A Report by the

NATIONAL ACADEMY OF PUBLIC ADMINISTRATION

Organizational Assessment of the Department of Transportation's Office of the Assistant Secretary for Research and Technology

NATIONAL ACADEMY OF PUBLIC ADMINISTRATION®

October 2018

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Organizational Assessment of the Department of Transportation's Office of the Assistant Secretary for Research and Technology

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Foreword

The Office of the Assistant Secretary for Research and Technology (OST-R) is comprised of a diverse set of program and operational offices, including: two offices responsible for managing research coordination processes established by separate legislative mandates;, a federal statistical agency; an office responsible for coordination and advocacy on issues related to positioning, navigation, timing (PNT) and spectrum management on behalf of the federal government; and two fee-for-service organizations, including a major performer of research, development, and technology projects funded by the Department of Transportation (DOT). The complexity of this organization, together with its proposed transfer to the Office of the Under Secretary for Policy, presents a number of management challenges.

DOT contracted with the National Academy of Public Administration (the Academy) to assess the organization of OST-R and the opportunities and challenges presented by its proposed transfer to Office of the Under Secretary for Policy. More specifically, the Academy was asked to (1) identify opportunities to improve the capacity to coordinate research across DOT; (2) better communicate the products and processes of Bureau of Transportation Statistics; and (3) better communicate the core activities of the Office of PNT and Spectrum Management and their relationship to DOT mission responsibilities and priorities.

The Academy formed an Expert Advisory Group of four Academy Fellows to provide guidance to a professional study team over the course of a four-month project. This report presents the team's assessment and recommendations in each of the three areas. The need to improve the transparency of OST operations and to strengthen linkages to DOT mission responsibilities and priorities is a common theme throughout. Of particular note are recommendations that enable a more strategic approach to research coordination and greater attention to PNT- and spectrum-related issues in the research coordination process.

I appreciate the strong support of DOT leaders, OST-R officials, and other stakeholders who provided important insights and context to inform this report. My earnest thanks to the Academy Fellows who served on the Expert Advisory Group and provided invaluable expertise and thoughtful guidance to the professional study team, and to the study team, including staff of the Academy and Management Concepts, who undertook this project.

Teresa W. Gerton
President and Chief Executive Officer
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Executive Summary

The National Academy of Public Administration (the Academy) contracted with the Department of Transportation (DOT) to assess the organization of Office of the Assistant Secretary for Research and Technology (OST-R) and the opportunities and challenges presented by its proposed transfer to Office of the Under Secretary for Policy (S3). The Academy agreed to provide a high-level assessment including three distinct scope elements (listed in order of priority):

- identify opportunities to improve the capacity to coordinate research across DOT, with a focus on strengthening the Annual Modal Research Plan (AMRP) process, including opportunities to obtain and make available more and better information on the research portfolios of DOT's modal operating administrations and tracking performance of research;
- better communicate what products the Bureau of Transportation Statistics (BTS) produces, for whom, and why; their production schedules; and their release processes; and
- better communicate the core activities of the Office of Positioning, Navigation, and Timing and Spectrum Management, and their relationship to DOT mission responsibilities and priorities.

While DOT conceived these scope elements as separate focus areas, there were two common themes: (1) improving transparency of operations to OST leadership, exploring linkages to DOT mission responsibilities and priorities; and (2) the opportunities and challenges presented by the proposed transfer of OST-R to S3, as they relate to the programs encompassed by the three focus areas.

In addition, during the assessment, the study team identified an important potential linkage between the Office of Positioning, Navigation, and Timing and Spectrum Management and the research coordination function. For this reason, the discussion of the Office of Positioning, Navigation, and Timing and Spectrum Management is presented second, following the discussion of research coordination.

Research Coordination

Current OST leaders have sought to adapt the Annual Modal Research Plan (AMRP) process to obtain more and better information for assessing modal research portfolios in terms of alignment with DOT strategic goals and priorities, past performance, and performance measurement plans. Toward this end, OST leaders have been directly engaged in an iterative process of developing and revising guidance for modal research plans, holding briefings on these plans by the modes, providing feedback, and directing revisions to plans.

The direct engagement of OST leaders in the comprehensive review of modal research portfolios has been necessary and beneficial. Only through immersing themselves in the details of modal research programs, could they come to understand how the programs relate to DOT strategic goals and priorities, appreciate the demands of performance measurement for such a diverse research portfolio, develop workable guidance, and effectively communicate expectations to the modes.

However, the direct engagement of OST leaders in the comprehensive review of modal portfolios is unsustainable. The time and talent of OST leaders is needed to address a range of issues. For this reason, it makes sense to delegate comprehensive reviews for performance and alignment, in large part, to leaders at the modal level. The report recommends delegating this responsibility gradually after steps are taken to help ensure adequate attention to performance and alignment.

Delegation to modal leaders will enable OST leaders to take on a strategic, continuing role in driving performance on top, cross-modal DOT priorities. By focusing on a small number of top priorities, OST leaders can delve into the level of detail necessary to sufficiently understand what the different modes are doing and how these activities should fit into a cross-modal strategy to achieve the Department's priorities. This also will allow OST leaders to actively monitor performance and identify where intervention is needed to enable success. The report discusses how OST leaders should take advantage of the regular meetings of RDT's Planning Council (composed of modal research executives and the Director of the Intelligent Transportation Systems Joint Program Office [ITS JPO]), as a mechanism for tracking progress and identifying problems where OST leadership intervention is needed to enable success.

OST leaders have taken steps to integrate RDT and ITS-JPO processes to strengthen the coordination of ITS-related research. The report recommends taking advantage of the ITS program's upcoming five-year strategic planning cycle to ensure alignment with current DOT goals and priorities and to craft a more strategic approach to ITS research.

Another major finding of the report is that the challenges surrounding the research coordination function at this time require a level of attention that neither OST leaders nor the Assistant Secretary for Research and Technology (when the position is filled) can provide. The report recommends the creation of a senior-level, career position (reporting to the Assistant Secretary for Research and Technology) dedicated to research coordination. Moreover, the report argues that creating such a position is important to take advantage of the prospective benefits of the proposed transfer of OST-R to S3.

Office of Positioning, Navigation, and Timing and Spectrum Management

The responsibilities of the Office of Positioning, Navigation and Timing and Spectrum Management for managing radiofrequency spectrum and requirements development for the federal government are closely related to advancing DOT's strategic goal of safety and priority on the advancement of automated vehicles. The safe deployment of automated vehicles will depend on adequate radiofrequency spectrum free of interference from other uses of adjacent spectrum. This will only become more of an issue as demand for spectrum increases. Safe deployment of automated vehicles also will depend on developing the requirements and capabilities needed to provide a back-up to GPS and navigation capabilities to address the gaps in GPS.

Research will be needed to help define requirements and to test and evaluate alternative technical solutions. This suggests a significant role for the Office of Positioning, Navigation and Timing and Spectrum Management in research coordination across the modes. However, it has lacked the staff to play this role effectively. The report recommends that OST leaders provide additional staff capacity to enable effective participation in the research coordination process.

Transferring OST-R to the Office of the Under Secretary for Policy returns the Office of Positioning, Navigation, and Timing and Spectrum Management to its original location under policy in OST. This move will enable the Office to better support the development of departmental PNT and spectrum policy by bolstering its authority and involving it more directly in strategic departmental goals development and advocacy in the areas of safety and automated vehicles.

Bureau of Transportation Statistics

OST leaders have expressed frustration with the timeliness and transparency of BTS production and release processes. An important finding in this regard is that for some of its products, BTS relies heavily on data from modal administrations and other agencies. These entities do not necessarily adhere to the same principles and practices that guide BTS' work as a federal statistical agency. When this is the case, BTS may need to spend substantial time on quality assurance. Also, BTS lacks visibility into modal and other agency processes. The report recommends that BTS take steps to more fully exercise its existing authority in these areas and that OST leaders provide support to BTS in those instances were cooperation by the modes is not forthcoming.

Although there is a public release schedule, OST leaders are often unaware when BTS releases its products due to limited communication. To address this, the report recommends that BTS notify senior OST leaders and other key stakeholders when

publishing data or a report, and that BTS develop a communication strategy and plan to keep OST leaders informed of the status of all programs, products, and releases.

BTS is undertaking a range of projects to improve the timeliness and transparency of its processes. However, there does not appear to be a clearly articulated plan for continuous improvement that aligns with the senior leaders' priorities and supports their goals to be flexible and nimble to address emerging issues. BTS should work with OST leaders to develop a plan that outlines clear improvement goals and priorities that follow all legal mandates and policy directives and establish a process for tracking and monitoring the progress of the improvements.

OST leaders have expressed a desire for BTS to take advantage of alternative sources of data (e.g., real-time data) in its research. Given the challenges (e.g., IT infrastructure, data testing, and validation) involved, it is important to take a strategic approach. The report recommends that BTS work collaboratively with OST leaders to develop a strategy that identifies research to be undertaken and the capabilities that BTS will need to pursue it.

The proposed transfer of OST-R to S3 could improve access and engagement with leaders, especially at the most senior levels. It also supports the Fixing America's Surface Transportation (FAST) Act requirement that the Director of BTS serve as the Senior Advisor to the Secretary on data and statistics. At the same time, moving a federal statistical agency under a policy office would be a departure from generally accepted practices and poses some risk to independence. However, given the FAST Act provisions for independence and the good intention of OST leaders, the risk to independence is manageable. Still, provision should be made to formally recognize the independence of BTS and the principles and practices that govern its work as a designated federal statistical agency. This might be done through a Departmental Administrative Order or Departmental Operating Order.

List of Report Recommendations

The following pages include a complete list of recommendations made in the report organized by section.

Table 1. List of Report Recommendations

Section 2: Research Coordination
Recommendation 2.1: *OST leaders should gradually delegate responsibility for the review of modal research programs to modal leaders, after taking steps to ensure adequate attention to performance and alignment. These steps would include:* • *establishing clear guidance for the development, assessment, and approval of the annual research plans within a delegated process;* • *briefing modal administrators on guidance; and* • *complementing delegated process with targeted reviews to drill down in areas of concern*
Recommendation 2.2: *OST leaders should focus on a small number of cross-modal, DOT priorities to enable the detailed review of modal research activities necessary to develop strategies, monitor progress, and identify needed intervention to achieve success. OST leaders should take advantage of the regular meetings of RDT's Planning Council as a mechanism for tracking progress and identifying problems where OST leadership intervention is needed.*
Recommendation 2.3: *To promote more consistent, higher quality reporting within the Research Hub of project-level information needed to support the review of modal research programs and to document the results of DOT-funded research, OST leaders should work collaboratively with the modes with careful attention to modal incentives. Specific actions should include:* • *communicating the intent to use the information from the Research Hub in research program reviews and actually use it;* • *working with the modes to develop guidance not only on the type of information to be reported, but how it should be reported to ensure that it is accessible and useful to decision-makers; and* • *communicating that the quality of modal reporting will be a significant consideration in the funding of research programs.*
Recommendation 2.4: *OST leaders should take advantage of the new ITS strategic planning cycle to align the ITS program with current DOT strategic goals and priorities, to craft a more strategic approach to investments, and to ensure broader, more systematic engagement of external stakeholders.*
Recommendation 2.5: *OST leaders should consider creating a senior-level career position dedicated to research coordination, reporting directly to the Assistant Secretary for Research and Technology. The person filling this position should have a strong technical reputation in the transportation domain, preferably with experience in research management and assessment. OST leaders should provide clear responsibilities for this position in two areas:*

- *overseeing integration of ITS-JPO and RDT research coordination processes; and*
- *overseeing development and delivery of capabilities for selected top DOT priorities.*

Section 3: Office of Positioning, Navigation, and Timing and Spectrum Management

Recommendation 3.1: *OST leaders should assess the resources required to address PNT needs across DOT and provide additional staff capacity to the Office of Positioning, Navigation, and Timing and Spectrum Management to enable its effective participation in the research coordination process.*

Recommendation 3.2: *The Office of Positioning, Navigation, and Timing and Spectrum Management should remain in OST-R to help ensure a continued focus on the emerging, but vital, PNT needs of surface modes of transportation.*

Section 4: The Bureau of Transportation Statistics

Recommendation 4.1: *To address delays and uncertainty in the production of statistical products reliant on data from the modes, BTS should exercise its existing cross-modal authority to get modes to follow quality assurance standards and to provide more visibility into their processes. OST should provide the support needed to facilitate these efforts in instances where modal cooperation is not forthcoming.*

Recommendation 4.2: *BTS needs to work with OST leaders to identify research to be undertaken that requires big data and/or real-time data and develop a strategy for building the capabilities that BTS will need to pursue them.*

Recommendation 4.3: *As part of the release process, BTS should notify OST leaders and other key stakeholders when publishing data and reports. Also, BTS should develop a communication strategy and plan with OST leaders to keep them informed of the status of all programs, products, and releases.*

Recommendation 4.4: *BTS should work with OST leaders to develop a plan that outlines clear improvement goals and priorities consistent with legal mandates and policy directives and establish a process for tracking the progress of improvement efforts.*

Recommendation 4.5: *BTS should create an informal advisory group comprised of academic and industry experts in transportation statistics to provide guidance, without the bureaucratic process associated with the Advisory Council on Transportation.*

Section 1: Introduction

The Office of the Assistant Secretary for Research and Technology (OST-R) is comprised of a diverse set of program and operational offices, including:

- Research Development and Technology (RDT) and the Intelligent Transportation Systems Joint Program Office (ITS JPO), offices responsible for managing research coordination processes established by separate legislative mandates;
- Bureau of Transportation Statistics (BTS), a designated federal statistical agency;
- The Office of Positioning, Navigation and Timing and Spectrum Management, responsible for coordination and advocacy on PNT related issues for the civil side of the federal government (DOT is the designated civil government lead on PNT issues); and
- two fee-for-service organizations: the Volpe National Transportation Systems Center, which is a major performer of the research, development, and technology projects funded by the Department of Transportation; and Transportation Safety Institute, which provides transportation-related training services.

