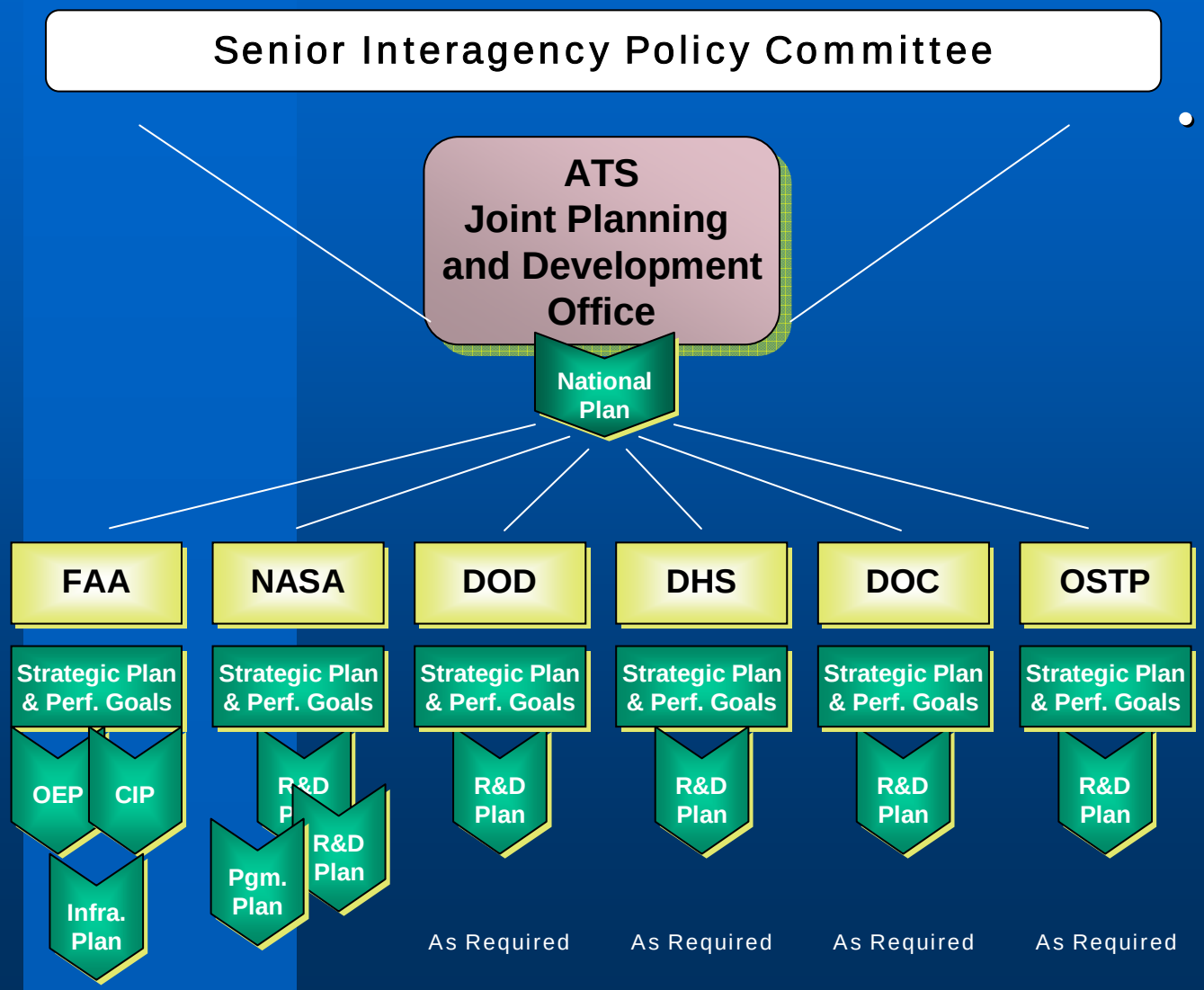
Partners in Development of National Plan for the Future NAS



- JPDO develops and maintains National Transformational Plan which includes:
  - Associated policies, technology, processes
  - Overall operational concepts
  - Supporting research
  - Implementation strategies
  - Policy and implementation commitments

Back-Up / Extra Slides

Airspace Systems Program Budget ($M)

Project	FY04	FY05	FY06	FY07	FY08	FY09	Total
Small Aircraft Transportation System	31.5 ^	16.5	4.1				52.1
Virtual Airspace Modeling & Simulation	30.5	23.9	37.6	30.7			122.7
Human Measures and Performance	19.0	15.7	22.1	19.7 *	19.6 *	19.6 *	115.6
Efficient Aircraft Spacing	19.1	36.5	38.6	39.4	42.1	44.2	219.9
Efficient Flight Path Management	1.4	12.3	20.5	22.5	28.9	29.0	114.5
Strategic Airspace Usage	0.5	14.6	21.5	23.2	30.4	30.3	120.4
Spaced-Based Technologies	9.1	14.6	25.6	32.6	39.0	39.1	160.0
UAV in the NAS			20.6	20.2	20.2	11.9	72.9
Technology Integration	19.2	14.6	14.8	15.8	16.7	17.7	98.8
Total	130.3	148.6	205.4 **	203.9 **	196.9 **	191.7 **	1076.9

