United States Government Accountability Office

Report to Congressional Committees

July 2025

AVIATION RESEARCH AND DEVELOPMENT

FAA Could Improve Its Reporting on Safety Programs

GAO-25-107697

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GAO Highlights

Highlights of GAO-25-107697, a report to congressional committees

Why GAO Did This Study

FAA manages a portfolio of congressionally funded R&D programs supporting policymaking, planning, and standards development. FAA annually produces two statutorily required documents for Congress related to its R&D portfolio: *The National Aviation Research Plan* and the *Research and Development Annual Review*. These reports provide a forecast and review of the past year of the FAA's research and development efforts.

The FAA Reauthorization Act of 2024 includes a provision for GAO to review the FAA's use of funding for safety R&D projects. This report examines how FAA identifies and reports on its allocation of funding for safety-related R&D. GAO reviewed FAA documents and data on R&D programs and enacted funding from FY 2019 through FY 2024 to understand the FAA's goals, funding allocations, and types of R&D projects. GAO compared the FAA's process and reporting practices with leading practices for R&D and components of federal standards for internal controls. Also, GAO interviewed FAA staff about their process to identify safety projects and reporting practices.

What GAO Recommends

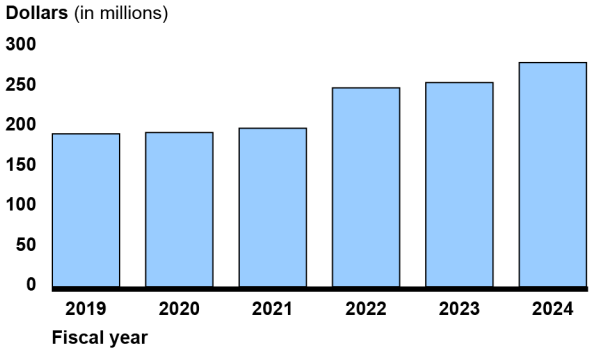
GAO is making one recommendation to FAA to report annually on the percentage of its appropriated funds, including the programs and funding amounts, that are used for safety R&D projects. The Department of Transportation concurred with the recommendation.

For more information, contact Derrick Collins at CollinsD@gao.gov.

What GAO Found

From fiscal years (FY) 2019 through FY 2024, the Federal Aviation Administration (FAA) received over $1.3 billion in appropriations for the Research, Engineering, and Development (RE&D) budgetary account (see fig.). The FAA Reauthorization Act of 2018 established a requirement that at least 70 percent of the appropriations from this account be for safety research and development (R&D) projects. During FY 2019 through 2024, FAA officials said they used subject matter expertise and professional judgment to determine that most of the funding from the RE&D budgetary account was used for safety R&D projects. In FY 2024, for example, FAA officials determined all funding for 22 of 24 programs funded by the RE&D account supported safety R&D projects. Of the two remaining programs, officials said 25 percent of funding for one of these programs also supported safety R&D projects. Using the programs and process identified by FAA, more than 70 percent of the RE&D budgetary account was allocated for safety R&D projects from FY 2019 through FY 2024.

Total Federal Aviation Administration Funding for the Research, Engineering, and Development Budgetary Account, Fiscal Years 2019-2024



Source: GAO analysis of Federal Aviation Administration data. | GAO-25-107697

From FY 2019 through FY 2024, FAA had not documented its process or criteria for identifying safety R&D projects. While FAA has internal guidance that describes its R&D development process, this guidance did not define what constitutes a safety R&D project. In February 2025, FAA updated its guidance to describe its new process and define the criteria it will use moving forward to identify safety R&D projects to meet the statutory requirement. The updated guidance will be used for the FAA's R&D planning for FY 2027 that will begin in the fall of 2025.

The FAA's annual reports do not include key information to support Congress's oversight of safety R&D funding. According to FAA officials, FAA reports to Congress upon request on whether it is meeting the statutory requirement for funding safety R&D but does not report this information regularly or publicly as part of its annual reports. Without such reporting, Congress and the public are unable to determine whether FAA is complying with the statutory requirement for funding safety R&D projects. As FAA is taking steps to document its new process and criteria for selecting safety R&D projects, reporting on the results of this process would further increase transparency on its spending and whether the agency is meeting its statutory requirement in support of its safety goals.

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Abbreviations

DOT	Department of Transportation
FY	fiscal year
Guidance Document	*Research & Development Portfolio Development Process: Guidance Document*
NARP	National Aviation Research Plans
NextGen	Next Generation Air Transportation System
R&D	research and development
RE&D	Research, Engineering, and Development
REDAC	Research, Engineering, and Development Advisory Committee

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
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July 8, 2025

The Honorable Ted Cruz
Chairman
The Honorable Maria Cantwell
Ranking Member
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Brian Babin
Chairman
The Honorable Zoe Lofgren
Ranking Member
Committee on Science, Space, and Technology
House of Representatives

As part of the Department of Transportation (DOT), the Federal Aviation Administration (FAA) conducts research in support of its mission to run the world's safest, most efficient aerospace system. FAA manages a portfolio of federally funded research and development (R&D) programs identified by Congress that support policymaking, planning, and standards development. FAA distributes this funding for projects to improve airport operations, accelerate the use of new technologies, and improve safety in the national airspace system.

FAA receives annual appropriations for its R&D programs through three budgetary accounts established by Congress. In fiscal year (FY) 2024, FAA received over $500 million for R&D from these accounts. The FAA Reauthorization Act of 2018 established a requirement that at least 70 percent of the appropriations from one of these accounts—the Research, Engineering, and Development (RE&D) account—be for R&D projects related specifically to safety.[1] The FAA Reauthorization Act of 2024 includes a provision for us to review the FAA's use of funding for safety

[1]For the purposes of our report, when we discuss the FAA's R&D programs and projects, we will only be discussing those funded through the Research, Engineering, and Development budgetary account because the statutory requirement only applies to this account. Each year, in the joint explanatory statement accompanying the appropriations act, Congress identifies the programs to be funded from each account, including the Research, Engineering, and Development account.

R&D projects. For this report, we evaluated how FAA identifies and reports on its allocation of funding for safety-related R&D.

To evaluate how FAA identifies and reports on this funding, we reviewed FAA documents on R&D programs and projects during FY 2019 through 2024. We selected this period because the statutory requirement went into effect in FY 2019. Our review included the annual National Aviation Research Plans (NARP), which discuss (1) R&D goals, (2) the research planned to support each goal, and (3) the funding aligned to each R&D program. We reviewed the annual NARPs to understand how goals and funding may have changed during this time. To understand the types of safety projects FAA conducts and their outcomes, we reviewed the FAA's Research and Development Annual Reviews, which describe the programs and select projects that received funding, as well as the results of those projects. Finally, we reviewed the FAA's previous three Research & Development Portfolio Development Process: Guidance Document (Guidance Document). This is the annual document FAA uses to guide the internal identification of R&D projects. The Guidance Document ensures the process to select projects ties to the FAA's strategic planning, budget, programs, and evaluation of the output of R&D. In addition, we interviewed FAA staff that manage its R&D portfolio about the steps staff followed to identify safety projects and about specific criteria, if any, they used to classify a project as safety related.

