



## SUBCOMMITTEE ON SPACE AND AERONAUTICS

### HEARING CHARTER

*“The Federal Aviation Administration’s Flight Plan: Examining the Agency’s Research and Development Programs and Future Plans”*

**Thursday, March 9, 2023**

**10:00 a.m.**

**2318 Rayburn House Office Building**

#### **Purpose**

The purpose of the hearing is to review the Federal Aviation Administration’s (FAA) portfolio of research and development (R&D) programs and examine priorities and challenges. The hearing will inform the Committee’s drafting of legislation authorizing FAA’s R&D activities.

#### **Witnesses**

- **Ms. Shelley Yak**, Director, FAA William J. Hughes Technical Center
- **Dr. R. John Hansman**, Director, International Center for Air Transportation, Massachusetts Institute of Technology
- **Mr. Eric Cunningham**, Vice President, Electric Power Systems, Collins Aerospace

#### **Overarching Questions**

- What is the state of Research and Development at FAA?
- How effectively has FAA implemented the Flight R&D title of the 2018 FAA Authorization?
- What are emerging topics for FAA R&D that Congress should address as part of the 2023 authorization process?

#### **Background**

Aviation is crucial to the United States, supporting commerce, law enforcement, and emergency response among other activities. The FAA is the nation’s sole certification authority

for the aviation community and serves a critical role in managing aviation in the United States<sup>1</sup>. The agency ensures the safety and efficiency of more than 16 million flights as well as nearly 45 billion pounds of freight annually. In fiscal year 2021, aviation contributed 5.2% to the US gross domestic product and saw \$488 billion in earnings<sup>2</sup>. The FAA also supports the rapidly growing commercial space launch market.

Both the FAA and the National Aeronautics and Space Administration (NASA) conduct federal civil aeronautics R&D. The agencies R&D efforts are complementary. The FAA conducts, coordinates, and supports R&D to enable the agency to address near-term strategic needs of the aviation industry. NASA works on long-term R&D, primarily through the Aeronautics Research Mission Directorate (ARMD) which focuses on high-risk high-payoff research investments. The ARMD's Strategic Implementation Plan outlines a vision for research aimed at the next 25 years and beyond<sup>3</sup>.

The FAA focuses primarily on applied R&D across six research domains: aircraft safety assurance; digital systems and technologies; environmental and weather impact mitigation; airport infrastructure and technologies; aerospace performance and planning; and human and aeromedical factors<sup>4</sup>. Together, these domains support FAA R&D activities that improve the safety and capacity of the NAS, inform and guide the development of standards and regulations, and accelerate the development and use of new technologies.

The FAA operates three laboratory facilities that provide research, development, and test & evaluation. The William J. Hughes Technical Center, located in Atlantic City, NJ, is the FAA's principal research facility. The Center houses 500,000 square feet of laboratory space as well as several simulation facilities. Additionally, the FAA operates the Civil Aerospace Medical Institute and the Flight Research and Analysis Group which are both located at the Mike Monroney Aeronautical Center in Oklahoma City, OK.

In support of the FAA's R&D goals, the Agency maintains partnerships with stakeholders including federal agencies, academia, industry, international entities, and technical societies. These include interagency agreements as well as centers of excellence (COE)<sup>5</sup>. COEs include: ASCENT which studies alternative jet fuels and environmental concerns related to aviation and ASSURE which researches unmanned aircraft systems. Cooperative research and development agreements (CRADA)<sup>6</sup> are another important partnership tool and serve as the FAA's primary technology transfer mechanism. Generally, CRADAs serve as a channel for the exchange of innovative solutions and technical advances between federal and non-federal

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<sup>1</sup> Federal Aviation Administration. *FY 2024 Research and Development Portfolio Development Process*. April 2022. [FY 2024 REB Guidance Document FINAL \(faa.gov\)](#).

<sup>2</sup> Federal Aviation Administration. *Air Traffic By The Numbers*. Updated August 31, 2022. [Air Traffic By The Numbers | Federal Aviation Administration \(faa.gov\)](#).

<sup>3</sup> NASA Aeronautics. *Strategic Implementation Plan*. Updated 2019. [NASA Aeronautics Strategic Implementation Plan 2019 Update](#).

<sup>4</sup> *Id.* at 1

<sup>5</sup> See 49 U.S.C. § 44513. Accessed at [USCODE-2021-title49-subtitleVII.pdf \(govinfo.gov\)](#).

<sup>6</sup> See 15 U.S.C. § 3710a. Accessed at <https://www.govinfo.gov/content/pkg/USCODE-2021-title15/pdf/USCODE-2021-title15.pdf>.

researchers. These tools along with other types of collaborative work leverage the R&D capabilities of partners to further support the FAA’s goals.

FAA R&D investments are balanced between strategic and mission-oriented projects. Strategic investments support the agency’s understanding of and enable emerging technologies and new business models. Mission-oriented investments enable agency priorities and continued FAA improvements. Funding for R&D is split between three FAA budgetary accounts: Research, Engineering, and Development (RE&D), Facilities and Equipment (F&E), and the Airport Improvement Program (AIP)<sup>7</sup>. For a complete listing of FAA’s R&D programs and their associated funding levels, see attachment “Planned R&D Budget by Account”.

