

DRAFT

National Aeronautics Research and Development Plan: Mobility Coordinating Group

Outreach Session

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Outline

- Mobility Definition and Scope
- Impetus and Challenges
- Implementation Epochs
- Mobility Chapter Organization
- Discussion Topics

Mobility

Mobility through the air is vital to economic stability, growth, and security as a nation

- Requires an aeronautics enterprise with:
 - sufficient capacity to meet increasing demand for air travel and transport
 - sufficient flexibility and affordability to accommodate the full range of aircraft requirements and attributes
- The capability to move goods and people, point-to-point, anywhere in the nation and around the world is essential to advance the local, state, and national economies of the US.
- The US, in cooperation with international partners, should play a leading role in ensuring global interoperability.

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Mobility CG Scope

- The National Aeronautics R&D Policy, dated December 20, 2006, states
 - “As the science and application of aeronautics progressed, an interdependence developed among the aircraft, the air transportation system, and the people who use these systems, resulting in a multi-dimensional, highly integrated aeronautics enterprise.”
 - Furthermore, “design or modification of any of these individual systems or parts, without consideration for the collective effect on the enterprise, may result in adverse or unintended consequences.”
 - “Treating the entire system as a whole is complex but necessary...”

Mobility considers together the air transportation system and the vehicles that fly within it.

It's More Than Just the Movement of People and Goods



- Aviation and Aerospace represent 5.4% of U.S. GDP.
- If expanded to include related industries, its 9% of U.S. GDP
- Contributes 11 million jobs to our economy

All Signs Point to Continued Strong Growth



- One Billion+ Passengers in U.S. Skies by 2015
- Potential for Triple Demand by 2025
- New Entrants Such as Very Light Jets
- Global Market Opportunities
- U.S. Travel and Tourism to Grow 4.2% Annually

General Aviation Challenges

- Maintaining access to National Airspace
- Preserving VFR
- Limiting Equipage Costs
- Limiting Restricted Airspace



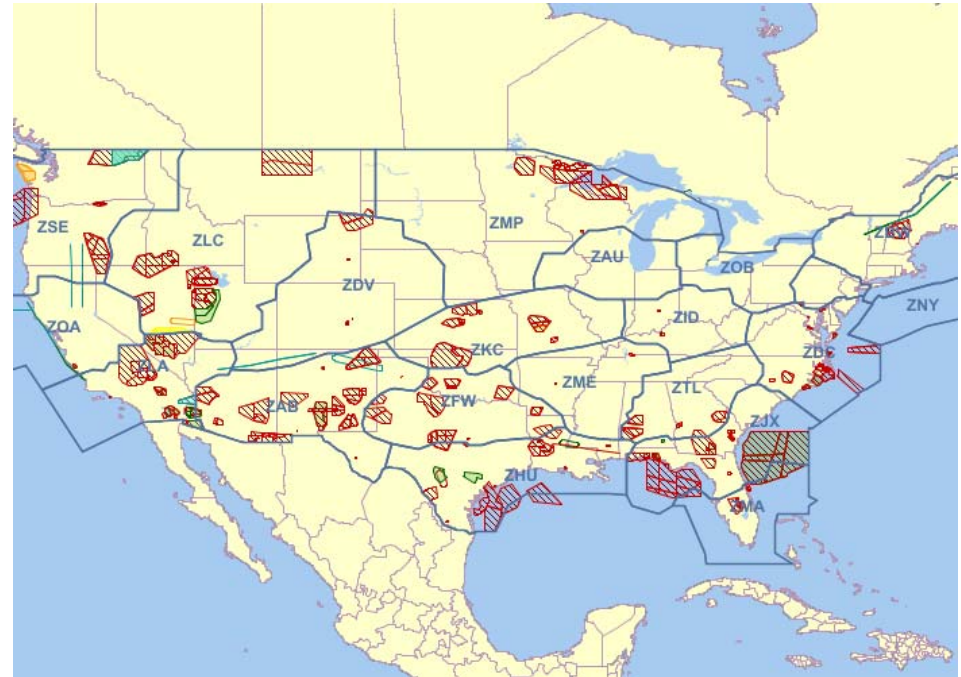
Air Taxi/VLJ Challenges



- **Personal Air Travel Alliance Survey of top five Air Taxi Operators**
 - 500 VLJ's within three years
 - 200-300 mile average flight
 - 18,000 – 21,000 feet altitude at 340 knots
 - Primarily secondary airport destinations
 - Target 1000 hrs/yr operation per VLJ
 - Dramatic Demand growth outside legacy carrier route structure

Defense (DoD/DHS) Airspace Challenges

- 13,000 aircraft fleet
- Management of Air Defense Identification zones
- Temporary flight restrictions
- Special Use Airspace
- Equipage costs
- Homeland Defense Requirements



Mobility Content Structure

- Core Thrust
 - Airspace
 - Airports
 - Aircraft
- Cross Cutting Themes within the Core Thrusts
 - Weather
 - Human/Machine Integration
- Enterprise Level Modeling and System Trades