Source: FY2006 POP, NBS Process 335 w/ASPO Adjustments

^ Includes NASA FY2004 Congressional Action

* HMP funding will be transferred to Foundational Research Program

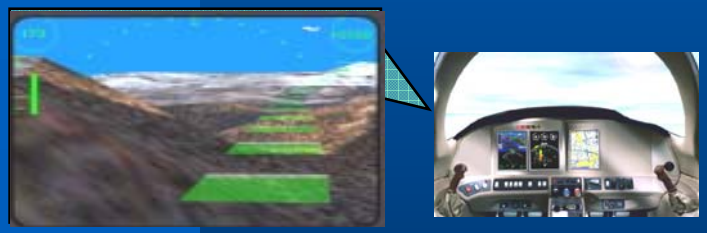
** Total budget will be reduced by 20% due to Foundational Research Program

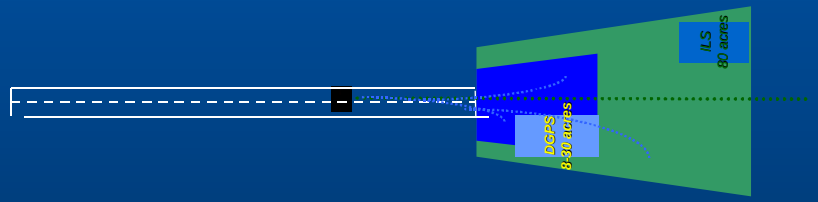
Small Aircraft Transportation System

Develop technology to enable small aircraft to operate at small non-radared and non-towered airports

Lower Landing Minimums at Minimally Equipped Landing Facilities

Increased Single-Pilot Crew Safety and Mission Reliability





En Route Procedures & Systems for Integrated Fleet Operations

Higher-Volume Operations at Non-Towered/Non-Radared Airports

Virtual Airspace Modeling & Simulation

Provide the technologies and processes for conducting trade-off analyses amongst future air transportation system's concepts and technologies

Model and simulate behavior of air transportation system concepts and their elements

Develop advanced air transportation operational concepts

Conduct assessments of advanced air transportation concepts

Human Measures and Performance

Improve the design of human-centered automation and interfaces, decision support tools, training protocols, team practices, and organizational procedures supporting current and future aviation systems

Pilot Training

Virtual Environments

Human-Centered Systems

Human Performance

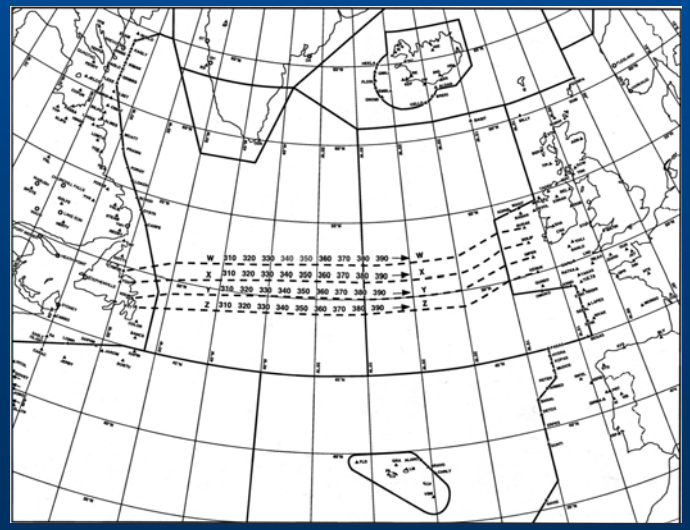
Fatigue Countermeasures

Efficient Aircraft Spacing

Explore innovations in air/ground information management and responsibilities, and further explore wake vortex operations in the terminal area

Wave Vortex Avoidance and Alleviation

Airborne Separation

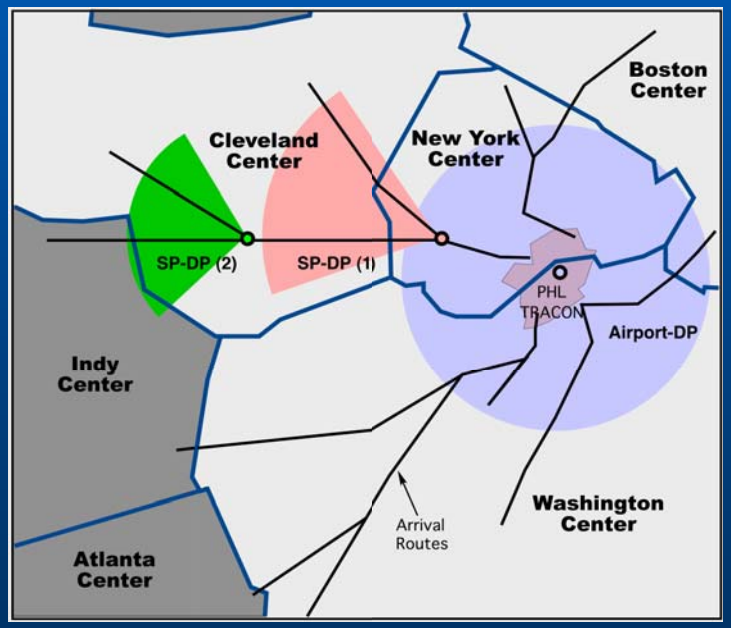


Airborne Spacing

Efficient Flight Path Management

Develop integrated ATM decision support tools and advanced traffic management concepts to facilitate National Airspace System (NAS) modernization

