



August 2020

TRANSPORTATION RESEARCH

Additional Actions Could Improve DOT's Internal Collaboration and Reliability of Information on Research Activities

GAO Highlights

Highlights of [GAO-20-622](#), a report to congressional requesters

Why GAO Did This Study

DOT's research activities are critical to DOT's mission to make the nation's transportation system safer and more efficient. To meet current research needs and prepare for emerging technologies, DOT partners with public and private entities. In fiscal year 2018, DOT funded about 2,300 partners and had a research budget exceeding \$1 billion.

GAO was asked to review DOT's research activities. This report addresses: (1) how DOT prioritizes and selects which research activities it will undertake; (2) the extent to which DOT facilitates research collaboration with external stakeholders and across the department; and (3) the extent to which DOT ensures its Research Hub database contains complete and accurate project information. GAO reviewed documents and analyzed data from DOT; observed DOT-funded research; interviewed DOT officials from OST-R and four selected modal administrations; and used GAO's leading collaboration practices to assess the extent of collaboration. GAO also interviewed 17 DOT research partners, including universities and associations.

What GAO Recommends

GAO recommends that OST-R (1) take steps to ensure the topical-research working groups follow all leading collaboration practices, and (2) take additional steps to ensure the information in the Research Hub is complete and accurate. DOT concurred with GAO's recommendations.

View [GAO-20-622](#). For more information, contact Elizabeth Repko at (202) 512-2834 or repkoe@gao.gov.

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TRANSPORTATION RESEARCH

Additional Actions Could Improve DOT's Internal Collaboration and Reliability of Information on Research Activities

What GAO Found

The Department of Transportation (DOT) uses a multistep, centralized process to prioritize and select research activities it will fund. DOT's modal administrations—which focus on specific modes of transportation like air, rail, and highways—conduct and manage most of DOT's research. The modal administrations GAO spoke to used a variety of methods to prioritize and select research, including soliciting stakeholders' feedback on research needs. The Office of the Assistant Secretary for Research and Technology (OST-R) is responsible for reviewing this proposed research to ensure alignment with DOT's strategic plans and to prevent duplicative research efforts, as required by statute.

DOT has multiple efforts to facilitate research collaboration both externally and internally, but in guidance to promote collaboration, OST-R did not incorporate all leading practices. Specifically, OST-R established topical-research working groups on 12 multimodal subject areas in October 2018 and issued accompanying guidance. This guidance incorporated some leading collaboration practices, such as directing working groups to identify leadership roles and relevant participants. However, the guidance did not incorporate two leading practices—defining and monitoring progress toward long-term outcomes and regularly updating and monitoring written agreements. Taking steps to ensure the working groups follow these practices could provide OST-R greater assurance that the groups coordinate their efforts effectively, better plan long-term research, and better position themselves to address future transportation challenges.

OST-R has taken some steps to help ensure that its public database on DOT-funded research projects (the Research Hub) contains complete and accurate information, as required by DOT's data management policy; however, data reliability issues remained. For example, as of July 2019—the latest available data at the time of GAO's analysis—36 percent of records in the database were missing research partners' contact information, hindering the research community's ability to obtain current project details. Taking additional steps, such as providing instructions to the modal administrations on how to improve the completeness and accuracy of the information they give OST-R for the Research Hub, would help ensure the database is fulfilling DOT's intended purpose that it serve as a reliable source of information on the department's research portfolio.

Examples of Research Activities on Advanced Driver-Assistance Systems and Connected Vehicles Funded by the U.S. Department of Transportation



Crash avoidance test.



Wireless equipment for testing.

Source: National Highway Traffic Safety Administration (left) and GAO (right). | [GAO-20-622](#)

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Abbreviations

DOT	Department of Transportation
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
ITS JPO	Intelligent Transportation Systems Joint Program Office
NHTSA	National Highway Traffic Safety Administration
OMB	Office of Management and Budget
OST	Office of the Secretary of Transportation
OST-R	Office of the Assistant Secretary for Research and Technology
RD&T	research, development, and technology
TRB	Transportation Research Board
UTC program	University Transportation Centers program
Volpe Center	John A. Volpe National Transportation Systems Center

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August 10, 2020

The Honorable Roger F. Wicker
Chairman
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Eddie Bernice Johnson
Chairwoman
The Honorable Frank Lucas
Ranking Member
Committee on Science, Space, and Technology
House of Representatives

The Honorable Deb Fischer
Chairman
Subcommittee on Transportation and Safety
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable John Thune
United States Senate

In fiscal year 2019, the Department of Transportation's (DOT) research, development, and technology (RD&T) budget totaled over \$1 billion.¹ As of June 2020, DOT funded almost 5,000 ongoing research activities.² These activities are critical to supporting DOT's mission to make the

¹Unless otherwise noted, where we refer to "research" in this report, we are referring to research, development, and technology.

²For the purposes of our review, we consider the term "research activities" to encompass a wide range of projects and efforts DOT undertakes to support the department's mission to make the nation's transportation system safer and more efficient. On its Research Hub database website, DOT defines its research projects or activities as follows: "Research is the systematic study directed toward fuller scientific knowledge or understanding of the subject studied, and is classified as either basic or applied according to the objectives of the sponsoring agency. Development is defined as systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements. Technology includes demonstration projects and other related activities associated with research and development activities." The Research Hub is DOT's public-facing, searchable database of active and recently completed DOT-funded research projects. United States Department of Transportation, *USDOT Research Hub 2.0*, accessed May 12, 2020, <https://researchhub.bts.gov/faq>.

nation's transportation system—a system vital to the traveling public and to the U.S. economy—safer and more efficient. DOT partners with other government agencies, academia, and private industry to carry out research activities through its nine modal administrations and a joint program office responsible for conducting DOT-wide research.³ The Office of the Assistant Secretary for Research and Technology (OST-R) is responsible for coordination, facilitation, and review of all of DOT's research programs, as well as directly managing its own statistical and research activities.⁴ OST-R is also responsible for aligning research activities with budgetary resources and strategic goals, and providing and expanding opportunities for research collaboration across the department and with external partners.⁵ The Fixing America's Surface Transportation Act (FAST Act) required DOT, among other things, to develop a 5-year strategic plan to guide future research activities, authorized the establishment of additional research partnerships, and create a comprehensive research database.⁶ DOT officials told us that the department expanded the Research Hub, a database originally established by the Research and Innovative Technology Administration in 2012, to address this mandate.

You asked us to examine DOT's research activities. This report addresses (1) how DOT prioritizes and selects which research activities it will undertake, (2) the extent to which DOT facilitates research collaboration with external stakeholders and across the department, and (3) the extent to which DOT ensures its Research Hub database contains complete and accurate project information.

³DOT modal administrations are generally responsible for activities related to specific transportation modes, such as air, rail, public transit, and highways. Examples of modal administrations include the Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration (NHTSA). Throughout this report, "modal administrations" refers to the modal administrations and joint program office.

⁴In 2014, OST-R was established in the Office of the Secretary (OST) Pub. L. No. 113-76, div. L., tit. I, 128 Stat. 5, 574 (2014).

⁵For the purpose of this report, we use the term "collaboration" broadly to include interagency activities that others have defined as "coordination." We previously reported that there are no commonly accepted definitions for each of these terms. GAO, *Results-Oriented Government: Practices That Can Help Enhance and Sustain Collaboration among Federal Agencies*, [GAO-06-15](#) (Washington, D.C.: Oct. 21, 2005).

⁶Pub. L. No. 114-94, §§ 6011, 6019, 129 Stat. 1312, 1568-69, 1579-80 (2015).

To address all three objectives and to better understand how DOT conducts research across the department, we selected four modal administrations—the Federal Highway Administration (FHWA); the Federal Motor Carrier Safety Administration (FMCSA); the Federal Railroad Administration (FRA); and the National Highway Traffic Safety Administration (NHTSA)—to review in depth. We analyzed data from DOT’s Research Hub database and reviewed DOT documentation to select one large, two medium, and one small modal administration based on: the number of active projects sponsored or managed by each modal administration and the amount of research funding each modal administration spent as well as whether we have issued recent work on similar issues.⁷ We assessed the reliability of these Research Hub data by reviewing documents provided by DOT and interviewing cognizant DOT officials. We also performed electronic testing to look for any missing or erroneous data. While we identified data limitations, as discussed later in this report, we determined the data were sufficiently reliable for our selection purposes. In addition, we interviewed OST-R officials and officials from the selected modal administrations to better understand their roles in, for example, prioritizing and selecting research activities and facilitating collaboration between research partners. To complement interviews with OST-R officials, we reviewed the National Academy of Public Administration’s 2018 OST-R organizational assessment.⁸

To further describe how DOT prioritizes and selects the research activities it undertakes, we reviewed DOT documentation, including DOT strategic plans. We also reviewed DOT’s research-planning documents from fiscal years 2017 through 2019, as well as the planning guidance and template from fiscal year 2019. In addition, we interviewed officials from both OST-R and selected modal administrations about the

⁷We applied these selection factors and found modal administrations naturally fell into large, middle-sized, and small groups in terms of number of active projects and amount of research funding. From these groups, we selected FHWA as the large modal administration, FMCSA and NHTSA as the middle-sized modal administrations, and FRA as the small modal administration. The information we gathered from these reviews is not generalizable across all modal administrations. We excluded the Federal Aviation Administration from our selection for a more in-depth review because we previously reviewed the Federal Aviation Administration’s management of its research and development portfolio and research partner collaboration. See 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).