We compared the process FAA staff described for identifying safety projects with leading practices for R&D based on a previously issued GAO report, including the importance of transparency in identifying and selecting projects to ensure management understands project decisions and priorities.[2] We also applied documentation and communication components of Standards for Internal Control in the Federal Government significant to the FAA's identification process and reporting for safety R&D.[3] Specifically, we considered underlying principles on the importance of maintaining documentation of internal controls for the purposes of retaining organizational knowledge. We also applied standards directing management to report information externally, especially communicating to outside parties who can help entities achieve their objectives.

[2]GAO, *Aviation Research and Development: FAA Could Improve How it Develops Its Portfolio and Reports Its Activities*, GAO-17-372 (Washington, D.C.: Apr. 24, 2017).

[3]GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: Sept. 2014).

We analyzed data provided by FAA from FY 2019 through FY 2024 on its R&D funding and projects. We analyzed the FAA's enacted funding for R&D programs and reviewed information provided by FAA on the amounts allocated for safety-related R&D. We also analyzed these data to identify the percent of funding allocated to safety R&D projects, according to FAA. We reviewed FAA data on R&D projects to understand and describe the types of projects that received funding. We also analyzed project counts to determine the total number of projects FAA had ongoing from FY 2019 through FY 2024. To determine the reliability of the data, we interviewed FAA officials on their data management practices and compared funding contained in joint explanatory statements and NARPs with data FAA provided. We determined these data to be reliable for the purpose of describing funds allocated for FAA R&D programs from FY 2019 through FY 2024.

We conducted this performance audit from July 2024 to July 2025 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

FAA funds R&D from three budgetary accounts established by Congress: (1) Research, Engineering, and Development; (2) Facilities and Equipment; and (3) the Airport Improvement Program.[4] Each of these accounts fund various R&D programs, and these programs support R&D projects.

- Research, Engineering, and Development. Provides funding for R&D projects that improve the national airspace system by increasing safety, security, productivity, capacity, and environmental capability to meet future air traffic demands.
- Facilities and Equipment. Provides funding for R&D related to advanced technology development and various Next Generation Air Transportation System (NextGen) programs, as well as capital investments for facilities and aviation safety systems.[5] The R&D

[4]Congress emphasizes safety research goals and priorities in its choice of programs to fund through appropriations.

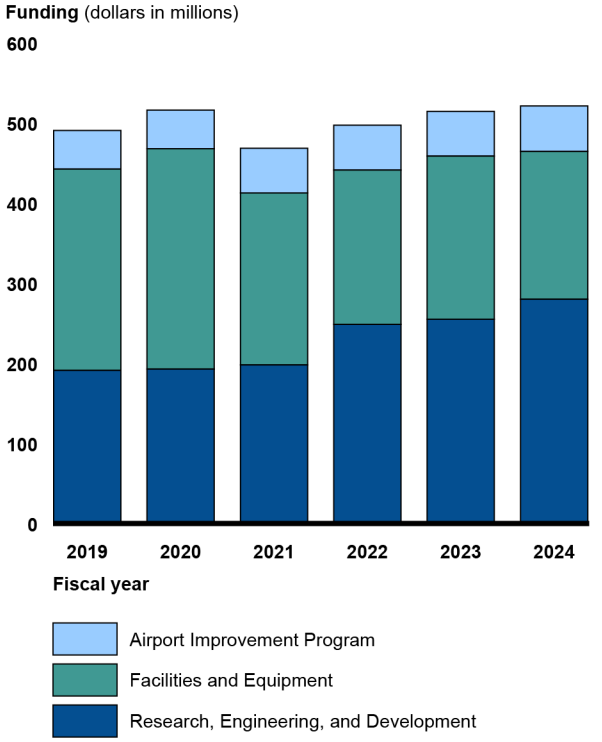
[5]The NextGen program is the FAA's effort to modernize areas of the national airspace system, including the air traffic control infrastructure.

projects supported through this account are typically for technologies in the concept or demonstration phases.

- Airport Improvement Program. Provides funds to airports to support the safety, capacity, and efficiency of these airports. Supports R&D projects for activities such as airport development and economic competitiveness.

From FY 2019 through FY 2024, FAA allocated over $3 billion for R&D across these three accounts (see fig. 1).

Figure 1: Total Federal Aviation Administration (FAA) Funding for Research and Development, by Budgetary Accounts, Fiscal Years 2019-2024



Source: GAO analysis of FAA data. | GAO-25-107697

Note: Congress generally determines the total funding for each of these accounts annually through appropriations. This represents the funding for research and development activities in these accounts. Congress also issues an accompanying joint explanatory statement that identifies the programs that will receive funding and the funding amounts for the Research, Engineering, and Development account.

The FAA Reauthorization Act of 2018 directed FAA to make safety-related activities its highest research priority, with Congress requiring that at least 70 percent of the amount appropriated for the RE&D budgetary

account be for safety projects.[6] Each year, Congress identifies the R&D programs it will fund through the RE&D account and specifies funding amounts for each program.[7] These funding programs align to specific areas of research, such as Unmanned Aircraft Systems Research or Fire Research and Safety, among others. (See app. I for a description of all R&D programs funded through the RE&D account for FY 2024.) From FY 2019 through FY 2024, Congress appropriated over $1.3 billion for the RE&D account to fund RE&D programs. This amount accounted for approximately 45 percent of the FAA's total R&D funding, with the remaining funding for R&D coming from the FAA's other accounts.

Prior to receiving appropriations, FAA follows its portfolio development process to identify the R&D projects the agency plans to include in its budget request. (See fig. 2). The process begins with the FAA's R&D Executive Board developing guidance and a budget aligned to each R&D program in the portfolio. This Guidance Document informs R&D program teams composed of scientists, engineers, and technical experts as they propose R&D projects aligned to their specific program.[8] The FAA's Research, Engineering, and Development Advisory Committee reviews the program teams' proposed projects and makes recommendations.[9] The program teams then review and address the Advisory Committee's recommendations, and the R&D Executive Board approves and finalizes the R&D portfolio and budget. Lastly, after final reviews by DOT and the

[6]While the Facilities and Equipment and the Airport Improvement Program accounts support some R&D, these accounts also fund other types of FAA activities.