Integrated Air Traffic Management



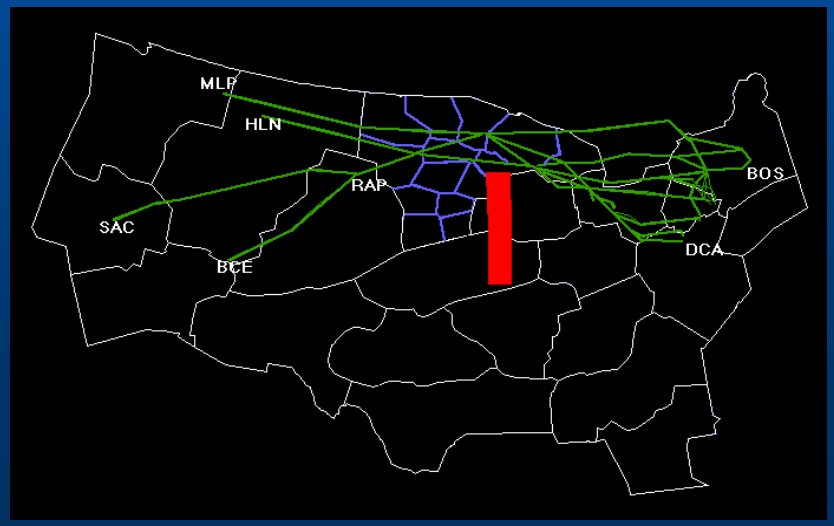
Multi-Facility Traffic Management

Strategic Airspace Usage

Develop selected technologies for airborne and surface planning to improve traffic flow management within the NAS, consistent with an evolutionary path to the future concept of operations

Integrated Surface Management

Strategic Traffic Flow Management



Collaborative Traffic Management

Space-Based Technologies

Develop communications, navigation, and surveillance technologies, architectures, and systems to improve efficient operations of the current and future NAS

Spectrum Efficiency and Advocacy

Airport Surface Network

Transitional Architecture and Global Air/Ground Network

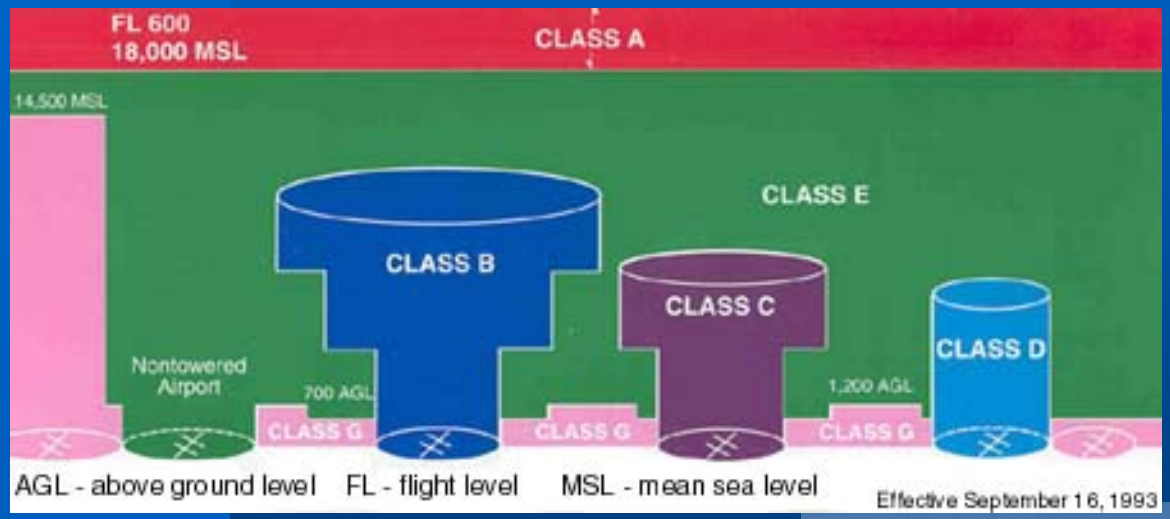
Efficient Oceanic/ Remote Communications & Surveillance