⁸National Academy of Public Administration, *Organizational Assessment of the Department of Transportation’s Office of the Assistant Secretary for Research and Technology* (Washington D.C.: October 2018).

processes used to create the plans. We also reviewed the FAST Act to identify requirements for setting DOT and modal administrations' research priorities and selecting research activities.

To examine the extent to which DOT facilitates research collaboration with external stakeholders and across the department, we analyzed data, interviewed external DOT research partners, reviewed documentation on an internal DOT effort, and observed DOT-funded research activities. We conducted semi-structured interviews with 17 external research partners we selected based on their number of DOT-funded research projects, the length of the research partnership, their active research funding relationship with a selected DOT modal administration or office, and the topic area of the funded research, among other criteria.⁹ While the information obtained from these interviews cannot be generalized to all research partners, the interviews provided illustrative examples of the relationships and collaborative efforts between DOT modal administrations and external partners. We also reviewed OST-R's topical-research working-group guidance. OST-R identified multimodal subject areas in which collaboration among the modal administrations would benefit DOT as a whole and established corresponding working groups for each subject area in October 2018. We compared the guidance for these groups to leading practices on collaboration identified in our prior work.¹⁰ We also reviewed documentation from two of the topical-research working groups to provide illustrative examples of how the groups' documents address the guidance. In addition, to further discuss DOT's efforts at collaboration, we visited two external partners—the Center for Connected and Automated Transportation and the University of Michigan Transportation Research Institute—and an internal partner—the John A. Volpe National Transportations Systems Center (Volpe Center). We selected the two external partners based on factors such as relatively high levels of DOT research funding the partners were receiving and the length of their partnerships with DOT. We visited the internal research

⁹We selected these research partners from an initial group of 70 research partnerships identified in the Research Hub and on DOT websites as currently having a direct relationship with the selected modal administrations. For a variety of reasons, only 17 of these 70 research partnerships met our interviewee selection criteria. For example, some of the partners told us that they did not have an active research-funding relationship with DOT, contrary to what was reported in the Research Hub. Others did not have a direct-funding relationship with one of the DOT modal administrations we selected for this review. For additional information, see appendix I.

¹⁰GAO, *Managing For Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, [GAO-12-1022](#) (Washington, D.C.: Sep. 27, 2012).

partner because it conducts research funded by all of DOT's modal administrations, including the selected modal administrations.

To examine the extent to which DOT ensures its Research Hub database contains complete and accurate project information, we analyzed data exported from the Research Hub as of July 2019.¹¹ The data exported included 10,748 research projects that started as early as 1992. We performed checks on the DOT-provided Research Hub data to determine the reliability of the agency data and to identify potential limitations, such as missing data fields and errors. We also reviewed DOT documents, such as the Research Hub user manual, examples of documents OST-R sends to the modal administrations related to updating the database, and DOT information policy and guidelines. See appendix I for more information on our objectives, scope, and methodology.

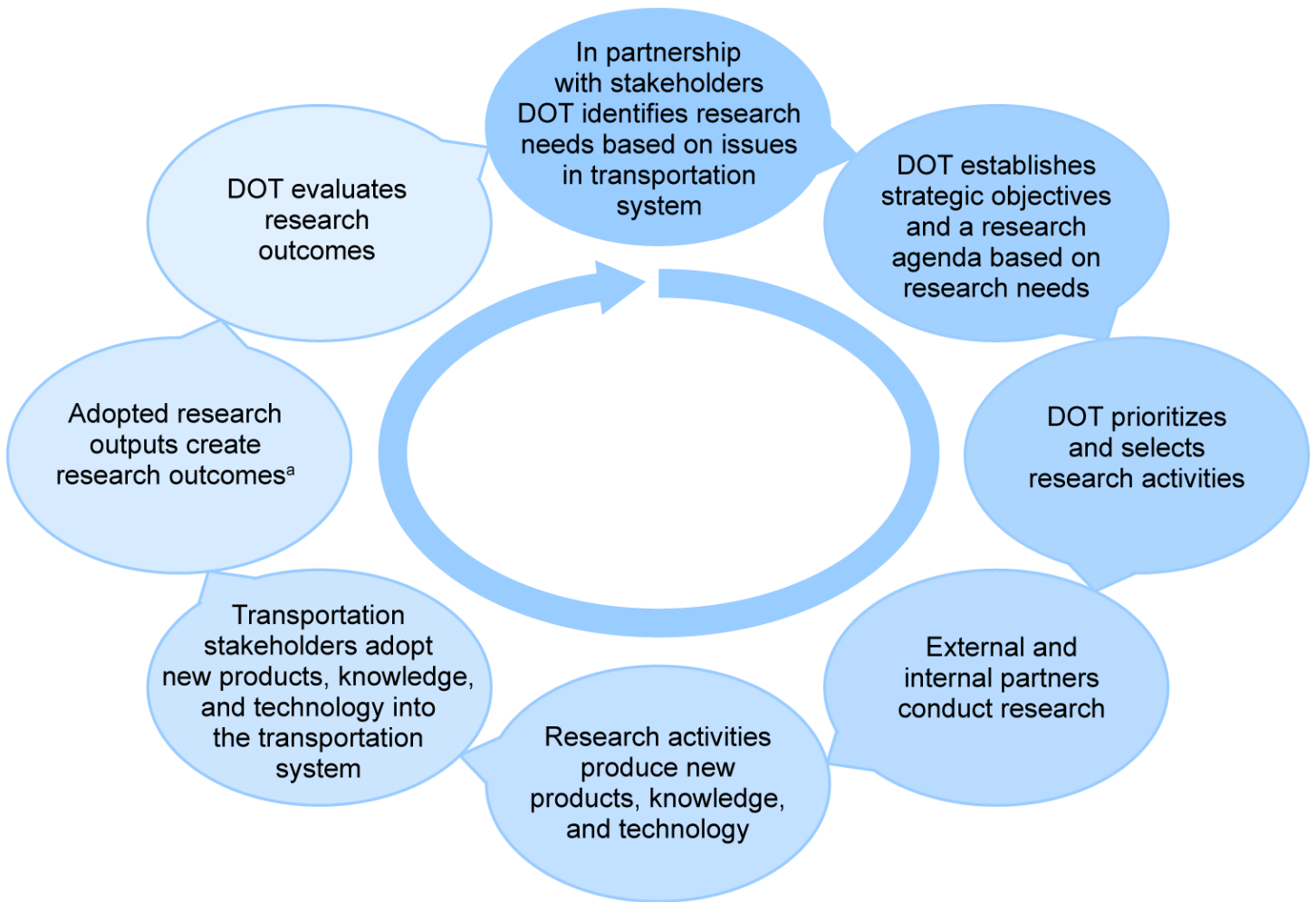
We conducted this performance audit from January 2019 to August 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions 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

DOT modal administrations conduct or manage the majority of DOT's research. Each modal administration focuses on specific transportation areas and issues, as designated by the Secretary. For example, FRA is responsible for enabling the safe, reliable and efficient movement of goods, and NHTSA is responsible for reducing deaths, injuries, and economic losses resulting from motor vehicle crashes. Each modal administration's area of focus directs its research needs and the activities it conducts; for instance, FRA conducts research on alternative techniques for detecting broken rails or track hazards. Modal administrations directly conduct research and engage with external research partners, such as universities and businesses, to conduct research through various agreements, including contracts, grants, and cooperative agreements. DOT research conducted both internally and by external partners is intended to follow a continual process, or lifecycle (see fig.1).

¹¹These were the most recent data available at the time we were conducting our analysis.

Figure 1: U.S. Department of Transportation's (DOT) Research Lifecycle



Source: GAO presentation of DOT information. | GAO-20-622

^aDOT defines outcomes or “impacts” as any “real world” effects of research on the transportation system or its surrounding legislative and organizational frameworks.

