



March 2024

SPECTRUM IT MODERNIZATION

Incorporating Leading Practices Could Improve Planning Effort

Accessible Version

GAO Highlights

Highlights of [GAO-24-106634](#), a report to congressional committees

Why GAO Did This Study

Use of the radio-frequency spectrum is vital to a wide variety of commercial and government activities. To manage use for the federal government, NTIA relies on multiple, spectrum-related IT systems, that, according to agency officials, are out-of-date and ineffective. The William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (FY21 NDAA) required NTIA to submit to Congress a plan to modernize its spectrum-related IT. Other agencies with their own required spectrum-related IT modernization plans are expected to coordinate with NTIA to help ensure interoperability among systems.

The FY21 NDAA also includes a provision for GAO to biennially review NTIA's and other agencies' efforts to modernize their spectrum-related IT. This report examines (1) the status of NTIA's and selected agencies' efforts to modernize their spectrum-related IT and (2) the extent to which NTIA's IT modernization project planning aligns with selected leading practices. GAO reviewed IT modernization plans and other agency documentation; and assessed NTIA's project planning efforts against selected leading practices.

What GAO Recommends

GAO is making four recommendations to NTIA to develop a reliable cost estimate, develop an integrated project schedule, finalize its stakeholder management plan, and establish performance measures. NTIA concurred with GAO's four recommendations and described activities it would undertake to implement them.

View [GAO-24-106634](#). For more information, contact Andrew Von Ah at (202) 512-2834 or VonahA@gao.gov.

March 2024

SPECTRUM IT MODERNIZATION

Incorporating Leading Practices Could Improve Planning Effort

What GAO Found

The National Telecommunications and Information Administration (NTIA) manages federal use of spectrum, a scarce natural resource. NTIA and selected federal agencies and agency components have planning underway to modernize the outdated IT systems used to manage spectrum. NTIA has issued an initial high-level modernization plan, identified the IT systems to modernize, and placed a contract order for acquisition planning support. Before proceeding to the next phase on design, NTIA has to complete a number of activities including finalizing a concept of operations, assessing alternatives, and developing project management plans. Four other agencies and components are in the planning or pre-planning phases of modernizing their own spectrum-related IT. For example:

- Department of Defense officials told us they awarded a contract to analyze the department's spectrum IT and identify ways to improve it.
- National Science Foundation officials said they have funded a project to streamline the processing of spectrum use requests.
- The Federal Aviation Administration and National Aeronautics and Space Administration do not plan to begin modernization planning until more details become available from NTIA.

GAO's analysis of NTIA's modernization planning found that its efforts aligned with several leading practices but did not align for practices on developing cost estimates, developing a project schedule, communicating with stakeholders, and establishing performance measures.

Extent to Which NTIA Spectrum-Related IT Modernization Project Planning Efforts Aligned with Selected Leading Practices

Leading practice	GAO assessment
Designate leadership and establish an implementation team	✓
Secure a funding source	✓
Establish outcome-oriented goals	✓
Establish processes for adapting plans and reporting progress to management	✓
Develop cost-estimates	✗
Develop a project plan and timelines	✗
Involve and communicate with external stakeholders in appropriate time intervals	✗
Establish performance measures	✗

✓ **Aligned:** An effort is aligned if the underlying activities generally reflected all or almost all of the key elements in the leading practice.

✗ **Not Aligned:** An effort is not aligned if the underlying activities did not generally reflect all or almost all of the key elements in the leading practice or if the underlying activities were not fully completed.

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-24-106634

Accessible Text for Extent to Which NTIA Spectrum-Related IT Modernization Project Planning Efforts Aligned with Selected Leading Practices

Leading practice	GAO assessment
Designate leadership and establish an implementation team	Aligned
Secure a funding source	Aligned
Establish outcome-oriented goals	Aligned
Establish processes for adapting plans and reporting progress to management	Aligned
Develop cost-estimates	Not aligned
Develop a project plan and timelines	Not aligned
Involve and communicate with external stakeholders in appropriate time intervals	Not aligned
Establish performance measures	Not aligned

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-24-106634

NTIA officials acknowledged that additional work was needed to implement the practices and complete other required planning steps. Effectively doing so would position the agency to implement a successful modernization.

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Abbreviations

DOD	Department of Defense
FAA	Federal Aviation Administration
IRAC	Interdepartment Radio Advisory Committee
IT	Information technology
NASA	National Aeronautics and Space Administration
FY21 NDAA	William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021
NSF	National Science Foundation
NTIA	National Telecommunications and Information Administration

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March 19, 2024

Congressional Committees

The radio-frequency spectrum is a scarce, natural resource used to support a wide variety of vital commercial and government activities.¹ For example, commercial entities use spectrum to provide wireless high-speed internet and broadcast television, while federal agencies use it for missions ranging from national defense to air traffic control.² Spectrum needs are expected to continue increasing due to 5G telecommunications and other new technologies. However, all of the usable spectrum has been designated for use among federal and nonfederal users; thus, it is essential that spectrum be managed as efficiently as possible. We have previously reported on the importance of efficiently managing spectrum to meet this increasing demand.³

The Department of Commerce's (Commerce) National Telecommunications and Information Administration (NTIA) manages spectrum use for federal users. For example, NTIA assigns spectrum to federal agencies, providing them with authorization to operate in defined frequency bands. To manage spectrum, NTIA relies on a combination of multiple, custom software applications, databases, engineering tools, and other spectrum-related information technology systems (hereafter, IT or IT systems). NTIA provides access to these IT systems to agencies that use spectrum. Additionally, some of these agencies have their own internal, custom IT to help manage spectrum use.⁴

¹The radio-frequency spectrum is a part of the natural spectrum of electromagnetic radiation. Frequencies, which are grouped into bands, are properties of electromagnetic waves that describe how many wave patterns or cycles pass by in a period of time.

²For the purposes of this report, the term "agency" refers to either a federal agency or an agency's component, as consistent with the list of "covered agencies" for section 9203 of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (FY21 NDAA). See Pub. L. No. 116-283, § 9203(e)(1), 134 Stat. 3388, 4797 (2021).

³See, for example, GAO, *Spectrum Management: NTIA Should Improve Spectrum Reallocation Planning and Assess Its Workforce*, [GAO-22-104537](#) (Washington, D.C.: Jan. 27, 2022).

⁴For additional information on the IT that NTIA and other agencies use and operate, see GAO, *Spectrum Management: Information Technologies for Managing Federal Use*, [GAO-22-105221](#) (Washington, D.C.: Feb. 17, 2022).