Improved Air/Ground Communications

High-Payoff CNS Technologies

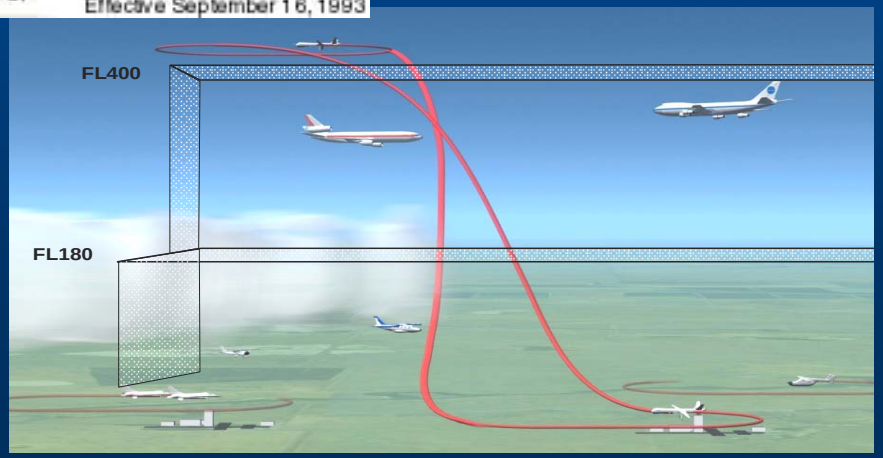
Uninhabited Aerial Vehicles in the NAS

Develop technologies and operational procedures necessary for routine operations in the NAS of uninhabited aerial vehicles above FL400 and above FL180



FAA Restricted Airspace Classes

Airspace Description



AS Program Customers/Stakeholders

NGATS Joint Planning and Development Office

NASA/FAA
Interagency Integrated Product Team (IAIPT)

NASA

Airspace Systems Program

- **Small Aircraft Transportation System**
- **Virtual Airspace Modeling & Simulation**
- **Human Measures & Performance**
- **Efficient Aircraft Spacing**
- **Efficient Flight Path Management**
- **Strategic Airspace Usage**
- **Space-Based Technologies**
- **UAV in the NAS *(FY06)***

FAA

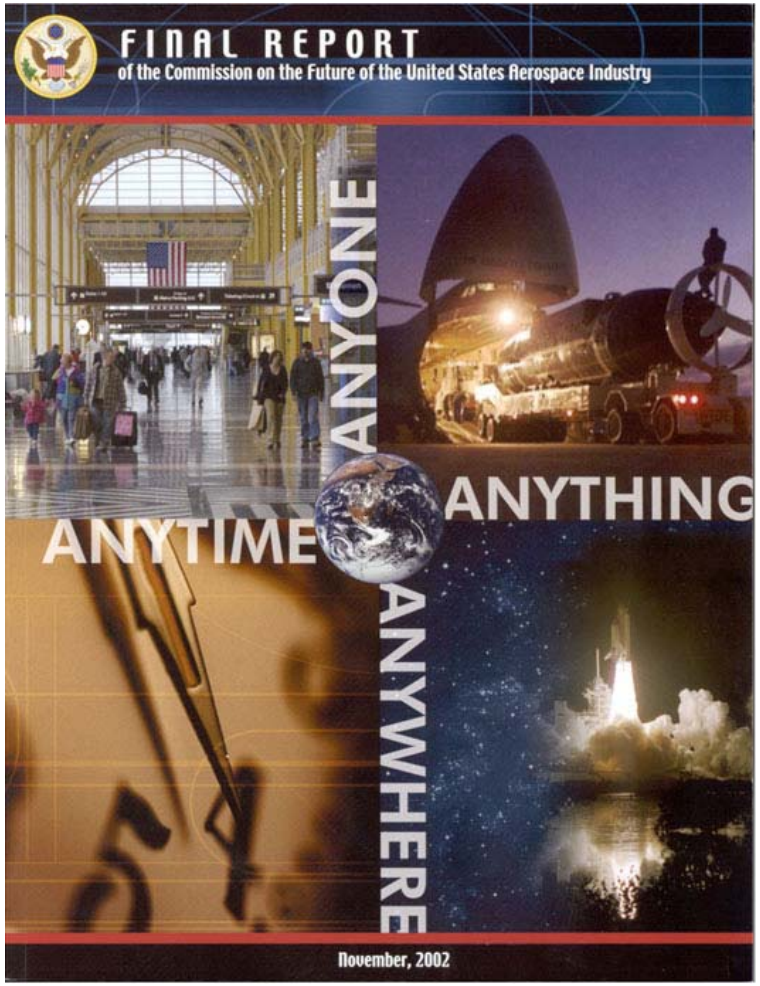
Advisory Groups

- ARAC Airspace Systems Program Subcommittee
- National Research Council

Participation with Stakeholders

- RTCA
- NCAM
- UNITE
- AIAA, AHS, SAE, ATA, ALPA, NATCA, ATCA, GAMA
- Industry
- FAA RE&D Advisory Committee
- FAA/Eurocontrol R&D Committee
- ICAO