Since fiscal year 2016, DOT’s research spending has generally increased overall but varied by modal administration or office (see table 1). However, DOT officials noted that the Federal Aviation Administration’s

research spending accounts for almost the entire increase from fiscal year 2016 to fiscal year 2019.¹²

Table 1: U.S. Department of Transportation’s (DOT) Research, Development, and Technology Spending for Selected Modal Administrations and an Office, Fiscal Years 2016-2019 (dollars in thousands)

DOT modal administration or office	Fiscal year 2016 actual	Fiscal year 2017 actual	Fiscal year 2018 actual	Fiscal year 2019 actual
Federal Aviation Administration	425,193 ^a	432,882	470,376	501,907
Federal Highway Administration	394,687	389,312	385,006	380,994
Federal Motor Carrier Safety Administration	12,036	11,865	9,073	9,073
Federal Railroad Administration	43,591	43,877 ^a	40,600	40,600
Federal Transit Administration	28,000	28,000	30,000	34,000
National Highway Traffic Safety Administration	86,554	68,977 ^a	75,982	76,323 ^a
Pipeline and Hazardous Materials Safety Administration	21,479	21,479	22,479	24,479
Office of the Assistant Secretary for Research and Technology	5,909	5,426	5,445 ^a	5,046 ^a
Total	1,017,449	1,001,818	1,038,961	1,072,422

Source: GAO summary of information in DOT budget justifications. | GAO-20-622

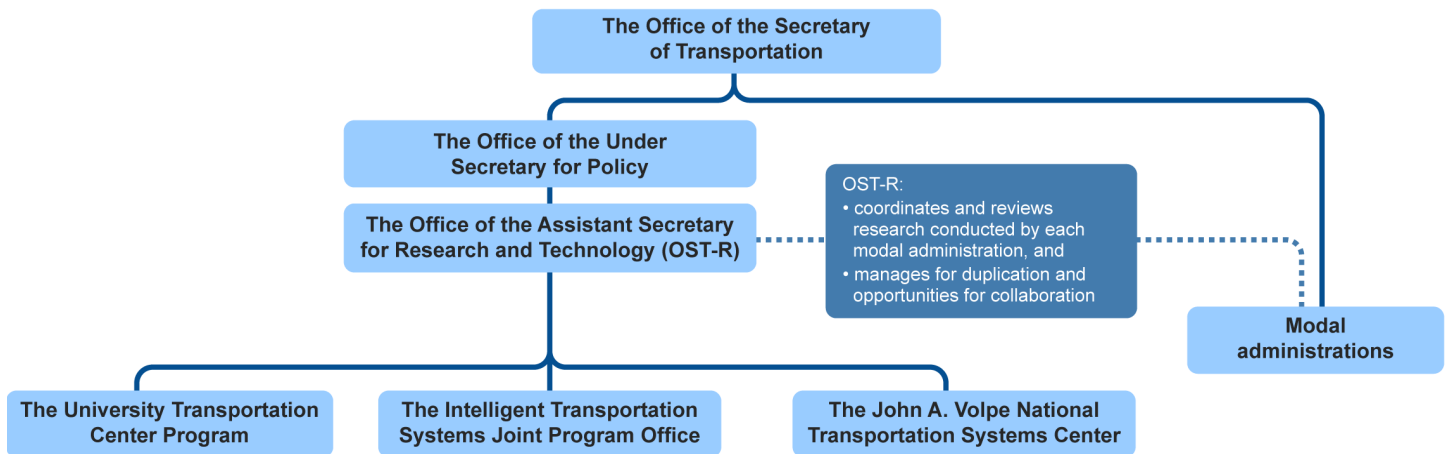
Note: All dollar amounts are nominal, and have not been adjusted for inflation.

^aThis is the enacted funding amount. The actual funding amount for this fiscal year is not available.

While each modal administration has its own management and organizational structure, research across DOT is coordinated and reviewed by OST-R (see fig. 2).

¹²DOT officials also stated that, without the Federal Aviation Administration’s increase in research spending since fiscal year 2016, DOT’s overall fiscal year 2019 research expenditures declined.

Figure 2: U.S. Department of Transportation’s Organizational Structure Related to Research, Development, and Technology



Source: GAO analysis of U.S. Department of Transportation information. | GAO-20-622

OST-R, and its role within DOT, was established in 2014 by the Consolidated Appropriations Act, 2014.¹³ OST-R is responsible for reviewing DOT research and development programs and activities and facilitating collaboration related to multimodal and multidisciplinary research activities.¹⁴ When reviewing DOT research, OST-R is responsible for ensuring DOT produces unbiased research, improving overall research products, and identifying opportunities for research to be applied across modes, preventing duplication and waste of resources.

The FAST Act also specified a number of research-related efforts the Secretary of Transportation, as delegated to OST-R, should undertake to better review and facilitate collaboration related to DOT’s research. Specifically, OST-R was to develop a 5-year research and development strategic plan consistent with the DOT Strategic Plan, performance plans, and any other DOT research and development plan in order to guide future federal transportation research and development activities.¹⁵ OST-R was also responsible for creating a comprehensive database of all research projects conducted by DOT. To fulfill this requirement, OST-R

¹³Pub. L. No. 113-76, div. L, tit. I, 128 Stat. 5, 574 (2014).

¹⁴49 U.S.C. § 330(d).

¹⁵DOT’s annual performance plan provides more information about the performance goals outlined in the *DOT Strategic Plan FY 2018-2022* (2018), including corresponding performance indicators.

maintains the Research Hub 2.0 database, which is a searchable web tool.¹⁶

In addition, the DOT modal administrations are required to develop Annual Modal Research Plans. DOT's modal administrations must compile draft modal-research plans that OST-R must then review and approve.¹⁷ OST-R uses the Annual Modal Research Plan process to communicate research priorities to the modal administrations, solicit input from the modal administrations, reduce duplication, and identify potential areas for cross-modal collaboration.

In addition to facilitating multimodal research collaboration, OST-R oversees several entities that conduct research, including:

- **The Volpe Center** conducts multidisciplinary and multimodal transportation research activities on behalf of DOT's modal administrations, the Office of the Secretary of Transportation, and external organizations. For example, the Volpe Center performed safety research for the Office of the Assistant Secretary for Transportation Policy by applying crowdsourced data from the Waze application with two case studies: the Tennessee Highway Patrol and the City of Bellevue, Washington.
- **The Intelligent Transportation Systems Joint Program Office (ITS JPO)** conducts research and education activities related to vehicles, infrastructure, and transportation systems that wirelessly communicate with each other and coordinates its initiatives across DOT. For example, to make these communications more secure, ITS JPO funded research to explore the feasibility of a security credentials management system that supported connected vehicle pilot deployment programs, and documented specifications associated with the system's implementation, according to DOT officials.
- **The University Transportation Centers (UTC) program** is a grant program through which DOT funds research consortiums of colleges and universities working to advance transportation research and develop the next generation of transportation experts. FHWA transfers funds for the program to OST-R for disbursement to the UTCs. Each

¹⁶DOT established the Research Hub prior to the FAST Act to track the lifecycle of DOT research. DOT then added more functions and content to satisfy FAST Act requirements, creating a second version of the Research Hub, or Research Hub 2.0.

¹⁷OST-R requires modal administrations to allocate research programs in their Annual Modal Research Plans to Critical Transportation Topic Areas.

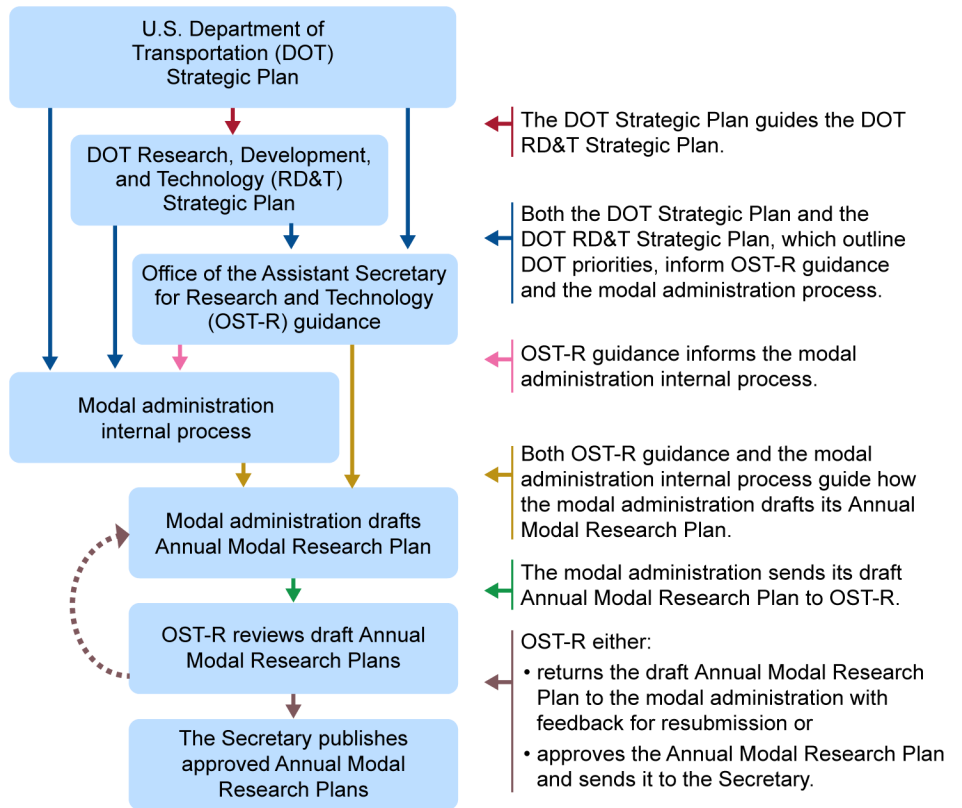
of the 37 UTCs serves as a center of transportation excellence on a specific research topic. For example, the Transportation Consortium of South-Central States focuses on infrastructure durability.

OST-R is also responsible for facilitating collaboration with transportation research stakeholders, such as the Transportation Research Board (TRB)—a division of the National Academies of Sciences, Engineering, and Medicine. TRB administers several DOT-funded research programs, maintains a large network of research committees, holds annual meetings of transportation experts to develop solutions to issues facing the transportation industry, and makes research available to the public online.