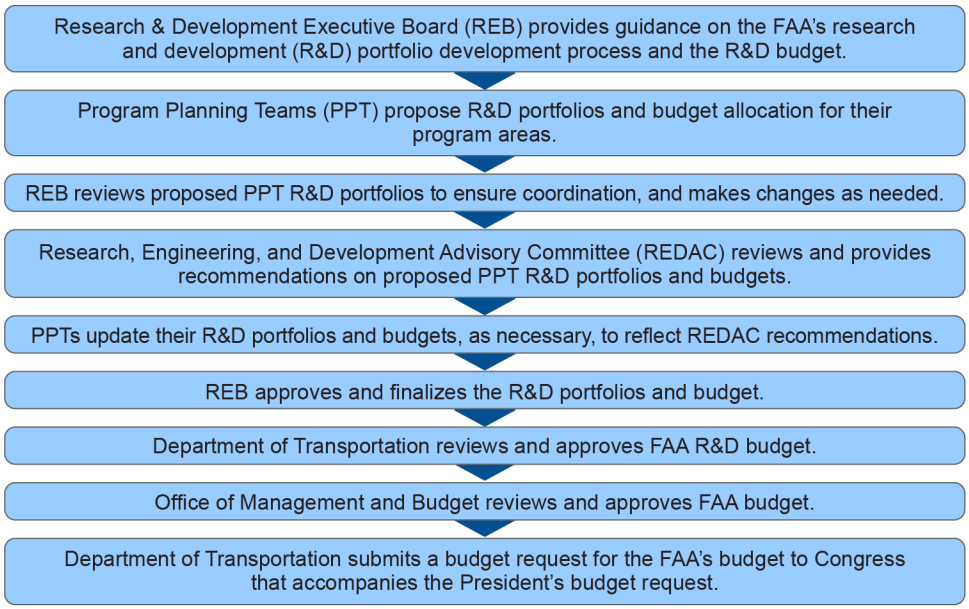
[7]Congress issues a joint explanatory statement that accompanies the annual appropriations act. This joint explanatory statement identifies the R&D programs that will receive funding and how much funding from the three budgetary accounts, including the RE&D account.

[8]FAA annually updates its Guidance Document that provides the guidance developed by the R&D Executive Board. The purpose of the guidance is to direct the FAA's R&D program teams to produce a balanced portfolio that does not duplicate other efforts outside of FAA.

[9]The Research, Engineering, and Development Advisory Committee (REDAC) is the FAA's advisory body for R&D and reviews the needs, objectives, plans, approaches, contents, and accomplishments of the FAA's research program. Its members represent corporations, universities, associations, consumers, and government agencies. REDAC was established by The Aviation Safety Research Act of 1988 in the interest of obtaining advice and recommendations from aviation-oriented organizations, associations, and academic interests. Pub. L. 100-591, 102 Stat. 3011 (1988); Fed. Aviation. Admin., Order 1110.110E, Research, Engineering, and Development Advisory Committee (2010).

Office of Management and Budget, DOT submits the FAA proposal to Congress to accompany the President's budget request.

Figure 2: The Federal Aviation Administration's (FAA) Process for Developing Its Research and Development Portfolios and President's Budget Request



Source: GAO analysis of FAA information. | GAO-25-107697

FAA annually produces two statutorily required documents for Congress related to its R&D portfolio: The National Aviation Research Plan and the Research and Development Annual Review.[10] The NARP describes planned research activities over a span of 5 years and highlights how those research activities support the FAA's R&D priorities. It also provides details on the FAA's partnerships with outside agencies, industry, and academia. The Annual Review is the companion document to the FAA's NARP. It emphasizes the FAA's R&D accomplishments over the previous fiscal year, including examples of R&D results that FAA shared with industry and a description of new technologies that FAA developed. FAA submits these documents to accompany the President's budget request.

[10]49 U.S.C. § 44501(c).

FAA Recently Established Criteria for Identifying Safety R&D Projects but Does Not Report on How It Meets Its Funding Requirement

Officials Explained How the Research, Engineering, and Development Account Funded Safety R&D Projects

From FY 2019 through FY 2024, for the purposes of complying with the 70 percent statutory requirement, FAA officials identified most of the funding from the RE&D budgetary account as being for safety projects.[11] In FY 2024, according to FAA officials, the FAA's process for complying with the statutory requirement was to identify all projects receiving funding from 22 of 24 programs, that are part of the RE&D account, as safety projects. Of the two remaining programs, officials said that 25 percent of the funding from one of the programs supported safety projects, while no funding for the second program supported safety projects (see fig. 3).[12] FAA followed a similar process for identifying safety programs beginning in FY 2019, according to FAA officials.

[11]The statutory language did not instruct FAA how to identify safety projects and, thus, gave FAA the discretion to determine whether its funded projects meet this requirement.

[12]More specifically, FAA identified 25 percent of the funding for the Environmental Research–Aircraft Technologies and Fuels program to be for safety projects because FAA stated that some aspects of the research in this program are related to safety. According to FAA officials, no Environment and Energy program funding was used for safety projects. Environment and Energy program funding is used for projects related to aircraft noise and emissions, among others.

Figure 3: Percentage of Program Funding Supporting Safety From FAA R&D Programs Funded by Congress Through the RE&D Budgetary Account, Fiscal Year 2024

Percentage of program funding supporting safety projects	Programs		
100% 22 programs	• Advanced Materials/ Structural Safety • Aeromedical Research • Air Traffic Control/ Technical Operations Human Factors • Aircraft Icing • Aircraft Radio Altimeter Development, Testing, and Certification • Alternative Fuels for General Aviation • Aviation Accessibility Research	• Aviation Workforce Development/ Grant Management • Commercial Space Transportation Safety • Continued Air Worthiness • Digital System Safety • Fire Research and Safety • Flight Deck/ Maintenance System Integration Human Factors • NextGen - Information Security • NextGen - Wake Turbulence	• Propulsion and Fuel Systems • System Planning and Resource Management • System Safety Management/ Terminal Area Safety • Unmanned Aircraft Systems Research • Weather Program • William J. Hughes Technical Center Laboratory Facilities • Women in Aviation Pilot Shortage
25% 1 program	• Environmental Research - Aircraft Technologies and Fuels		
0% 1 program	• Environment and Energy		

Sources: FAA (information); GAO (icons). | GAO-25-107697

Note: Congress appropriates funding for the Federal Aviation Administration's (FAA) Research, Engineering, and Development (RE&D) account and issues a joint explanatory statement that accompanies the annual appropriations act. This joint explanatory statement identifies research and development (R&D) programs and funding levels for the RE&D account.