However, we have reported that these IT systems are out-of-date⁵ and, according to NTIA officials, present various challenges for NTIA that hinder its ability to efficiently manage spectrum. For example, the systems require that NTIA use manual processes for managing tens of thousands of requests for frequency assignments from federal agencies each year. In addition, the systems' limited data retrieval and analysis capabilities impair NTIA's ability to use more dynamic assignment approaches that would allow users to share the same spectrum from different locations. We have previously found that federal agencies with outdated legacy IT systems, such as NTIA's systems, face a variety of risks in using the technology and could improve their modernization efforts.⁶

The William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (FY21 NDAA) required NTIA to develop and submit to Congress a plan to modernize its IT to more efficiently manage spectrum. It also required other covered agencies, defined as the Department of Defense (DOD) and other federal entities designated by NTIA, to develop and submit to NTIA plans to modernize their own IT to ensure it is interoperable with NTIA's modernized IT.⁷ NTIA designated the agencies that are part of the Interdepartment Radio Advisory Committee (IRAC) as the covered agencies required to issue modernization plans.⁸ In

⁵[GAO-22-105221](#).

⁶See, for example, GAO, *Information Technology: IRS Needs to Complete Modernization Plans and Fully Address Cloud Computing Requirements*, [GAO-23-104719](#) (Washington, D.C.: Jan. 12, 2023).

⁷The FY21 NDAA required each covered agency to submit a report describing a plan to modernize the agency's IT "with respect to the use of Federal spectrum by such agency." § 9203(c)(1), 134 Stat. at 4795.

⁸The FY21 NDAA defines a covered agency as DOD as well as any federal entity that the Assistant Secretary of Commerce for Communications and Information, the head of NTIA, determines is appropriate. § 9203(e)(1), 134 Stat. at 4797. NTIA chairs the IRAC, which includes a variety of subcommittees that have specialized functions, such as assisting NTIA in assigning frequencies. The IRAC consists of NTIA and the following 17 entities: Departments of Agriculture, Commerce, Defense (including the Air Force, Army, and Navy), Energy, Homeland Security, Interior, Justice, State, Transportation, Treasury, and Veterans Affairs, as well as the Federal Aviation Administration, National Aeronautics and Space Administration, National Science Foundation, U.S. Agency for Global Media, U.S. Coast Guard, and U.S. Postal Service. NTIA also designated the Federal Communications Commission, a liaison to the IRAC, as a covered agency. For the purpose of this report, we count DOD, Department of the Air Force (including Space Force), Department of the Army, and Department of the Navy (including Marine Corps) as one entity.

September 2021, NTIA released its initial high-level modernization plan and covered agencies began to issue their initial plans in late 2021.⁹

The FY21 NDAA also includes a provision for us to biennially review NTIA's and the covered agencies' IT modernization efforts after submission of all agencies' plans. This review focuses on agency planning efforts after the issuance of these initial plans.¹⁰ This report examines (1) the status of NTIA's and selected agencies' efforts to modernize their spectrum-related IT and (2) the extent to which NTIA's IT modernization project planning aligns with selected leading practices for effective IT modernization and project management.

To address our first objective, we reviewed NTIA's and covered agencies' initial plans to modernize their IT, as well as additional documentation from NTIA and selected agencies detailing the subsequent planning activities they conducted since releasing their initial plans. We selected the four agencies that have their own IT to modernize (as opposed to those that rely exclusively on NTIA-provided IT): DOD, the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), and the National Science Foundation (NSF). We also interviewed officials from NTIA, DOD, FAA, NASA, and NSF to further understand the status of their modernization efforts.

To address our second objective, we assessed NTIA's project planning efforts after the issuance of its initial plan against selected leading practices for effective IT modernization and project management. We identified these practices from various government and industry sources

⁹For the purpose of this report, we refer to the plans issued in response to the FY21 NDAA requirements as "initial" plans because they generally described high-level topics that would be important for agencies to consider for their modernization planning activities.

¹⁰Previously, GAO published a report describing the IT that NTIA and agencies use to manage spectrum. See [GAO-22-105221](#).

and that we have used in our prior work.¹¹ We selected leading practices to reflect basic project planning and management principles relevant to the timing and progress of NTIA's IT modernization project. We assessed NTIA's planning efforts as aligned or not aligned based on documentation NTIA provided for each leading practice.¹² We reviewed relevant documents NTIA distributed to covered agencies through its Spectrum Policy and Plans Steering Group—which consists of representatives from agencies that provide advice to NTIA on spectrum policies—to understand how NTIA coordinated with agencies on its modernization efforts. In addition, we interviewed officials from NTIA, DOD, FAA, NASA, and NSF for additional context and perspectives on NTIA's modernization efforts. Further details on our scope and methodology can be found in appendix I.

We conducted this performance audit from February 2023 to March 2024 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

¹¹These sources included our prior work on agency reforms and IT modernizations and publications by the Project Management Institute, Inc., a not-for-profit organization that has established standards for project management. See [GAO-23-104719](#); GAO, *Government Reorganization: Key Questions to Assess Agency Reform Efforts*, [GAO-18-427](#) (Washington, D.C.: June 13, 2018), and *Information Technology: Critical Factors Underlying Successful Major Acquisitions*, [GAO-12-7](#) (Washington, D.C.: Oct. 21, 2011); Project Management Institute, Inc., *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Seventh Edition* (Newtown Square, PA: 2021). PMBOK is a trademark of Project Management Institute, Inc. The sources also included our best practices for cost estimating, schedule assessment, and Agile project management. See GAO, *Agile Assessment Guide: Best Practices for Adoption and Implementation*, [GAO-24-105506](#) (Washington, D.C.: November 2023); *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, [GAO-20-195G](#) (Washington, D.C.: March 2020); and *Schedule Assessment Guide: Best Practices for Project Schedules*, [GAO-16-89G](#) (Washington, D.C.: December 2015).