DOT Follows a Centralized Process to Prioritize and Select Research Activities, Which Selected Modal Administrations Generally Viewed as Positive

We found that DOT developed a multi-step centralized process that incorporates strategic plans, modal administrations' internal processes, and Annual Modal Research Plans to prioritize and select which research activities DOT will fund (see fig. 3). DOT's modal administrations and OST-R have different roles in this process. Specifically, the modal administrations select research activities they plan to undertake in the following fiscal year and OST-R provides guidance to the modal administrations regarding their research activities and reviews these activities. According to DOT officials, the process also includes biannual briefings from modal administrations to OST-R to review progress made on research plans' implementation. While part of this process pre-dated the FAST Act, officials from OST-R and most selected modal administrations told us the new Annual Modal Research Plan process is beneficial to DOT's overall process for prioritizing and selecting research.

Figure 3: Flowchart Showing Process DOT Uses to Prioritize and Select Research



Source: GAO analysis of DOT information. | GAO-20-622

DOT strategic plans. To assist in carrying out its responsibilities and fulfilling requirements, OST-R relies on two strategic plans in developing the guidance it issues to modal administrations on prioritizing research activities:

- The *U.S. Department of Transportation Strategic Plan for FY 2018-2022 (DOT Strategic Plan for FY 2018-2022)* reflects the Secretary’s priorities for achieving DOT’s mission and establishes four long-term department strategic goals—safety, infrastructure, innovation, and accountability—along with detailed objectives for each. For example, the Safety strategic goal’s objective aims to leverage research to identify human behavior that may increase crash risks.
- The *U.S. Department of Transportation Research, Development, and Technology Strategic Plan FY 2017-2021 (DOT RD&T Strategic Plan FY 2017-2021)* describes DOT’s research priorities and the activities

DOT has undertaken to address them. The FAST Act required DOT to develop this strategic plan, which must be consistent with the DOT-wide Strategic Plan, to help guide future federal transportation research and development activities.¹⁸ The *DOT RD&T Strategic Plan FY 2017-2021* focuses on the Critical Transportation Topic Areas, which currently do not fully align with DOT’s overall strategic goals, according to DOT officials.¹⁹ OST-R officials stated that DOT was planning to release an updated RD&T Strategic Plan that aligns with the *DOT Strategic Plan for FY 2018-2022*, but has not yet done so. In May 2020, officials stated that DOT continues to work toward completing and publishing the Plan.

OST-R guidance and modal administrations’ internal processes. As noted above, the two strategic plans inform the guidance that OST-R uses to communicate DOT research priorities to modal administrations and assist the modal administrations in conducting their internal processes to prioritize and select future research. For example, the *DOT Strategic Plan for FY 2018-2022* includes improving cybersecurity as a priority area. In a guidance memorandum issued in October 2018, OST-R and the Office of the Under Secretary for Policy outlined how to implement new DOT Research Principles to support the goals in DOT’s Strategic Plan, including that DOT research should focus on areas of immediate importance, such as cybersecurity.

We found that the DOT modal administrations we selected used different methods, established prior to the FAST Act, to prioritize and select research activities, including:

- **Roadmaps or program plans.** FHWA and NHTSA use internal “roadmaps” or “program plans” developed with input from industry and research stakeholders to guide future research. For example, FHWA has a 10-year Pavement Management Roadmap, which includes a

¹⁸49 U.S.C. § 6503. The *DOT RD&T Strategic Plan FY 2017-2021* was created prior to the current DOT-wide Strategic Plan.

¹⁹The *DOT RD&T Strategic Plan FY 2017-2021* outlines the department’s Critical Transportation Topic Areas and how DOT plans to support them through research activities. The plan notes that DOT research aims to support four Critical Transportation Topic Areas—promoting safety, improving mobility, improving infrastructure, and preserving the environment. The Critical Transportation Topic Areas are based on the contents of the Strategic Plan as required by the FAST Act—improving mobility of people and goods, reducing congestion, promoting safety, improving the durability and extending the life of transportation infrastructure, preserving the environment, and preserving the existing transportation system.

long-term vision for pavement management and research activities that could lead to new tools, methods, and technology to support pavement management, for example.

- **External stakeholder input at events.** FMCSA and NHTSA officials told us they use external stakeholder input at events in their prioritization and selection processes. For example, FMCSA holds annual public forums to garner feedback from stakeholders attending TRB's Annual Meeting, while NHTSA holds Research Public Meetings; events during which research staff present NHTSA's ongoing and recently completed research and solicit feedback on future work.
- **Prioritization tool.** FRA uses its Decision Lens prioritization tool—computer software that, according to FRA officials, analyzes information and provides quantitative and qualitative information—to assist with planning, prioritization, and resource allocation. The officials told us they use Decision Lens to engage with internal FRA stakeholders in order to help officials objectively rank proposed research activities. They explained that they do this by asking FRA senior officials and staff to rank each proposed activity using evaluation criteria, such as whether the activity aligns with DOT's strategic goals.

Following enactment of the FAST Act, DOT's modal administrations are required to prepare Annual Modal Research Plans.

Annual Modal Research Plan process. Each modal administration's Annual Modal Research Plan should describe research planned at a program level for the upcoming fiscal year along with a detailed outlook of research goals for the following fiscal year, as required by the FAST Act.²⁰ According to DOT officials, biannual briefings from modal administrations to OST-R are conducted to review progress made on research plan implementation. In addition, OST-R provides specific guidance to the modal administrations to direct Annual Modal Research Plan drafting. OST-R's fiscal year 2019 Annual Modal Research Plan guidance included a template (see table 2). Both documents aimed to ensure DOT's research portfolio aligned with the Secretary of

²⁰49 U.S.C. § 6501. DOT research activities can be divided into two levels: project level and program level. We consider research at a project level to refer to individual research activities. We consider research at a program level to be a collection of research projects working together toward an overall research goal.

Transportation's priorities, complied with the FAST Act, and effectively and efficiently used research funds.

Table 2: U.S. Department of Transportation's (DOT) Selected Annual Modal Research Plan Template Components and Examples, Fiscal Year 2019

Selected component from Annual Modal Research Plan template	Example from published Annual Modal Research Plan
Information regarding overall research objectives and goals, critical programs, collaboration efforts, and anticipated outcomes	The overall mission of the Federal Transit Administration's research is to advance public transportation innovation by leading research, development, demonstration, deployment, evaluation, and implementation practices and technologies that enhance effectiveness, increase efficiency, expand quality, promote safety, and ultimately improve the transit rider's experience.
Funding details and detailed information about each research program for fiscal year 2019 showing each program's alignment with DOT's department-wide strategic goals	The Federal Aviation Administration's Continued Airworthiness Program expects to use \$11,269,000 for applied research that works toward DOT's strategic goal of Safety and Critical Transportation Topic Area of promoting safety.
A description of each potential research activity for fiscal year 2020, including how it will build on fiscal year 2019 activities and what problem this new research will address	The Federal Highway Administration's Highway & Transportation Data program focuses on supporting and advancing the current and future state of data collection, processing, analysis, modeling, dissemination, and visualization. In fiscal year 2020, the program planned to conduct a survey by deploying methods for data collection and processing developed in fiscal year 2019.

Source: GAO analysis of DOT documentation. | GAO-20-622

OST-R provided modal administrations with a priority list of projects to include in their fiscal year 2019 Annual Modal Research Plans. These priority projects supported OST office objectives, addressed OST needs and interests, and involved collaboration between a modal administration and at least one OST office. For example, OST-R, FHWA, and the Office of Intelligence, Security, and Emergency Response collaborated on a priority project proposal related to infrastructure resilience and disaster recovery.

After the modal administrations draft the Annual Modal Research Plans, they must send them to OST-R for review. OST-R established a Research Review Working Group that reviews the Annual Modal Research Plans along with modal research spend plans, which include budgeting information.²¹ OST-R can either approve an Annual Modal Research Plan or return it to the modal administration that drafted it for revision and resubmission. During its review of the plans, OST-R must

²¹The Research Review Working Group is comprised of representatives from OST-R, the Office of Budget and Performance, and the Office of the Assistant Secretary for Transportation Policy.

identify any duplication, per the FAST Act, and cannot approve any plan that contains significant duplication. Each year, the Secretary of Transportation is to certify to Congress that each Annual Modal Research Plan has been reviewed and that DOT's research activities contain no duplication. Once approved, the Secretary publishes the Annual Modal Research Plans on both the DOT website and the Research Hub database website.

Some selected modal administration officials noted challenges related to the Annual Modal Research Plan process. For example, FMCSA officials told us that while the process has generally been the same since fiscal year 2017, the templates for the plans have changed slightly each year. These officials stated that they understood the process is fairly new but indicated that even these slight changes can be burdensome for modal administrations. FRA officials said that the timelines for OST-R approval of the Annual Modal Research Plans can take longer than anticipated, which can lead to delays in issuing contracts and disbursing funds for research activities. Additionally, DOT has experienced delays publishing the Annual Modal Research Plans online. For example, pursuant to the FAST Act, the Secretary is to publish each Annual Modal Research Plan online by January 30, but the fiscal years 2018 and 2019 Annual Modal Research Plans were not published online until November 15, 2019, according to DOT officials.²² OST-R officials told us they are continuing to refine the process over time.