Using the programs FAA identified as funding safety R&D projects, more than 70 percent of the RE&D budgetary account was allocated for safety R&D projects each year from FY 2019 through FY 2024—totaling roughly $1 billion. For example, in FY 2024, FAA identified that 74 percent of funding from this budgetary account was allocated for safety projects. See Appendix II for all RE&D funding for these years and the percent FAA identified as being allocated for safety projects.

Examples of FAA Research and Development Safety Programs and Projects

The Federal Aviation Administration (FAA) identified programs in the Research Engineering and Development budgetary account with funding allocated for safety research and development projects in fiscal year 2024. These research programs fund projects related to aircraft structural safety, fire research and safety, and aircraft wake turbulence, among others. These programs include the following:

- Advanced Materials/Structural Safety. Supports FAA safety and regulatory activities in the technical areas of composites and other advanced materials and processes, and their impact on flight safety.
- Fire Research and Safety. Conducts research on the prevention of catastrophic aircraft accidents caused by in-flight fires and increased survivability during a postcrash fire.
- Wake Turbulence. Wake turbulence is air turbulence created behind an aircraft in motion. This turbulence can affect the handling of aircraft following other aircraft. The main goal of the Wake Turbulence program is to analyze and collect wake turbulence data on new aircraft to establish standards for the minimum distance trailing aircraft can be behind another aircraft's wake turbulence.

Source: GAO analysis of FAA information. | GAO-25-107697

In FY 2024, the RE&D account funded 417 total projects, most of which were identified as safety projects, according to FAA. Appendix III contains a list of all RE&D-funded safety programs and examples of projects.

FAA officials said they checked compliance with the statutory requirement as part of their portfolio development process. As part of this process, the R&D Executive Board conducts a final review of the entire R&D portfolio before submitting it to senior FAA management. During this review, FAA officials said the Chair of the R&D Executive Board and the board's financial manager check to ensure the proposed allocations to RE&D funded programs meet the statutory requirement. This check entails tabulating the enacted funding for the approved RE&D-funded programs that support safety projects and dividing it by the total enacted funding for all RE&D-funded programs.

FAA Did Not Have a Transparent Process for Identifying Safety R&D Projects but Recently Established Written Criteria

From FY 2019 through FY 2024, FAA had not documented its process or criteria for identifying safety R&D projects that met the statutory requirement. Congress appropriates funds for the FAA's RE&D account and identifies programs, but FAA selects which individual projects in these R&D programs to fund. According to FAA, its Guidance Document provides direction to staff to identify R&D projects that support the FAA's mission of ensuring a safe and efficient aerospace system. While this ties the R&D portfolio to safety, what constitutes a safety project was not defined in the FAA's guidance. According to FAA officials, the process they used from FY 2019 through FY 2024 to identify safety projects was based solely on subject matter expertise and professional judgment. For example, FAA officials stated they used professional judgment to determine that 25 percent of funding in the Environmental Research–Aircraft Technologies and Fuels program was for safety projects. However, FAA staff stated they did not conduct detailed analyses of

projects in this program to determine that 25 percent of funding was for safety projects.

During the course of our review, in February 2025, FAA updated its Guidance Document to describe a new process and define the criteria it will use moving forward to identify safety R&D projects that meet the statutory requirement.[13] FAA officials stated that our review was a factor in its decision to examine the process used to identify safety-related projects and its documentation of that process. According to the FAA's Guidance Document, the R&D Executive Board will review research proposed by project teams and assess each project against the new safety criteria (see fig. 4). The R&D Executive Board will then calculate the enacted funding for the approved RE&D-funded programs that support safety projects and divide it by the total enacted funding for all RE&D-funded programs to ensure that the statutory requirement is met. According to FAA officials, this process, and its updated Guidance Document, will ensure that enough projects meet the safety criteria so that at least 70 percent of the funding in the RE&D budgetary account is allocated for safety projects. The updated Guidance Document will be used for the FAA's R&D planning for FY 2027 that will begin in fall 2025.

Figure 4: The Federal Aviation Administration's (FAA) New Criteria to Assess if Proposed Research Projects Support Safety, as of 2025

A proposed research project supports safety and counts toward meeting the statutory requirement if that project:
Reduces or removes known risks that could result in harm, injuries, or fatalities.
Identifies emerging risks that could result in harm, injuries, or fatalities.
Informs the development and update of safety and risk acceptance criteria and methods.
Develops standards for the operational integration of new technologies and innovations that limit the risk of harm, injuries, and fatalities.
Enhances the timeliness and effectiveness of technology, personnel, and operational certification methods to improve their efficacy in preventing harm, injuries, fatalities, or property damage.
Reduces the resources spent on activities that do not contribute to preventing harm, injuries, fatalities, or property damage.
Informs the safety assessment of proposed technologies, operations, or concepts.

Source: FAA (information); GAO (icons). | GAO-25-107697

[13]This information was added to the FY 2027 version of the FAA's *Research and Development (R&D) Portfolio Development Process: Guidance Document,* which was released in February 2025.

Note: The FAA Reauthorization Act of 2018 directed that safety-related activities be the FAA's highest research priority and that at least 70 percent of the amount appropriated for research and development be for safety projects. This statutory requirement applies to funds appropriated to the Research, Engineering, and Development budgetary account.

We have previously recognized transparency of process, methods, and results as important to R&D efforts. In 2017, we identified using a transparent process for identifying and selecting projects as a leading R&D practice because it allows management to understand the decisions and priorities that guide project selection.[14] Furthermore, federal standards for internal control state that documenting processes preserves organizational knowledge and mitigates the risk of having that knowledge limited to a few personnel.[15] By documenting its process and criteria for identifying safety projects in a transparent manner, FAA is taking steps that could enable internal and external stakeholders to independently replicate its process and ensure that its R&D projects are supporting the FAA's mission and goals of providing for a safer national airspace system.

FAA Annual Reports Do Not Include Information on Safety R&D to Support Oversight

The FAA's reporting on R&D does not include key information to support Congress's oversight of safety funding, including which selected programs contribute to the FAA's safety objectives or the extent to which FAA is meeting the statutory requirement. FAA is statutorily required to annually produce two public reports about research—the NARP and the Research and Development Annual Review.[16] Over time, FAA has changed how it reports RE&D-funded programs in the NARP (see table 1). For example, of the six NARPs available since 2017, all reported R&D funding by budgetary account (e.g., RE&D), but only the first two NARPs also reported on R&D funding by DOT goals and other categories. In the earlier NARPs, where R&D funding is reported by DOT goal, FAA noted, "[m]any R&D programs apply to more than one DOT goal however, for budgeting purposes, most programs are included under only one DOT

[14]GAO, *Aviation Research and Development: FAA Could Improve How It Develops Its Portfolio and Reports Its Activities,* GAO-17-372 (Washington, D.C.: Apr. 24, 2017).

