Aviation Strategic Outlook
Areas Driving the NAS CNS-ATM System of Systems

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Introduction

Strategic Outlook Areas

• Resiliency of the NAS
• Management of NAS Infrastructure and Technology Management
• Reducing the Environmental Footprint
• Minimizing the impact of weather on operations
• Understanding the Internet-of-things
• New Aviation Entrants
NextGen Integrated Framework

NextGen Operations → Measurable Benefits

Cross-Cutting Factors
- Environmental
- Safety
- Information Security
- Economic
- International
- Regulation

Enablers
- People
- Procedures
- Technology
- Data/Information
- Policy

Legend:
- Private Sector
- FAA (USG)
- Local entities
Foresight & Horizon Scanning

Diagram:
- Future Vision
- Emerging Trends
- R&D Centers
- Think Tanks
- International Trends
- Stakeholder/Domain news
- Emerging Dependencies
- Aviation R&D
- Operational Stakeholder Needs & Shortfalls

Outputs:
- External Factors and Aviation Trends
- Strategic Drivers Analysis
- Evaluate & Prioritize
- Risk & Opportunity ratings
- Strategic Outlook Report
- Enterprise Integration Analyses
- Update Enterprise Planning Artifacts
- Update Program Acquisition Artifacts
- Strategic Path
- Tactical Path
Resiliency of the NAS

Challenges:
• Technical: existing and emerging systems support the needed function and performance requirements.
• Operational: Proactively maintain and evolve the NAS through robust designs, implementation, maintenance and logistics methodologies.
• Schedule: develop an overall framework to incorporate outcomes into function and performance requirements, risk and opportunities strategies, research & development tasks, and inter-agency partnerships.
• Organizational: consolidate resiliency efforts and contingency strategies

Key Questions:
• Technical: How will the Future NAS support resiliency. What are the NAS elements (services, facility, systems and workforce) and risks that impacts operations and constrain the NAS from meeting resiliency goals?
• Operational: Is a NAS availability of 99.7% sufficient to meeting our NAS resiliency goals?
• Technical: Do the NAS CNS-ATM systems have a sufficient functional architecture and appropriate level of performance to provide services when needed to meet NAS resiliency goals?

Resiliency definition is:

Resiliency: The ability of a system to maintain an acceptable level of service during system failure scenarios and/or degraded facility conditions and prevent or mitigate impact to air traffic operations.
NAS Infrastructure & Technology Management

Challenges:
• Schedule: technology rate of transformation (long acquisition timeline vs. fast technology market cycle time).
• Organizational: technology-centric strategies that bias acquisitions and technical refreshes.
  • Driven by cost and schedule at expense of function and performance.
  • Current Culture of technology-based driven acquisition.
  • Reactionary vs Proactive strategic planning
• Availability of resources and time for analyses to be completed before program initiation
• Organizational: leverages rapid capability office structures and processes.

Key Questions:
• Capability: Can the use of system-of-systems modeling techniques in the AMS process enable the ability to forecast future infrastructure needs?
• Organizational: Can the systems engineering process support the technical discovery and application of new technologies, new uses for existing technologies and increased collaboration between CNS-ATM asset owners/operators and consumers?
• Organizational: How to best link the Top-Down (theoretical) with the Bottom-Up (reality) approach while leveraging insights on customer behavior and emerging trends to inform the macro infrastructure agenda.
• Policy: How to develop a benefits case that balances stakeholders moving towards a “quad bottom line”:
  • Improved performance (capacity, reliability, availability, service delivery).
  • Greater social benefits
  • Improved environmental benefits
  • Better financial returns
Reducing the Environmental Footprint

Challenges:
- Policy: emergence of electric-hybrid concepts for aircraft and airport vehicles to support a hybrid-thrust world around 2030.
- Harmonization: Leveraging operational improvements using enabling technologies to capture benefits.
- Operational: climate-friendly routing of aircraft without the need for costly redesign of aircraft, their engines and airports.

Key Questions:
- Policy: Can we find an acceptable balance between implementation of low-carbon transportation solutions while supporting increasing demand and capacity objectives?
- Policy: Can we have more shared investment and planning across domains to support complimentary solutions.
- Technology: What CNS-ATM systems and implementations would enable airlines and airports to move to alternative fueled transportation vehicles (aircraft, aircraft support, airport support and ATC maintenance support vehicles) to support a ban on all carbon-fueled vehicles?
Impact of Wx on Operations

Challenges:
• Cultural: safely apply decision support tools to support controller and traffic flow tasks during weather events.
• Operational: Apply combination of satellite-based navigation, synthetic vision and enhanced vision technologies for aircraft operators to land at more airports, in most weather conditions.