Despite these challenges, officials from most selected modal administrations viewed the Annual Modal Research Plan process as beneficial to DOT's department-wide process for prioritizing and selecting research. FMCSA officials said the process has increased awareness among modal administrations about each other's related research. FRA officials told us the Annual Modal Research Plan process helps them plan for research areas that may need attention. FHWA officials said they use

²²49 U.S.C. § 6501. The FAST Act specifies a timeline for the Annual Modal Research Plan process: (1) by May 1, modal administrations must submit plan drafts to OST-R for review; (2) by September 1, OST-R must either approve the plan or provide any feedback to the modal administrations after reviewing the drafts for corrective action; and (3) by January 30, the Secretary publishes approved plans on a public website. OST-R has also created internal deadlines to help meet this timeline. In February of each year, according to officials, OST-R sends a template to the modal administrations communicating expected contents for the plans, and by May 1 of each year, modal administrations must send draft plans back to OST-R for review. In addition, OST-R officials noted that modal research plan publishing delays were at the direction of OMB, which instructed DOT not to publish the plans until after the office's review was complete. DOT had not published the fiscal year 2020 Annual Modal Research Plans as of May 2020.

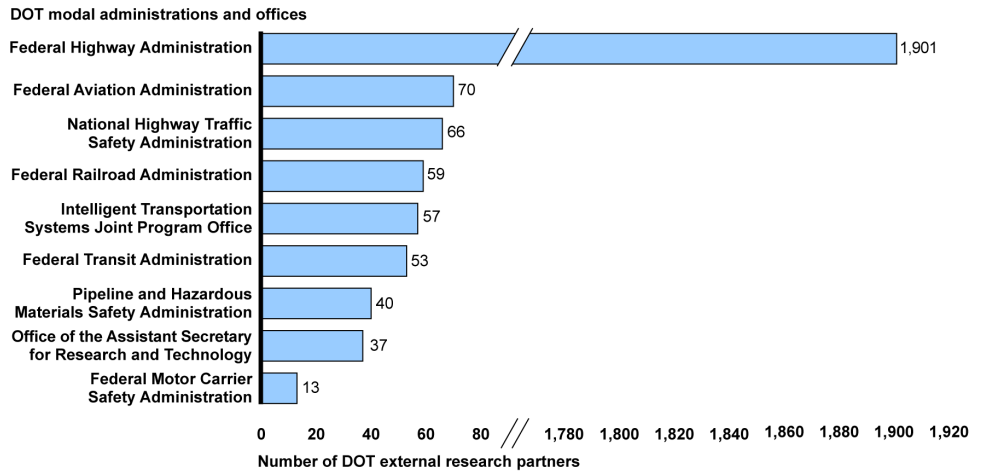
the Annual Modal Research Plans as the foundation for all of FHWA's research reporting and budgeting. FHWA officials also said that connecting research to strategic goals in the plans enables them to better ensure alignment with departmental priorities, reduce potential duplication, and facilitate collaboration related to cross-modal research topics.

DOT Has a Number of Efforts to Facilitate Research Collaboration, but Gaps in Incorporating Leading Practices May Limit the Usefulness of Guidance for Working Groups

DOT Facilitates Research Collaboration through OST-R Programs and Modal Administrations' Outreach to External Partners

DOT's modal administrations and offices directly oversee research and funded partners, including external research partners that perform research activities for the department. In fiscal year 2018—the most recent fiscal year for which funding information was available—DOT funded about 2,300 external research partners (see fig. 4). Research spending for these external partners accounted for about 72 percent of DOT's research expenditures in the same fiscal year; the remaining 28 percent funded other DOT research activities, including internal activities. According to DOT, research planning includes engagement with external partners in research institutions and the private sector to develop and enhance new technological tools capable of improving safety, security, and performance of the transportation system.

Figure 4: The Number of External Research Partners Directly Funded by the U.S. Department of Transportation's (DOT) Modal Administrations and Offices, Fiscal Year 2018



Source: GAO presentation of DOT information. | GAO-20-622

Officials from the four modal administrations we selected for our review told us that they primarily fund their research through contracts with external partners, which include universities and private businesses. The external research partners perform various types of research activities, including vehicle safety tests and human behavioral research (see fig. 5).

Figure 5: Examples of Research, Development, and Technology Activities Funded by the U.S. Department of Transportation



Crash avoidance test with an advanced driver assistance system using robotic control testing equipment.



This equipment – used by the Ann Arbor Connected Vehicle Test Environment – allows connected vehicles to wirelessly communicate with each other and their surrounding environment. The vehicle's equipment transmits speed and position data to other research equipment located roadside, in other vehicles, and at intersections.



A system with a platform that can be lowered and raised to eliminate the large first step and reduce additional steps needed to board a train. An operator demonstrates the difference between a typical first step (left) height and the reduced step (right) height. This system reduces the chances of injuries for workers in the rail industry.

Source: National Highway Traffic Safety Administration (top left), GAO (top right), and GS Engineering, Inc. | GAO-20-622

Two programs within OST-R, ITS JPO and the Volpe Center, are involved when research involves collaboration across modal administrations. OST-

R officials told us that ITS JPO works closely with modal administrations and external research partners on information and communication technology as well as connected and automated vehicles. For example, according to FMCSA officials, ITS JPO funded a recent collaborative project between FHWA and FMCSA in which an external research partner explored the use of advanced driver-assistance systems by trucking fleets. In addition, modal administrations fund the Volpe Center to conduct research, such as research related to understanding driver behavior through the use of simulations. Volpe Center officials told us that the Center often connects modal administrations that have similar research interests in order to more efficiently use funding and staff resources. For example, the Volpe Center brought together the Federal Aviation Administration and FHWA for research on transportation-related noise and its effects.

Modal administrations and offices also collaborate with the external partners whose research projects they fund. All 17 of the DOT's external research partners we spoke to said they were satisfied or very satisfied with their relationship with the modal administration or office that managed their research. Similarly, all of these partners said they were either likely or very likely to apply for DOT research funding in the future. In addition, 14 research partners stated that modal administrations had regularly scheduled meetings with them, and nine said the modal administration they work with had established advisory groups of experts to inform efforts or policy. Finally, 16 of the research partners we spoke to indicated that their organizational cultures generally aligned with those of the modal administration or office that that managed their research.

OST-R's Guidance for Research Working Groups Incorporates Some, but Not All, Leading Collaboration Practices

In addition to DOT modal administrations collaborating directly with external partners on research projects, there are also internal DOT collaborative efforts. OST-R is responsible for ensuring DOT produces unbiased research, improving overall research products, and identifying opportunities for research to be applied across modes, preventing duplication and waste of resources. In order to ensure DOT-wide collaboration on research activities, OST-R established multimodal topical-research working groups. According to DOT, these working groups, established in October 2018, help ensure that the department funds and facilitates research that supports the development and deployment of innovative practices and technologies in the transportation system. Largely through the Annual Modal Research Plan process (described above), OST-R identified 12 multimodal subject areas in which collaboration among the modal administrations would benefit DOT as a whole and advance DOT's four strategic goals: safety, infrastructure,

innovation, and accountability. OST-R currently oversees 11 topical-research working groups covering the 12 multimodal subject areas, such as Cybersecurity, Human Factors, and Automation.

In our prior work, we found that collaborative mechanisms like DOT's topical-research working groups benefit from following leading collaboration practices.²³ We have also reported that effective collaboration can help reduce or better manage fragmentation, overlap, and duplication of federal programs.²⁴ In our April 2015 guide to evaluating and managing fragmentation, overlap, and duplication, we define fragmentation as those circumstances in which more than one federal agency, or organization within an agency, is involved in the same broad area of national need and opportunities exist to improve service delivery.²⁵ In DOT's case, this definition relates to transportation research, with more than one modal administration or office involved in the same broad area of national need.

OST-R officials told us they provided basic guidance to the working groups in October 2018 and March 2019, but generally let the working group members direct their own efforts. We found that the guidance OST-R provided to the topical-research working groups incorporated a number of leading collaboration practices, and that the groups whose charters and written agreements we reviewed had followed the guidance and incorporated those practices into their documents.²⁶ However, we also found that OST-R's working-group guidance lacked some collaboration practices (see fig. 6).








²³[GAO-12-1022](#). Experts define a collaborative mechanism as any arrangement or application that can facilitate collaboration between agencies.

²⁴GAO, *Fragmentation, Overlap, and Duplication: An Evaluation and Management Guide*, [GAO-15-49SP](#) (Washington, D.C.: Apr. 14, 2015). [GAO-15-49SP](#) defines overlap as when multiple agencies or programs have similar goals, engage in similar activities or strategies to achieve them, or target similar beneficiaries. [GAO-15-49SP](#) defines duplication as instances when two or more agencies or programs are engaged in the same activities or provide the same services to the same beneficiaries. We have previously identified a number of areas in which multiple DOT modal administrations perform activities in the same functional category, including research. GAO, *Department of Transportation: Experts Identified Areas for Operational Improvements without Implementing Organizational Changes*, [GAO-17-478](#) (Washington, D.C.: May 18, 2017).