[15]GAO, *Standards for Internal Control in the Federal Government,* GAO-14-704G (Washington, D.C.: Sept. 2014). Similarly, we reported in 2022 that transparency of methods and results is a prerequisite for research efforts to ensure methods are replicable. See GAO, *Research Reliability: Federal Actions Needed to Promote Stronger Research Practices*, GAO-22-104411 (Washington, D.C.: July 28, 2022).

[16]See 49 U.S.C. § 44501(c).

goal."[17] Therefore, there may be R&D programs FAA identifies as containing safety projects, but for budgetary purposes, the programs may be listed under a different DOT goal in earlier NARPs. Further, the programs that fall under the DOT goal of "safety" in the earlier NARPs may not be the only programs that FAA identified for the purposes of meeting the statutory safety R&D funding requirement. For example, the Wake Turbulence program is listed under the DOT goal "Innovation" in the 2017-2018 NARP, but FAA included the projects in this program toward meeting the statutory requirement for safety R&D.[18] FAA officials told us that they changed how they report this information in NARPs to streamline the reporting format and make the document more concise, accessible, and easier to understand.

Table 1: The Federal Aviation Administration's (FAA) Research and Development (R&D) Funding Reporting in the National Aviation Research Plans (NARP)

Funding reporting	NARP (2017-2018)[a]	NARP (2020-2025)	NARP (2022-2026)	NARP (2023-2027)	NARP (2024-2028)	NARP (2025-2029)
Budgetary account (e.g., Research, Engineering, and Development)	✓	✓	✓	✓	✓	✓
Department of Transportation's performance/strategic goals (e.g., safety)	✓	✓	—	—	—	—
FAA organization (e.g., Aviation Safety)	✓	—	—	—	—	—
Research category (e.g., applied research)	✓	—	—	—	—	—
NextGen R&D funding	✓	—	—	—	—	—

Source: FAA National Aviation Research Plans. | GAO-25-107697

[a]The 2017-2018 NARP was published in June 2019.

According to FAA officials, upon request, FAA also reports to Congress on whether it meets the statutory requirement for safety R&D but does not

[17]Federal Aviation Administration, *2017/2018 National Aviation Research Plan (*NARP*)* (Washington, D.C.: June 2019); and *National Aviation Research Plan (*NARP*) FY 2020-2025 (*Sept. 2020).

[18]Wake turbulence is air disturbance created by the wings of an aircraft in flight. This turbulence can affect the safety and handling of aircraft following other aircraft. The main goal of the Wake Turbulence program is to provide data-driven analysis through data collection for the mitigation of wake turbulence hazards, supporting assessment of new procedures, and recommending minimum separation distances for trailing aircraft behind another aircraft's wake turbulence.

report this information regularly or publicly. FAA last briefed Congress on meeting the requirement in 2020. At that time, it reported meeting the 70 percent requirement but, as of April 2025, FAA had not since provided information to Congress regarding compliance with the requirement. While the FAA's NARP and the Annual Review describe the goals and priorities for the allocation of resources among the R&D programs, FAA does not report on whether it meets the safety R&D funding requirement in these reports.[19]

Although FAA reports annually on its R&D programs, this reporting does not include whether it is meeting the 70 percent requirement for funding safety R&D projects and is missing other information that would help Congress and other stakeholders understand which selected programs address safety priorities. Federal standards for internal controls state that effective information and communication are vital for an entity to achieve its objectives. According to these standards, management should be communicating necessary quality information externally so that external parties can help the entity achieve its objectives and address related risks.[20] For FAA, these objectives include its research goals supporting safety in the national airspace. Without regularly reporting publicly on the programs and how much funding is being used for safety R&D projects, Congress and the public are unable to determine whether FAA is complying with statutory allocation requirements for safety R&D projects. Furthermore, without such reporting, it would be unclear whether the new process and criteria support the FAA's safety-related goals. As FAA is taking steps to document its process and criteria for selecting safety R&D projects, reporting on the results of its new selection process and criteria would further increase transparency in noting whether the agency is meeting its statutory requirement and supporting its safety-related goals.

Conclusions

Research and development projects at FAA are essential to help improve the safety of the national airspace by advancing aviation technologies and modernizing the FAA's infrastructure, among other purposes. FAA produces public reports that broadly describe the research it undertakes, but FAA does not specifically report on the amount of funds spent on safety R&D projects through these or other reports. Given the statutory requirement that FAA allocate at least 70 percent of its appropriated RE&D funds to safety projects, regular reporting on the use of R&D funds

[19]FAA is not required to report in the NARP or *Annual Review* on the safety R&D requirement.

[20]See GAO-14-704G.

for safety projects would enhance oversight of the FAA's spending and provide Congress with information on how FAA is allocating these funds. Further, while FAA has taken important steps to document its process and criteria for choosing safety R&D projects, reporting on the results of the FAA's implementation of this selection process and criteria could enhance the agency's efforts to increase transparency and replicability of results. Without such reporting, it is unclear to Congress and the public what R&D programs support safety and the extent to which FAA is allocating these funds, as required. In addition, this reporting would further support the FAA's mission and goals to improve safety in the national airspace system.

Recommendations for Executive Action

We are making the following recommendation to DOT:

The Secretary of Transportation should direct FAA to report on the percentage of its appropriated funds, including the programs and funding amounts, from the Research, Engineering, and Development account that are used for safety R&D projects, as part of its annual reporting process. (Recommendation 1)

Agency Comments

We provided a draft of this report to the Department of Transportation (Federal Aviation Administration) for review and comment. DOT provided a written response, reproduced in appendix IV, in which it concurred with the recommendation. In its written response, DOT acknowledged the value additional reporting would bring to increased transparency and oversight of the Federal Aviation Administration's research and development portfolio. DOT stated it was taking steps to include this information in a future version of the National Aviation Research Plan and the Research and Development Annual Review.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Transportation, the Administrator of FAA, and other interested parties. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

If you or your staff have any questions about this report, please contact me at CollinsD@gao.gov. Contact points for our Offices of Congressional

Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.

//SIGNED//

Derrick Collins
Director, Physical Infrastructure

Appendix I: Programs Funded Through the Research, Engineering, and Development Account, Fiscal Year 2024

Table 2 provides a list of all the Federal Aviation Administration's (FAA) research and development (R&D) programs that Congress funded in fiscal year 2024 through the Research, Engineering, and Development (RE&D) budgetary account. The table also identifies which R&D programs FAA considers to be for safety projects for the purposes of meeting the statutory requirement.

