Research Landscape for the National Airspace System

Presented to: REDAC Subcommittees

By: Steve Summer, Research Portfolio Branch

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Federal Aviation Administration

Aviation Innovation and Continued Advancements

Landscape Purpose

- Provide an effective tool to <u>communicate</u> the need for FAA research to ensure support of industry objectives and direction

- Provide an effective tool for <u>research planning</u> to ensure research investments are in the right areas & identify gaps requiring new or additional research

The Landscape

Categorized Research Drivers:

1. **Advances in New Vehicles and New Missions** – New vehicle types, or existing vehicles operating in non-traditional ways.

2. **Advances in Technology and Materials** – Cutting edge materials, manufacturing techniques, communications, airframe and propulsion systems, fuels, airport safety technologies and emerging airport pavement technologies.

3. **Advances in Data and Processing Power** – Advances to data and information management, and its impact on aircraft development, flight control, and ATM.

4. **System Wide Advancements and Improvements** – FAA priorities/objectives and continued improvements to the NAS.

Research Landscape
for the
National Airspace System

$2020 - 2030$

Draft

Challenges for each driver listed in 3 areas*

- Airport and Ground Operation

- Operational and Safety

- Environmental

Marked Drivers by expected maturity

- Near-Term (0-3 years)
- Mid-Term (3-5 years)
- Far-Term (5-10 years)

*Not all drivers will have challenges in each area
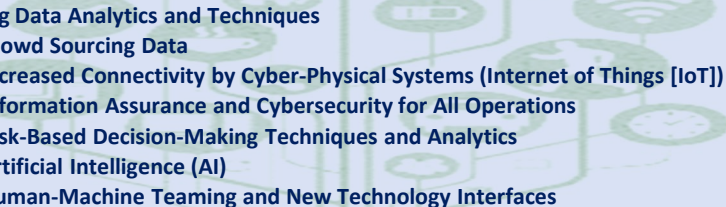
Research & Development Drivers

Advances in New Vehicles/New Missions

- Non-Traditional NAS Access Points
- Routine Small Unmanned Aircraft Systems (UAS) Operations Beyond Visual Line of Sight (BVLOS)
- Space Operations
- Autonomous Ground Service Equipment at Airports
- Growth of Mixed Operations (Piloted, Autonomous, Unmanned)
- New Mission Types
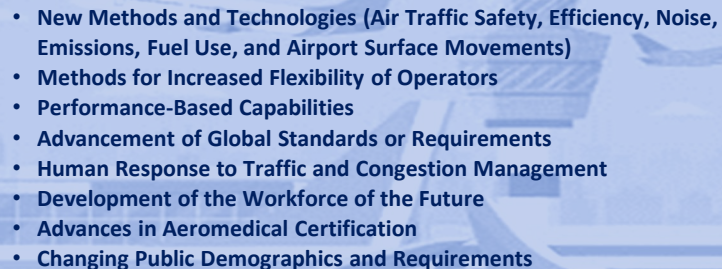- Supersonic Flight
- Urban Air Mobility

Advances in Data and Processing Power

- Big Data Analytics and Techniques
- Crowd Sourcing Data
- Increased Connectivity by Cyber-Physical Systems (Internet of Things [IoT])
- Information Assurance and Cybersecurity for All Operations
- Risk-Based Decision-Making Techniques and Analytics
- Artificial Intelligence (AI)
- Human-Machine Teaming and New Technology Interfaces

Advances in Technology and Materials

- Aircraft Command and Control Using Automation and Remote Sensing Technologies
- Certification using New Technologies, Standards, or Processes
- Future Fuel Technologies
- Infrastructure Resiliency and Continuity of Operations
- New Medical Technologies and New Medications
- New Vehicles or Components Which Make Use of New Technologies, Software, or Materials
- Position, Navigation, & Timing (PNT) Technologies
- Remote and Virtual Technologies
- New Technologies for Airport Pavement Infrastructure and Design
- Advances in Electric or Hybrid Electric Propulsion

System Wide Advancements/Improvements

- New Methods and Technologies (Air Traffic Safety, Efficiency, Noise, Emissions, Fuel Use, and Airport Surface Movements)
- Methods for Increased Flexibility of Operators
- Performance-Based Capabilities
- Advancement of Global Standards or Requirements
- Human Response to Traffic and Congestion Management
- Development of the Workforce of the Future
- Advances in Aeromedical Certification
- Changing Public Demographics and Requirements

Driver-Project Mapping

- **As part of FY22 prioritization effort, researchers identified the research drivers for each project**
  - Objective: Evaluating our R&D portfolio against the Landscape provides a tool to evaluate resource alignment and possible opportunities for research

- **Lessons Learned:**
  - Need better socialization with researchers regarding landscape drivers – definition, utilization, etc.
  - Tool for input should allow for multiple drivers to be selected, allow for easier identification of drivers