²⁵[GAO-15-49SP](#).

²⁶We reviewed charters and written agreements from two of the topical-research working groups to provide illustrative examples of how these groups' documents address the OST-R guidance.

Figure 6: Comparison of the U.S. Department of Transportation’s (DOT) Topical-Research Working-Group Guidance with Leading Collaboration Practices

Key features		Selected key considerations	Does guidance for topical-research working groups incorporate leading practices?
	Outcomes and accountability	Have short-term and long-term outcomes been clearly defined? Is there a way to track and monitor their progress?	Partially
	Bridging organizational cultures	What are the missions and organizational cultures of the participating agencies?	Generally
	Leadership	If leadership is shared, have roles and responsibilities been clearly identified and agreed upon?	Generally
	Clarity of roles and responsibilities	Have participating agencies clarified roles and responsibilities?	Generally
	Participants	Have all relevant participants been included? Do they have the ability to commit resources for their agency?	Generally
	Resources	How will the collaborative mechanism be funded and staffed? Have online collaboration tools been developed?	Generally
	Written guidance and agreements	If appropriate, have participating agencies documented their agreement regarding how they will be collaborating? Have they developed ways to continually update and monitor these agreements?	Partially

Generally DOT’s topical-research working-group guidance incorporates the leading practice.

Partially DOT’s topical-research working-group guidance incorporates some, but not all, aspects of the leading practice.

Source: GAO analysis of DOT information. | GAO-20-622

Note: Taken together the key features and considerations contained in the figure are the leading collaboration practices.

OST-R guidance generally incorporated the following leading collaboration practices:

Bridging organizational cultures. Our work has shown that it is important to establish ways to operate across agency boundaries, which can involve key considerations such as developing common terminology. OST-R guidance established ways to operate across traditional modal administration boundaries. In the guidance to working groups, OST-R acknowledged DOT’s traditional “modal-centric” approach and stated that the working groups were designed to help change it. For example, the

guidance outlined an approach for building awareness of ongoing and planned research activities across DOT to inform cross-modal efforts.²⁷

Leadership. Our work has also shown that designating leaders is often beneficial because it centralizes accountability and can speed decision-making. OST-R guidance directed working groups to designate a chair and offered them the option of identifying a co-chair to provide additional support to the chair, and potentially a different perspective to the group. In the written agreements we reviewed, working groups had identified these leadership positions.

Clarity of roles and responsibilities. One of the practices we have identified as helpful in enhancing collaboration is clarifying each participating entity's roles and responsibilities. OST-R guidance clearly identified the roles and responsibilities for OST leadership, modal leadership, and the representatives from each modal administration. Specifically, the guidance directed modal administration leaders to designate the modal representatives for each group, who are to attend working-group meetings and provide substantive input. For example, the Technology Transfer working group's charter specified roles and responsibilities for its modal administration members, including providing mode-specific insights as well as writing and reviewing guidance documents.

Participants. We have also identified the importance of ensuring that relevant participants are included in and have the appropriate knowledge and abilities to contribute to the collaborative effort. OST-R guidance directed each group to include at least one representative from each modal administration, unless that modal administration did not conduct any activities in the relevant topic area. The charters we reviewed from two of the working groups contained lists of participants and the agencies they represented. For example, the Human Factors working group includes at least one representative from each modal administration with a human factors program, OST-R, TRB and eight federal representatives.

²⁷OST-R officials noted that the future of DOT's research is likely to be increasingly cross-modal, while remaining cognizant of individual modal missions and statutory modal mandates. The officials pointed to DOT's effort to develop its third automated vehicles policy, *Preparing for the Future of Transportation: Automated Vehicles 3.0* (2018), which involved several modal administrations, as DOT's model for cross-modal research planning.

Resources. We previously reported that collaborating agencies should identify the information technology, physical, financial, and human resources needed to initiate or sustain their collaborative effort. OST-R guidance directed modal leadership and representatives to provide technology and human resources for the working groups. OST-R guidance also directed modal leadership to allow for work schedule changes to accommodate additional working group tasks and estimated the amount of work time working group tasks may take. In addition, the guidance encouraged working groups to develop electronic mechanisms for sharing information, such as a dedicated website. For example, the Human Factors working group has a publicly accessible website with information such as a membership list, publications, and presentations from recent events.

OST-R guidance partially incorporated the following leading collaboration practices:

Outcomes and accountability. The key feature of organizational outcomes and accountability includes clearly defining short-term and long-term goals and developing a way to track and monitor progress toward these goals. OST-R guidance directed the working groups to set annual goals and report progress toward those goals quarterly. For example, the Human Factors working group identified as one of its annual goals facilitating information sharing at both regular working group meetings and workshops at the annual TRB meeting. However, while OST-R's guidance stated that the groups can consider longer-term outcomes, it did not direct groups to define or monitor them. In addition, although the Human Factors working group identified goals in its strategic plan that were distinct from its annual goals, such as providing human factors information to DOT senior policy makers, these goals did not represent long-term outcomes. Directing working groups to define and monitor progress towards achieving long-term outcomes could give DOT assurance that the working groups are organizing their efforts effectively, planning long-term research rather than just focusing on immediate concerns, demonstrating the results of their activities to DOT leadership and other stakeholders, and addressing emerging transportation challenges.

Written guidance and agreements. Our work has shown that agencies that articulate their agreements in formal documents can strengthen their commitment to working collaboratively. We have also reported that written agreements are most effective when they are regularly updated and monitored. While OST-R guidance recommended that working groups

develop written agreements, specifically group charters, it did not direct working groups to regularly update or monitor them. For example, the documents we reviewed from two of the working groups did not include information related to regularly updating written agreements. Establishing a way to do so could better position working groups to address evolving and future transportation challenges in ways that the written agreements do not currently permit. For example, current working-group guidance does not allow for the participation of external stakeholders in the groups, something that the working groups may want, at some point, to consider.

When asked about why OST-R had not directed the working groups to define and monitor long-term outcomes or regularly update their written agreements, OST-R officials told us they were planning to assess the functioning of the topical-research working groups after their first year. The purpose of this assessment, according to OST-R officials, is to review accomplishments and identify any efforts that are no longer necessary. These officials acknowledged that it may be useful to incorporate these additional leading collaboration practices in the working group guidance as appropriate. In addition, if OST-R annually assessed working groups, as planned, the groups could use these reviews as opportunities to revisit long-term outcomes and written agreements.

OST-R Has Taken Steps to Help Ensure the Quality of Research Project Information in DOT's Research Hub, but Data Reliability Issues Remain

The Research Hub is DOT's searchable database of active and completed DOT-funded projects. DOT describes the Research Hub as its comprehensive public-facing account of DOT's research projects. According to DOT, it designed the database to fulfill a variety of objectives, including to:

- help OST-R in its research collaboration and facilitation efforts;
- allow DOT staff to quickly and accurately respond to requests for information on research projects from external stakeholders, including Congress; and
- provide a comprehensive and accurate account of DOT's research portfolio to the transportation research community in the United States and abroad.

OST-R, which manages the database, has taken some actions intended to help ensure the quality of the information in the Research Hub. Specifically, OST-R regularly updates the data in the Research Hub using information from the modal administrations and TRB. Every year, OST-R provides each modal administration a list of its Research Hub entries. OST-R then directs the modal administrations to review the list and

ensure that the information on their research programs is current and complete. In addition, according to OST-R officials, for the fiscal year 2019 review and approval process, they requested that the modal administrations review their Research Hub content and develop action plans to maintain up-to-date content, including commitments of staff time and resources. After modal administrations complete their reviews, OST-R enters any updated information into the Research Hub.²⁸ OST-R also supplements information on research projects in the Research Hub with relevant information on DOT-funded projects in TRB's Research in Progress database.²⁹

However, we found these actions did not fully ensure that the information contained in the Research Hub is complete and accurate, which could hinder its ability to serve as an effective collaborative, tracking, and information-sharing mechanism. DOT's Data Management Policy states that DOT entities should ensure data quality, including completeness and accuracy. In addition, DOT's Information Dissemination Quality Guidelines state that information should be reviewed by the agency on a regular basis to ensure that disseminated information is complete and accurate.³⁰ Further, as previously noted, an objective of the Research Hub database is to provide comprehensive and accurate information on DOT-funded research.

- **Incomplete.** We found that there were a number of key fields with missing information (see table 3). For example, of the 10,748 research project records in the Research Hub as of July 2019, 36 percent were missing contact information for the research partner, such as a name, phone number, fax number, or email address, and

²⁸OST-R officials stated that the Research Hub cannot be updated directly from source databases because the multiple source databases are structured differently and cannot interact directly with the Research Hub.

²⁹The Research in Progress database contains information on more than 12,000 current or recently completed transportation research projects funded by DOT, state DOTs, and others. OST-R officials told us that they update the Research Hub using information from TRB's database on a monthly basis.

³⁰According to DOT officials, the Information Dissemination Quality Guidelines are not applicable to the Research Hub. However, the officials noted that it is reasonable to look to the guidelines for best practices.

