Annual SERC Research Review (ASRR)
Implementing the Next Generation Air Transportation System

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What is NextGen?

- NextGen is not a single program or procedure but a comprehensive initiative that integrates new and existing technologies. NextGen represents the complete transformation of our national airspace system.
The Impact of Aviation in the US

- 5,000 Planes in air at any time
- 1 Billion passengers per year
- More than 10 Million jobs
- More than 5% of GDP
Current System Performance

- Demand remains high
- Air Traffic System not utilizing current available technologies
Why do we need to do anything?

- Make it **Safer** – current ground based radar “sees” aircraft every 12 seconds versus satellite which updates every second
- Make it **More Efficient** - delays in 2009 resulted $2 Billion in lost income and $9 Billion in lost productivity
- Make it **Flexible** - demand and congestion will increase dramatically and our system must be flexible to accommodate NAS user needs
- Make it **Sustainable** – impacts the environment with petroleum based fuels, carbon emissions and noise
Transition to NextGen: The Path is Extremely Complex
Air Transportation Forms a Complex Dynamic System Driven by Economic, Societal & Technical Factors

- Pax & Cargo
  - Baseline Demand
  - Effective Price
  - Trip Time
  - Market Clearing
  - Effect on GDP
  - trips offered
  - travel costs
  - travel times
  - money paid
  - trips taken

- Fleets & Schedule
  - Passenger & Flight Delays
  - Flight Cancellations
  - Schedules
  - Fleet Finances
  - Aircraft Fleets

- NAS
  - Airport Capacity
  - Enroute Capacity
  - ATC Infrastructure
  - ATC Controllers
  - FAA Budgets
  - Aviation Trust Fund
  - services offered
  - services & capacity used
  - taxes
What do we need?

A system that will:

• Ease congestion and offer increased capacity to match demand while ensuring safety

• Reduce impact on the environment and without impacting the aviation’s contribution to our economy

• Prepare for the new types of aircraft that may utilize our airspace – UAS and commercial spacecraft, for example
Where Do We See NextGen?

ECONOMIC IMPACT

SAFETY

SUSTAINABILITY

FLEXIBILITY
NextGen is...

Economic Impact
NextGen is...

Safety
NextGen is... Sustainability
NextGen is…

Flexibility
Delivering Benefits Today & Tomorrow

2018 Estimates
$23 Billion in Benefits

Reduce Delays
35%

Reduce CO₂ Emissions
14M Tons Cumulative

Reduce Fuel Use
1.4B Gallons Cumulative
What Does The System Look Like in 2018?

- Efficient Cruise
- Enhanced Surface Traffic Management
- Streamlined Departure Management
- Enhanced Surface Traffic Operations
- Streamlined Arrival Management
- Flight Planning
- Pushback / Taxi
- Takeoff
- Domestic/Oceanic Cruise
- Descent / Final Approach / Landing

Phases of Flight Mid-Term 2018
Automatic Dependent Surveillance – Broadcast (ADS-B)

- Far more accurate than ground-based radar
- Provides properly equipped aircraft with:
  - Terrain maps
  - Surface Traffic information
  - Airborne traffic information
  - Weather information
  - Critical flight information
  - Increased Situational Awareness
RNAV: General purpose satellite navigation

RNP: High-precision satellite navigation for congested airspace
  - Provides aircraft with the ability to fly shorter, more efficient flight paths
  - Increases capacity of runways and in the airspace –
    - Ability to “de-conflict” airports, avoid sensitive areas
  - Reduces delays, fuel burn, and aircraft noise

WAAS/LPV: Provides ILS-like capability without ILS infrastructure costs
WAAS/LPVs Facilitate General Aviation Access
Over 2,440 published serving more than 1,200 airports

Key Benefits
- Increases safety
- Improves access to airports without ILS infrastructure in low visibility conditions
- Allows operations during ILS outages

Wide Area Augmentation System (WAAS) Localizer Performance with Vertical Guidance Approaches (LPVs)
Surface Surveillance and Data Sharing

Surface data sharing for ASDE-X infrastructure underway in 2010

- Leverage installed ASDE-X infrastructure
- Will provide surface traffic data sharing
- Stepping stone for more robust collaborative decision support tools

Benefits
- Delay reduction
- Reduced fuel burn and environmental footprint
- Improved situational awareness and decision making
- Collaborative planning at airport

Leveraging demos at JFK and MEM
Incremental Approach to Implementing NextGen
Produces Benefits and Builds a Foundation

Best Equipped Best Served Prototyping

Tailored Arrivals

3D PAM

Airspace Deconflict

Surface Management

GBAS

UAS

Focus on Integrated

RPI

Airspace Deconflict

CSPO

4-D FMS

Staffed NextGen Tower

DFW

4-D FMS

Staffed NextGen Tower

DFW

FAA

NextGen
New NextGen Integration and Evaluation Capability (NIEC)
Allows Early Exploration & Assessment of Integrated System Dynamics & Interfaces
Complex Challenges Ahead

Transforming one of the most intricate systems in the world while maintaining and improving safety

- New Systems
- New Procedures
- New Aircraft Capabilities
- Renewable Fuels
- New Supporting Infrastructure
- New Operational Practices
Objectives Reflect Both Common Goals & Diverse Interests

NextGen Objectives Include...