Key Questions:
• What CNS/ATM systems can derive benefits by gracefully degrading and optimizing the recovery of operations around a weather event?
• How will aircraft designs support all weather operations and how can the NAS leverage those emerging capabilities to improve efficiency and capacity?
• How can weather DST’s to controller be improved to support the gracefully degradation and optimize recovery around a WX events?
Internet-of-Things

Challenges:
• Design: determine candidates for autonomous-system-based operations that integrate seamlessly with primary and backup NAS systems and services.
• Technology: Leveraging existing and emerging autonomous methodologies to address transportation system solutions.
• Implementation: Application of AI capabilities may force the re-evaluation of many NAS implementation strategies, CNS-ATM technologies, and operating principals.
• Organizational: acceptance of advanced concepts to the FAA operational institutions.
• Data Analytics: Air Traffic Management (ATM), Operations and Maintenance data can inform processes aimed at identification of efficiencies in capability, acquisitions, and operations-availability of NAS infrastructure.

Key Questions:
• Operational: What are the opportunities and challenges facing the NAS as these capabilities emerge across the NAS domains?
• Technical: What are the criteria for what is the right environment in which to implement these capabilities?
• Technical: Identify those tasks the human does well and what the machine does well and building on that marriage to improve the future NAS capability?
New Aviation Entrants

Challenges:
• Technical: operational concepts and scenarios for integration into the NAS developed independently of each other leading to insufficient assumptions, dependency gaps and constraints on overall operations.
• New business models may focus operations in locations other than the core 30 airports resulting in gaps in Future NAS capabilities resulting in new congestion areas with rippling effects across the NAS.

Key Questions:
• Operational: Could these low-cost operators drive increased demand in area the Future NAS has not planned?
• Programmatic: How might the emergence of these new vehicle types and business models affect Future NAS capability implementation plans?
• Technical: What is the required CNS-ATM capabilities needed to account for unique performance characteristics of new aviation entrants.
• Policy: What are the criteria to determine a balanced approach to user access?
Interdependencies

Resiliency of the NAS

- NextGen Capabilities
- APNT
- Critical Infrastructure Standards
- Cybersecurity
- Operations & Maintenance Network

Wx is the largest contributor to NAS Impact

Build Plan optimizes Operations

- Improved insights to optimize operations
- Demand exceeds Capacity
- Unlock Data
- Become more Vulnerable
- Big Data
- Dark Data
- Intelligent Assistance
- Artificial Intelligence
- Machine Learning
- Passenger Connectivity

Internet-of-things

Management of Infrastructure and Technology Planning

- Minimize Impact of WX on Operations
- Reduce the Environmental Footprint
- Budget Management
- Planning Uncertainty
- Inconsistent NAS Investments
- Stagnant Equipage Rates
- Reduce airborne delays
- Positive Cost to Benefits
- Marginal Cost to Benefits

New Entrants

- UAS
- Supersonic / Hypersonic
- Commercial Space
- Low-cost International Operators
- Tethered Dirigibles

Legend
- External Factor
- Aviation Trend
- Common Factor / Trend
Near - & Long-term Interdependencies

Strategic Outlook 2017
- Resiliency of the NAS
- Manage Infrastructure and Technology
- NAS Ops vs. MS

Strategic Outlook 2017
- Resiliency of the NAS
- Application of AI Capabilities and Blockchain

Strategic Outlook 2017
- Manage Infrastructure and Technology
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Enterprise Monitor – Global View

Awareness and Operational Impact Global View

NAS Service Status View

Smart Impact View
Enterprise Monitor - Detail

Metroplex Target Surveillance View

Avionics Equipage View

Airport Traffic Metrics View
Summary

• The Strategic Outlook is a continuous effort to monitor external factors and aviation trends that can impact the Future NAS.

• Relevant factors and trends drive follow-on Enterprise Integration Analyses.

• The Enterprise Integration Analyses is the assessment of impacts at the NAS enterprise level and program level.

• The outcome of the enterprise level analyses could result in updates to the NAS vision and enterprise planning artifacts to better manage emerging enterprise level challenges.