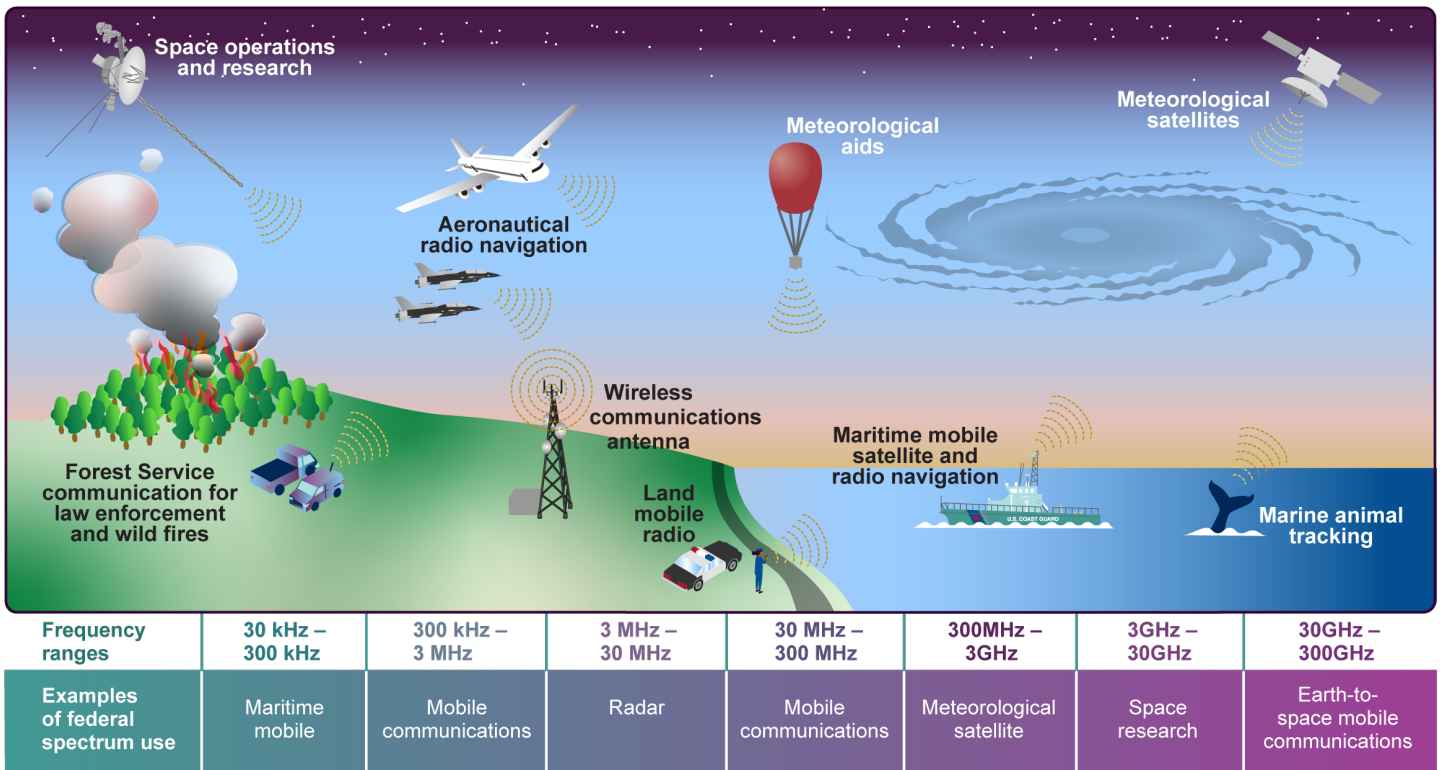
¹²For our analysis, an effort is “aligned” if the underlying activities generally reflected all or almost all of the key elements in the leading practice. An effort is “not aligned” if the underlying activities did not generally reflect all or almost all of the key elements in the leading practice or if the underlying activities were not fully completed. For further information on the leading practices and our scoring, see appendix I.

Background

NTIA is responsible for promoting the best possible and most efficient use of spectrum resources across the federal government, subject to and consistent with the needs and missions of federal agencies. Federal agencies use their assigned spectrum for a broad range of activities (see fig. 1). NTIA follows a multistep process to assign spectrum to federal agencies. This process is intended to prevent harmful interference between different users.¹³ NTIA also certifies the spectrum-dependent equipment (i.e., communication devices that rely on spectrum to transmit a signal) that federal agencies acquire. This helps ensure that the equipment conforms to federal spectrum standards and can operate in available spectrum.

¹³In this process, agencies make an initial request for spectrum; NTIA electronically processes the request and checks for errors, such as formatting mistakes in the request; and members of the IRAC Frequency Assignment Subcommittee review the requests for possible objection, and, potentially, resolve disputes between agencies. Harmful interference can occur when interference from one user's transmissions seriously degrades, obstructs, or repeatedly interrupts another user's transmissions because the two transmissions' frequencies are the same or adjacent to each other and occur at the same time in the same area. Prior to submitting a frequency request, agencies may use various IT systems to check for potential interference.

Figure 1: Examples of Federal Uses of Spectrum



Source: GAO illustration and analysis of National Telecommunications and Information Administration information. | GAO-24-106634

Accessible Text for Figure 1: Examples of Federal Uses of Spectrum

Examples of Federal Uses of Spectrum

Space operations and research

Aeronautical radio navigation

Meteorological aids

Meteorological satellites

Forest Service communication for law enforcement and wild fires

Wireless communications antenna

Land mobile radio

Maritime mobile satellite and radio navigation

Marine animal tracking

Examples of federal spectrum use	Frequency ranges
Maritime mobile	30 kHz – 300 kHz
Mobile communications	300 kHz – 3 MHz
Radar	3 MHz – 30 MHz
Mobile communications	30 MHz – 300 MHz
Meteorological satellite	300 MHz – 3 GHz
Space research	3 GHz – 30 GHz
Earth-to-space mobile communications	30 GHz – 300 GHz

Source: GAO illustration and analysis of National Telecommunications and Information Administration information. | GAO-24-106634

We previously reported that NTIA uses a total of nine specialized IT systems to manage spectrum and provides most of these systems to agencies so they can participate in NTIA’s spectrum management processes.¹⁴

Federal agencies, which assess their spectrum needs and report data to NTIA, also need to manage their spectrum use wisely. While agencies that use spectrum rely in part on NTIA-provided IT, some of the agencies—DOD and FAA, in particular—use NTIA-provided IT in combination with agency-specific IT to meet mission needs.

NTIA and nearly all covered agencies issued their initial IT modernization plans from 2021 to 2022 in response to the FY21 NDAA. NTIA’s initial plan highlighted the need to assign spectrum frequencies more quickly and enhance the interoperability of different IT.¹⁵ The plan also provided a high-level, brief overview of the possible approaches, timelines, and system improvements for NTIA to consider for its IT modernization. Nearly all (17 of 18) covered agencies issued initial modernization plans.¹⁶ These plans generally described the IT the agencies use to manage spectrum, including whether the agencies have their own IT to modernize. The plans also presented high-level, general approaches the agencies could consider to ensure interoperability with NTIA’s and other agencies’ systems. Four of the covered agencies—DOD, FAA, NASA, and NSF—reported they have their own IT to modernize that relates to their unique mission need. The remaining (14 of 18) covered agencies

¹⁴GAO-22-105221.

¹⁵NTIA, Office of Spectrum Management, *Plan to Modernize and Automate the Infrastructure of NTIA Related to Managing Federal Spectrum Use* (Washington, D.C.: September 2021).