ATM “view” of evolution

Research

Building NextGen

FY07 – 11
 4DT Management
 Performance-Based Ops & Services
 Equivalent Visual Ops (CDTI)
 Roles of Pilots & Controllers

FY12 – 18
 Super Density Operations
 Time-Based Surface Ops
 Right Sizing of Facilities

FY19 – 25
 Research for Transformed NextGen State

Core Technologies, Capabilities & Sys Eng

Epoch 1 FY07-11

- Complete R&D leading to mid-term
- Continue R&D that address long-term NextGen challenges
- Develop & implement known & new procedures, infrastructure, technologies
- Develop NextGen systems integration plan for mid-term transition to NextGen
- Complete infrastructure and systems engineering for mid-term

Mid-Term Transition to NextGen

Epoch 2 FY12-18

- Aircraft equipped for the mid-term & upgradeable to NextGen target
- Deliver NextGen services & capabilities across domains
- Complete “hard” infrastructure – airports, runways, terminals, security
- Management & operating models support transition to NextGen and long-term sustainability

NextGen Solutions Fully Integrated & Operating

Epoch 3 FY19-25

- NextGen solutions fully-integrated & operating across air transportation system
- Services managed & operating in ways that achieve transformational outcomes across air transportation system

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Mobility Chapter Structure

- Background and Scope
- State of the Art and Critical Challenges
- National Goals and Objectives
- Summary of R&D Needs
- Gap Analysis
- Cross Cutting Themes

White Paper Themes

- 19 White Papers were received and reviewed by the Mobility CG
- Several common themes were identified within the White Papers submitted to the Mobility CG
 - Leverage existing studies as basis for mobility plan including the 2006 Decadel study, the JPDO roadmap for ATM, and the NIA report for vehicle-related R&D
 - Insert new vehicle classes into the airspace such as rotorcraft and UAS
 - Consider system design including multi-mode transportation and multidisciplinary design optimization for vehicles
 - Pursue design of new aircraft, particularly supersonic aircraft
 - Insure aircraft avionics components enable precision navigation

Outreach Meetings

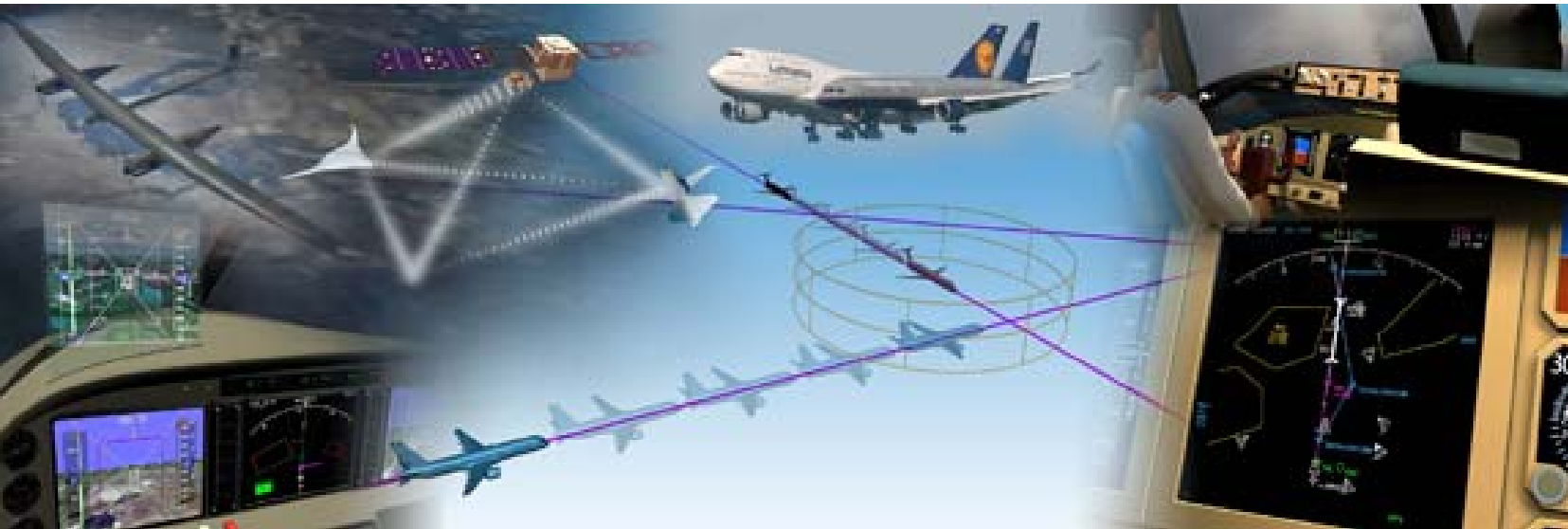
- Public Forums:
 - “Friends/Partners in Aviation Weather” Vision Forum - June 27
 - **Joint Propulsion Conf - Cincinnati, July 8 -11**
 - **NASA Ames Conference Center, July 30**
 - Industry/Association Forum, TBD
- Focus will be on gathering input from the participants on their perspectives of what should be included in the plan

Discussion Questions

- What are the technical design challenges for vehicle performance and procedures that are required to enable NextGen trajectory based operations?
- What are the key critical challenges (5, 10, 20 years) and how does one measure success against these challenges?
- What are the critical decisions associated that require focused R&D activities to assist in making these decisions?