The RE&D account is the largest component of the FAA R&D portfolio. It provides funding for establishing and overseeing the agency’s R&D policies and plans as well as supporting all aspects of aviation from research on materials to development of new products and procedures. For FY23 the budget request for RE&D is \$260.5 million<sup>8</sup>.

The F&E account has two major R&D thrusts, programs to develop and validate technology and systems that support air traffic services and airport safety and capacity. As well as various NextGen Portfolios. For FY23 the budget request for F&E is \$218.2 million<sup>9</sup>.

The AIP account provides grants to local and state airport authorities to assist in airport development, facility preservation, economic competitiveness, and environmental sustainability. For FY23 the budget request for AIP is \$55.8 million<sup>10</sup>.

### National Aviation Research Plan

The FAA is congressionally mandated to submit a National Aviation Research Plan (NARP) annually to Congress. The NARP provides an overview of the FAA’s R&D plans over the next five years. The most recent NARP was released in January 2022 for FY 2022-2026. In the NARP for FY 2022-2026, the FAA identified five major R&D goals<sup>11</sup>:

- Improve airport operations, air traffic, and airspace management capabilities: Research under this goal supports airport and spaceport operations, air traffic management, weather information, aerospace vehicle operations, and noise and emissions management.
- Accelerate use of new technologies for aerospace vehicles, airports, and spaceports: Research under this goal supports applied innovation that identifies and demonstrates new technologies, certification and licensing of operators and technology, the study

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<sup>7</sup> Federal Aviation Administration. *National Aviation Research Plan (NARP) FY 2022-2026*. August 2022. [FY22-26-National-Aviation-Research-Plan\\_1.pdf \(faa.gov\)](#).

<sup>8</sup> Department of Transportation. *FY 2023 Federal Aviation Administration Budget Estimate*. [FY 2023 CJ Budget - Cover FINAL.pub \(Read-Only\) \(transportation.gov\)](#).

<sup>9</sup> *Id.*

<sup>10</sup> *Id.*

<sup>11</sup> *Id.* at 7

of alternative fuels for aviation, and provides data to inform improvements to the NAS.

- Capitalize on the use of NAS, airport, and spaceport infrastructure: This research focuses on increasing the useful life of aviation infrastructure and decreasing maintenance and repair costs, NAS operations recovery from disruptive events, and cybersecurity research that protects and defends FAA systems.
- Improve human performance within the system: This research focuses on the optimization of human performance through capability assessments, training, and operational evaluations to improve the safety of operations in the NAS.
- Improve integrated modeling capabilities and system-wide analysis: Research under this goal includes developing a scientific understanding of aerospace systems to develop NAS improvements, analytical and predictive capabilities used in the capture, parsing, analysis, and sharing of data, and a toolset to evaluate NAS system-wide performance.

### The Research, Engineering, and Development Advisory Committee

The Research, Engineering, and Development Advisory Committee (REDAC) is an external group, with members representing corporations, universities, associations, consumers, and government agencies. REDAC meets twice a year to review the FAA's R&D portfolio and provides advice and recommendations to the Agency. In April of 2022, the REDAC sent a letter to the FAA with findings and recommendations based on their Winter-Spring 2022 meetings<sup>12</sup>. The following are excerpts:

- *The NAS Operations Subcommittee recommends that the FAA clearly identify requirements for integration and coordination between emergent and conventional Air Traffic Services, and develop and communicate near- and long-term RE&D plans to address these requirements.*
- *We firmly believe that partnerships with other governments, other federal agencies, the Centers of Excellence and private corporations who are involved in the research portfolios that the Office of Environment and Energy has in place are key to completing this mission and are the most effective vehicle to conduct and coordinate future research and maximize limited resources.*
- *The need to maintain a leadership position at International Civil Aviation Organization/Committee on Aviation Environmental Protection (ICAO/CAEP) is still vital to the U.S. Aviation interest.*
- *Industry is researching the introduction of Artificial Intelligence (AI) and Machine Learning (ML) technologies into many different aircraft systems and has a need for regulatory guidance from the FAA on the use of these technologies in a safety critical context.*

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<sup>12</sup> Hansman, R.J. *Research, Engineering and Development Advisory Committee (REDAC) Recommendations for Fiscal Year 2024 Research and Development Portfolio*. April 2022. [REDAC Report Letter \(faa.gov\)](#).

- *The Subcommittee on Aircraft Safety further finds that the identified research output of developing a new mechanism to map risks and development approaches is unclear in the context of currently issued FAA software assurance guidelines for durability and reliability means of compliance and airworthiness.*

### The Government Accountability Office

In April 2017, the GAO issued a report titled “Aviation Research and Development: FAA Could Improve How It Develops Its Portfolio and Reports Its Activities”<sup>13</sup>. The report evaluated the FAA’s R&D structure and operation, the agency’s coordination with NASA on R&D, and the agency’s coordination with the private sector on R&D. Three major recommendations came out of the report: (1) The FAA should take a more strategic approach in identifying research priorities across the agency; (2) Increase transparency for the project selection process; and (3) ensure that the NARP and R&D annual reviews meet statutory requirements.