Commission on the Future of the United States Aerospace Industry



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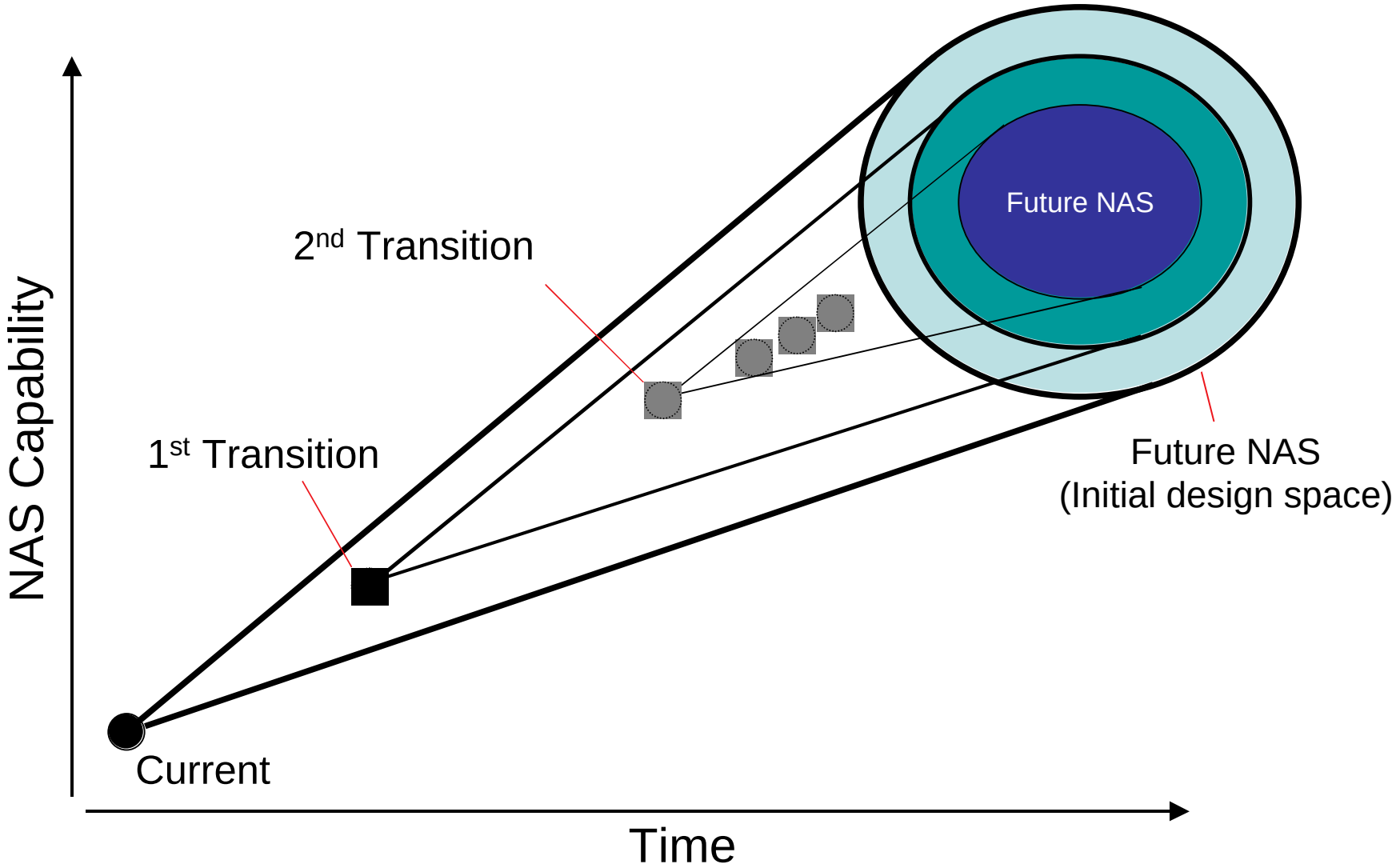
Recommendations:

#2: "The Commission recommends transformation of the U.S. air transportation system as a national priority."

#3: "The Commission recommends that the U.S. create a space imperative."

#9: "The Commission recommends that the federal government significantly increase its investment in basic aerospace research, which enhances U.S. national security, enables breakthrough capabilities, and fosters an efficient, secure and safe aerospace transportation system."