These program and operational offices were first brought together in an operating administration, the Research and Innovative Technology Administration (RITA), established by statute in 2004, before being moved to the Office of the Secretary (OST) when OST-R was established by statute in 2015.

The President's FY 2019 budget request proposes the transfer of OST-R to the Office of the Under Secretary for Policy (S3) for the stated purpose of improving research coordination.

Origin and Scope of Assessment

The Academy contracted with the DOT to assess the organization of OST-R and the opportunities and challenges presented by its proposed transfer to S3. The Academy agreed to provide a high-level assessment including three distinct scope elements (listed in order of priority):

- identify opportunities to improve the capacity to coordinate research across DOT, with a focus on strengthening the AMRP process, including opportunities to obtain and make available more and better information on the research portfolios of DOT's modal operating administrations and tracking performance of research;

- better communicate what products BTS produces, for whom and why; their production schedules; and their release processes; and

- better communicate the core activities of the Office of Positioning, Navigation and Timing and Spectrum Management, and their relationship to DOT mission responsibilities and priorities.

While DOT conceived these scope elements as separate focus areas, there were two common themes: (1) improving transparency of operations to OST leadership, exploring linkages to DOT mission responsibilities and priorities; and (2) the opportunities and challenges presented by the proposed transfer of OST-R to S3, as they relate to the programs encompassed by the three focus areas.

Study Approach and Methodology

A study team of the Academy performed the project with guidance from an Expert Advisory Group (EAG) composed of four Academy Fellows. The Academy selected members of the EAG for their experience and expertise including: leadership roles across the transportation domain; federal research management and assessment; federal statistical agencies and the use of statistics in policy; and general administrative leadership. Appendix A details the biographical information for each of the EAG members.

The study team combined interviews (described in more detail below) with an extensive review of agency documentation, including program, policy, planning, and budget documents, as well as internal briefings.

Interviews

The study group conducted thirty interviews, with the following groups:

- Senior members of OST (S3) leadership;
- Leaders and senior officials of OST-R components encompassed by the assessment, including RDT and ITS JPO (related to research coordination), BTS and the Office of Positioning, Navigation, and Timing and Spectrum Management;
- Research executives from modal operating administrations; and
- External experts in areas including DOT organization and management, federal research management, principles and practices of federal statistical agencies, and PNT-related issues

Organization of the Report

Organized into three sections, reflecting the three general scope elements noted above. The Office of Position, Navigation, and Timing and Spectrum Management is addressed in Section 2 because of its potential role in research coordination.

- Section 2: Research Coordination
- Section 3: The Office of Positioning, Navigation, Timing and Spectrum Management
- Section 4: The Bureau of Transportation Statistics

Section 2: Research Coordination

The Academy agreed to undertake an assessment of DOT's research coordination function that included the following elements (listed in order of priority):

- Identify opportunities to strengthen the Annual Modal Research Plan (AMRP) process, with particular attention to:
    - obtaining and making available more and better information on modal research portfolios pertinent to assessing performance and alignment with policy, and
    - tracking the progress of research over its life cycle, from initial results through outputs, outcomes and impacts.
- Identify opportunities to integrate the ITS JPO more effectively into DOT's broader research coordination function, including harnessing its funding process to improve research coordination.

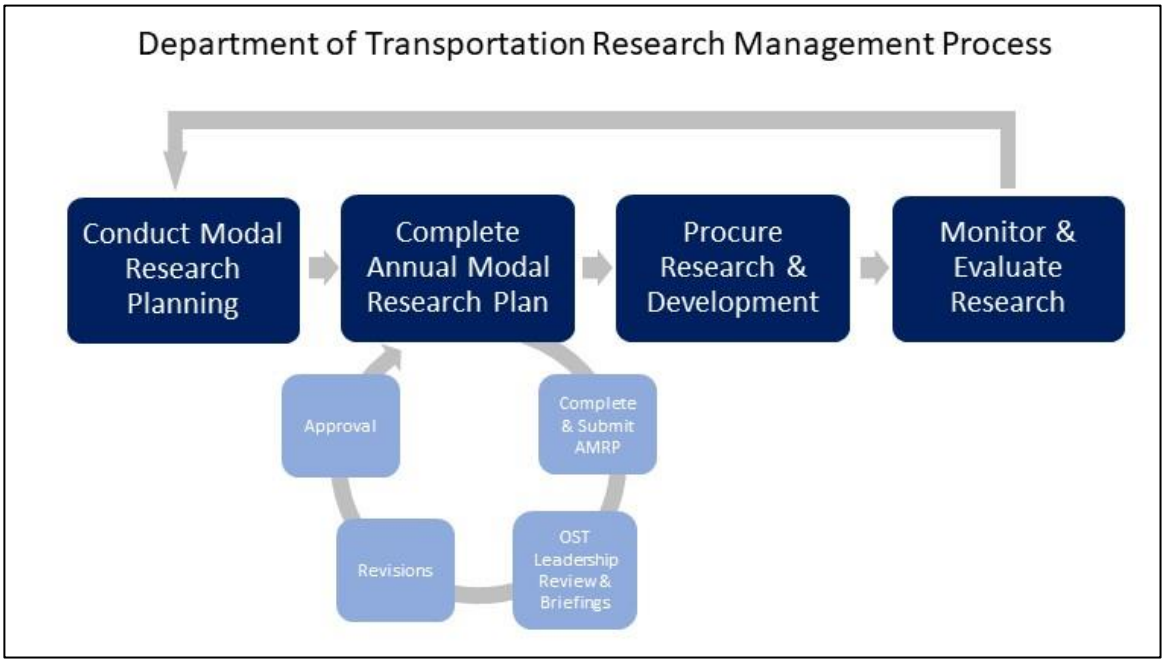
The discussion of research coordination is organized into four areas:

1. *Strengthening the Annual Modal Research Plan Process*
2. *Integrating ITS-JPO and RDT Coordination Processes*
3. *OST-R Leadership Required to Support Effective Research Coordination*
4. *Opportunities and Challenges Presented by the Proposed Transfer of OST-R to S3*

Strengthening the Annual Modal Research Plan Process

The main focus of the Academy's assessment of research coordination is on identifying opportunities to strengthen the AMRP process. However, this assessment requires looking at other coordination mechanisms and the broader set of research management processes in which the AMRP process is nested. For example, the information available to inform the AMRP process depends, in part, on the information generated in preceding planning processes and performance information gathered in subsequent monitoring of research performance. The diagram on the following page depicts the broader research management process at a high level.

Figure 1. Department of Transportation Research Management Process



This section discusses:

1. origins of the AMRP process and the efforts of current OST leaders to adapt the process to obtain more and better information needed to assess modal research portfolios in terms of policy alignment and performance;
2. the unsustainability of undertaking a comprehensive review of modal research portfolios in terms of policy alignment and performance at the headquarters level;
3. opportunities to delegate responsibility for comprehensive reviews to modal leaders, while maintaining adequate attention to policy alignment and performance;
4. the importance of strategic focus on a few top priorities to enable OST leaders to more effectively track performance and identify when intervention is needed to realize performance goals; and
5. opportunities to realize the potential of the Research Hub to strengthen the AMRP process.

Historically, DOT's modal operating administrations (modes),[1] such as the Federal Highway Administration and Federal Aviation Administration, have operated quite independently with little coordination of their research activities. However, Congress has sought to strengthen research coordination, with a particular focus on avoiding duplication of research activities across the modes. The Mineta Act of 2004,[2] which created OST-R's predecessor, the Research and Innovative Technology Administration, mandated that DOT coordinate modal research activities to avoid duplication of effort. In 2015, the FAST Act sought to strengthen the research coordination function by elevating the research coordination function to the Secretary-level with the creation of OST-R. In addition, it mandated that the modes and joint programs develop comprehensive annual research plans to be reviewed by OST-R and that the Secretary of Transportation certify that there is no duplication of research effort across modes.

The AMRP process encompassed a FY 2017 budget of nearly $1.2 billion dollars for research, development, and technology,[3] with Research and Development (R&D) accounting for over $900 million of the total. (See Appendix D for breakdown of DOT's research, development, and technology budget by Modal Operating Administration and type of research.) This budget is distributed across seven of DOT's eight modes, each with diverse missions and research focuses.

The OST-R's Research, Development, and Technology (RDT) component is responsible for managing the annual modal research plan process and focuses its review primarily on identifying potential duplication across modes. It has devoted limited attention to assessing modal research programs for alignment with DOT goals and priorities or performance measures. In the past, RDT career officials have lacked the leadership support to obtain needed information from the modes.

Current OST leaders have a strong interest in aligning modal research portfolios with DOT's strategic goals and priorities and strengthening performance measurement. Toward these ends, OST leaders have sought to adapt the annual modal research plan process to

[1] The DOT has eight Modal Operating Administrations: the Federal Highway Administration (FHWA), the Federal Motor Carrier Safety Administration (FMCSA), the National Highway Traffic Safety Administration (NHTSA), the Federal Railroad Administration (FRA), the Federal Transit Administration (FTA), the Federal Aviation Administration (FAA), the Pipeline and Hazardous Materials Safety Administration (PHMSA) and the Maritime Administration (MARAD).

[2] The Norman Y. Mineta Research and Special Programs Improvement Act (49 U.S.C. 101).

[3] The DOT defines research and development as including basic research (without specific application), applied research (for a specific need) and developmental research (design, development and improvements of prototypes and processes). Technology is defined as demonstration projects and other related activities.

obtain more and better information for assessing alignment and to learn how the performance of research programs is evaluated and tracked, what measures are used, and how the programs are performing against the assigned measures. OST leaders have been directly engaged in an iterative process of developing and revising guidance for modal research plans,[4] holding briefings on these plans by the modes, providing feedback, and directing revisions to plans.

These efforts yielded annual modal research plans for FY 2019 that provide much better information than prior plans about the alignment and performance of modal research programs. Paradoxically, the success of this effort has created another challenge—too much information. OST leaders struggled with finding a balance between obtaining enough detail to assess portfolios and not being overwhelmed by it. This stems from the inherent difficulty of a centralized approach to reviewing such a large and diverse research portfolio.

Enabling a More Strategic Approach

The direct engagement of OST leaders in the comprehensive review of modal research portfolios has been necessary and beneficial. Only through immersing themselves in the details of modal research programs could OST leaders come to understand how the programs relate to DOT strategic goals and priorities and to appreciate what performance measurement entails, given the different types and focus of research across the modes due to their different missions. For instance, measuring the performance of research focused on informing the development of safety regulations is much different from measuring the performance of research to inform the development and deployment of new transportation technologies. Additionally, only through direct engagement and an iterative process could they develop workable guidance and communicate expectations to the modes.

However, the continued direct engagement of OST leaders in the comprehensive review of modal portfolios is unsustainable. The time and talent of OST leaders is needed to address a range of issues. For this reason, it makes sense to delegate comprehensive reviews for performance and alignment, in large part, to leaders at the modal level. Comprehensive reviews of modal research plans for duplication would continue as mandated by law.

OST leaders acknowledge that their direct engagement in the comprehensive review of Annual Modal Research Plans is not sustainable. At the same time, they have concerns about how to ensure adequate attention to alignment and performance. The study team's research suggests a number of steps OST could take to enable delegation while ensuring continued scrutiny of modal research plans. OST would need to establish clear guidance for

[4] All guidance documents remain in draft and cannot be cited.

the development, assessment, and approval of the annual research plans in a delegated process. Modal administrators need to be in place and briefed on guidance. Additionally, in the spirit of "trust but verify," OST leaders might employ targeted reviews to drill down in areas of concern.

Recommendation 2.1: *OST leaders should gradually delegate responsibility for the review of modal research programs to modal leaders, after taking steps to ensure adequate attention to performance and alignment. These steps would include:*

- *establishing clear guidance for the development, assessment, and approval of the annual research plans within a delegated process;*
- *briefing modal administrators on guidance; and*
- *complementing the delegated process with targeted reviews to drill down in areas of concern.*

Institutionalizing an enhanced annual modal research plan process and delegating responsibility to modal leaders would allow OST leaders to take on a more strategic, continuing role: driving performance on DOT-level priorities. By focusing on a small number of top priorities, OST leaders can delve into the level of detail necessary to sufficiently understand what the different modes are doing and how these activities should fit into a strategy to achieve the Department's priorities to actively monitor performance, and identify where intervention is needed to enable success. OST leaders should focus on multi-modal initiatives where the intervention of DOT leadership is most likely needed.

In the context of a strategic focus on a few top priorities, regular meetings of RDT's Planning Council (composed of modal research executives and the Director of the Intelligent Transportation Systems Joint Program Office) offers a mechanism for tracking progress and identifying problems where OST leadership needs to intervene to enable success.

Recommendation 2.2: *OST leaders should focus on a small number of cross-modal, DOT priorities to enable the detailed review of modal research activities necessary to develop strategies, monitor progress, and identify needed intervention to achieve success. OST leaders should take advantage of the regular meetings of RDT's Planning Council as a mechanism for tracking progress and identifying problems where OST leadership intervention is needed.*

There is an opportunity to marry a focus on top priorities with the incentive of modal research leaders to showcase their contributions to progress in the areas of greatest importance to OST leaders. In the case of cross-modal priorities, responsible modal research leaders, tasked to work as a team, led by a designated lead, would gather information and develop a presentation on the progress of research. These presentations would take the form of short, accessible briefings to OST leaders, accompanied by more

formal reporting for the purpose of documentation. This reporting could provide the basis for the selective development of success stories for publication on DOT's website for the benefit of external stakeholders.