15 percent were missing similar contact information for the project research manager.³¹

Table 3: Numbers and Percentages of Missing Information from Key Fields of the U.S. Department of Transportation’s (DOT) Research Hub

Data field name	Number of projects with missing information	Percentage of projects with missing information (rounded to the nearest percentage)
Project start date	1,584	15 percent
Project end date	3,446	32 percent
Manager contact information ^a	1,579	15 percent
Research partner contact information ^b	3,890	36 percent
Project abstract	1,135	11 percent
Research program	541	5 percent

Source: GAO analysis of DOT data. | GAO-20-622

Note: As of July 2019, there were 10,748 research project records in the Research Hub database.

^aManager contact information includes the point of contact’s name, phone number, fax number, or email address.

^bResearch partner contact information includes the point of contact’s name, phone number, fax number, or email address.

Without this information, it is not possible for an external party, such as another member of the transportation research community or another federal agency, to use information in the Research Hub to contact either the partner conducting the research or the staff member managing the project in order to obtain more up-to-date or complete information on that research project. In addition, although OST-R officials told us they encourage the modal administrations to populate the outcomes field in the Research Hub, we found this field is rarely

³¹According to DOT officials, database fields containing staff names and contact information for research partners and DOT research managers are defined as optional fields in the Research Hub, meaning that completion of these fields by the modal administrations is not mandated by OST-R.

populated making it difficult to identify if DOT-funded research projects yielded the intended results.³²

- **Inaccurate.** We also found that a number of entries in the Research Hub were inaccurate. For example, of the external research partners we contacted, several noted that the Research Hub entries for their organizations were incorrect. Seven partners we contacted with projects in the Research Hub marked “active” told us that they had no active direct research funding.³³ Another partner we spoke to with active DOT funding noted that it had completed one project several years before, but the project was still marked “active” in the Research Hub. The National Academy of Public Administration conducted an organizational assessment of OST-R in 2018 and also found that the Research Hub contained inaccurate information.³⁴ For example, the assessment found that the information in the database was often outdated.³⁵

When we asked OST-R officials about the data reliability issues, specifically the completeness and accuracy of the data, they told us that OST-R is unable to verify the quality of the data entered into the Research Hub database due to resource constraints. These officials said

³²DOT defines a research project’s outcomes or “impacts,” or the way a research project is used, as something that “[s]ummarizes any ‘real world’ impacts of the project (e.g. any impacts on policy, rulemaking, patents, technology transfer outputs, commercialization, etc.)” For example, FHWA officials noted that they use analysis of transportation data and trends to anticipate future transportation needs, as well as to gauge the effectiveness of policy options in addressing those needs. In addition, NHTSA officials said they used research findings and data from NHTSA’s Vehicle Safety Research program to inform agency policy decisions on key programs such as future updates of the New Car Assessment Program, which provides consumers with information on vehicle safety performance. NHTSA’s research was also used by the agency to develop *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices Ninth Edition* (2017). According to NHTSA, the guide is a reference to assist State Highway Safety Offices in selecting effective, science-based traffic safety countermeasures for major highway safety problem areas, such as alcohol- and drug-impaired driving and pedestrian safety.

³³Of the seven research partners without active direct funding, four told us that they were either subgrantees or subcontractors on DOT-funded research. However, because DOT officials told us that the Research Hub contained only directly funded research partners, they should not have appeared in the Research Hub in their capacity as subgrantees and subcontractors.

³⁴National Academy of Public Administration, *Organizational Assessment*, 9.

³⁵In its organizational assessment of OST-R, the National Academy of Public Administration stated that the Research Hub could be a useful tool if it contained high-quality information.

that OST-R focuses its data review efforts on identifying and eliminating duplicate records and entering updated information from other sources, while the modal administrations are responsible for ensuring the completeness and accuracy of their project information in the Research Hub through the annual update process. However, OST-R has not provided guidance or specific instructions to the modal administrations on what information should be updated and which fields are required—information that OST-R officials agreed would be useful in strengthening the data quality. Such guidance or instructions could also communicate examples of the types of steps that modal administrations could take to help ensure data quality, such as by including drop down menus or other quality controls.

OST-R officials told us that they are fully aware of the limitations of the current Research Hub. They said that when they need to provide more complete or accurate information on research activities to DOT leadership, Congress, and other stakeholders, officials request that information directly from the modal administrations. OST-R officials explained that they are working toward improving the database and said they expect to pilot a new version of the Research Hub containing improvements in fiscal year 2021, but did not provide any documentation or further details of this effort. Without complete and accurate data, the Research Hub cannot fulfill its objectives, including to provide accurate information on DOT-funded research to Congress and the transportation research community. Taking additional steps to improve the reliability of the information in the Research Hub would help ensure that the database is fulfilling its intended purpose to serve as a comprehensive and accurate source of information on DOT's research portfolio.

Conclusions

The enactment of the FAST Act and establishment of OST-R resulted in a new framework to guide DOT's research activities, which constitute a significant investment of resources and which support DOT's critical mission to ensure the nation has a safe and efficient transportation system. Among the steps OST-R took to facilitate research collaboration within this new framework was to establish working groups that cut across modal administrations. However, OST-R could strengthen its research collaboration by taking steps to help ensure the guidance it provides to the working groups incorporates all leading practices, including defining and monitoring progress toward the achievement of long-term outcomes or regularly updating written agreements. Taking these steps would provide OST-R greater assurance that groups are organizing their efforts effectively, planning long-term research rather than focusing on immediate concerns, demonstrating the results of their research to

stakeholders, or responding effectively to evolving and future transportation challenges. Effective collaboration can also mitigate challenges associated with fragmentation of efforts across organizations within an agency, which could lead to potentially wasteful overlap and duplication of research efforts.

Furthermore, without taking additional steps to ensure that the Research Hub is a complete and accurate source of information on DOT-funded research—a DOT objective of the database—OST-R cannot be certain it serves as an effective mechanism for collaboration among both internal and external research partners. Moreover, without including complete and accurate research project information in the Research Hub, such as information on research outcomes, OST-R cannot reliably demonstrate that DOT's investments in these projects are helping to make the transportation system safer and more effective.

Recommendations for Executive Action

We are making the following two recommendations to OST-R:

- The Assistant Secretary for Research and Technology should take steps, such as updating guidance or other written communication, to ensure that the topical-research working groups (1) define and monitor progress toward achieving long-term outcomes, and (2) regularly update and monitor their charters and other written agreements to reflect these outcomes, in line with leading practices. (Recommendation 1)
- The Assistant Secretary for Research and Technology should take additional steps, such as providing more specific guidance or instructions to the modal administrations on the information that should be updated or required, to ensure that the information in the Research Hub is complete and accurate. (Recommendation 2)

Agency Comments

We provided a draft of this report to DOT for review and comment. In its comments, reproduced in appendix II, DOT concurred with our recommendations. The department also provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees and the Secretary of Transportation. 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 us at (202) 512-2834 or repkoe@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 III.

A handwritten signature in black ink that reads "Elizabeth Repko". The signature is written in a cursive style and is followed by a long horizontal line that extends to the right.

Elizabeth Repko, Acting Director
Physical Infrastructure Issues

Appendix I: Objectives, Scope, and Methodology

Our work focused on the research, development, and technology activities (collectively referred to as “research”) funded by the Department of Transportation (DOT). This report addresses (1) how DOT prioritizes and selects which research activities it will undertake, (2) the extent to which DOT facilitates research collaboration with external stakeholders and across the department, and (3) the extent to which DOT ensures its Research Hub database contains complete and accurate project information.

To address all three objectives and to better understand how DOT conducts research across the department, we selected four modal administrations—the Federal Highway Administration (FHWA); the Federal Motor Carrier Safety Administration (FMCSA); the Federal Railroad Administration (FRA); and the National Highway Traffic Safety Administration (NHTSA)—to review in depth. We analyzed data from DOT’s Research Hub database and reviewed DOT documentation to select these modal administrations based on: the number of active projects sponsored or managed by each modal administration; the amount of research funding each modal administration spent; and whether we have issued recent work on similar issues.¹ We assessed the reliability of these Research Hub data by reviewing documents provided by DOT and interviewing cognizant DOT officials. We also performed electronic testing to look for any missing or erroneous data. While we identified data limitations, we determined the data were sufficiently reliable for our selection purposes. In addition, we interviewed OST-R and selected modal administration officials to better understand their roles in, for example, prioritizing and selecting research activities. We also asked selected modal administration officials about how they collaborate with other modal administrations, their research agreements with partners, and the measures they use to evaluate the performance of federally funded research, among other things. To complement interviews with

¹The Research Hub is DOT’s public-facing, searchable database of active and recently completed DOT-funded projects. We applied these selection factors and found modal administrations naturally fell into large, middle-sized, and small groups in terms of number of active projects and amount of research funding. From these groups, we selected FHWA as the large modal administration, FMCSA and NHTSA as the middle-sized modal administrations, and FRA as the small modal administration. The information we gathered from these reviews is not generalizable across all modal administrations. We excluded the Federal Aviation Administration from our selection for a more in-depth review because we previously reviewed the Federal Aviation Administration’s management of its research and development portfolio and research partner collaboration. See 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).