Transforming the NAS



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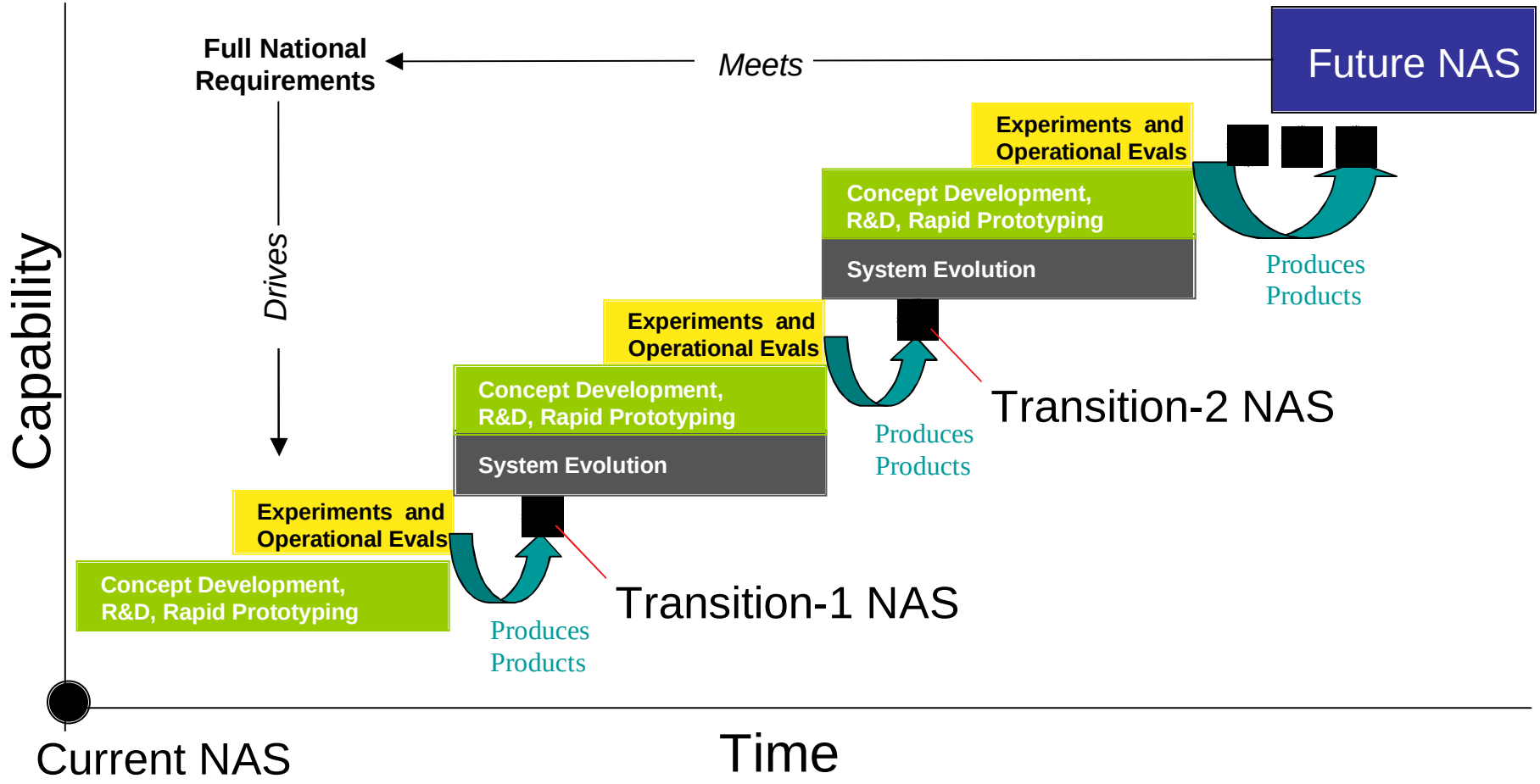
From Concept to Implementation

Strategic Evolution Process



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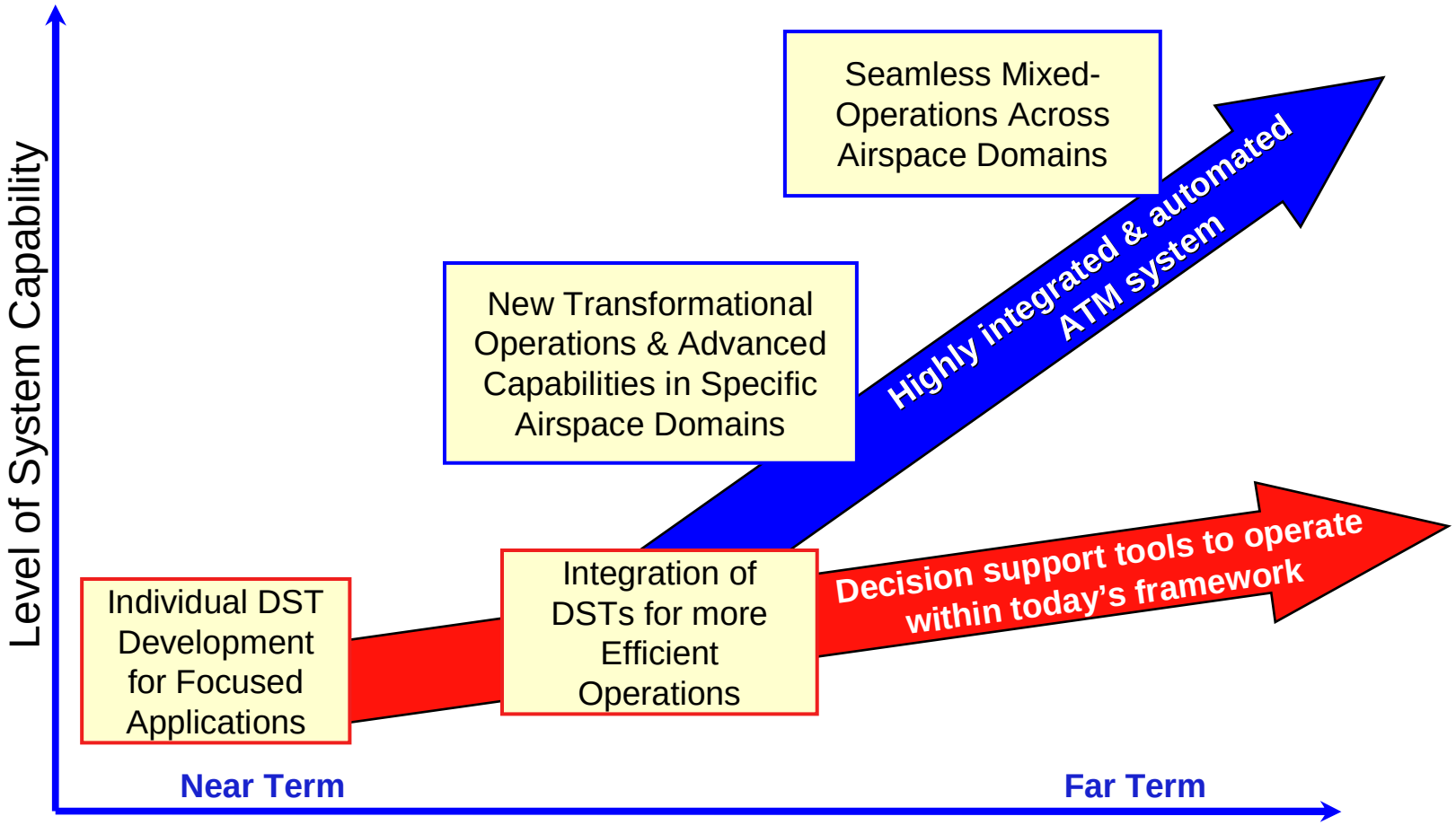
NAS Transformation