¹⁶The Department of Veterans Affairs did not develop a plan. According to department officials, the agency did not develop a plan because leadership was unaware of the FY21 NDAA requirement. However, officials told us that the agency is coordinating with NTIA and other agencies with similar modernization requirements to develop an initial draft plan.

reported in their plans that they do not have their own custom IT to modernize and thus will rely on using NTIA's modernized IT.¹⁷

NTIA also reported in its initial 2021 plan that it would leverage existing committees and working groups to communicate with covered agencies on its IT modernization, such as the IRAC and the Policy and Plans Steering Group. The plan briefly highlighted that coordinating with covered agencies is important for developing modernization requirements, including interoperability specifications, as well as goals and parameters for measuring success. NTIA also reported in its initial plan that it would seek to align NTIA's modernization with the needs of each covered agency, including constraints and implementation timelines. In 2022, NTIA followed up its 2021 initial modernization plan by reporting it is planning a \$109 million investment to carry out a project to modernize its spectrum management IT.¹⁸

To implement the modernization project—deemed a high-dollar, mission critical IT investment—NTIA reported that it would implement an acquisition strategy in accordance with Commerce acquisition policies and guidance.¹⁹ Specifically, the *Commerce Acquisition Manual* provides policy and guidance that all components within Commerce, including NTIA, must follow to conduct an acquisition.²⁰ The *Commerce Acquisition*

¹⁷According to Federal Communications Commission officials, the agency has spectrum-related IT that it uses in its role regulating non-federal spectrum use. Such IT is separate from IT related to its own use of federal spectrum, which is the focus of the modernization plans. For IT related to its own use of federal spectrum, the agency reported it will rely on using NTIA's modernized IT.

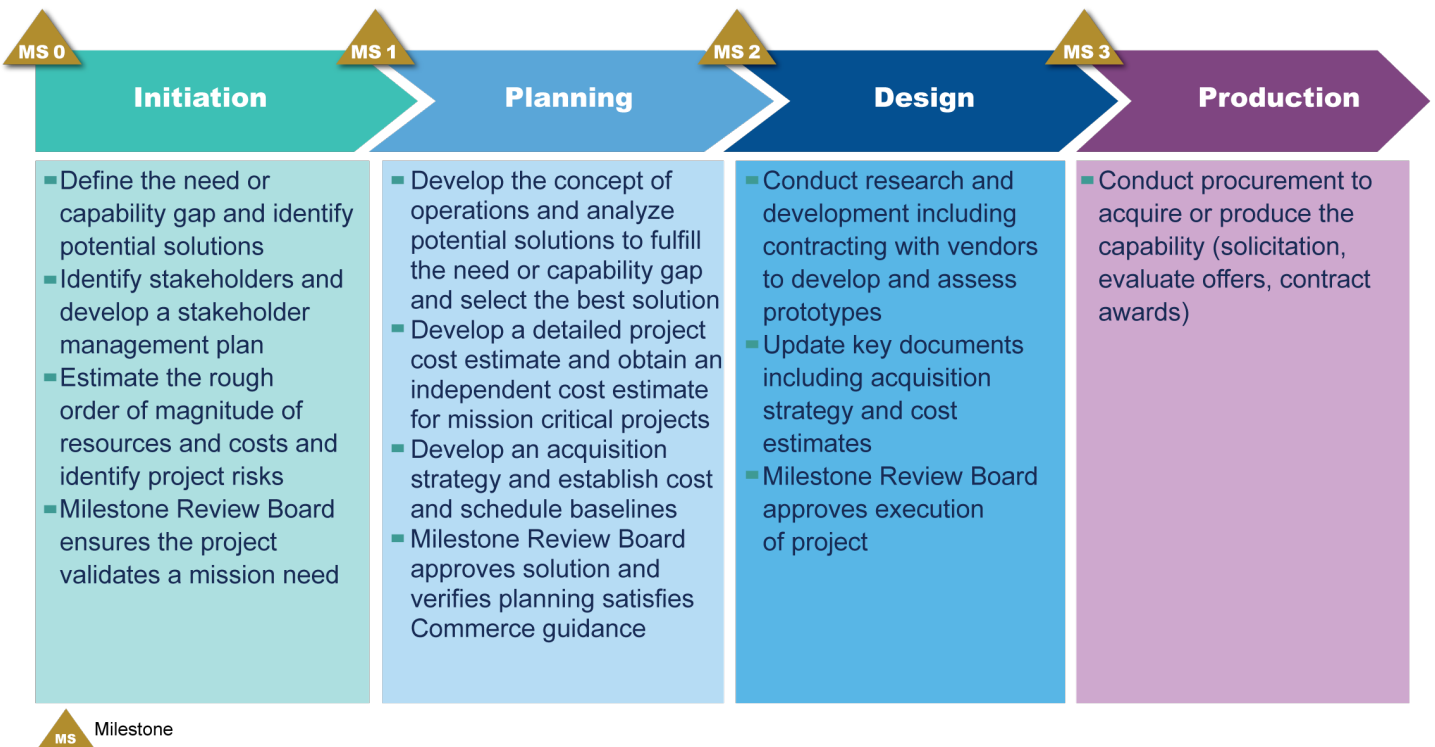
¹⁸NTIA, *FY 2022 Nonrecurring Expense Fund Justification of Program and Performance* (Washington, D.C.: July 2022).

¹⁹Commerce acquisition policy defines projects as “high-dollar” if the project's development costs, valued in current year dollars, exceed \$75 million or if the project's lifecycle costs, valued in current year dollars, exceed \$250 million. Commerce policy also states that regardless of dollar thresholds, any project that warrants special management attention is considered “high risk” due to factors such as project complexity, technology, or visibility. See Commerce, *DOC Acquisition Program and Project Management Guidebook Version 2.1* (Oct. 5, 2023). In addition to NTIA's designations, in November 2023, the Biden Administration issued the *National Spectrum Strategy* and a Presidential Memorandum calling for federal departments and agencies to modernize spectrum policy and take steps to make the most efficient use of spectrum. The strategy cites, among other things, NTIA's effort to prepare for modernizing its spectrum management infrastructure as an initial step toward achieving one of the strategy's goals. See, The White House, *National Spectrum Strategy* (Washington, D.C.: Nov. 13, 2023), and Presidential Memorandum, *Modernizing United States Spectrum Policy and Establishing a National Spectrum Strategy*, 88 Fed. Reg. 80079 (Nov. 13, 2023).

²⁰Commerce, *Commerce Acquisition Manual: 1307.1 Acquisition Planning* (Aug. 2020).

Program and Project Management Guidebook supplements this guidance by describing a framework that all high-dollar acquisition projects must follow.²¹ As shown in figure 2, the framework outlines development phases that project managers must follow and milestones they must achieve to obtain approval from NTIA and Commerce investment review boards to proceed to the next phase. In March 2023, Commerce approved the project, completing the initiation phase milestone (milestone 1). Due to the high-dollar designation for the IT modernization project, NTIA must receive approval from both the NTIA and Commerce investment review boards before it can enter the project design phase.

Figure 2: Acquisition Milestones, Phases, and Selected Activities from the Department of Commerce Acquisition Program and Project Management Framework that Components within Commerce Must Follow



Source: GAO analysis of the Department of Commerce Acquisition Program and Project Management Guidebook. | GAO-24-106634

²¹Commerce, *DOC Acquisition Program and Project Management Guidebook Version 2.1* (Oct. 5, 2023).