Table 2: Federal Aviation Administration (FAA) Research and Development (R&D) Programs Funded by Congress Through the Research, Engineering, and Development Account and Whether They Are Safety Related, Fiscal Year 2024

Programs	Descriptions	Safety related[a]
Advanced Materials/Structural Safety	Supports FAA safety and regulatory activities in the technical areas of composites and other advanced materials and processes, and their impact on flight safety.	✓
Aeromedical Research	Focuses on safety sensitive personnel and airline passenger health, safety, and performance in current and forecasted future civilian aerospace operations. This includes research in biomedical, biodynamics, and survivability/cabin safety sciences.	✓
Air Traffic Control/Technical Operations Human Factors	Provides scientific and technical information that the Air Traffic Organization will apply in its work to improve the safety and efficiency of complex air traffic control systems.	✓
Aircraft Icing	Conducts research to develop a better understanding of the effects of environmental icing and to improving icing weather information for decision-making in terminal areas and in-flight avoidance of icing conditions.	✓
Aircraft Radio Altimeter Development, Testing, and Certification	Supports testing and analysis of next generation radio altimeters to ensure the safe compatibility with 5G and other prospective wireless transmissions in the adjacent bands.	✓
Alternative Fuels for General Aviation	Researches, tests, and qualifies viable, safe, unleaded replacement fuels for current leaded aviation gasoline in order to eliminate the use of leaded aviation gasoline.	✓
Aviation Accessibility Research	Investigates the feasibility of enabling passengers to stay in their personal wheelchairs while traveling on commercial aircraft.	✓
Aviation Workforce Development/Grant Management	Provides grants to support education, recruitment, and development of aircraft pilots and aviation maintenance technicians.	✓
Commercial Space Transportation Safety	Focuses on the safe integration of commercial space operations into the National Airspace System, spaceport infrastructure, systemic safety initiatives, and regulatory reform.	✓
Continued Airworthiness	Focuses on longer-term maintenance of the structural integrity of fixed-wing aircraft and rotorcraft, continued safety of aircraft engines, development of inspection technologies, and the safety of electrical wiring systems and mechanical systems.	✓
Digital System Safety	Analyzes airworthiness and certification assurance aspects of highly integrated, complex digital aircraft systems.	✓
Environment and Energy	Advances the understanding of civil aviation noise and emissions, how they propagate and are modified in the atmosphere, and their ultimate health and welfare impacts.	—

Programs	Descriptions	Safety related[a]
Environmental Research – Aircraft Technologies and Fuels	Through the Continuous Lower Energy, Emissions, and Noise program, FAA is working with the aviation industry to develop aircraft and engines that increase fuel efficiency while reducing noise and emissions.	25 percent is considered safety related
Fire Research and Safety	Conducts research on the prevention of catastrophic aircraft accidents caused by in-flight fires and increased survivability during a postcrash fire.	✓
Flight Deck/Maintenance/System Integration Human Factors	Provides a research foundation that informs FAA personnel who develop, update, and utilize human-factors-related regulations, guidance material, procedures, standards, orders, job aids, and other aviation safety documentation.	✓
NextGen - Information Security	Focuses on identifying breakthrough discoveries in core research areas and applying the resulting information to help create a more resilient and sustainable aviation ecosystem. Emphasis on artificial intelligence and machine learning, data science, and collaboration across industry segments to address aviation cybersecurity threats.	✓
NextGen – Wake Turbulence	Analyze and collect wake turbulence data to establish wake mitigation separation standards between aircraft that air traffic controllers will apply to a new series of aircraft entering operational service.	✓
Propulsion and Fuel Systems	Develops the damage tolerance framework and supporting data to provide a basis for the necessary advisory materials and a design software code. The program also develops improved, nondestructive evaluation methods to characterize engine component material conditions that can compromise integrity.	✓
System Planning and Resource Management	Leads the planning, coordination, development, presentation, and review of the FAA's R&D portfolio. Its key outputs include the National Aviation Research Plan (NARP) and the Research and Development Annual Review, both submitted to Congress.	✓
System Safety Management/Terminal Area Safety	The System Safety Management program develops safety data collection methods, advanced safety data and risk analysis techniques, and prototypes of risk-based, decision-making capabilities to identify and analyze emerging safety issues. The Terminal Area Safety program focuses on developing training solutions and identifying effective technologies to mitigate key causes of fatal accidents, such as the loss of control, runway excursions, and runway overruns.	✓
Unmanned Aircraft Systems Research	Studies the safety implications of new, uncrewed aircraft operational concepts and the technology on the National Airspace System and supporting the development of new and modified regulatory standards.	✓
Weather Program	Performs applied research to enhance safety and operational efficiency in adverse weather conditions in the National Airspace System, as well as in oceanic and remote regions.	✓
William J. Hughes Technical Center Laboratory Facilities	Sustains the facilities located at the FAA's William J. Hughes Technical Center to support R&D goals. These programs require specialized facilities to emulate and evaluate field conditions. The laboratories include a cockpit simulation facility and a human factors laboratory, among others.	✓

Programs	Descriptions	Safety related[a]
Women in Aviation Pilot Shortage	Researches and analyzes how to diversify the pilot workforce by promoting greater representation of women pilots; identifying pilot shortage factors in recruitment and retention, including, but not limited to, increasing appeal for exposure to the industry; financial and education barriers; work-life integration; gender bias and discrimination; slow institutional and culture change policy; aging workforce; and compensation fluctuating recruitment requirements.	✓

Source: GAO analysis of FAA information. | GAO-25-107697

Note: Congress appropriates funding for the FAA's RE&D account and issues a joint explanatory statement that accompanies the annual appropriations act. This joint explanatory statement identifies R&D programs and funding levels for the RE&D account.

[a]A checkmark (✓) in the "Safety related" column indicates that FAA considers 100 percent of the funding for these programs to be for safety projects.

Appendix II: Federal Funding for the Federal Aviation Administration Research and Development Programs

The Federal Aviation Administration (FAA) Reauthorization Act of 2018 directed that safety-related activities be the FAA's highest research priority and that at least 70 percent of the amount appropriated for the Research, Engineering, and Development (RE&D) budgetary account be for safety research and development (R&D) projects.

Between fiscal years (FY) 2019 and 2024, there were slight changes to the R&D programs funded by Congress through its RE&D budgetary account and that FAA identified as safety related for the purposes of meeting the statutory requirement. For example:

- In FY 2019, Congress funded 23 FAA R&D programs under its RE&D budgetary account. In FY 2024, Congress funded 24 FAA R&D programs under that budgetary account.
- Between FY 2019 and FY 2024, four programs were eliminated: (1) Aircraft Catastrophic Failure Prevention Research, (2) Next Gen - Air Ground Integration Human Factors, (3) Next Gen - Weather Technology in the Cockpit, and (4) Flight Deck Data Exchange Requirements). During the same period, five programs were added: (1) Digital System Safety;[1] (2) Aviation Workforce Development/Grant Management; (3) Women in Aviation Pilot Shortage; (4) Aviation Accessibility Research; and (5) Aircraft Radio Altimeter Development, Testing, and Certification.
- In addition, there was one program not funded in FY 2019 or FY 2024 but that received one year of funding in the years between.