New Ways of Operating to Meet New Needs for Air Mobility



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Mapping of the Airspace Systems Program to the JPDO NGATS 2025 Capability Requirements

Presentation to the ARAC Airspace Systems Program Subcommittee

Robert A. Jacobsen, Program Manager

John A. Cavolowsky, Dep. Prog. Mgr for Technical Integration

August 4, 2005

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Primary Purpose of the Analysis

To understand the degree of alignment between the ASP to the NGATS Curb-to-Curb capabilities requirements.

- This is a “bottoms up” mapping.

To assist in realigning and reprioritizing the ASP to be more fully supportive of the JPDO.

- This is a work in progress.

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ASP/NGATS Observations

- ASP is reviewing its activities relative to NGATS requirements.
  - Much of NASA's current and proposed research is directly relevant to the NGATS concepts even though the vocabulary may not appear so.
- The core of the ATM process in the future NGATS concept is the "evaluator concept."
  - This is a direct derivative of the Traffic Flow Management/Strategic Management activities underway and planned by ASP.
  - Shared responsibility and controller human factors are key research elements.
- Not all ASP research is directly targeted to NGATS, but most of it is.
  - Analysis of promising automation concepts and technology to take forward for further development and demonstration in support of NGATS/JPDO goals and objectives.
  - Prototype software that can be extended for operational demonstration of transformed NAS operations.
- ASP's TNAS program augmentation is focused on the longer term concepts of strategic ATC/ATM.