Realizing the Potential of the Research Hub to Strengthen the AMRP Process

The DOT Research Hub is a centralized database of information on projects funded across DOT. The Research Hub has been adapted to meet the FAST Act mandate to develop a consolidated research database that lists the research abstracts, funding, findings and outputs of DOT's research portfolio.[5]

The Research Hub is intended to serve a variety of objectives.[6] In keeping with the scope of the assessment, the Academy study team focused on the potential of the Research Hub to serve as a source of more and better information for (1) assessing annual modal research plans and (2) tracking the progress of research over its life cycle, through its outputs, outcomes, and impacts.

Supporting the Review of Annual Modal Research Plans

The review of Annual Modal Research Plans should be conducted at the level of research programs, looking at past performance and performance plans of the overall portfolio of projects undertaken to achieve identified program objectives. However, program reviews should be supported by a complete and accurate database about individual projects, including available documentation of project contributions to outcomes and impacts. DOT's Research Hub could potentially provide information about ongoing and completed projects. It might also provide information on prospective projects, but a provision is needed to block public access to information on these projects until after they are approved as part of modal research plans.

Tracking Research over Its Life Cycle

The Research Hub cannot provide the kind of near-term operational tracking of research initiatives suggested in the earlier discussion of regular reporting to OST leaders at meetings of the RDT Planning Council. DOT's Research Hub is better understood as a potential means for documenting the progress of research over its life cycle through to

[5] The database is structured to capture and enable searches of information including project abstracts; the program through which each project is funded; start and end dates; total funding amount; organizations that sponsor, manage, and conduct the research; points of contact at the organization; links to final reports and datasets; summary information on research products; and any documented outcomes and impacts of the research.

[6] These objectives include: (1) identify duplicative research activities; (2) identify opportunities for multi-modal research collaboration; (3) document research findings, outputs, outcomes and impacts; and (4) provide transparency for the DOT's research portfolio. See DOT Strategic Plan for RDT 2017-2021, p.99

outputs, outcomes and impacts. As already discussed, this information would be available to support the review of Annual Modal Research Plans. Also, it would facilitate information gathering for periodic program evaluations.

Reporting Project Information to the Research Hub

The effectiveness of DOT's Research Hub in supporting these objectives depends on complete, accurate and timely reporting by the modes. Currently, the modes have little incentive to do so. Consequently, information in the database varies widely in quality, completeness and is often not up to date.

OST leaders have considered addressing this problem by mandating that the modes submit information to the Research Hub, but a mandate is unlikely to promote high-quality reporting. High-quality reporting depends on the perception that data in the Research Hub will be used for sensible and important purposes. In the context of DOT, this means that OST leaders must communicate that the Research Hub will be used in the review of research programs. OST leaders will need to work collaboratively with the modes, much as they have in the case of the Annual Modal Research Plan process, to ensure that information is reported in a way that is accessible and useful to decision makers. This might be done on a pilot basis. Pilot results would be translated into more general guidance. To further incentivize modal reporting, OST leaders should communicate that the quality of reporting will be a significant consideration in the funding of research programs.

Recommendation 2.3*: To promote more consistent, higher quality reporting within the Research Hub of project-level information needed to support the review of modal research programs and to document the results of DOT-funded research, OST leaders should work collaboratively with the modes with careful attention to modal incentives. Specific actions should include:*

- *communicating the intent to use the information from the Research Hub in research program reviews and actually use it;*
- *working with the modes to develop guidance not only on the type of information to be reported, but how it should be reported to ensure that it is accessible and useful to decision-makers; and*
- *communicating that the quality of modal reporting will be a significant consideration in the funding of research programs.*

Integrating ITS-JPO and RDT Coordination Processes

OST-R includes two program offices—RDT and ITS JPO—that are responsible for managing two separate research coordination processes that have operated largely independent of each other. These processes grew out of two different statutory mandates, issued almost twenty-five years apart. As discussed in the previous section, the FAST Act of 2015 mandated the AMRP process, as well as a five-year strategic plan for DOT research,

development, and technology, both of which are managed by RDT. The FAST Act does not provide for integration of the RDT and ITS coordination processes. However, the ITS portfolio has been subject to review as part of the annual modal research plan submitted by the FHWA, which funds the ITS-JPO.[7] The ITS program was established by legislation[8] in 1991, which authorized annual funding for multi-modal ITS research from the Federal Highway Trust Fund (ITS JPO received actual funding of approximately $100 million per year minus administrative costs over the last several years). The JPO manages a mandated five-year strategic planning process and annual planning processes intended to guide investments in multi-modal ITS research projects. The RDT and ITS strategic planning processes are organized on different time lines (FY 17 – FY 21 and FY 15 – FY 19, respectively). Until recently, RDT officials have not been involved in JPO's planning processes.

This section discusses (1) challenges faced in the coordination of ITS research; (2) efforts of OST leaders to strengthen ITS research coordination through integration with RDT and the AMRP process; and (3) opportunities to further strengthen the ITS coordination process. Another opportunity is suggested by the potential research coordination role of the Office of Positioning, Navigation, and Timing and Spectrum Management discussed in Section 3.

Two factors identified as hindering the full potential of the JPO for research coordination are:

- JPO's lack of authority to obtain full information about the ITS-related research activities of the modal operating administrations; and
- lack of engagement of political leaders of the modes in annual planning process.

While JPO is able to account for the ITS-related research it funds through its annual awards process, it has had difficulty in getting complete information about the ITS-related research funded independently by the modes. OST has increased the focus on ITS-JPO in the AMRP process, making the JPO submit its own AMRP. (As noted earlier, ITS research was previously presented as one of the research programs of the Federal Highway Administration.) OST has applied the authority of the Secretary through the AMRP process to obtain information on the full range of ITS research activities by the modes.

The ITS JPO develops potential ITS projects for funding in collaboration with the modal operating administrations through two processes: (1) meetings of the Management Council

[7] FHWA passes along funding from the Highway Trust Fund authorized for the ITS program and pays the costs of administrative support to the ITS program.

[8] Intermodal Surface Transportation Efficiency Act of 1991 (Public Law 102-240)

(composed of Modal Administrators) once or twice a year to get input and feedback on potential projects; and (2) monthly meetings of a chartered Strategic Planning Group (composed of modal research leaders) to develop and refine potential projects for funding and to discuss ongoing projects. However, the Management Council has not met since the end of the Obama administration—consequently, newer ITS projects have been developed without regular, formal engagement of political leaders at the modal level.

This year, OST leaders have used meetings of the JPO's Strategic Planning Group to coordinate policy and funding issues related more specifically to Automated Vehicles (AV), including the allocation of a separate $100 million in funding for AV research provided in the Omnibus Act in March of 2018.[9] RDT officials have been included in these meetings as part of a broader effort by OST to integrate RDT and JPO research coordination activities.

OST officials have expressed concern about two factors they believe are hindering the performance of JPO: the tactical focus of its research program and the insularity of its decision-making. While noting a shift in recent years, DOT officials have described a tendency to focus on the development and deployment of particular technologies in localized applications rather than on developing capabilities to meet broader system requirements. OST leaders have expressed the need for Secretary-level engagement in the JPO planning process to help ensure a more strategic approach and more systematic engagement of industry and other external stakeholders.

The current ITS strategic plan runs through FY 2019. The beginning of a new planning cycle presents OST leaders with a major opportunity to: shape the next five-year ITS strategic plan and align the ITS program with current DOT goals and priorities; craft a more strategic approach to investments; and ensure more systematic engagement of external stakeholders. Also, OST leaders can use the monthly meetings of JPO's Strategic Planning Group, to monitor the progress of the ITS investments and identify opportunities to facilitate coordinated action to achieve objectives.

Recommendation 2.4: *OST leaders should take advantage of the new ITS strategic planning cycle to align the ITS program with current DOT strategic goals and priorities, to craft a more strategic approach to investments, and to ensure broader and more systematic engagement of external stakeholders.*

[9] Consolidated Appropriations Act for Fiscal Year 2018 (Public Law 115-141)

OST-R Leadership Required to Support Effective Research Coordination

An effective research coordination function will depend, not only on the active engagement of OST leaders, but on a strong OST-R leadership team as well. The Assistant Secretary for Research and Technology, which has overall responsibility for OST-R, must oversee a diverse set of components and cannot provide the attention required to address the particular demands of research coordination. A senior-level, career position, dedicated to research coordination is needed. This section discusses the roles of this position and the conditions for success of this position.

Roles for a Senior-level Position Dedicated to Research Coordination

The Academy study team's assessment of the challenges surrounding the research coordination function at DOT suggests five roles for a senior-level position overseeing research coordination. They are as follows:

1. provide sustained focus on the overall integration of the research coordination activities of the RDT and the ITS JPO;
2. nurture the potential research coordination role of the Office of Positioning, Navigation, Timing and Spectrum Management (see Section 3);
3. tap outside expertise and perspectives;
4. facilitate communication between OST leaders and the career leaders of OST-R components; and
5. provide an independent, technical perspective.

Provide sustained focus on the improvement and integration of research coordination activities

As discussed in the preceding sections, there is a need for greater integration of the research coordination processes managed by the RDT and JPO, as well as to improve the individual processes. While OST has taken a number of actions to strengthen these coordination processes and improve integration, substantial work will be needed to manage and oversee these efforts and institutionalize an integrated research coordination function. Additionally, if OST decides to delegate more responsibility for review to the modes, oversight will be needed to help ensure adequate attention to policy alignment, performance monitoring, and stakeholder engagement.

Nurturing the potential research coordination role of the Office of Positioning, Navigation, and Timing and Spectrum Management

The nascent research coordination role of the Office of Positioning, Navigation, and Timing and Spectrum Management (discussed in Section 3) will take time to develop. Attention will be needed to address challenges as they arise, assess progress, and take steps to adapt and institutionalize the role as appropriate.

Tapping outside expertise and perspective

The effective review and monitoring of DOT's research programs demand a significant and changing mix of expertise that cannot be maintained in house or left to *ad hoc* arrangements. This would be true even if OST decides to pursue a delegated approach to the review and monitoring of modal research portfolios and adopt a more-strategic focus on a few top priorities. OST-R must have the capacity to tap external expertise more broadly and systematically.

Facilitating communication between OST leaders and OST-R career leaders

Interviews suggest that communication with OST leaders about research coordination has been hindered by the lack of a single, authoritative voice at a senior level to speak to research coordination efforts. Given the current fragmentation of the research coordination function, it is important to have a leader in OST-R who can provide an integrated, objective perspective on the research agenda.

Conditions for Success of a Senior-level Position Dedicated to Research Coordination

Success of a senior-level position dedicated to research coordination depends on a strong technical reputation and relationships in the broader technical community. These are critical to the position's influence and independence. Someone with a strong reputation and network beyond the agency will be less vulnerable to pressures that might hinder independent judgment. Individual networks and reputation will enable the leader to tap outside expertise to inform the agency's work and coordinate its work with related activities by other agencies and the broader community. Given that direct authority in a decentralized organization such as DOT will be limited, the influence of a leader will depend to a great degree on the ability to command respect based on reputation. Moreover, the perception of independence could enhance communication and give OST the necessary confidence to gradually reduce its level of direct involvement in research coordination activities and focus their engagement on a few top priorities.

Another key consideration for OST-R leaders is continuity. Continuity of leadership is especially important given the identified need for sustained focus on improving and integrating coordination and nurturing the nascent research coordination role of the Office of Positioning, Navigation, and Timing and Spectrum Management. It would also minimize the potential disruption that accompanies changes in political leadership. The importance of continuity suggests the establishment of a senior *career* position as part of OST-R leadership team.

Attracting a person with the attributes described in the preceding discussion will depend not only on the general prospect of influence but specific mechanisms for influence. OST leaders must identify the specific advisory and decision-making responsibilities of the position.

Recommendation 2.5: *OST leaders should consider creating a senior-level, career position dedicated to research coordination, reporting directly to the Assistant Secretary for Research and Technology. The person filling this position should have a strong technical reputation in the transportation domain, preferably with experience in research management and assessment. OST leaders should provide clear responsibilities for this position in two areas:*

- *overseeing integration of ITS-JPO and RDT research coordination processes; and*
- *overseeing development and delivery of capabilities for selected top DOT priorities.*

The effectiveness of this position will depend on the level of staff support available. This presents a challenge in the context of OST-R's limited FTE allocation. While there may be opportunities to carve out some staff support in the context of a more integrated research coordination function, the Academy study could not undertake the level of analysis needed to speak to this issue.

Proposed Transfer of OST-R to the Office of the Under Secretary for Policy (S3)

The proposed transfer of OST-R to S3 has the potential to strengthen significantly the research coordination function. A direct report to S3 would help ensure a continued focus on aligning modal research portfolios with DOT strategic goals and priorities and continued attention to performance monitoring. While the Assistant Secretary for Research and Technology would no longer be a direct report to the Secretary, placement of OST-R in S3 arguably provides a better link to top leaders, given the status of the Under Secretary within the Department. This connection would bolster the authority of OST-R vis-à-vis the modes to enable coordination. Another benefit of being in S3 is that it would facilitate involvement in the discussion of policy, which will be especially important in helping actualize the development of complex systems such as those that underpin automated vehicles. Also, OST-R could benefit from the ability of S3 to induce action by other OST offices to address resource, procurement, and other challenges to enable progress on key initiatives.