OST-R officials, we reviewed the National Academy of Public Administration's 2018 OST-R organizational assessment.²

To describe how DOT prioritizes and selects the research activities it undertakes, we examined DOT documentation. We reviewed the *U.S. Department of Transportation Strategic Plan for FY 2018-2022* and the *U.S. Department of Transportation Research, Development, and Technology Strategic Plan FY 2017-2021*. We also reviewed Annual Modal Research Plans from fiscal years 2017 through 2019 as well as the template and guidance for the fiscal year 2019 plans, and we interviewed both OST-R and selected modal administration officials about the processes used to create the plans. Through interviews and documentation, we further reviewed the role of modal administrations in setting research priorities and selecting activities and assessed how each selected modal administration does so. We also reviewed the Fixing America's Surface Transportation Act to identify requirements related to setting DOT's and modal administrations' research priorities and selecting research activities.

To determine the extent to which DOT facilitates research collaboration with external stakeholders, we analyzed external research partner data, interviewed selected DOT research partners, and observed DOT research activities. To obtain the amount of DOT research funding received by individual external research partners, we requested information from DOT officials in July 2019 on current external research partners and active research projects. DOT officials directed us to use data from the Research Hub database to obtain the requested information. DOT provided an export of the most recently available data from the Research Hub as of July 2019. The data exported included 10,748 research projects that started as early as 1992, of which 1,786 or about 17 percent were marked "active." The research program with the largest number of projects in the Research Hub was the University Transportation Centers program with 3,942 projects or more than a third of all projects.

To better understand the relationships between DOT and the research partners we selected, we requested information from DOT on 70

²National Academy of Public Administration, *Organizational Assessment of the Department of Transportation's Office of the Assistant Secretary for Research and Technology* (Washington D.C.: October 2018).

partnerships between those selected partners and DOT's modal administrations and offices. Requested information included:

- the modal administration or office that is managing the research partner;
- the total amount of all research funding the research partner has been awarded since January 1, 2016, through the funding or sponsoring relationship; the date that the modal administration or office began funding the research partner;
- the date that DOT's funding to the research partner ended or will end, including projected dates; and
- whether the research partner is an active research partner or whether their research partnership has been completed.

To describe the extent of DOT's research funding and external research partnerships, we requested from DOT the number of partners funded and managed by each modal administration or office that oversaw and funded research in fiscal year 2018, as well as the funds obligated and expended to external research partners in fiscal year 2018. We assessed the reliability of the DOT's research-funding external research-partner information by reviewing documents provided by DOT and interviewing cognizant DOT officials. Among other things, we requested that modal administrations and offices provide a brief description of the steps taken to create the summary statistics they provided. For example, the Federal Transit Administration explained that it gathered the data it provided from its financial systems, including two systems used to award and manage cooperative agreements, grants, and procurements. We determined that the funding and partner data provided by DOT were sufficiently reliable for our selection purposes.

To determine the extent to which DOT facilitates research collaboration, we reviewed documentation—such as OST-R guidance, charters, and meeting notes—from topical-research working groups established in October 2018. In establishing these groups, OST-R identified multimodal subject areas in which collaboration among the modal administrations would benefit DOT as a whole and established corresponding working groups for each subject area. We also reviewed documentation from two of the topical-research working groups to provide illustrative examples of how the groups' documents address the guidance. Further, we interviewed officials from selected modal administrations to better understand these groups, including how the groups have functioned in practice. We compared the guidance for the topical-research working

groups to leading practices on collaboration identified in our prior work, to assess the effectiveness of the groups as collaborative mechanisms.³

In addition, we conducted semi-structured interviews with 17 research partners we selected based on their number of DOT-funded research projects, the length of the research partnership, their active research-funding relationship with a selected DOT modal administration or office, and the topic area of the funded research, among other criteria.⁴ While the information obtained from these interviews cannot be generalized to all research partners, the interviews provided illustrative examples of the relationships and collaborative efforts between DOT modal administrations and external partners. In addition, we visited two selected DOT external research partners—the Center for Connected and Automated Transportation and the University of Michigan Transportation Research Institute—as well as an internal research partner—the John A. Volpe National Transportations Systems Center—to better understand how DOT collaborates with its research partners and the measures these partners use to evaluate the federally funded research they undertake. We selected the external partners to visit based on a number of factors, including the presence of one or more DOT research partner in a location, the amount of DOT research funding the partners at a location were receiving at the time, and the length of its partnership with DOT. We visited the internal research partner because it conducts work funded by all of DOT’s modal administrations, including the selected modal administrations.

³GAO, *Managing For Results: Key Considerations for Implementing Interagency Collaborative Mechanisms*, [GAO-12-1022](#) (Washington, D.C.: Sep. 27, 2012).

⁴The DOT-funded research partners we spoke to are: Applied Pavement Technology, Inc.; Aptima, Inc.; the Association of Metropolitan Planning Organizations; Battelle; The City College of New York; Esensors, Inc.; the Transportation Consortium of South-Central States; the National Association of State Emergency Medical Services Officials; the Mineta Consortium for Transportation Mobility; the American Association of Motor Vehicle Administrators; The Ohio State University; the National Center for Sustainable Transportation; the University of Maryland; the University of Michigan Transportation Research Institute; the Center for Connected and Automated Transportation; the Virginia Tech Transportation Institute; and Westat. We selected these research partners from an initial non-generalizable sample of 70 research partnerships we identified in the Research Hub and on DOT websites as currently having a direct relationship with the selected modal administrations. For a variety of reasons, only 17 of these 70 research partnerships met our interviewee selection criteria. For example, some of the partners told us that they did not have an active research funding relationship with DOT, contrary to what was reported in the Research Hub, others did not have a direct-funding relationship with a selected DOT modal administration. We determined that the Research Hub data provided by DOT were sufficiently reliable for our selection purposes.

To determine the extent to which DOT ensures its Research Hub database contains complete and accurate project information, we analyzed data from the database and assessed the reliability of the Research Hub data by reviewing documents provided by DOT and by interviewing cognizant DOT officials. We performed checks on the DOT-provided Research Hub data of 10,748 project records as of July 2019 to determine the reliability of the agency data and to identify potential limitations, such as missing data fields and errors. As of July 2019, the project status field was marked “unavailable” for about 17 percent of the project records rather than “active,” “completed,” or “terminated.” We comment on Research Hub data quality issues in our report and make a recommendation to DOT on how to address them. In addition, we reviewed DOT documents, such as the Research Hub user manual, examples of documents OST-R sends to the modal administrations related to updating the database, and DOT information policy and guidelines.

We conducted this performance audit from January 2019 to August 2020 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.

Appendix II: Comments from the Department of Transportation

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U.S. Department of
Transportation

Office of the Secretary
of Transportation

July 24, 2020

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

Assistant Secretary
for Administration

1200 New Jersey Avenue SE
Washington, D.C. 20590

Dear Ms. Repko:

The Department of Transportation (DOT) is committed to ensuring that its research activities are fully coordinated in support of its transportation safety and efficiency mission. DOT's research activities provide the foundation for the multimodal policy and rulemaking actions necessary to improve the quality of life for the American people in all communities, from rural to urban, and increase the productivity and competitiveness of American workers and businesses.

The Department has recently taken actions and has actions underway to coordinate its research and development activities including:

- The Department has established an additional topical research working group, the Public Access Implementation Working Group, for the purpose of updating the Department's Plan to Increase Public Access to the Results of Federally-Funded Scientific Research Results. This additional topical research working group has incorporated the recommended best practices set forth in the audit report. This new topical research working group is serving as a model for the other topical working groups to further improve their effectiveness through adoption of these best practices.
- Starting in Fiscal Year 2020, the Department is developing a Department-wide Performance Management Data System to improve the data collection processes, data accuracy, and completeness of the internal sources of the Operating Administrations for the Research Hub, DOT's searchable database of active and completed DOT-funded projects, and to more effectively coordinate DOT's research portfolio, in collaboration with the Operating Administrations. Starting in Fiscal Year 2021, the Department will begin to assess and improve the data collection processes, data accuracy, and completeness of the external sources for the Research Hub.

Upon review of the draft report, the Department concurs with the two recommendations to ensure that (1) the topical research working groups define and monitor progress toward

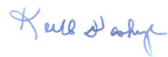
**Appendix II: Comments from the Department
of Transportation**

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achieving long-term outcomes and regularly update and monitor their charters and other written agreements to reflect these outcomes, in line with leading practices, and (2) additional steps are taken to ensure that the information in Research Hub is complete and accurate. The Department will provide a detailed response to each recommendation within 180 days of the issuance of GAO's final report.

We appreciate the opportunity to respond to the GAO draft report. Please contact Madeline M. Chulumovich, Director of Audit Relations and Program Improvement, at (202) 366-6512, with any questions.

Sincerely,



Keith Washington
Deputy Assistant Secretary for Administration

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Elizabeth Repko, (202) 512-2834 or repkoe@gao.gov

Staff Acknowledgments

In addition to the contact named above, Brandon Haller (Assistant Director); Marcia Fernandez (Analyst-in-Charge); Susan Fleming; Lauren A. Friedman; Emi Fujita-Conrads; Richard Hung; Terence Lam; Edward Malone; Josh Ormond; Kelly Rubin; Anna Beth Smith; Sarah Veale; Laurel Voloder; and Crystal Wesco made key contributions to this report.

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