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<sup>13</sup> Government Accountability Office. *Aviation Research and Development: FAA Could Improve How It Develops Its Portfolio and Reports Its Activities*. April 2017. [GAO-17-372, AVIATION RESEARCH AND DEVELOPMENT: FAA Could Improve How It Develops Its Portfolio and Reports Its Activities](#).

**Planned R&D Budget by Account (from the FY22-26 NARP)**

<b>Program</b>	<b>Account</b>	<b>2023 Estimate (\$000)</b>	<b>2024 Estimate (\$000)</b>	<b>2025 Estimate (\$000)</b>	<b>2026 Estimate (\$000)</b>
Fire Research and Safety	RE&D	7,367	7,607	7,847	8,087
Propulsion and Fuel Systems	RE&D	5,471	5,711	5,951	6,191
Advanced Materials/Structural Safety	RE&D	2,886	3,366	3,846	4,326
Aircraft Icing	RE&D	3,353	3,593	3,833	4,074
Digital System Safety	RE&D	5,287	5,527	5,767	6,007
Continued Airworthiness	RE&D	12,430	12,670	12,910	13,150
Flightdeck/Maintenance/System Integration Human Factors	RE&D	15,292	15,532	15,772	16,012
System Safety Management/Terminal Area Safety	RE&D	10,111	10,351	10,591	10,831
Air Traffic Control/Technical Operations Human Factors	RE&D	5,911	6,151	6,391	6,631
Aeromedical Research	RE&D	8,975	9,215	9,455	9,695
Weather Program	RE&D	16,178	16,418	16,658	16,898
Unmanned Aircraft Systems Research	RE&D	14,935	15,175	15,415	15,655
Innovation and Emerging Technologies	RE&D	10,000	10,240	10,480	10,720
Alternative Fuels for General Aviation	RE&D	2,385	2,625	2,865	3,105
Commercial Space Transportation	RE&D	5,708	5,948	6,188	6,427
NextGen- Wake Turbulence	RE&D	3,728	3,968	4,208	4,448
NextGen- Weather Technology in the Cockpit	RE&D	3,028	3,268	3,508	3,748
NextGen- Information Security	RE&D	4,769	5,249	5,729	6,209
Energy and Environment	RE&D	21,163	21,403	21,643	21,883
NextGen- Environmental Research- Aircraft Technologies, Fuels, and Metrics	RE&D	33,976	34,216	34,456	34,696
System Planning and Resource Management	RE&D	4,141	4,381	4,621	4,861
Aviation Workforce Development	RE&D	5,925	6,165	6,405	6,645
William J. Hughes Technical Center Laboratory Facility	RE&D	10,981	11,221	11,461	11,701
ARPA-C Aviation Climate Research	RE&D	50,000	50,000	50,000	50,000
<b>Subtotal RE&amp;D</b>		<b>264,000</b>	<b>270,000</b>	<b>276,000</b>	<b>282,000</b>
Advanced Technology Development and Prototyping	F&E	39,800	36,560	41,230	36,520
William J. Hughes Technical Center Facilities	F&E	16,900	16,900	16,900	16,900

William J. Hughes Technical Center Infrastructure Sustainment	F&E	10,000	10,000	10,000	10,000
Next Generation Transportation System- Separation Management	F&E	26,500	21,700	21,000	24,000
Next Generation Transportation System- Traffic Flow Management Portfolio	F&E	10,000	10,000	11,000	14,000
Next Generation Transportation System- On Demand NAS	F&E	8,500	9,500	10,500	15,000
Next Generation Transportation System- NAS Infrastructure	F&E	14,500	14,400	14,500	17,000
Next Generation Support Portfolio	F&E	8,000	8,000	8,000	8,000
Next Generation Transportation System- Unmanned Aircraft Systems	F&E	26,000	27,000	24,000	31,000
Next Generation Transportation System- Enterprise, Concept Development, Human Factors, and Demonstrations Portfolio	F&E	11,000	11,000	11,500	12,000
Center for Advanced Aviation System Development (CAASD)	F&E	57,000	57,000	57,000	57,000
<b>Subtotal F&amp;E</b>		<b>228,200</b>	<b>222,060</b>	<b>225,630</b>	<b>241,420</b>
Airport Cooperative Research Program- Capacity	AIP	5,000	5,000	5,000	5,000
Airport Cooperative Research Program- Environment	AIP	5,000	5,000	5,000	5,000
Airport Cooperative Research Program- Safety	AIP	5,000	5,000	5,000	5,000
Airport Technology Research Program- Capacity	AIP	19,950	19,950	19,950	19,950
Airport Technology Research Program- Environment	AIP	2,500	2,500	2,500	2,500
Airport Technology Research Program- Safety	AIP	18,511	18,511	18,511	18,511
<b>Subtotal AIP</b>		<b>55,961</b>	<b>55,961</b>	<b>55,961</b>	<b>55,961</b>
<b>Total R&amp;D</b>		<b>548,161</b>	<b>548,021</b>	<b>557,591</b>	<b>579,381</b>