Realizing these potential opportunities will depend on two-way communication between policy and research. This will depend in part on strong technical leadership with the standing to enable substantive input into policy as discussed in the preceding section concerning the creation of a senior-level, career position reporting to the Assistant Secretary for Research and Technology.

Section 3: Office of Positioning, Navigation, and Timing and Spectrum Management

This section aims to provide OST leaders with a better understanding of the core activities of the Office of Positioning, Navigation, and Timing and Spectrum Management and how they relate to DOT mission responsibilities and priorities. The section discussion is organized under the following areas:

- Positioning, Navigation, and Timing
- Radiofrequency Spectrum
- The Department of Transportation's Role in PNT and Radiofrequency Spectrum
- The Office of Positioning, Navigation, and Timing and Spectrum Management at the Department of Transportation
- Proposed Transfer of OST-R to S3

Positioning, Navigation, and Timing

PNT is essential to U.S. and global transportation, commerce, and security. Positioning is the ability to determine accurately a specific location; navigation is the ability to determine the current and desired position, and maneuver with accuracy and precision between the two; and timing is the ability to acquire and maintain accurate and precise time. The most well-known PNT system is the Global Positioning System (GPS).

GPS is a satellite-based PNT system that utilizes radiofrequency spectrum to provide users (the public, commercial industry, military, and government) with a global navigation system on a continuous, worldwide basis, free of direct user fees. GPS is owned by the Unites States government and operated by the United States Air Force. GPS consists of thirty-one satellites that share information around positioning, navigation, and timing to over three billion users worldwide, free of charge.

Given its free and open access, GPS has integrated itself into almost every aspect of consumer and professional services. Users expect the system to operate with high integrity, accuracy, and be widely available. As the most widely recognized PNT system, GPS has become essential to the public, all modes of transportation, the military, and the international community. It is essential to many critical infrastructure areas, including transportation systems, food and agriculture, financial services, emergency services, the communications sector, and the energy sector.

With the rapid advancement of GPS technology over the past twenty years, the country and its critical infrastructure have become critically dependent on GPS as its major PNT system.

It is important to recognize that GPS has limitations. As a satellite-based PNT system, GPS provides a very weak radiofrequency signal and, therefore, has a number of capability gaps.[10]

1. *Physically impeded environments* – Certain topography and conditions challenge the quality of a satellite-based GPS radiofrequency signal, such as urban canyons, indoors, underwater, and in areas with dense foliage.
2. *Electromagnetically impeded environments* – Satellite-based GPS radiofrequency signal is easily interfered with by widely available, consumer grade GPS signal jammers[11] and ionospheric disturbances.
3. *High accuracy with integrity* – Satellite-based GPS radiofrequency signal is unable to provide the accuracy needed for advanced driver assistant systems, automated vehicles, and for automated seaway and rail applications. This challenge is also heavily impacted by physically impeded environments as discussed in point one.
4. *Timely notification of degraded or misleading information* – Satellite-based GPS radiofrequency signal is, at times, delayed in its timely notification of degraded or misleading information. All safety-of-life transportation applications are affected.
5. *Inaccurate geospatial information* – Reliable maps, in addition to GPS, are necessary for all modes of transportation. Changing conditions that are not well-mapped impact the ability of users to understand the intended path of travel.

Alternative PNT systems date back as far as World War II but are no longer maintained, therefore raising concerns regarding their accuracy, availability, and integrity. The most widely considered alternative PNT system is the Enhanced Long Range Aids to Navigation (eLORAN), but questions remain about whether or not this is a sufficient backup to GPS in the event of disruption caused by the capability gaps outlined above.

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[10] Department of Transportation (Karen Van Dyke), *National PNT Architecture,* https://www.gps.gov/governance/advisory/meetings/2011-06/vandyke.pdf

[11] Testimony of Mr. Martin Faga, Former President/CEO, MITRE Corporation, Former Assistant Secretary of the Air Force, before the House Transportation and Infrastructure Committee: "there are thousands of [jamming] events per day. But they are small. They are mostly these little jammers. There was a famous case of Newark Airport having a problem with the effects of a jammer. Finally, a person was caught and fined $32,000 for the violations. But that was day after day. These are people who are trying to hide their own movement, perhaps, from their own employer or what have you. They buy devices that claim they have a range of only 10 meters, and in fact have a range of 2 or 3 miles." https://transportation.house.gov/calendar/eventsingle.aspx?EventID=399235

Radiofrequency Spectrum

Position, navigation, and timing capabilities require a moderate amount of radiofrequency spectrum to operate. The U.S. government reserves and maintains a large band of radiofrequency spectrum for use by many federal agencies. The National Telecommunications and Information Administration (NTIA), within the Department of Commerce, manages the federal government's use of spectrum.[12]

The Department of Transportation's Role in PNT and Radiofrequency Spectrum

Before discussing the role of the Office of Positioning, Navigation, and Timing and Spectrum Management, it is important to understand the role of DOT in PNT and spectrum management, and how DOT's responsibilities are different than the Office of Positioning, Navigation, and Timing and Spectrum Management. DOT has overall authority for ensuring safe, efficient transportation networks for the United States.[13] It also serves as the lead for all civil PNT and radiofrequency requirements and represents all civil departments and agencies in the development, acquisition, management, and operations of GPS.[14] National Security Presidential Directive-39 establishes a permanent committee, co-chaired by the Department of Defense (DoD) and DOT at the Under/Assistant Secretary level, called the National Space-Based PNT Executive Committee (EXCOM).[15]

EXCOM is a national-level coordinating committee that works with other Departments and representatives and makes recommendations to the White House on "policies, architectures, requirements, and resource allocation for maintaining and improving U.S. space-based PNT infrastructures, including GPS…."[16] EXCOM typically meets two to four times a year, and receives day-to-day support from the National Space-Based PNT Coordination Office (NCO), who provides program and project management support to the action items that come from the EXCOM meetings. While DOT staffs the Director of the NCO position, it is important to note that NCO's responsibility is not to represent DOT's position

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[12] National Telecommunications and Information Administration, *Spectrum Management,* https://www.ntia.doc.gov/category/spectrum-management

[13] Title 49, U.S. Code, Section 101

[14] Title 49, U.S. Code, Section 301

[15] This committee includes members from leadership at the State Department, Department of the Interior, Department of Agriculture, Department of Commerce, the Department of Homeland Security, representation from the Joint Chiefs of Staff, and the National Aeronautics Space Administration. Department of Transportation, Homeland Security and Defense, *2017 Federal Radionavigation Plan,* (Washington: September 2017), 2-14, https://rosap.ntl.bts.gov/view/dot/32801

[16] Ibid., 2-15

on PNT. Instead, the office coordinates PNT-related viewpoints across departments and agencies.

The Office of Positioning, Navigation, and Timing and Spectrum Management at the Department of Transportation

A 2007 memorandum from then-Secretary of Transportation Mary Peters, assigns OST-R as the Departmental lead on PNT and spectrum related matters. This responsibility is vested in the Office of Positioning, Navigation, and Timing and Spectrum Management within OST-R. The Office of Positioning, Navigation, and Timing and Spectrum Management has responsibility for coordinating "the development of Departmental positions on PNT and spectrum policy and the protection of PNT systems from harmful radiofrequency interference and operational degradation in conjunction with the Office of the Under Secretary for Policy and the Assistant Secretary for Transportation Policy."[17] It also has lead responsibility for providing "civil PNT systems analysis and coordination, including requirements development and architectural development" for alternatives and augmentations to GPS.[18]

In recognition of the very weak radiofrequency signal provided by the current satellite-based GPS system and the critical dependence that has resulted from the rapid advancement of GPS technology, National Security Presidential Directive-39 requires the Secretary of Transportation to:

- "Develop, acquire, operate, and maintain Global Positioning System space or terrestrial augmentations for civil transportation applications; and
- In coordination with the Secretary of Homeland Security, develop, acquire, operate, and maintain backup position, navigation, and timing capabilities that can support critical transportation, homeland security, and other critical civil and commercial infrastructure applications within the United States, in the event of a disruption of the Global Positioning System or other space-based positioning, navigation, and timing services, consistent with Homeland Security Presidential Direction-7."[19]

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[17] Department of Transportation, *Responsibilities of the Office of Position, Navigation and Timing, and Spectrum Management,* https://www.transportation.gov/pnt/responsibilities

[18] Department of Transportation, *Responsibilities of the Office of Position, Navigation and Timing, and Spectrum Management,* https://www.transportation.gov/pnt/responsibilities

[19] National Security Presidential Directive-39, *U.S. Space Based Position, Navigation, and Timing Policy,* (Washington: December 15, 2005), https://fas.org/irp/offdocs/nspd/nspd-39.htm.

The role of the Office of Positioning, Navigation, and Timing and Spectrum Management in the management of radiofrequency spectrum

As discussed above, the Office of Positioning, Navigation, and Timing and Spectrum Management has responsibility to protect radiofrequency spectrum allocations and takes part in the development of a federal position on reallocations or licenses that would harm or interfere with GPS and other PNT systems. The Office of Positioning, Navigation, and Timing and Spectrum Management coordinates with NTIA, which manages radiofrequency spectrum for federal agencies that operate in the same band of radiofrequency spectrum. The Office of Positioning, Navigation, and Timing and Spectrum Management ensures cross-modal transportation needs and concerns related to PNT are considered and represented in the decision-making process about commercial industry requests to own and operate in bands of radiofrequency spectrum adjacent to spectrum reserved for the government.

Over the past decade, especially the past five years, the Office of Positioning, Navigation, Timing, and Spectrum Management has been obliged to focus its limited staff and resources on spectrum management issues.[20] This reflects the strong, continuing interest of commercial industry in procuring radiofrequency spectrum and the serious concerns within the technical community about the potential for significant disruption of GPS resulting from commercial entities operating in adjacent radiofrequency spectrum. In particular, the Office of Positioning, Navigation, and Timing and Spectrum Management devoted much of its time and resources to the GPS Adjacent Band Compatibility Assessment, which determined the "the maximum transmitted power levels of adjacent band radiofrequency systems that can be tolerated by GPS and Global Navigation Satellite System (GNSS) receivers."[21] Data in this report are used to reach conclusions regarding commercial proposals to occupy adjacent radiofrequency spectrum. The National Space-Based Positioning, Navigation, & Timing Advisory Board have found the potential for

[20] The Office of Positioning, Navigation, and Timing and Spectrum Management is led by a Director who is funded by OST-R through the Volpe National Transportation Systems Center (Volpe). It has one spectrum engineer who is funded through DOT headquarters fund and shared with ITS-JPO, and it has one electronics engineer who is funded by FAA and through Volpe.

[21] Department of Transportation, *GPS Adjacent Band Compatibility Assessment,* (Washington: April 2018), https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/186/dot-gps-adjacent-band-final-reportapril2018.pdf

significant disruption of GPS, especially high-precision GPS (which is critical to the safe deployment of automated vehicles, a DOT priority).[22]

The efforts of commercial industry to gain access to radiofrequency spectrum currently reserved for the federal government will only increase. Over the next ten years, NTIA, in collaboration with other federal stakeholders, has the goal of making 500 megahertz of federal and nonfederal radiofrequency spectrum available to commercial industry for purchase.[23] This will require additional compatibility assessments, similar to the level of effort put forth during the recent GPS Adjacent Band Compatibility Assessment, requiring additional input and resource commitment from the already-limited Office of Positioning, Navigation, and Timing and Spectrum Management at DOT.

The role of the Office of Positioning, Navigation, and Timing and Spectrum Management in research coordination

A major responsibility of the Office of Positioning, Navigation, and Timing and Spectrum Management is the development of requirements, or capabilities, to backup and address the gaps in our current satellite-based GPS system. The Office of Positioning, Navigation, and Timing and Spectrum Management is working closely with the modal operating administrations (including Federal Aviation Administration [FAA], Federal Highway Administration [FHWA], Federal Railway Administration [FRA], Federal Transportation Administration [FTA], National Highway Traffic Safety Administration [NHTSA], and Federal Motor Carrier Safety Administration [FMCSA]) and other stakeholders to specify the capabilities (accuracy, availability, and integrity) required of a backup PNT system. Once PNT identifies the needed capabilities, they must test and evaluate different possible solutions.

This is also true in the context of two DOT and Congressional priorities: safety and autonomous vehicles.[24] The safe deployment of connected and automated vehicles will

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[22] The National Space-Based Positioning, Navigation, & Timing Advisory Board, *GPS Spectrum and Interference Issues*, https://www.gps.gov/spectrum/

[23] Presidential Memorandum, *Unleashing the Wireless Broadband Revolution* (June 28, 2010), directs NTIA to work with the Federal Communications Commission "to make available a total of 500 MHz of Federal and nonfederal spectrum over the next 10 years…" https://obamawhitehouse.archives.gov/realitycheck/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution

[24] The Consolidated Appropriations Act, 2018, passed by Congress and signed by President Trump requires the Department "to conduct research on the development of Automated Vehicles," and reallocated $100m from in grants from the FAST Act " "to remain available until expended, for a Highly Automated Vehicle (HAV) research and development program to fund planning, direct research, and demonstration grants' for HAV technologies and Advanced Driver-Assistance Systems (ADAS)." U.S. Department of Transportation, *Comprehensive Management Plan for Automated Vehicle Initiatives,* (Washington: July 2018), 3,

depend on PNT backup and augmentation capabilities that are accurate, available, and reliable. Current satellite-based GPS is not sufficient. The 2017 Radio Navigation Plan acknowledges these challenges, adding that integrity requirements are unknown, and that future research will "need to coordinate with FHWA, FTA, FRA, and OST-R to define and enhance these requirements."[25] Autonomous road vehicles will be possible only with a solution to this problem.