BACK UP

Key Capabilities: Performance-Based Operations and Services



- ▶ Collaborative ATM
- ▶ Modernized Surface Ops.
- ▶ Weather Impacted Ops.
- ▶ Trajectory-based Ops.
- ▶ Trajectory-based Separation Management
- ▶ Dynamic Resource & Aerospace Management

Key Capabilities: Network Enabled Information Access



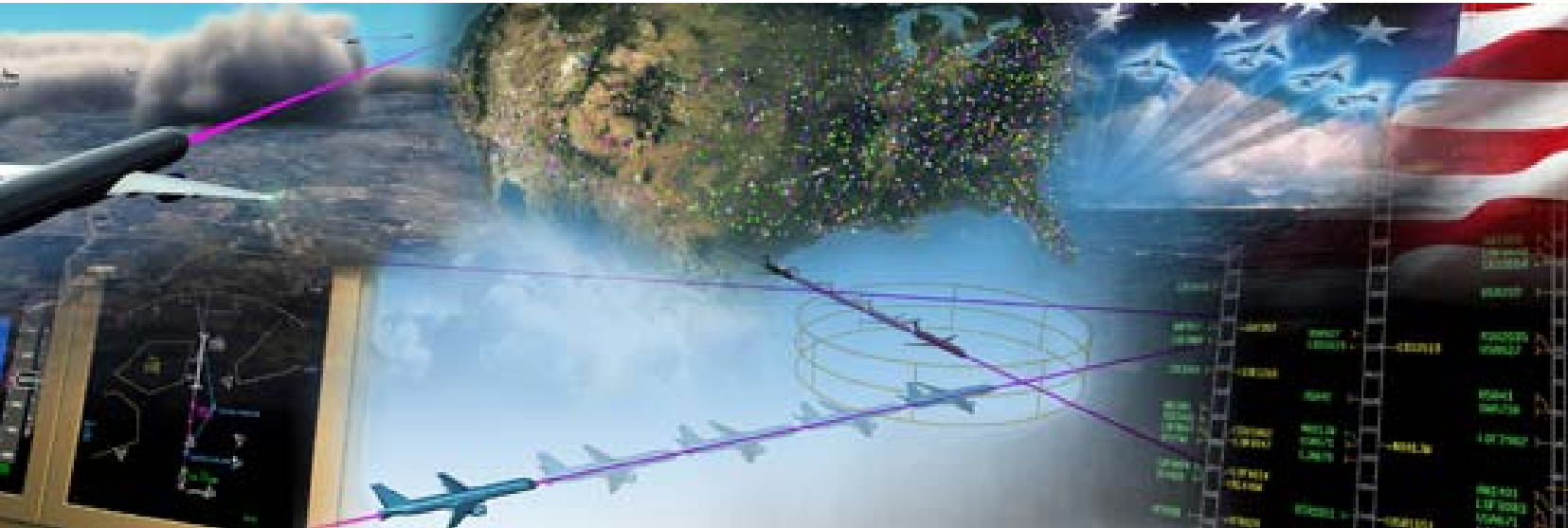
- Network Enabled Operations (NEO)
- Network Enabled Infrastructure (NEI)
- Network Enabled Weather (NEW)

Key Capabilities: Weather Assimilated into Decision Making



- Net-centric weather information is made available and understandable to all approved users
- A reliable virtual, common weather picture is foundational for optimal air transportation decision-making
- Presentation of weather data is tailored to user operational needs
- Widespread use of integrated probabilistic weather-related decision support systems
- Automatic updates to users based on operational need
- An adaptive observing system integrating ground, airborne and spaced-based sensors

Key Capabilities: Aircraft Trajectory-Based Operations



Services and Operations based on precise trajectory execution

- ▶ Self-Separation Services
- ▶ Flow Corridors
- ▶ Super Density Arrival/Departure Airspace

Key Capabilities: Equivalent Visual Operations



- Improved information availability which allows aircraft operations without regard to visibility
- Access to PNT enables increased accessibility for airport surface and arrival/departure operations
- Enables more predictable and efficient operations regardless of meteorological conditions

Key Capabilities: Super Density Operations



- ▶ Use of RNP operations and procedures
- ▶ Mitigation of wake vortex constraints
- ▶ Improved runway incursion prevention algorithms
- ▶ Automatic distribution of runway braking action reports
- ▶ Distribution of taxi instructions before landing
- ▶ Use of aircraft sensors