Table 3 shows all RE&D programs Congress funded for each fiscal year, from 2019 through 2024, and the percent of funding FAA identified as allocated for safety projects. Based on the FAA's identification of safety programs, FAA exceeded the 70 percent statutory requirement each year during FY 2019 through 2024. In FY 2019, FAA reported allocating the highest percentage—over 79 percent—of its funding for safety projects. According to FAA, in FY 2024, the FAA's funding for safety projects was over $200 million and represented the most funding FAA allocated for these projects for the period studied.

[1]In 2020, the Digital System Safety program was separated from the Aircraft Icing/Digital System Safety program.

Table 3: Research, Engineering, and Development Programs, Funding Allocated, and Percent Considered Safety-Related, According to the Federal Aviation Administration (FAA), During Fiscal Years 2019 Through 2024

(Dollars in thousands)

Research and development programs	2019	2020	2021	2022	2023	2024
Advanced Materials/Structural Safety	$14,720	$14,720	$14,720	$14,720	$14,720	$14,720
Aeromedical Research	9,080	7,919	10,235	11,000	9,000	10,000
Air Traffic Control/Technical Operations Human Factors	5,800	5,800	5,685	5,911	5,911	5,911
Aircraft Catastrophic Failure Prevention Research	1,570	1,565	1,565	-	-	-
Aircraft Radio Altimeter Development, Testing, and Certification	-	-	-	-	-	5,000
Aircraft Icing[a]	9,253	4,500	1,521	2,472	2,472	2,472
Airliner Cabin Environment Research	0	1,000	0	0	0	0
Alternate Fuels for General Aviation	1,900	1,900	2,524	5,434	10,000	11,201
Aviation Accessibility Research	-	-	-	-	-	2,000
Aviation Workforce Development/Grant Management	-	-	-	10,000	15,000	20,000
Commercial Space Transportation Safety	2,500	2,500	5,840	5,708	4,708	2,000
Continued Air Worthiness	11,269	10,269	11,269	8,829	8,829	8,425
Digital System Safety	-	4,500	4,905	3,689	3,689	3,689
Environment & Energy[b]	18,013	18,013	20,303	22,000	21,000	21,000
Environmental Research – Aircraft Technologies and Fuels[c]	29,174	29,174	31,464	67,500	68,000	68,000
Fire Research and Safety	7,200	7,200	7,136	7,136	7,136	7,136
Flight Deck Data Exchange Requirements	1,035	1,005	1,000	1,000	-	-
Flight Deck/Maintenance/System Integration Human Factors	7,305	7,300	7,469	14,301	14,301	14,301
NextGen - Air Ground Integration Human Factors	6,757	5,300	6,000	3,000	-	-
NextGen - Information Security	1,232	2,675	4,769	4,769	4,769	5,707
NextGen - Wake Turbulence	6,831	5,000	3,698	3,728	3,728	3,728
NextGen - Weather Technology in the Cockpit	3,644	3,144	1,982	2,659	4,000	-
Propulsion and Fuel Systems	2,100	2,100	4,215	3,000	3,000	4,000
System Planning and Resource Management	2,135	12,135	13,022	3,300	4,141	5,097
System Safety Management/Terminal Area Safety	5,500	4,500	5,485	7,000	9,252	9,252
Unmanned Aircraft Systems Research	24,035	24,035	24,035	22,077	22,077	31,128
Weather Program	15,476	12,911	6,236	13,786	13,786	14,786

Research and development programs	2019	2020	2021	2022	2023	2024
Women in Aviation Pilot Shortage	-	-	-	-	-	5,000
William J. Hughes Technical Center Laboratory Facilities	4,571	3,500	2,921	5,481	5,481	5,447
Total	**$191,100**	**$192,665**	**$198,000**	**$248,500**	**$255,000**	**$280,000**
Total safety related[d]	**151,207**	**152,772**	**154,098**	**175,875**	**183,000**	**208,000**
Percent Safety Related	79%	79%	78%	71%	72%	74%

Source: GAO analysis of FAA information. | GAO-25-107697

Note: Congress appropriates funds for these research and development programs through the Research, Engineering, and Development budgetary account. FAA determines which projects to fund under each program.

[a]In FY 2019, according to FAA, the Aircraft Icing and Digital System Safety program were one funding program but two distinct programs. Since FY 2020, according to FAA, these were separated into two R&D programs. However, these programs were listed together in the joint explanatory statement until the Consolidated Appropriations Act, 2022.

[b]This program's funding is not considered to be safety related.

[c]Only 25 percent of this program's funding is considered safety related for the purposes of meeting the statutory requirement.

[d]The total safety-related funding was calculated by adding all funds for the programs, with two exceptions: 25 percent of the funding from the Environmental Research – Aircraft Technologies and Fuels program is for safety projects, and 0 percent of funds for the Environment & Energy program is for safety projects.

Appendix III: Safety-Related Research and Development Programs and Selected Projects, Fiscal Year 2024

In fiscal year 2024, the Federal Aviation Administration (FAA) identified 22 research and development (R&D) programs that exclusively supported safety projects and one R&D program (Environmental Research – Aircraft Technologies and Fuel) with 25 percent of its funding supporting safety projects. Table 4 provides examples of the types of FAA projects funded by these programs in fiscal year 2024.

Table 4: Federal Aviation Administration (FAA) Safety-Related Research and Development (R&D) Programs and Selected Projects, Fiscal Year 2024

R&D program	Project title	Project summary
Advanced Materials/Structural Safety	Evaluate Analytical Method for Evaluating Composite Seat Performance	Current industry standards and test methods for seating systems were developed assuming metallic structure. This research examines the use of composites for seating systems and how to modify the current certification testing.
Aeromedical Research	Rotorcraft Injury Mechanism Analysis - Procedure Development and Validation	Seeks continuous improvements to occupant safety and survivability techniques in emergency situations. It is focused on developing procedures to gather and organize crash and injury information from rotorcraft accidents and use the data to identify causes of the injuries and potential mitigation strategies.
Air Traffic Control/Technical Operations Human Factors	Develop Consensus Standards for Controller and Technical Operations in Job Task Performance	Recommends standards for controller and technical operations job task performance where unique situational human factors apply at national airspace system facilities, including local conditions, equipment, traffic, workload, and coordination requirements.
Aircraft Icing	Safe Operations and Take-off in Aircraft Ground Icing Conditions	Provides technical data and information on ground deicing to the FAA's Flight Standards on a perennial basis. This information is used by aircraft operators to submit annual deicing plans.
Aircraft Radio Altimeter Development, Testing, and Certification	Radio Altimeter 5G Out-of-Band Emissions	Studies emitters for out-of-band emission levels. Advances the radio altimeter transceiver technologies through literature, technology review, and test data. The performance of the developed radio altimeter technologies will be verified and validated in the new operational environments.
Alternative Fuels for General Aviation	Alternate Fuels for General Aviation	Performs research to identify and qualify (through testing), a safe and suitable unleaded fuel. The program performs research to ensure the current general aviation level of safety is maintained with alternative unleaded fuels.
Aviation Accessibility Research	Emergency Egress for Disabled Persons	Determine the best methods for passengers with mobility issues to evacuate during emergencies.
Aviation Grant Management	Aviation Workforce Development for Aircraft Pilots Program	Supports the education, development, and recruitment of future aviation professionals to ensure the safety of the national airspace system.
Commercial Space Transportation Safety	Human Operations and Spaceflight	Researching the effect of spaceflight on human physiology, medicine, and other areas. This research also emphasizes human spaceflight research data collection and storage.