This suggests a significant role for the Office of Positioning, Navigation, and Timing and Spectrum Management in the research coordination process**.** All of the modal administrations conduct PNT-related research pertaining to their mission area. At current staffing levels, the Office of Positioning, Navigation, and Timing and Spectrum Management is unable to effectively coordinate PNT-related research at DOT. It was not until last summer, when the Office of Positioning, Navigation, and Timing and Spectrum Management had the help of an intern, that it was able to explore the modal research plans and identify PNT-related research. The summer intern, who worked closely with the Office of Research, Development, and Technology Programs and Activities (RDT), identified GPS- and PNT-related research currently underway across the modal administrations. The Office of Positioning, Navigation, and Timing and Spectrum Management found significant gaps in FAA's annual modal research plan as it pertained to PNT-related research. Using the information gathered during the examination of the annual modal research plans, the Office of Positioning, Navigation, and Timing and Spectrum Management identified areas of collaboration between the modes—a central function of OST-R.

Recommendation 3.1: *OST leaders should assess the resources required to address PNT needs across DOT and provide additional staff capacity to the Office of Positioning, Navigation, and Timing and Spectrum Management to enable its effective participation in the research coordination process.*

FAA has significant PNT requirements due to the high-volume of air traffic in the United States. Air Traffic Controllers and pilots are reliant on PNT systems to ensure aircraft stay within their assigned airspace during all phases of flight. FAA currently has about one hundred Spectrum Engineers who work on PNT-related requirements for air traffic. It is important to note, however, that PNT requirements for aviation are different from the requirements for other modes of transportation. The Office of Positioning, Navigation, and

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https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/317351/usdot-comprehensive-management-plan-automated-vehicle-initiatives.pdf

[25] Department of Transportation, Homeland Security and Defense, *2017 Federal Radionavigation Plan,* (Washington: September 2017), 4-32, https://rosap.ntl.bts.gov/view/dot/32801

Timing and Spectrum Management needs to maintain focus on the emerging, but vital, PNT needs of other surface modes of transportation—especially as they relate to connected and automated transportation.

Recommendation 3.2: *The Office of Positioning, Navigation, and Timing and Spectrum Management should remain in OST-R to help ensure a continued focus on the emerging, but vital, PNT needs of surface modes of transportation.*

Proposed transfer of OST-R to the Office of the Under Secretary for Policy (S3)

Transferring OST-R to S3 returns the Office of Positioning, Navigation, and Timing and Spectrum Management to its original location—policy. It was not until the August 1, 2007 memo from then-Secretary Peters that the Office of Positioning, Navigation, and Timing and Spectrum Management moved to the Research and Innovative Technology Administration (RITA). The elevation to S3 will enable the Office of Positioning, Navigation, and Timing and Spectrum Management to better support the development of Departmental PNT and spectrum policy by bolstering the Office of Positioning, Navigation, and timing and Spectum Management's authority and involving it more directly in strategic departmental goals development and advocacy in the areas of safety and automated vehicles.

Section 4: Bureau of Transportation Statistics

This section aims to provide OST leaders with a better understanding of Bureau of Transportation Statistics (BTS) products and processes, identify opportunities for improvement and consider the opportunities and challenges presented by the proposed transfer of BTS to the Office of the Under Secretary for Policy (S3). The section discussion is organized under the following areas:

- History, Funding, Organization and Staffing
- Products, Services and Customers
- Timeliness and Transparency of the Production Process
- Transparency of the Release Process
- Recent Efforts to Improve the Timeliness and Transparency
- Bringing in Outside Expert Perspectives
- Proposed Transfer of BTS to S3

History, Funding, Organization and Staffing of BTS

BTS is one of thirteen federal statistical agencies designated by the White House Office of Management and Budget (OMB). It was established in 1992 under the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 to administer data collection, analysis, and reporting and to ensure the most cost-effective use of transportation-monitoring resources. BTS was created with the intent of bringing a greater degree of coordination, comparability, and quality standards to transportation data, and facilitates in the closing of important data.[26] In 1992, BTS was formalized as one of DOT's operating administrations to serve as the primary source for transportation statistics, maps, and data that provided policy-neutral reports and analyses. While each modal administration continued to provide detailed statistics related to their operation, BTS' mandate was to provide an objective multi-modal, holistic perspective.

In 2005, Congress directed that BTS to be transferred into the newly created Research Innovation and Technology Administration (RITA). The Director position was changed

[26] When DOT was established in 1966, it was given a mandate to collect and report transportation statistics. At that time, each of DOT's modal administrations performed this task. However, a study by the Transportation Research Board (TRB) found a wide range of data gaps that made sound analysis impossible and recommended that one central group within DOT be identified as the data hub. Provisions for funding and establishing the BTS were included in the Intermodal Surface Transportation Efficiency Act. For the findings of the TRB study, see *Data for Decisions: Requirements for National Transportation Policy Making (Special Report 234)* in 1992.

from a senate-confirmed, presidential appointee a career, Senior Executive Service appointment. As a result of the FAST Act[27] in 2015, BTS along with other RITA components, moved in to the Office of the Secretary as part of the Office of the Assistant Secretary of Transportation for Research and Technology (OST-R). The FAST also mandated that the Director of BTS should be the Senior Advisor to the Secretary on data and statistics.

The BTS receives funding from four sources: contract authority, budget authority, cooperative and interagency agreements with external customers, and product sales. The main source of contract authority funding for BTS activities is the annual appropriation of $26 million a year from the Federal Highway Trust Fund, as specified in Chapter 63 of Title 49 U.S.C.,[28] however a portion of this has been used to pay for the overhead costs of OST-R and, before that, RITA.[29] While this funding has remained consistent over the years, inflation has steadily reduced BTS purchasing power. BTS also receives funding for airline-specific activities, funded under a budget authority. Legislation[30] requires FAA's Airport and Airway Trust Fund to allocate $4 million per year to fund the Office of Airline Information activities within BTS.

The BTS currently has fifty-five direct full-time equivalent (FTE) positions working in six program areas. The six program areas and their core responsibilities include:

1. ***Office of Statistical and Economic Analysis:*** Data Modeling and Estimation
2. ***Office of Spatial Analysis and Visualization:*** Visual Analytics
3. ***Office of Survey Programs:*** Data Collection and Acquisition
4. ***Office of Transportation Analysis:*** Data Analysis and Interpretations
5. ***Office of Airline Information:*** Data Collection and Acquisition
6. ***Office of Transportation Information Resources:*** Information Curation and Dissemination

[27] Fixing America's Surface Transportation Act (Public Law 114-94)

[28] Title 49, U.S. Code, Section 6301.

[29] When RITA was created, no provision was made for funding the associated overhead costs of an operating administration. This situation continued when the RITA components were transferred into the newly created OST-R.

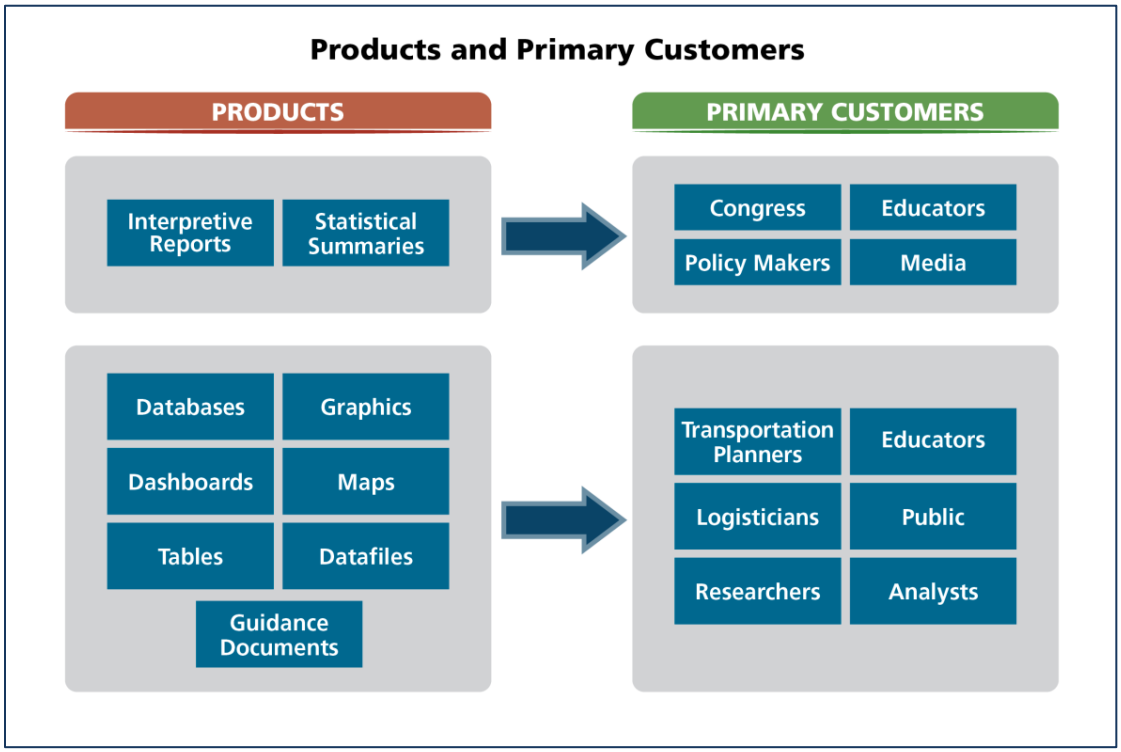
[30] Title 26, U.S. Code, Section 9502.

BTS Products, Services, and Customers

BTS programs work collaboratively to produce over 100 products and services annually. The main BTS programs focus on freight transport, airlines and airports, transportation economics and finance, geospatial data, passenger travel, and safety. Additionally, BTS is responsible for managing the National Transportation Library (NTL) database, which provides support across DOT, and for writing and publishing three congressionally mandated annual reports (see Appendix E for a detailed list).[31]

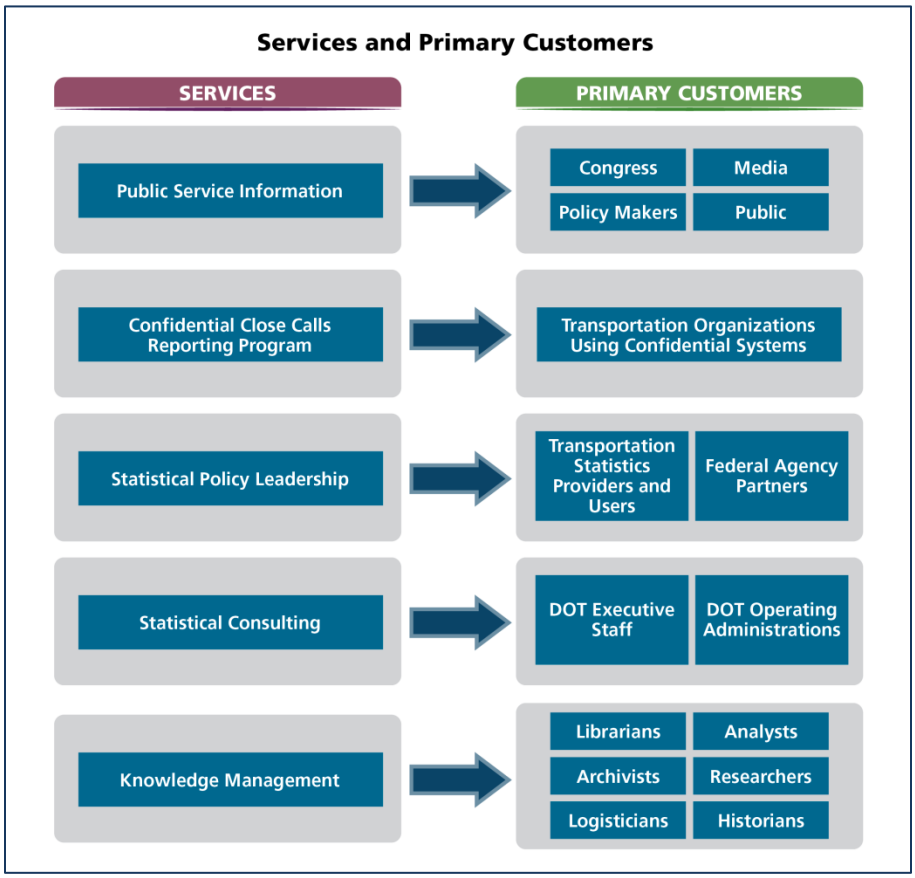
Figures 2 and 3 provide a high-level overview of the types of products and services BTS provides and their primary customers.

Figure 2. BTS Products and Primary Customers



[31] Congress has mandated that BTS produce the following reports: Transportation Statistics Annual Report (49 USC 6312), Port Performance Freight Statistics Annual Report (49 USC 6314), and Tank Car Safety Annual Report (FAST Act Section 7308(c)).

Figure 3. BTS Services and Primary Customers



BTS conducts and produces the majority of its activities and products in accordance with 49 U.S.C. 6301-6314, which directs BTS or the Secretary to collect, compile, analyze, and publish data on the performance of the transportation system and impacts in the following areas:

- safety;
- infrastructure condition;
- freight and passenger movements;
- environmental effects; and
- economics and finance.

BTS is required to compile and publish all data so that is accessible to the public. To do so, BTS maintains three data repositories:

1. Intermodal Transportation Database
2. National Transportation Library
3. National Transportation Atlas Database

Timeliness and Transparency of the Production Process

OST leaders expressed frustration with the timeliness and transparency of the production process and questioned why it takes BTS so long to produce statistical products.