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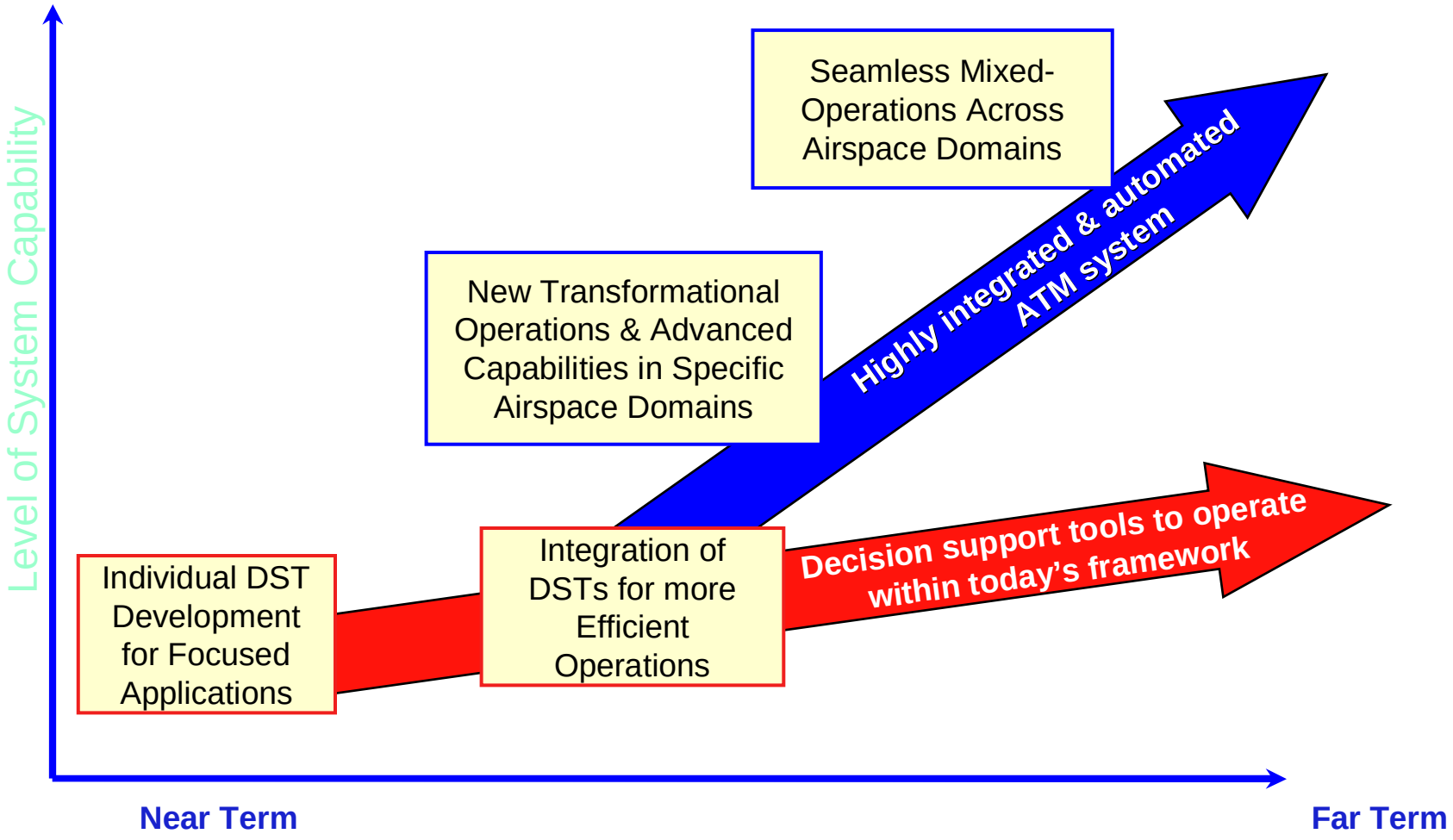
NAS Transformation

New Ways of Operating to Meet New Needs for Air Mobility



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Mapping and Analysis Observations

- Many R&D activities map to many NGATS 2025 capability requirements.
  - Current project portfolio is not organized to provide clearly understandable applicability to NGATS 2025.
- We have conducted several ASP mapping analyses.
  - NGATS 2025 Capabilities ***PRIMARY***
  - Agile Air Traffic System IPT Action Plan
  - ASP independent R&D requirements assessment
- How does this help to restructure ASP project elements?
  - An alignment with a functional architecture may be a better approach.

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JPDO C2C Capabilities

- **Network-Enabled Information Access**
- **Performance-Based Services**
- **Layered, Adaptive Security**
- **Weather Assimilation into Decisions**
- **Broad-Area Precision Navigation**
- **Aircraft Trajectory-Based Operations**
- **“Equivalent Visual” Operations**
- **Expanded Airport Operations with “Super Density”**

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Sample JPDO C2C Expanded Capabilities
Net-Enabled Information Access

C2C Capabilities
1. Net-enabled info access
a. Creation of network-centric architecture standards and protocols
b. Definition of appropriate dissemination and the use of information, accounting for safety, security, and mission criticalities
c. Determination of architectures that optimize reliability, scalability, and cost in the air transportation, communication, navigation, and surveillance environments
d. Ground-to-ground information sharing
i. Integrated surveillance system across government
ii. Timely info (weather, safety, security) from private, commercial, & government sources
iii. Network allowing for facility consolidation (with careful and early attention given to creating effective policy for consolidation)
e. Air-to-ground & ground-to-air information sharing
i. Aircraft position and intent
ii. Clearance and 4D trajectories
iii. Weather info
f. Air-to-air information sharing to support
i. Cockpit situational awareness
ii. Conflict resolution

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Airspace Systems Program Organization

Airspace Systems Program Office

Program Manager:	Robert Jacobsen
Deputy Manager:	Dr. Frank Aguilera
Deputy for Tech Integration:	Dr. John Cavolowsky
Deputy for Ops & Plans:	Lynda Haines
Business Manager:	Ruth Marlaire

Strategy Team
ARC: Dr. Thomas Edwards
LaRC: David Hinton
GRC: Anita Liang
DFRC: Eddie Zavala

Small Aircraft Transportation System
Project Manager:
Jerry Hefner
(LaRC)

Virtual Airspace Modeling & Simulation
Project Manager:
Harry Swenson
(ARC)

Human Measures and Performance
Project Manager:
Dr. Richard Mogford
(ARC)

Efficient Aircraft Spacing
Acting Project Manager:
Guy Kemmerly
(LaRC)

Efficient Flight Path Management
Project Manager:
Daniel Kozarsky
(ARC)

Strategic Airspace Usage
Project Manager:
Dr. Parimal Kopardekar
(ARC)

Space-Based Technologies
Project Manager:
Robert Kerczewski
(GRC)

Uninhabited Aerial Vehicles in the NAS
Project Manager:
Jeffrey Bauer
(DFRC)

(Project Lead Center)

Beginning In FY06