Accessible Text for Figure 2: Acquisition Milestones, Phases, and Selected Activities from the Department of Commerce Acquisition Program and Project Management Framework that Components within Commerce Must Follow

Milestone	Phase	Phase information
Zero	Initiation	<ul style="list-style-type: none"> Define the need or capability gap and identify potential solutions Identify stakeholders and develop a stakeholder management plan Estimate the rough order of magnitude of resources and costs and identify project risks Milestone Review Board ensures the project validates a mission need
One	Planning	<ul style="list-style-type: none"> Develop the concept of operations and analyze potential solutions to fulfill the need or capability gap and select the best solution Develop a detailed project cost estimate and obtain an independent cost estimate for mission critical projects Develop an acquisition strategy and establish cost and schedule baselines Milestone Review Board approves solution and verifies planning satisfies Commerce guidance
Two	Design	<ul style="list-style-type: none"> Conduct research and development including contracting with vendors to develop and assess prototypes Update key documents including acquisition strategy and cost estimates Milestone Review Board approves execution of project
Three	Production	<ul style="list-style-type: none"> Conduct procurement to acquire or produce the capability (solicitation, evaluate offers, contract awards)

Source: GAO analysis of the Department of Commerce Acquisition Program and Project Management Guidebook. | GAO-24-106634

NTIA and Selected Agencies Have Efforts Underway to Modernize Their IT

NTIA Is Taking Steps to Complete the Planning Phase of Modernization

NTIA has completed the initiation phase of its IT modernization project and has taken various steps toward completing the planning phase and

preparing to enter the next phase of its IT modernization project, the project’s design phase. As shown in figure 2 above, for major IT acquisitions such as NTIA’s IT modernization, Commerce has a prescribed four-phase framework that components within Commerce, including NTIA, must follow.

During the initiation phase, NTIA completed a range of activities culminating in March 2023, when Commerce approved NTIA moving into the planning phase. For example, as discussed later in this report, NTIA established an office to lead the modernization and developed a rough order of magnitude cost estimate for the project. In response to requirements in the FY21 NDAA, NTIA developed its high-level initial modernization plan and specified how it intended to collaborate with covered agencies to ensure interoperability of systems. NTIA also developed a risk profile in October 2022 that identified risks to the project and mitigation strategies.

NTIA also assessed its individual IT systems to help identify those that could be modernized. Of the nine systems that NTIA uses to manage spectrum, NTIA identified in its project planning documents the six systems that it intends to modernize (see table 1).

Table 1: Summary of NTIA Spectrum-Related IT Systems Planned for Modernization

System	Description
Frequency Management and Reporting System	NTIA uses this system to process and maintain frequency assignments and the Government Master File database, NTIA’s record of all federal frequency assignments. ^a
Data Capture and Forward System	NTIA uses this system to consolidate, manage, and provide initial data validation for frequency proposals on NTIA’s unclassified network.
FreqCoord	Federal and nonfederal users rely on this web-based system to coordinate frequency sharing in certain frequency bands. ^b The system can identify potential interference and, absent conflicts, transfer frequency requests for frequency assignment processing. ^c
Spectrum Transition Tool	Federal agencies use this system to relocate spectrum-dependent systems from one band to another. Agencies also use it to report annually to NTIA on the status of relocation.
Interdepartment Radio Advisory Committee Network	Members of the Interdepartment Radio Advisory Committee use this online portal to access NTIA information needed for committee proceedings. This committee assists NTIA in assigning frequencies and developing policies for managing federal spectrum use.
Equipment Location – Certification Information Database Online	Federal agencies use this online database system to electronically process agencies’ requests to NTIA to certify their spectrum-dependent equipment (i.e., equipment that uses spectrum, such as transmitters on aircraft that send a signal).

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-24-106634

^aFrequencies are properties of electromagnetic waves that describe how many wave patterns or cycles pass by in a period of time.

^bNTIA assigns spectrum to federal agencies, providing them with authorization to operate in defined frequency bands. See 47 U.S.C. § 902(b)(2)(A). These authorizations allow agencies to use specific frequencies at specific locations under specified technical parameters.

^cHarmful interference can occur when interference from one user's transmissions seriously degrades, obstructs, or repeatedly interrupts another user's transmissions because the two transmissions' frequencies are the same or adjacent to each other and occur at the same time in the same area.

As part of the planning phase, NTIA has completed a variety of activities, with other activities remaining as of November 2023. For example, NTIA developed a draft concept of operations in June 2023 to depict potential capabilities the modernized IT could include from a user's perspective. In addition, Commerce issued a request for information in September 2023 to inform NTIA's market research on technical capabilities.²²

To prepare for entering the project's design phase, NTIA obtained support for acquisition planning. In May 2023, NTIA placed an order on an existing contract with MITRE, a federally funded research and development center, to assist with various acquisition planning activities for the IT modernization project. These activities include conducting market research; drafting an analysis of alternatives, project management plan(s), and an independent cost estimate for the project; and overall helping NTIA to determine the best acquisition strategy to modernize its IT.²³

As shown in figure 2 above, NTIA must complete these activities before it can obtain approvals from the NTIA and Commerce IT investment review boards to enter the design phase of its modernization project. NTIA officials told us that they plan to complete all the required activities prior to the IT investment review board meetings scheduled for 2024. However, given the significant amount of work remaining and need to balance speed and quality, it is unclear when NTIA will complete all required activities and achieve approval to proceed to the next phase, the design phase.

Selected Agencies Are in Various Stages of Modernization

DOD, FAA, NASA, and NSF—the agencies that reported in their initial modernization plans that they have custom IT to modernize—are in

²²Commerce, *Special Notice: NTIA Federal Spectrum Data Systems Modernization RFI* (Washington, D.C.: September 2023), accessed Oct. 10, 2023, <https://sam.gov/opp/a96b1d0c5e1b4978b71edc9d652a8fc3/view>.

²³An analysis of alternatives is a process that assesses potential solutions to mitigate documented capability gaps. Typically performed early in the acquisition cycle, the process examines costs, benefits, schedules, risks, sensitivity, viability, and operational effectiveness for each alternative and the status quo in order to select a preferred alternative that satisfies mission need.

various stages of modernizing or upgrading their systems. For additional information regarding each system that may be modernized, see Appendix II.

DOD. DOD is in the early modernization planning stages following the issuance of its initial plan. The plan included a strategic framework of goals and guiding principles, high level descriptions of spectrum management systems and processes, and a high-level timeline.²⁴ To address an immediate need, DOD officials said they intend for the existing IT that DOD uses to manage spectrum to be migrated to a cloud capability to improve security and make the systems more accessible to users.²⁵ In addition, DOD reported in its initial plan that it intends to transform the capabilities of Spectrum XXI, a software tool originally created for the department that nearly all IRAC agencies use to request frequency assignments from NTIA. According to DOD officials, while DOD plans to improve this software tool, any further modifications to it are on hold as the department migrates its spectrum-related IT systems to the cloud.