To address these concerns, it is important to understand, first, the principles that govern the work of BTS, as one of the thirteen Principal Federal Statistical Agencies designated by OMB; and second, the implications of those principles for BTS production schedules. *Principles and Practices for a Federal Statistical Agency,*[32] identifies four fundamental principles that should guide the work of these agencies:

1. be in a position to provide objective information that is relevant to uses of public policy;
2. have credibility with those who use its data and information;
3. have the trust of those whose information it obtains; and
4. have a strong position of independence within the government.

Additionally, there are certain tasks that must be completed during each phase of the data collection and production processes, and each requires a certain amount of time and effort. For BTS to maintain its credibility and adhere to the principles of a Federal Statistical Agency, it is important that they pay adequate attention and spend an appropriate amount of time to conduct their work, throughout each of five phases below:

1. data collection;
2. data processing;
3. quality assurance and validation (data cleaning);
4. analysis and interpretation; and
5. reporting and dissemination of information.

Given its responsibility to ensure its data is always credible and trustworthy, BTS executes specific processes and procedures to validate the accuracy of its data. The many steps involved in validation impact its ability to produce the data quickly.

A key challenge affecting timeliness stems from the requirement that BTS aggregate data that originates in modal administrations of the Department and other agencies. However, the modal administrations and agencies do not necessarily adhere to the same principles

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[32] National Academies of Sciences, Engineering, and Medicine. 2017. *Principles and Practices for a Federal Statistical Agency: Sixth Edition*. Washington, DC: The National Academies Press. https://doi.org/10.17226/24810.

and practices for statistical agencies that guide BTS, in which case additional time must be spent on quality assurance and validation before analysis and interpretation work can begin. Another source of delay and uncertainty stems from limited visibility into modal processes.

BTS has authority under its authorizing statute[33] that would enable the Bureau to address modal data quality and command greater visibility into modal data production schedules, but they have not exercised the authority. Targeted support of the Secretary could facilitate the effective exercise of this authority in some instances where modal cooperation is not forthcoming.

Recommendation 4.1: *To address delays and uncertainty in the production of statistical products reliant on data from the modes, BTS should exercise its existing cross-modal authority to get modes to follow quality assurance standards and to provide more visibility into their processes. OST should provide the support needed to facilitate these efforts in instances where modal cooperation is not forthcoming.*

Where BTS owns the data collection process, they have greater control over the development of the development of surveys and testing; but even then, developing and testing a survey can take months. Before the survey is ready, BTS, or the responsible mode, must pilot test the survey questions to ensure clarity and validity and assess the target audience to determine whether they are reaching the appropriate group(s).

Access to real-time data can be extremely advantageous when making a quick decision, but it presents two big challenges: 1) to ensure data accuracy and 2) manage the volume. First, data must be accurate and correctly entered for it to be reliable. Testing and validation of the data source are necessary in order to fully rely on the system that is providing real-time data. Additionally, today's "big data" sets require a robust IT infrastructure that is able to store large volumes of data and maintain the proper security procedures and protocols.

Recommendation 4.2: *BTS needs to work with OST leaders to identify research to be undertaken that require big data and/or real-time data and develop a strategy for building the capabilities that BTS will need to pursue them.*

[33] Per 49 USC Chapter 6302
http://uscode.house.gov/view.xhtml?path=/prelim@title49/subtitle3/chapter63&edition=prelim

Transparency of the Release Process

The Office of Transportation Information Resources is responsible for preserving, curating, and disseminating BTS information. Once BTS collects, processes, analyzes, and interprets the data, the last step is to publish the information according to specific legislative mandates, in designated locations. Depending on the type of data and its purpose, BTS publishes products to one or multiple different locations on the BTS website, such as the information gallery, applications and/or databases, descriptive and interpretive products, and the National Transportation Library.

BTS may release information monthly, quarterly, annually, or on an ad-hoc basis, depending on the application or legislative mandate. Per "OMB Statistical Policy Directive – 4: Release and Dissemination of Statistical Products by Federal Statistical Agencies,"[34] BTS has the sole responsibility for releasing the data and should minimize the time in between recurring releases.

According to the FAST Act, no leadership approvals are necessary before BTS publishes any report or product; however, BTS sets the schedule for statistical releases and publishes an annual data release schedule for the public (See Appendix F). Although there is a public release schedule, DOT leaders are often unaware of what or when BTS releases products due to limited communication.

Recommendation 4.3: *As part of the release process, BTS should notify OST leaders and other key stakeholders when publishing data and reports. Also, BTS should develop a communication strategy and plan with OST leaders to keep them informed of the status of all programs, products, and releases.*

Recent Efforts to Improve Timeliness and Transparency

BTS is seeking ways to address their timeliness issues and is working to be more responsive to customer needs by releasing preliminary data to customers when they have an immediate need. Some customers may not need or want to wait for the data to be 100 percent complete; and in some cases, preliminary results, 95 percent complete will meet the customer's needs. When BTS releases data before being final, it makes clear that the data reflects preliminary results. Also, it indicates when the release of the final version should be expected. Currently, BTS is testing a new product development and publishing

[34] Office of Management and Budget, Notice of Final Decision, "Statistical Policy Directive No. 4: Release and Dissemination of Statistical Products Produced by Federal Statistical Agencies", *Federal Register 73, no. 46 (March 7, 2008)*: 12622, https://www.cdc.gov/nchs/data/about/policies/statistical-policy-directive-no-4.pdf.

strategy whereby BTS publishes artifacts, graphs, data sets, and figures online first; then, develops and publishes the accompanying report.

BTS is also identifying ways to streamline data collection, processing, and reporting times and, to the greatest extent possible, taking advantage of technology and IT shared services, particularly with data collection and storage. Until recently, BTS stored its data on multiple platforms; now, work to consolidate those platforms and store the data in the cloud is complete. This makes it easier to find and manage data, as well as to identify areas of duplication.

BTS is also taking advantage of data that already exists. By pulling specific data that has already been collected, BTS is able to enhance quality assurance and reduce respondent burden. As an example, BTS uses System Wide Information Management (SWIM) data from the Air Traffic Control data feed to collect information on flight delays, rather than requesting this data separately from the FAA. Similarly, BTS is changing how it collects performance freight statistics. BTS does not have the infrastructure to survey all individual ports, so they are examining the GPS data already being collected in an Automated Information System (AIS). BTS collaborated with the United States Army Corps of Engineers (USACE) to capture dwell times to see how long vessels are sitting in a port being unloaded and loaded. While BTS still must spend time validating any data it receives, the modes, or BTS, are not having to spend time creating and distributing an additional survey to collect information that is already being captured. This shortens the overall process, as they are able to use data already available to them.

BTS is undertaking a range of projects to improve its processes. However, there does not appear to be a clearly articulated plan for continuous improvement that aligns with the senior leader's priorities and supports their goals to be flexible and nimble to address emerging issues. Granted, BTS must adhere to specific legal mandates and statistical policy directives related to data quality and independence as a Federal Statistical Agency. However, a system for prioritizing and tracking improvement efforts would ensure alignment with DOT priorities and the efficient use of resources.

Recommendation 4.4: *BTS should work with OST leaders to develop a plan that outlines clear improvement goals and priorities consistent with legal mandates and policy directives and establish a process for tracking the progress of improvement efforts.*

Bringing in Outside Expert Perspectives

In the recent past, BTS gained outside perspectives from an advisory council comprised of approximately eleven members with expertise in transportation data collection and analysis, economics, or transportation safety. The Advisory Council on Transportation,

established according to the rules outlined in The Federal Advisory Committee Act,[35] provided BTS leadership with a great deal of information and insight on the transportation industry, their standard practices, and the techniques used in the research community. However, the charter for this council was terminated this year, as a result of the Administration's Federal Government Reform Plan (M-17-22).[36] BTS would benefit from establishing a different forum in order to obtain external perspectives and guidance from a variety of industry experts.

Recommendation 4.5: *BTS should create an informal advisory group comprised of academic and industry experts in transportation statistics to provide guidance, without the bureaucratic process associated with the Advisory Council on Transportation.*

Proposed Transfer of OST-R to the Office of the Under Secretary for Policy (S3)

The President's FY 2019 budget request proposes the transfer of the OST-R to S3. This presents both opportunities and challenges to consider.

In the recent past, DOT leaders have not been aware of how, when, and why BTS is doing its work. The lack of an Assistant Secretary or a Deputy Assistant Secretary has hindered the ability of BTS to communicate effectively up the organizational chain. The transfer of OST-R to S3 potentially provides BTS with more opportunity for engagement with OST leaders, at the most senior levels. It also supports one of the mandates in the FAST Act that requires the Director of BTS be the Senior Advisor to the Secretary on data and statistics.

Additionally, the President's Management Agenda in March of 2018[37] laid out a number of cross-agency goals, including the goal of leveraging data as a strategic asset, "*…to grow the economy, increase the effectiveness of the Federal Government, facilitate oversight, and promote transparency."* With greater communication between the Secretary and BTS, there will be an opportunity to better leverage transportation data and expertise within the transportation community, as well as across other governmental agencies that collect data relevant to the transportation industry.

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[35] *Federal Advisory Committee Act, U.S. Code 5 Appendix* (2012), §§ 1 et seq.

[36] Executive Office of the President, Office of Management and Budget, *Comprehensive Plan for Reforming the Federal Government and Reducing the Federal Civilian Workforce*, by Mick Mulvaney. Memorandum for Heads of Executive Departments and Agencies M-17-22 (Washington, D.C., 2017), https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-22.pdf

[37] Executive Office of the President, President's Management Council, *President's Management Agenda* (Washington, D.C., 2018). https://www.whitehouse.gov/wp-content/uploads/2018/03/Presidents-Management-Agenda.pdf.

The proposed placement of BTS, a Principal Federal Statistical Agency, in the Office of the Under Secretary for Policy would be a departure from generally accepted practice. Currently, there are no statistical agencies located within the policy offices of their respective Department (see Appendix G). However, given the FAST Act provisions for independence, and the good intention of OST leaders, the risk to independence is manageable. Still, provision should be made to formally recognize the independence of BTS and the principles and practices that govern its work as a designated federal statistical agency. This might be done through a Departmental Administrative Order or Departmental Operating Order.

Appendix A: Expert Advisory Group and Study Team

Expert Advisory Group

Lillian C. Borrone*, Director STV, Inc.; Former Board Chair, Eno Center for Transportation; Former Commissioner, U.S. Commission on Ocean Policy; Retired Assistant Executive Director; former Port Department Director, Port Authority of New York and New Jersey: Associate of Parish and Chambers, Inc.; Deputy Administrator; Urban Mass Transportation Administration, U. S. Department of Transportation; Senior Transportation Technician, Metropolitan Washington Council of Governments. Lillian holds a B.A. in Political Science from American University and a M.Sc. in Civil Engineering from Manhattan College.

Barry Bozeman*, Arizona Centennial Professor of Technology Policy and Public Management; Director, Center of Organizational Research and Design, Arizona State University. Former Ander Crenshaw Chair, Department of Public Administration and Policy, University of Georgia; Regents' Professor of Public Policy, School of Public Policy and Director, Research Value Mapping Research Program, Georgia Institute of Technology; Director, Center for Technology and Information Policy, Maxwell School of Citizenship and Public Affairs and L.C. Smith College of Engineering, Syracuse University; Director, Doctoral Program in Public Administration, Maxwell School of Citizenship and Public Affairs, Syracuse University.

Justin Johnson*, Secretary of Administration, State of Vermont. Former Deputy Secretary, Vermont Agency of Natural Resources; Board Member, Regional Greenhouse Gas Initiative; Former Positions with Vermont Department of Environmental Conservation: Commissioner, Deputy Commissioner; Former Communications Manager, Institute for Sustainable Communities; Communications Coordinator, Vermont Department of Environmental Conservation; Manager-Communications, Mornington Peninsula Shire Council; Chief-of-Staff, Rep. Bruce Billson MP (Australian Federal Parliament); Marketing Specialist, Vermont Department of Agriculture; Editor, Rural Press USA/Rural Press Limited.

Janet Weiss*, Mary C. Bromage Collegiate Professor of Business and Professor of Public Policy, Gerald R. Ford School of Public Policy, University of Michigan. Former Visiting Scholar, Trachtenberg School of Public Policy and Public Affairs, George Washington University; Visiting Professor, McCourt School of Public Policy, Georgetown University; Former positions with University of Michigan: Vice Provost for Academic Affairs; Dean, Rackham Graduate School. Former Fellow, Center for Advanced Study in the Behavioral Sciences, Stanford, CA; Former positions with School of Organization and Management and Institution for Social and Policy Studies, Yale University: Assistant Professor; Associate Professor.

***Academy Fellow**

Academy Study Team

Roger Kodat, *Program Area Director*— Mr. Kodat has led more than 20 projects for the Academy, several focusing on strategic planning and organizational transformation. He brings 20 years of commercial and investment banking experience with JPMorganChase, and six years of senior level federal government experience at the Department of the Treasury. He was appointed by President George W. Bush in 2001 to serve as Deputy Assistant Secretary of Treasury, responsible for Federal Financial Policy. Some of his tasks at Treasury included: policy formulation for the 2006 Postal Accountability and Enhancement Act; rule-making and oversight of Federal loan and loan guarantee programs; and managing the Federal Financing Bank (a $32 billion bank at that time). Mr. Kodat holds a BS in Education from Northwestern University and both an MBA in Finance and MA in Political Science from Indiana University.