R&D program	Project title	Project summary
Continued Airworthiness	Loss of Control Inflight	Examines models, methods, and means that would indicate to a rotorcraft pilot the potential severity of an impending loss of control.
Digital System Safety	Onboard Network Security and Integrity (Aircraft Systems Information Security Protection)	Identifies cyber vulnerabilities and risks in aircraft and provides recommendations for FAA Safety Risk Assessment plans to be used in certification by aircraft and systems manufacturers.
Environmental Research – Aircraft Technologies and Fuels	Commercial Aviation Alternative Fuels Initiative	Shares knowledge across the full breadth of jet fuel and aviation stakeholders to support the development of jet fuels from alternative sources.
Fire Research and Safety	Molecular-Level Research for Detecting Material Formulation Changes that Impact Flammability	Examines materials, fire research tools, and techniques—to detect changes in material that impact flammability. The research project design is to evaluate aircraft materials for flammability.
Flight Deck/Maintenance/System Integration Human Factors	Pilot Visual Scanning Techniques of Instruments, Systems and References for Flightpath Management	Examines two-person flight operations to understand how pilot visual scanning behaviors do or do not complement the actions of other crewmembers in a transport airplane.
NextGen – Information Security	Aviation Architecture Framework	Develops and applies advanced analytical and visual methods to prevent cyberattacks and enhance the cyber resiliency of the aviation ecosystem.
NextGen – Wake Turbulence	Assessments of Wake Separations for new aircraft types entering the National Airspace System	Sets separations between the new aircraft type, with an expected outcome being that new aircraft types are safely integrated into the National Airspace System and can deliver their full benefit to their operators.
Propulsion and Fuel Systems	Improved Nondestructive Evaluation to Prevent Uncontained Engine Failures	Together with another project, looks at reducing engine rotor failures due to material anomalies by improving the design, manufacturing, and inspection of these parts.
System Planning and Resource Management	System Planning and Resource Management	Manages the Research, Engineering, and Development portfolio and submits the mandatory R&D planning documents to Congress each year.
System Safety Management/Terminal Area Safety	Wet Runway Wheel Braking Testing	Helps reduce the risk of runway overruns on wet runways and develop wet runway performance and runway construction/maintenance standards.
Unmanned Aircraft Systems Research	Aircraft Certification Considerations for Urban Air Mobility	Enables the FAA' s exploration of certification challenges related to urban air mobility.
Weather Program	Analysis of Airborne Weather Radar to Detect High Ice Water Conditions	Analyzes airborne weather radar in high ice content areas to be used to support radar manufacturers in development of products that will enhance safety.
Women in Aviation Pilot Shortage	Women in Aviation and Pilot Shortage Study	Seeks to address the shortage of women in aviation fields, particularly the shortage of women pilots, through the continued development of a skilled workforce and supporting the training of women pilots.

R&D program	Project title	Project summary
William J. Hughes Technical Center Laboratory Facilities	Zero Trust Testbed	Reliance on interconnected and complex digital systems necessitates a cybersecurity that ensures the resilience, security, and trustworthiness of aviation infrastructure. This project seeks to develop and validate zero trust architectures.

Source: GAO summary of FAA information. | GAO-25-107697

Note: Congress funds these research and development programs through the Research, Engineering, and Development budgetary account. FAA then determines which programs are safety related and what projects to fund under each program.

Appendix IV: Comments from the Department of Transportation

U.S. Department of Transportation
Office of the Secretary of Transportation

Assistant Secretary for Administration

1200 New Jersey Avenue, SE
Washington, DC 20590

June 17, 2025

Derek Collins
Director, Physical Infrastructure Issues
U.S. Government Accountability Office (GAO)
441 G Street NW
Washington, DC 20548

Dear Mr. Collins:

Aviation safety is the top priority of the Federal Aviation Administration (FAA). The professionals at the FAA approach their jobs with gravity and strive to ensure safety every day. While flying remains the safest mode of transportation, aviation safety is not static and is not a given; there is always room for improvement and shifts to optimize the existing culture of safety.

GAO's review confirms that the FAA met the statutory requirement that at least 70 percent of Research, Engineering, and Development (RE&D) funding be allocated to safety-related projects from fiscal years 2019 through 2024. We acknowledge the report's finding that, while this requirement was consistently met, documentation and external reporting of the methodology and results could be improved.

Upon review of the draft report, FAA concurs with GAO's recommendation to report on the percentage of its appropriated funds, including the programs and funding amounts, from the RE&D account that are used for safety research and development (R&D) projects, as part of its annual reporting process. In February 2025, the agency updated its internal guidance to include formal criteria and procedures for identifying and documenting safety R&D projects. These improvements will enhance transparency and strengthen oversight of the FAA's R&D portfolio. We are also taking steps to reflect this information in forthcoming editions of the National Aviation Research Plan and the Research and Development Annual Review. These enhancements will improve the clarity and accessibility of the FAA's reporting to Congress and the public. DOT will provide a detailed response to the recommendations within 180 days of the final GAO report issuance.

We appreciate the opportunity to review the GAO draft report. Please contact Gary Middleton, Director of Audit Relations and Program Improvement, at 202-366-6512 with any questions or to obtain additional details.

Sincerely,

Anne Byrd

Dr. Anne Byrd
Assistant Secretary for Administration

Appendix V: GAO Contact and Staff Acknowledgments

GAO Contact

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Staff Acknowledgments

In addition to the individual named above, Jean Cook (Assistant Director), Eric Hudson (Analyst in Charge), Laura Bonomini, Jim Geibel, Steve Rabinowitz, Kelly Rubin, Yinghua Shi, Michelle Weathers, and Alicia Wilson made key contributions to this report.