To further prepare for modernization planning, DOD officials told us that DOD awarded a contract in 2023 to the Institute of Defense Analyses, a federally funded research and development center, to analyze the department's spectrum management IT and recommend ways to improve it. The study is intended to analyze DOD's current spectrum management infrastructure, architecture, protocols, and tools that are used Department-wide to conduct spectrum analyses and manage spectrum use including Spectrum XXI. The study also is intended to identify potential procedural and technical gaps, and recommendations to support modernization of these tools. DOD officials said they would assess the study's recommendations upon its expected completion by early 2024. The officials said they plan to request budgetary resources to carry out its modernization efforts beginning in fiscal year 2026.

FAA. Since the issuance of its initial modernization plan in 2021, FAA has identified IT systems to modernize but has paused additional planning until NTIA clarifies its planning and modernization strategy. According to FAA officials, FAA intends to modernize two systems that provide varying

²⁴DOD officials told us the modernization plan produced in response to the FY21 NDAA is part of a broader strategic effort that DOD has outlined in its *Electromagnetic Spectrum Superiority Strategy* and related implementation plan. Specifically, DOD officials told us the modernization plan will assist DOD in addressing one of the goals in the implementation plan.

²⁵Cloud computing is a means for providing on-demand access to shared resources such as networks, servers, and data storage.

spectrum management capabilities including engineering models, enhanced interaction with NTIA's systems, and air-to-ground analytical capabilities for aircraft communication and navigation systems.²⁶ The officials also said that improving data communication with NTIA and automatic processing of FAA's ongoing review of frequency assignments are priority areas for improvement efforts. While FAA identified the systems it intends to improve, officials said they are awaiting further details of NTIA's complete modernization plans, such as its schedule, before they can develop their own implementation schedule and budget for FAA's modernization.

NASA. NASA officials told us NASA has prioritized implementing ongoing, periodic enhancements to its IT and, as of November 2023, does not have further plans to modernize its IT. Specifically, since the issuance of its initial modernization plan in 2021, NASA officials told us they are not proceeding with modernization planning until they receive more detailed information from NTIA on its planned system requirements. According to NASA officials, information regarding NTIA's planned system requirements would assist NASA in understanding whether its existing IT may also require modernization to maintain interoperability with NTIA's updated systems.

NASA officials said they plan to continue implementing periodic enhancements to NASA's primary spectrum management IT system, the NASA Electronic Radio Data Base System. According to officials, this system is a collection of databases, a document repository, and includes various interfaces that assist NASA in its spectrum functions. Officials reported in NASA's plan that it has sufficient resources to continue implementing the enhancements to maintain this system; it may reassess its resource needs once NTIA provides further modernization requirements.

NSF. NSF has taken steps to address a key challenge identified in its 2021 initial modernization plan and, according to NSF officials, does not have further modernization needs or plans as of November 2023. Specifically, according to NSF officials, NSF funded a \$250,000 project to implement a streamlined application and archival system for requests to

²⁶The two systems include the Web Automated Frequency Manager and the Internet Radio Coverage Analysis System.

use frequencies within the National Radio Quiet Zone.²⁷ NSF plans for the system to streamline the processing of over 1,000 annual requests from prospective spectrum users within the National Radio Quiet Zone. NSF plans to develop the system as a web-based submission and tracking tool that automates these coordination requests. Officials said the new system will be completed and in operation in calendar year 2024.

NTIA's Project Planning Efforts Align with Several, but Not All Selected Leading Practices

Our analysis of NTIA's project planning efforts showed that they aligned with several but not all selected leading practices for effective IT modernization and project management.²⁸ Specifically, as shown in figure 3, we found NTIA's efforts aligned with leading practices related to establishing an implementation team, setting goals for the project, and securing funding for the project, among others. However, we found that NTIA's planning efforts did not align with leading practices for developing a cost estimate, developing a schedule to complete the project, regularly communicating with stakeholders, and developing performance measures.²⁹

²⁷According to NSF officials, NSF issued this supplemental award using an existing cooperative agreement with Associated Universities, Inc., which manages the National Radio Astronomy Observatory. NSF officials said they used the NSF Spectrum Innovation Initiative program to fund the supplemental award. The Federal Communications Commission created the National Radio Quiet Zone to minimize ground-based sources of interference and to protect the Green Bank Observatory, a site with multiple radio telescopes, and the Sugar Grove Research Station.

²⁸We assessed NTIA's modernization planning efforts against selected leading practices for effective IT modernization and project management that we identified from various government and industry sources and that we have used in our prior work. See [GAO-23-104719](#), [GAO-18-427](#), [GAO-12-7](#), [GAO-24-105506](#), [GAO-20-195G](#), and [GAO-16-89G](#). More information on our selection and how we conducted this assessment can be found in appendix I.

²⁹For our analysis, an effort is "aligned" if the underlying activities generally reflected all or almost all of the key elements in the leading practice. An effort is "not aligned" if the underlying activities generally did not reflect all or almost all of the key elements in the leading practice or if the underlying activities were not fully completed. For further information on the leading practices and our scoring, see appendix I.

Figure 3: Extent to Which NTIA Spectrum-Related IT Modernization Project Planning Efforts Aligned with Selected Leading Practices

Leading practice	GAO assessment
Designate leadership and establish an implementation team	✓
Secure a funding source	✓
Establish outcome-oriented goals	✓
Establish processes for adapting plans and reporting progress to management	✓
Develop cost-estimates	✗
Develop a project plan and timelines	✗
Involve and communicate with external stakeholders in appropriate time intervals	✗
Establish performance measures	✗

✓ **Aligned:** An effort is aligned if the underlying activities generally reflected all or almost all of the key elements in the leading practice.

✗ **Not Aligned:** An effort is not aligned if the underlying activities did not generally reflect all or almost all of the key elements in the leading practice or if the underlying activities were not fully completed.

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-24-106634

Accessible Text for Figure 3: Extent to Which NTIA Spectrum-Related IT Modernization Project Planning Efforts Aligned with Selected Leading Practices

Leading practice	GAO assessment
Designate leadership and establish an implementation team	Aligned
Secure a funding source	Aligned
Establish outcome-oriented goals	Aligned
Establish processes for adapting plans and reporting progress to management	Aligned
Develop cost-estimates	Not aligned
Develop a project plan and timelines	Not aligned
Involve and communicate with external stakeholders in appropriate time intervals	Not aligned
Establish performance measures	Not aligned

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-24-106634

Note: We assessed NTIA's modernization planning efforts against selected leading practices for effective IT modernization and project management that we identified from various government and industry sources and that we have used in GAO's prior work. See [GAO-23-104719](#), [GAO-18-427](#), [GAO-12-7](#), [GAO-24-105506](#), [GAO-20-195G](#), and [GAO-16-89G](#). More information on our selection and how we conducted this assessment can be found in appendix I.