Jonathan Tucker, *Project Director*— Jon Tucker is a senior analyst and project director at the Academy. His areas of expertise include: strategic planning/foresight, organizational design, change management, and S&T/innovation policy. His public management consulting experience includes projects with twenty federal agencies. Recent projects include: developing a strategic plan for the Office of Urban Indian Health Programs (U.S. Indian Health Service); developing options for the establishment of a new Under Secretary at USDA focused on international trade; developing a white paper for the Project Management Institute on institutionalizing project and program management in the federal government; assessing Census transformation initiatives; developing a long-term strategic plan for operational transformation at the Social Security Administration. In addition to his consulting activities, Jon contributes to the work of the Academy's Strategic Foresight Panel (part of the broader Academy Transition 2016 initiative). Jon also has experience assessing science and technology policies and programs, with a focus on supporting innovation. He has worked for organizations including Battelle; the National Research Council; the National Institute of Standards and Technology; and the New York State Department of Economic Development. He holds a Ph.D. in Public Policy (with a concentration in Science and Technology Policy) from George Mason University, an M.S. in Science and Technology Studies from Rensselaer Polytechnic Institute, and a B.A. from New College of Florida.

Adam Darr, *Research Analyst*— Mr. Darr joined the Academy in 2015 as a Research Associate having previously interned in the summer of 2013. He has served on numerous Academy projects, including work for the National Science Foundation, Farm Service Agency, U.S. Secret Service, Federal Aviation Administration, and National Nuclear Security Administration. His areas of emphasis have been governance and management reform, organizational change, human capital, project and acquisition management, customer service best practices, and strategic planning. Mr. Darr graduated from Virginia Commonwealth University (VCU) with a B.A. in Political Science and Homeland Security/Emergency Management.

Richard Pezzella, *Research Associate*— Richard joined the Academy in June 2018 after completing a series of internships around Washington. Previously, he worked in Washington during the summer of 2016 as a grassroots organizer with Mayday America, a campaign finance reform group. After college graduation, in May 2017, he returned to Washington to intern in the office of Congressman Eliot L. Engel, and government relations and communications firm, Signal Group. His areas of interest and expertise include infrastructure, public health, international relations, technology, and space policy. Richard graduated in May 2017 from SUNY New Paltz with a Bachelor of Arts in Anthropology and International Relations, and comes originally from Brooklyn, New York.

Debra Eshelman, *Consultant, Management Concepts*— Debbie Eshelman is Managing Director at Management Concepts where she provides consulting and training services to companies in the public, private and non-profit sectors. Ms. Eshelman brings over 25 years of experience to Management Concepts in the areas of human capital management, organizational development, strategic planning, group facilitation and leadership development. In her current role, Ms. Eshelman advises senior leaders in the private sector and federal government agencies on organizational development initiatives, change management strategies, and enterprise wide human capital projects. Ms. Eshelman partners with senior leaders to provide a wide array of services that are customized to meet the client's unique needs. Ms. Eshelman holds a Master's Degree in human resource development from Virginia Polytechnic Institute, and a Bachelor of Arts degree in education from the University of Florida.

Alison Schuster, *Consultant, Management Concepts*— Alison Schuster serves as a Human Capital Consultant in the People & Performance Consulting practice at Management Concepts. As a certified change management practitioner, Alison supports client projects on effective organizational change management and human capital challenges. In her previous role with Management Concepts, she was the Development and Outreach Manager to 300+ Independent Consultant Instructors, developing and managing training programs to certify instructors on how to successfully leverage technology in the classroom. Alison also developed and managed the overall communication and outreach strategy. Prior to joining Management Concepts, Alison worked in HR and sales for several DC area companies. Alison holds a BA in Sociology from Clemson University and an MS in Nonprofit Management and Leadership from Walden University. She also holds a Prosci Change Management Certification and is a Society for Human Resource Management – Senior Certified Professional (SHRM-SCP).

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Appendix B: Participating Individuals and Organizations

Office of the Under Secretary for Policy

Augustine, John – Director, Office of Infrastructure, Finance and Innovation, Office of the Under Secretary for Transportation Policy

Fulton, Finch – Deputy Assistant Secretary for Transportation Policy, Office of the Under Secretary for Policy

Lefevre, Maria – Executive Director, Office of the Under Secretary for Transportation Policy

Smith, Loren – Senior Advisor, Office of the Under Secretary for Transportation Policy

Szabat, Joel – Deputy Assistant Secretary for Aviation and International Affairs, Office of the Under Secretary for Policy

Office of the Assistant Secretary for Research and Technology

Aylward, Anne – Director, Volpe National Transportation Systems Center

Cain, Alasdair – Director, Research, Development, and Technology

Connors, Susan – Deputy Director for Operations, Volpe National Transportation Systems Center

Farley, Audrey – Executive Director, Office of the Assistant Secretary for Research and Technology

Hu, Patricia – Associate Administrator and Director, Bureau of Transportation Statistics

Martin, Harold – Director, National Space-Based PNT Coordination Office

Popkin, Stephen – Deputy Director for Research and Technology, Volpe National Transportation Systems Center

Schmitt, Rolf – Deputy Director, Bureau of Transportation Statistics

Sprung, Michael – Supervisory Transportation Specialist, Office of Transportation Analysis, Bureau of Transportation Statistics

Van Dyke, Karen – Director, Office of Positioning, Navigation and Timing and Spectrum Management

Womack, Kevin – Director, Transportation Safety Institute

Modal Operating Administration Research Executives

Allahyar, Maryam – Associate Administrator and Director, Office of Research, Development, and Technology, Federal Railroad Administration

Beuse, Nathaniel – Associate Administrator for Vehicle Safety Research, National Highway Transportation Safety Administration

Compton, Richard – Director, Office of Behavioral Safety Research, National Highway Traffic Safety Administration

Kalla, Hari – Associate Administrator, Office of Research, Development, and Technology, Federal Highways Administration

Mandel, Rich – Branch Manager for Research and Development Management, Federal Aviation Agency

Michael, Jeff – Associate Administrator for Research and Program Development, National Highway Traffic Safety Administration

Molz, Maureen – Division Chief for Research and Development Management, Federal Aviation Agency

Regal, Kelly – Associate Administrator of Research and Information Technology, Federal Motor Carrier Safety Administration

Valdes, Vince – Associate Administrator, Office of Research, Demonstration and Innovation Federal Transit Administration

External Experts

Faga, Martin* – Former President/CEO, MITRE Corporation; Member, National Advisory Board on Space-Based Positioning, Navigation, & Timing

Fearnsides, John* – Chief Executive Officer, MJF Strategies (Former Chief Scientist, United States Department of Transportation)

Harris-Kjotein, Brian – National Academy of Sciences

Offut, Susan* – Consultant (Former Chief Economist, United States Government Accountability Office)

Potock, Nancy* – Chief Statistician of the United States of America, Office of Management and Budget

***Academy Fellow**

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Appendix D: FY 2019 RD&T Budget Authority per Modal Administration

July 20, 2018

TABLE 18

RESEARCH, DEVELOPMENT & TECHNOLOGY DEPARTMENT OF TRANSPORTATION BUDGET AUTHORITY

Mode/ Program Area	FY 2017 Actual	FY 2018 Enacted	FY 2019 Request	FY 2019 Applied	FY 2019 Development
FHWA					
Subtotal R&D	317,665	319,396	336,467	284,975	51,493
Subtotal Technology	266,278	264,954	287,489	0	0
Subtotal Facilities	0	0	0	0	0
Total	583,943	282,207	623,956	284,975	51,493
FMCSA					
Subtotal R&D	9,072	8,885	8,997	5,492	600
Subtotal Technology	2,793	2,981	2,981	1,681	0
Subtotal Facilities	0	0	0	0	0
Total	11,865	11,866	11,978	7,173	600
NHTSA					
Subtotal R&D	68,977	75,983	63,746	49,054	0
Subtotal Technology	0	0	0	0	0
Subtotal Facilities	0	0	0	0	0
Total	68,977	75,983	63,746	49,054	0
FRA					
Subtotal R&D	40,876	41,376	20,392	12,605	10,788
Subtotal Technology	0	0	0	0	0
Subtotal Facilities	3,001	3,001	3,001	0	0
Total	43,877	44,377	23,393	12,605	10,788
FTA					
Subtotal R&D	28,000	28,000	28,000	7,500	20,500
Subtotal Technology	0	0	0	0	0
Subtotal Facilities	0	0	0	0	0
Total	28,000	28,000	28,000	7,500	20,500
FAA					
Subtotal R&D	400,682	431,343	317,983	122,600	195,383
Subtotal Technology	0	0	0	0	0
Subtotal Facilities	32,200	39,000	33,000	0	33,000
Total	432,882	470,343	350,983	122,600	228,383
PHMSA					
Subtotal R&D	21,479	22,479	11,709	4,346	7,363
Subtotal Technology	0	0	0	0	0
Subtotal Facilities	0	0	0	0	0
Total	21,479	22,479	11,709	4,346	7,363
OST					
Subtotal R&D	17,426	34,445	12,925	3,086	9,839
Subtotal Technology	0	0	0	0	0
Subtotal Facilities	0	0	0	0	0
Total	17,426	34,445	12,925	3,086	9,839
TOTAL DOT					
Total R&D	904,177	961,907	800,219	489,658	295,966
Total Technology	269,071	267,935	290,470	1,681	0
Total Facilities	35,201	42,001	36,001	0	33,000
GRAND TOTAL	1,208,449	1,271,843	1,126,690	491,339	328,966

DEFINITIONS: R&D

The activity is composed of: basic research (without specific application), applied research (for a specific need) and developmental research (includes: design, development, and improvements of prototypes and processes).

TECHNOLOGY:

Demonstration projects and other related activities associated with research and development activities.

FACILITIES:

Acquisition, design, and construction and repairs of all physical facilities for use in research and development activities.

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Appendix E: Legislative Mandate Tables

PROGRAM	Legislative Mandates	Description
Freight		
Commodity Flow Survey	49 USC 6303	National data collection of multimodal freight shipments including value and weight freight flows for origin, destination, commodity, and mode
Freight Analysis Framework	49 USC 6303	Total accounting of freight movement to, from, within the US
Transborder and Border Crossing	49 USC 6303	Cross-border multimodal freight data collection
Port Performance Freight Statistics Program	49 USC 6314	Data and analysis of port capacity and throughput
Vehicle Inventory and Use Survey	49 USC 6302(b)(3)(B)(vi)	National survey of motor vehicle fleet, including an inventory and operating characteristics of trucks
Multimodal freight analysis/applications	49 USC 6302(b)(3)(B)(vi)	Summary statistics and trend analysis of freight system extent, use, condition, safety, and performance
Airline Information		
Air Traffic	Title 14 Part 241- Sec. 19-5	Airline passenger volume data collection
Origin and Destination	Title 14 Part 241- Sec. 19-7	Airline travel pattern and price data collection
Finance	Title 14 Part 241	Airline financial data collection
Performance	Title 14 Part 234, 244, 250	Airline on-time and tarmac delay data collection
Economics and Finance		
Transportation Satellite Accounts	49 USC 6303	Estimation of transportation components of the National economic accounts
Transportation Services Index	49 USC 6302(b)(3)(B)(vi)	Monthly estimates of transportation service activity (leading economic indicator)
Multimodal economic analysis/applications	49 USC 6302(b)(3)(B)(vi)	Summary statistics and trend analysis of economic contributions, employment, finance, and economic issues related to transportation
Statistics on Alternative Finance	49 USC 6302(b)(3)(B)(vi)	Development of data on PPP and other innovative transportation finance
Geospatial Data		
National Transportation Atlas Database	49 USC 6309	Compilation of nationwide geographic databases of transportation facilities, networks, and associated infrastructure
Mapping & Cartography	49 USC 6302(b)(3)(B)(vi)	Maps as need for BTS programs and in response to DOT requests
Geospatial Analysis	49 USC 6302(b)(3)(B)(vi)	Network analysis, spatial statistics, accessibility studies
National Transit Network Database	49 USC 6309	Collection of nationwide data on fixed-guideway and fixed-route transit service and intercity bus service
Passenger Travel		
National Census of Ferry Operators	23 USC 147	Nationwide data collection on ferry facilities and use
Multimodal passenger travel analysis/applications	49 USC 6302(b)(3)(B)(vi)	Summary statistics and trend analysis of passenger travel, and passenger transportation system extent, use, condition, safety, and performance
National Transportation Library		
Digital Repository	49 USC 6304	Acquire, preserve and manage transportation information and information products and services
DOT Public Access Plan	49 USC 6304	Ensure public access to Publications and Digital Data Sets arising from DOT programs
Data Curation and Management	49 USC 6304	Serve as the public repository and point of access for DOT information materials
Safety		
Tank Car	FAST Act Section 7308(c)	Data collection to monitor conversion of rail tank cars to current USDOT safety specification
WMATA Close Call	Reimbursable	Precursor safety condition data collection and analysis
Dept. of Interior Close Call	Reimbursable	Precursor safety condition data collection and analysis
Safety Data Initiative - WAZE and EDT pilot	S1 Initiative	Exploratory application of big data and data fusion for safety analysis
Safety Data Initiative - Visualization Challenge	S1 Initiative	Program to stimulate innovative safety analysis
Congressionally Mandated Reports		
Transportation Statistics Annual Report	49 USC 6312	Annual summary of transportation extent, use condition, safety, and consequences, and the state of transportation statistics
Port Performance Freight Statistics Annual Report	49 USC 6314	Annual summary of port capacity and throughput statistics
Tank Car Safety Annual Report	FAST Act Section 7308(c)	Annual summary of conversion of rail tank car to current USDOT safety specification
Intra-Department Support		
DOT Information Collection Requests	49 USC 6302(b)(3)(B)	Review of OMB clearance requests by USDOT agencies
Statistical Guidelines and Confidentiality	49 USC 6302(b)(3)(B)	Guidance documents and technical assistance to USDOT agencies
DOT GPRA Data and Results	49 USC 6302(b)(3)(B)(ix)	Review of data used in Performance an Accountability Report
Multimodal Freight Network	FAST Act	Support to OST-Policy and FHWA
OST mapping and information needs	S1 Requests	Mapping support to S1, S2, S3, and B1 on demand
Crisis Management Center	CMC Requests	Mapping and geospatial support to Crisis Management Center and the National Response Program
Office of the Director		BTS Director, Deputy Director, public affairs, and administrative support