Driver-Project Mapping, Grouped by Category

Advances in New Vehicles/New Missions

Driver	Timeframe	# Projects
Non-Traditional NAS Access Points	Near	3
Routine Small Unmanned Aircraft Systems (UAS) Operations Beyond Visual Line of Sight (BVLOS)	Near	4
Space Operations	Near	0
Autonomous Ground Service Equipment at Airports	Mid	0
Growth of Mixed Operations (Piloted, Autonomous, Unmanned)	Mid	18
New Mission Types	Mid	1
Supersonic Flight	Mid	7
Urban Air Mobility	Mid	7

Advances in Data and Processing Power

Driver	Timeframe	# Projects
Big Data Analytics and Techniques	Near	5
Crowd Sourcing Data	Near	1
Increased Connectivity by Cyber-Physical Systems (Internet of Things [IoT])	Near	0
Information Assurance and Cybersecurity for All Operations	Near	1
Risk-Based Decision-Making Techniques and Analytics	Near	7
Artificial Intelligence (AI)	Mid	1
Human-Machine Teaming and New Technology Interfaces	Far	10

Advances in Technology and Materials

Driver	Timeframe	# Projects
Aircraft Command and Control Using Automation and Remote Sensing Technologies	Near	6
Certification using New Technologies, Standards, or Processes	Near	15
Future Fuel Technologies	Near	4
Infrastructure Resiliency and Continuity of Operations	Near	1
New Medical Technologies and New Medications	Near	3
New Vehicles or Components Which Make Use of New Technologies, Software, or Materials	Near	16
Position, Navigation, & Timing (PNT) Technologies	Near	2
Remote and Virtual Technologies	Near	2
New Technologies for Airport Pavement Infrastructure and Design	Mid	9
Advances in Electric or Hybrid Electric Propulsion	Far	0

System Wide Advancements/Improvements

Driver	Timeframe	# Projects
New Methods and Technologies (Air Traffic Safety, Efficiency, Noise, Emissions, Fuel Use, and Airport Surface Movements)	NA	32
Methods for Increased Flexibility of Operators	NA	3
Performance-Based Capabilities	NA	6
Advancement of Global Standards or Requirements	NA	8
Human Response to Traffic and Congestion Management	NA	5
Development of the Workforce of the Future	NA	17
Advances in Aeromedical Certification	NA	7
Changing Public Demographics and Requirements	NA	12

Driver-Project Mapping, Grouped by Timeframe

Driver	Timeframe	# Projects	Driver	Timeframe	# Projects
Non-Traditional NAS Access Points	Near	3	Autonomous Ground Service Equipment at Airports	Mid	0
Routine Small Unmanned Aircraft Systems (UAS) Operations Beyond Visual Line of Sight (BVLOS)	Near	4	Growth of Mixed Operations (Piloted, Autonomous, Unmanned)	Mid	18
Space Operations	Near	0	New Mission Types	Mid	1
Aircraft Command and Control Using Automation and Remote Sensing Technologies	Near	6	Supersonic Flight	Mid	7
Certification using New Technologies, Standards, or Processes	Near	15	Urban Air Mobility	Mid	7
Future Fuel Technologies	Near	4	New Technologies for Airport Pavement Infrastructure and Design	Mid	9
Infrastructure Resiliency and Continuity of Operations	Near	1	Artificial Intelligence (AI)	Mid	1
New Medical Technologies and New Medications	Near	3	Advances in Electric or Hybrid Electric Propulsion	Far	0
New Vehicles or Components Which Make Use of New Technologies, Software, or Materials	Near	16	Human-Machine Teaming and New Technology Interfaces	Far	10
Position, Navigation, & Timing (PNT) Technologies	Near	2	New Methods and Technologies (Air Traffic Safety, Efficiency, Noise, Emissions, Fuel Use, and Airport Surface Movements)	NA	32
Remote and Virtual Technologies	Near	2	Methods for Increased Flexibility of Operators	NA	3
Big Data Analytics and Techniques	Near	5	Performance-Based Capabilities	NA	6
Crowd Sourcing Data	Near	1	Advancement of Global Standards or Requirements	NA	8
Increased Connectivity by Cyber-Physical Systems (Internet of Things [IoT])	Near	0	Human Response to Traffic and Congestion Management	NA	5
Information Assurance and Cybersecurity for All Operations	Near	1	Development of the Workforce of the Future	NA	17
Risk-Based Decision-Making Techniques and Analytics	Near	7	Advances in Aeromedical Certification	NA	7
			Changing Public Demographics and Requirements	NA	12

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Next Steps/Discussion

Refine/Validate Driver-Project Mapping

Conduct further analysis of Driver-Project Mapping

Improve User Input Tool

Improve Socialization of Landscapes with Researchers

Continued Updates to Landscape (Drivers, Timeframes, etc.)

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