NTIA's Efforts to Plan for Its IT Modernization Project Align with Four Leading Practices

We found that NTIA's efforts to plan for its IT modernization project aligned with the following four leading practices.

Designate leadership and establish an implementation team. An agency should designate a leader and dedicated team responsible for managing the project. In anticipation of forthcoming modernization efforts, NTIA established an office within its Office of Spectrum Management in December 2018 to plan and lead all aspects of its modernization project. NTIA hired a program manager in February 2023 to lead the project from within this office. As of November 2023, NTIA had filled eight of the nine positions that comprise the new office, including IT specialists that will implement the project.

Secure a funding source. An agency should ensure that the project implementation team has the resources to manage the project. NTIA officials told us NTIA obtained approval to use Commerce's Nonrecurring Expenses Fund to fund the modernization project.³⁰ NTIA plans to obligate \$109 million over a 9-year period (fiscal years 2022 through 2030) to support the project.³¹ The funds will support awarding of the contract to integrate and modernize NTIA's spectrum IT systems, awarding of a separate contract to verify and validate the modernized system, and the hiring of IT specialist staff to manage the project's implementation.

Establish outcome-oriented goals. An agency should establish clear outcome-oriented goals to identify what the project will achieve. NTIA established five goals for the spectrum IT modernization project in 2022, as shown in table 2. NTIA also identified in its fiscal year 2022 budget justification several general objectives for the project to address. For example, NTIA intends for the project to reduce the security risk level of the spectrum IT systems, eliminate unsupported technology, provide an ability to view and analyze federal spectrum data using visual platforms on the Internet and classified networks, and improve the timeliness and

³⁰Under 15 U.S.C. § 1521a, the Office of Management and Budget must approve using this fund for information and business technology system modernization, and the Committees on Appropriations of the House of Representatives and the Senate must receive notification at least 15 days in advance of the planned use of the funds.

³¹In addition to the Nonrecurring Expenses Fund, NTIA plans to use spectrum fees to fund an additional \$74 million over a 9-year period (fiscal years 2022 through 2030) to support enhancements to the legacy IT systems as NTIA implements the modernized system.

transparency of processes that facilitate managing spectrum requests, assignments, and certification.

Table 2: NTIA Goals for its Spectrum-Related IT Modernization Project

Goal	Description
Strengthen IT security	Enhance the security of NTIA spectrum IT systems to ensure their continued availability for essential federal missions, and to protect spectrum data from unauthorized release.
Modernize IT platform	Improve NTIA’s ability to enhance and scale the modernized spectrum IT system and provide the IT foundation for future spectrum capabilities.
Enhance analysis	Provide capabilities that execute more accurate, trusted, and repeatable spectrum analyses to improve federal spectrum use efficiencies.
Streamline processes	Improve timeliness, reduce level of effort, and increase transparency of federal spectrum processes.
Improve data	Improve accessibility, interoperability, and comprehensiveness of spectrum data.

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-24-106634

NTIA has begun to take steps toward meeting these goals. For example, to assist NTIA in meeting its goal of strengthening IT security, NTIA officials said they are prioritizing immediate security improvements to the systems it intends to modernize. NTIA officials said that in 2023 they modified an existing contract to migrate the existing systems to a commercial cloud service for improved security. The officials said they intended for the migration to the cloud service to occur concurrently with the modernization planning efforts. Regarding the first goal, we have previously reported on the ongoing challenges federal agencies face in securing federal systems and information.³² Given the challenges and risks, ensuring the cybersecurity of the nation, which includes securing federal systems, remains on GAO’s High-Risk List.³³ As NTIA continues to plan its IT modernization project, identifying and addressing cybersecurity risks will be essential to efficiently and effectively protecting NTIA’s and other agencies’ systems and data.

Establish processes for adapting plans and reporting progress to management. An agency should establish a process for adapting plans and activities throughout the project and reporting to management its progress on the project. To execute the modernization project, NTIA officials said they will use an “Agile” project management approach that

³²See, for example, GAO, *Cybersecurity High-Risk Series: Challenges in Securing Federal Systems and Information*, [GAO-23-106428](#) (Washington, D.C.: Jan. 31, 2023).

³³GAO, *High-Risk Series: Efforts Made to Achieve Progress Need to Be Maintained and Expanded to Fully Address All Areas*, [GAO-23-106203](#) (Washington, D.C.: Apr. 20, 2023).

incrementally develops the IT.³⁴ With the project defined as a high-dollar, mission critical IT investment, NTIA must follow the phased milestone, reporting, and approval processes outlined in the Commerce acquisition framework and manual, as depicted in figure 2. As noted above, in March 2023, Commerce approved the project, completing the initiation phase milestone (milestone 1).

The project team has since begun preparing the documentation needed for the next milestone, the planning phase milestone (milestone 2). This effort includes, for example, developing a report on its progress to present to the Commerce and NTIA internal IT investment review boards. Officials said the Commerce acquisition framework allows them to tailor their acquisition approach to suit the project's size, complexity, and risk. As of November 2023, NTIA officials told us they are finalizing the project's management plan that will provide further detail on the agency's approach.

NTIA's Efforts to Plan for Its IT Modernization Project Do Not Align with Four Leading Practices

We found that NTIA's efforts to plan for its IT modernization project did not align with the following four leading practices at the time of our review.

Develop cost-estimates. An agency should develop a high-quality, reliable cost estimate when planning for a project. As of November 2023, NTIA had not developed a detailed cost estimate for its modernization project. As part of developing its budget justifications for its fiscal year 2022 budget request, NTIA estimated the modernization would cost \$109 million. However, according to NTIA officials, this was a rough order of magnitude estimate, not a detailed cost estimate. As part of the contract order placed to assist with acquisition planning, NTIA tasked MITRE to develop an independent cost estimate to inform the project cost estimate NTIA intends to develop.³⁵ NTIA officials said they are planning to develop their estimate in preparation for their next milestone review with

³⁴Agile is an approach to software development in which software is developed incrementally and is continuously evaluated for functionality, quality, and customer satisfaction.

³⁵According to Commerce's acquisition framework, an independent cost estimate is an estimate of a project's lifecycle costs undertaken by an entity outside of the project's chain of command. The independent cost estimate is developed to support milestone decisions for a project's stakeholders. It is relied upon to validate the reasonableness of the government cost estimate and to identify any gaps or risks related to the project's cost or funding baseline.

the two IT investment review boards, scheduled for 2024, before it can enter the project's design phase.