- Improved Access
- Stakeholder Equity
- Return on Capital
- Industry/Government Partnership
- Improved Flexibility
- Reduced Delay
- Noise Reduction
- Reduced Emissions
- Enhanced Safety
- Improved Travel Experience
- Global Harmonization
- Enhanced Safety
- Improved Flexibility
- Global Harmonization
- Improved Travel Experience
Constraints Also Reflect Diverse Factors

- Environmental Impacts
- Economic Landscape
- Funding & Capital
- Political Climate
- Policies
- Technology Insertion
- Local Community Needs
- Industry Investment
- Aircraft & Equipment Capability
- Geography
- Maintenance Requirements
- Training Requirements
System Dynamics - NextGen Development & Implementation

- SoS development programs
- Stakeholders
- CONOPS
- Common goals and needs
- Enterprise architecture
- Schedule and cost estimates
- Systems engineering processes
- Critical competencies
- Culture
- Governance system
- Operational capabilities
- Solutions and capabilities
- Validation & Verification

Key relationships:
- Require
- Develop
- Requires/Enables
- Supports
- Enables/Constrains
- Influences
- Controls
- Requires
- Reviews and approves
- Resulting in deployment of
- Informs
- Described by
- Implemented using
- Maturing through
- Sharing
- Representing
- Satisficing and updating
- Describes
- Developed using
- Controls a
- Congruent with
- Integrate to form
- Defines
- Integrated to form
- Supports development of
- Supports
- Enables/constrains
- Requires
- Enables/constrains
- Requires
- Requires
- Requires
- Requires
- Supports
- Enables/constrains
- Enables/constrains
- Enables/constrains
- Enables/constrains
- Conforms with
- Conforms with
- Conforms with
- Capture updated versions
Internal Challenges

- Inherent resistance to change as evidenced in Executive Survey
  - Strong safety culture
  - Ownership/control issues

- Culture
  - Embracing NextGen as an Agency

- Requirement for “Systems thinking”

- Value of engineering expertise
  - Balance of practical experience with trained engineers & scientists
  - Understand the difference between needs & requirements

- Labor relations
  - Strong bargaining unit involvement & buy-in key to success

- Streamlining & defining processes

- Recruiting qualified employees
Key Areas for Improvement

The Foundation for Success analysis effort identified the following four key areas of improvement:

**Governance**
- The FAA would benefit from **tighter alignment and closer integration of NextGen elements**
  - Program management will benefit from elevated visibility and consistency
- NextGen needs the ability and authority to **bridge the strategic requirements with its tactical implementation**

**Capabilities**
- While pockets of best practices exist, as a whole the FAA needs to bolster key **individual and organizational capabilities** necessary to fully support and develop NextGen
- These capabilities span multiple areas, including **program management, systems integration, software engineering** and **communication**

**Processes**
- The current set of processes implemented to support NextGen **do not adequately manage its complexity and scope**
- These processes, as implemented, tend to **overlook rather than overcome organizational boundaries**

**Culture**
- A number of **cultural barriers** need to be addressed within NextGen-related activities to **mitigate their negative effect** on the program
- These include the **lack of information sharing, discomfort with managing uncertainty**, and the struggle to bridge tactical and strategic viewpoints

FAA
NextGen Design Considerations

The underlying principles for the NextGen Organizational top-level design will carry forward in the functional design of the full organization:

- Ensure appropriate assignment and recognition of responsibility, accountability and authority

- Ensure sufficient and consistent integration and communication
  - Amongst planning, program management, and operating group
  - Across all lines of business in NextGen activities

- Ensure the NextGen effort is receiving the attention and resources necessary to successfully achieve its vision

- Ensure NextGen operating model creates a platform for continued development of the FAA program management capability
A New Paradigm for NAS-wide Management: Continuous Interdisciplinary Involvement

- “Hand-offs” are eliminated in favor of collaboration. NextGen, LoBs, Staff Offices, Programs and Operations engage throughout the capability lifecycle.
- A single FAA-wide process for changes to the NAS that works with all contributors to the NAS.
- This collaborative approach requires shared accountability, responsibility and risk. This is achieved through direct and obligatory engagement.
- The collaborative teams will be responsible for activities such as requirements mgmt, configuration mgmt, and assumption/constraint mgmt.
Maintaining Consensus Around Individual Stakeholder Interests

A Dynamic Environment for NextGen

- GAO
- INSPECTOR GENERAL
- ADMINISTRATION
  - DOT
  - White House
  - DOD
  - DOC
  - DHS
  - NASA
- CONGRESS
- FAA
  - HQ
  - Field
- OPERATORS
- INTERNATIONAL PARTNERS
- LABOR
- COMMUNITIES
- AIRPORTS
- MANUFACTURERS
- OTHER STAKEHolders
- DOT
- DOD
- DHS
- White House
- DOC
- NASA
- INSPECTOR GENERAL
- FAA
- HQ
- Field
- OPERATORS
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- OTHER STAKEHolders
- DOT
- DOD
- DHS
- White House
- DOC
- NASA
External Challenges

• Complexity
• Diverse/competing interests of stakeholders
• Fiscal problems of airlines
  - Discourages investment in NextGen avionics
• Environmental constraints
• Congressional support
  - Potential constituency opposition to NextGen improvements
    - Airspace changes
    - New runways
    - Changing job roles/locations
NextGen Implementation Plan
- Targeted for 2018
- Benefits and Accomplishment
- Overview of FAA’s work plan

www.faa.gov/nextgen
- News
- Demonstrations
- Documentation