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Appendix F: Data Release Schedule for 2018

Subject -2018	Release Date1	Time2
January		
North American Freight Data, October 2017	Thursday, January 04, 2018	11:00 AM
Airline Fuel Cost and Consumption, November 2017	Tuesday, January 09, 2018	11:00 AM
Transportation Services Index, November 2017	Wednesday, January 10, 2018	11:30 AM
Airline Full-Time/Part-Time Employment, November 2017	Thursday, January 11, 2018	11:00 AM
Airline Traffic Data, October 2017	Friday, January 12, 2018	11:00 AM
Average Air Fares, 3rd Quarter 2017	Tuesday, January 16, 2018	11:00 AM
Passenger Airline Employment, November 2017	Thursday, January 18, 2018	11:00 AM
North American Freight Data, November 2017	Thursday, January 25, 2018	11:00 AM
February		
Airline Fuel Cost and Consumption, December 2017	Tuesday, February 06, 2018	11:00 AM
Airline Full-Time/Part-Time Employment, December 2017	Thursday, February 08, 2018	11:00 AM
Transportation Services Index, December 2017	Wednesday, February 14, 2018	11:30 AM
Airline Traffic Data, November 2017	Thursday, February 15, 2018	11:00 AM
Passenger Airline Employment, December 2017	Tuesday, February 20, 2018	11:00 AM
North American Freight Data, December 2017	Tuesday, February 27, 2018	11:00 AM
March		
Airline Fuel Cost and Consumption, January 2018	Tuesday, March 06, 2018	11:00 AM
Airline Full-Time/Part-Time Employment, January 2018	Thursday, March 08, 2018	11:00 AM
Transportation Services Index, January 2018	Wednesday, March 14, 2018	11:30 AM
Airline Traffic Data, December 2017	Thursday, March 15, 2018	11:00 AM
North American Freight Data, Annual 2017	Friday, March 16, 2018	11:00 AM
Passenger Airline Employment, January 2018	Monday, March 19, 2018	11:00 AM
U.S. and Foreign Airline Annual Traffic, 2017	Thursday, March 22, 2018	11:00 AM
North American Freight Data, January 2018	Tuesday, March 27, 2018	11:00 AM
April		

Airline Fuel Cost and Consumption, February 2018	Tuesday, April 03, 2018	11:00 AM
Airline Full-Time/Part-Time Employment, February 2018	Monday, April 09, 2018	11:00 AM
Transportation Services Index, February 2018	Wednesday, April 11, 2018	11:30 AM
Airline Traffic Data, January 2018	Thursday, April 12, 2018	11:00 AM
Average Air Fares, 4th Quarter 2017	Tuesday, April 17, 2018	11:00 AM
Passenger Airline Employment, February 2018	Thursday, April 19, 2018	11:00 AM
North American Freight Data, February 2018	Tuesday, April 24, 2018	11:00 AM

May

Airline Financial Data, 4th Quarter 2017	Monday, May 07, 2018	11:00 AM
Airline Fuel Cost and Consumption, March 2018	Tuesday, May 08, 2018	11:00 AM
Airline Full-Time/Part-Time Employment, March 2018	Wednesday, May 09, 2018	11:00 AM
Transportation Services Index, March 2018	Wednesday, May 09, 2018	11:30 AM
Airline Traffic Data, February 2018	Thursday, May 10, 2018	11:00 AM
Passenger Airline Employment, March 2018	Thursday, May 17, 2018	11:00 AM
North American Freight Data, March 2018	Tuesday, May 22, 2018	11:00 AM

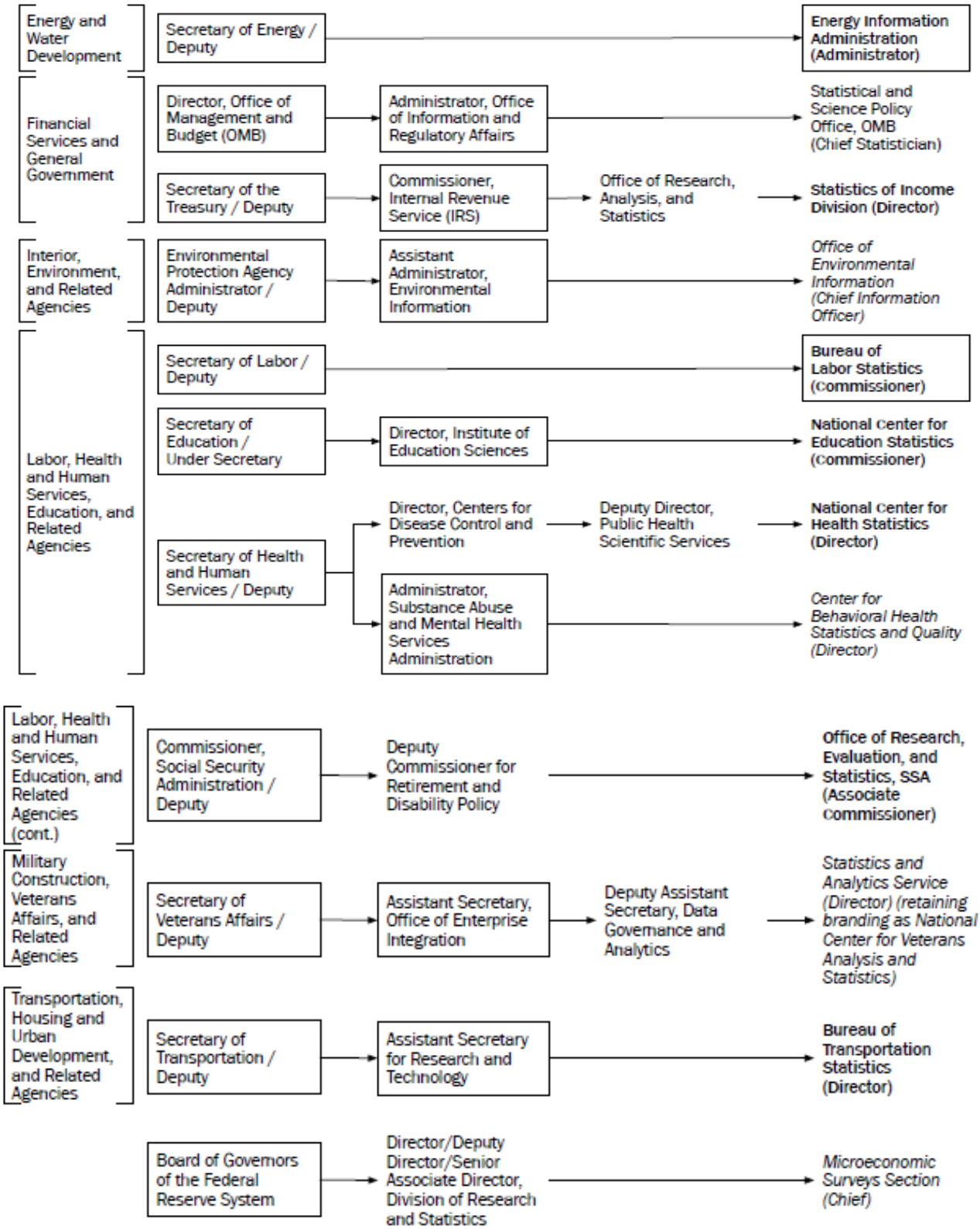
June

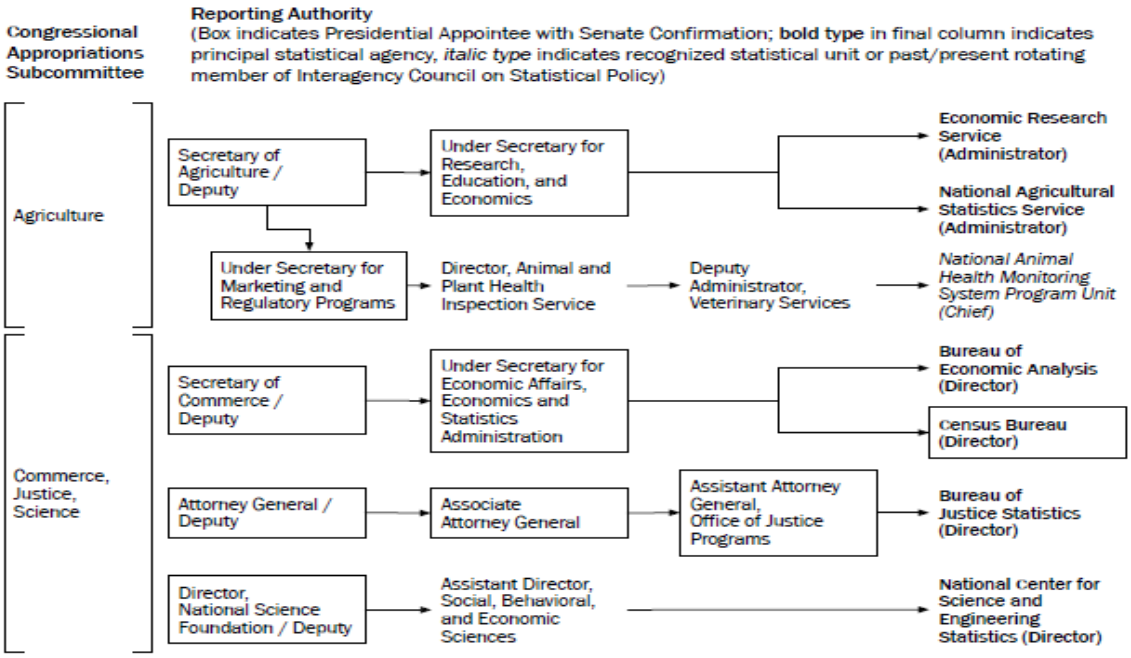
Airline Fuel Cost and Consumption, April 2018	Tuesday, June 05, 2018	11:00 AM
Airline Full-Time/Part-Time Employment, April 2018	Thursday, June 07, 2018	11:00 AM
Transportation Services Index, April 2018	Wednesday, June 13, 2018	11:30 AM
Airline Traffic Data, March 2018	Thursday, June 14, 2018	11:00 AM
Airline Financial Data, 1st Quarter 2018	Monday, June 18, 2018	11:00 AM
Passenger Airline Employment, April 2018	Tuesday, June 19, 2018	11:00 AM
North American Freight Data, April 2018	Tuesday, June 26, 2018	11:00 AM

July

Airline Fuel Cost and Consumption, May 2018	Tuesday, July 10, 2018	11:00 AM
Airline Full-Time/Part-Time Employment, May 2018	Wednesday, July 11, 2018	11:00 AM
Transportation Services Index, May 2018	Thursday, July 12, 2018	11:30 AM
Airline Traffic Data, April 2018	Friday, July 13, 2018	11:00 AM
Average Air Fares, 1st Quarter 2018	Tuesday, July 17, 2018	11:00 AM
Passenger Airline Employment, May 2018	Thursday, July 19, 2018	11:00 AM

Appendix G: Reporting Authority




Congressional Appropriations Subcommittee
Reporting Authority
(Box indicates Presidential Appointee with Senate Confirmation; bold type in final column indicates principal statistical agency, italic type indicates recognized statistical unit or past/present rotating member of Interagency Council on Statistical Policy)
Agriculture
Secretary of Agriculture / Deputy
Under Secretary for Research, Education, and Economics
Economic Research Service (Administrator)
National Agricultural Statistics Service (Administrator)
Under Secretary for Marketing and Regulatory Programs
Director, Animal and Plant Health Inspection Service
Deputy Administrator, Veterinary Services
National Animal Health Monitoring System Program Unit (Chief)
Commerce, Justice, Science
Secretary of Commerce / Deputy
Under Secretary for Economic Affairs, Economics and Statistics Administration
Bureau of Economic Analysis (Director)
Census Bureau (Director)
Attorney General / Deputy
Associate Attorney General
Assistant Attorney General, Office of Justice Programs
Bureau of Justice Statistics (Director)
Director, National Science Foundation / Deputy
Assistant Director, Social, Behavioral, and Economic Sciences
National Center for Science and Engineering Statistics (Director)

Appendix H: Acronym List

AMRP	Annual Modal Research Plan
AV	Autonomous/Automated Vehicle
BTS	Bureau of Transportation Statistics
DOT	Department of Transportation
EAG	Expert Advisory Group
eLORAN	Enhanced Long Range Aids to Navigation
EXCOM	National Space-Based PNT Executive Committee
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FTE	Full Time Equivalents/Employees
GPS	Global Positioning System
IT	Information Technology
ITS-JPO	Intelligent Transportation Systems Joint Program Office
NCO	National Space-Based PNT Coordination Office
NHTSA	National Highway Traffic Safety Administration
NTL	National Transport Library
OMB	Office of Management and Budget
OST	Office of the Secretary
OST-R	Office of the Assistant Secretary for Research and Technology
PHMSA	Pipeline and Hazardous Materials Safety Administration

PNT	Positioning, Navigation, and Timing
RDT	Office of Research, Development, and Technology
S3	Office of the Under Secretary for Policy
SWIM	System Wide Information Management
TRB	Transportation Research Board
TSI	Transportation Safety Institute
UTC	University Technology Centers

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