As NTIA develops its cost estimate, it has the opportunity to ensure the estimate incorporates best practices we have previously identified for reliable cost estimates. Specifically, our *Cost Estimating and Assessment Guide* establishes best practices that, if implemented, result in a cost estimate that is comprehensive, well documented, accurate, and credible.³⁶ Our *Agile Assessment Guide* also states that Agile projects should adhere to these cost estimating practices.³⁷ While NTIA officials said they have not yet developed an estimate because other tasks assigned to MITRE were in progress, according to the Cost Guide, the estimate should identify and estimate all cost elements from the project's initial concept all the way through each phase in the project's duration. *The Cost Guide* (and Commerce's own *Acquisition Program and Project Management Guidebook*) also states that the independent cost estimate should be developed after the government's cost estimate is produced. It is unclear whether NTIA's cost estimate will align with these practices. Following these best practices as it develops its estimate could help NTIA ensure that it has a reliable estimate of all project costs and in turn help it effectively manage the costs of modernizing its spectrum IT.

Develop a project plan and schedule. An agency should develop a project plan and schedule that includes the required work and milestones needed to complete the project. As of November 2023, NTIA had not developed a detailed schedule that reflects all necessary work to complete its modernization project. As described above, NTIA released its high-level, initial modernization plan in September 2021. Although entitled a "plan", this document was not a comprehensive project plan. Instead, it served as a brief overview of NTIA's intent and to be responsive to the FY21 NDAA modernization plan requirement. At the time of our review, NTIA officials said they had begun developing, with input from MITRE, an overarching management plan for the project. NTIA officials said they are planning to develop an integrated master schedule to manage the implementation of the project after a contract is awarded to modernize the systems. NTIA also developed a one-year summary schedule from 2023 to 2024 that details the various documents it must complete to receive approval from the IT investment review boards to implement its proposed acquisition strategy.

³⁶[GAO-20-195G](#).

³⁷[GAO-24-105506](#).

As NTIA develops a schedule that documents all of the required work to complete the project, such as an integrated master schedule, it has the opportunity to ensure the schedule incorporates best practices we have previously identified for a reliable schedule. Specifically, our *Schedule Assessment Guide* identifies best practices associated with high quality, reliable project schedules.³⁸ While NTIA officials said they have not yet developed a complete schedule because other activities were in progress, according to the Schedule Guide, the master schedule should include the entire required scope of effort. This includes the work necessary from all government, contractor, and other key parties for a project's successful execution from start to finish. Our *Agile Assessment Guide* also states that Agile projects should adhere to these scheduling practices.³⁹ It is unclear whether the schedule NTIA develops will align with these practices. Incorporating these best practices could help NTIA ensure it has a reliable schedule that will help it establish a baseline, gauge progress, identify and resolve potential problems, and promote accountability at all levels of the project.

Involve and communicate progress to external stakeholders in appropriate time intervals. An agency should communicate with external stakeholders on a regular basis to develop and implement the project. In response to a requirement in the FY21 NDAA, and as described above, NTIA stated in its initial modernization plan that its process for collaborating with covered agencies to ensure interoperability of systems would be to work through existing committees and working groups, such as the IRAC and the Policy and Plans Steering Group.⁴⁰ While NTIA has begun to hold meetings with agencies on its modernization efforts, NTIA had not formally documented, at the time of our review, how it will regularly involve and communicate progress on its modernization project to covered agencies. NTIA officials told us they are developing a stakeholder management plan to establish formal processes for coordinating with agencies. However, at the time of our review, NTIA had not finalized its stakeholder management plan or any documentation

³⁸[GAO-16-89G](#).

³⁹[GAO-24-105506](#).

⁴⁰The FY21 NDAA directed that NTIA's modernization plan include a strategy for coordination between the covered agencies within the Policy and Plans Steering Group. According to the statute, among other things, this strategy should describe a plan for coordinating the covered agencies' efforts to modernize their IT to be interoperable with NTIA's modernized IT. FY21 NDAA, § 9203(b)(2)(F), 134 Stat. at 4794–95; see also *id.* § 9203(c)(1), 134 Stat. at 4795.

that demonstrates its policies and procedures for how it will facilitate coordination, including how frequently NTIA would hold meetings.

NTIA officials said they re-started coordination efforts in mid-2023. Specifically, NTIA held one meeting with agencies through the IRAC in 2023 and two meetings with agencies using a newly established working group in 2023. Through these meetings, NTIA solicited feedback on various topics including how NTIA should design its modernized IT and how federal agencies preferred to interact while using the IT. Prior to 2023, NTIA officials said they had held monthly meetings with agencies in 2021. However, NTIA did not hold meetings with agencies for a period of 15 months from February 2022 until June 2023, when NTIA reconvened the working group.

Officials from two covered agencies told us that they were not satisfied with the timeliness and level of information shared during this period (February 2022 to June 2023). For example, officials at one agency said the frequency of the NTIA-led working group meetings was insufficient and they expected more opportunities to provide feedback before NTIA implements the project. In addition, the officials said they need more detailed information from NTIA on what it plans to modernize in order for the covered agency to ensure that any changes to its internal IT systems are interoperable with NTIA's eventual modernized systems.

Our analysis of leading practices for effective planning found that management should involve and communicate with external stakeholders on a project's progress in appropriate time intervals including by establishing policies and procedures to facilitate coordination, such as through communication plans. Additionally, our prior work on duplication, overlap and fragmentation, has found that fragmentation can occur when more than one agency is involved in the same broad area of national need.⁴¹ Specifically, we have found that opportunities exist for agencies to better manage fragmentation by improving interagency communication and coordination. By documenting how it will regularly involve and communicate progress to external stakeholders in appropriate time intervals, NTIA can better ensure that it is effectively identifying stakeholders' requirements and resolving any potential fragmentation issues that might impair IT interoperability.

Establish performance measures. An agency should establish performance measures to assess progress toward meeting project goals. While NTIA established goals for its IT modernization project, it did not

⁴¹GAO, *Fragmentation, Overlap, and Duplication: An Evaluation and Management Guide*, [GAO-15-49SP](#) (Washington, D.C.: April 14, 2015).

establish performance measures to assess the extent to which it is meeting the project's goals and objectives. Officials said they did not develop such measures because other efforts they need to complete first were in progress. Specifically, officials said they were waiting until after MITRE completed its analysis of alternatives. This analysis is one of the documents required by Commerce's acquisition framework that NTIA tasked MITRE with developing. Further, while officials said they would draft the measures before they begin implementing the project, they do not have a timetable for their completion.

We have previously reported that effective organizations set goals and measures that reflect, among other things, clearly defined targets that indicate what should be observed and in what time frames.⁴² We acknowledge that pending NTIA's selection and approval of a preferred alternative, the project's acquisition strategy and implementation could vary. However, knowing the project's goals and what needs to be measured to achieve those goals should drive how NTIA implements the project. Without measures to assess progress, it is unclear whether NTIA could fully demonstrate its progress in modernizing its IT. By developing measures, NTIA could better ensure the modernized IT is targeted to and on track to meet the modernization's intended goals. NTIA could also use measures to provide better assurance to Congress, NTIA leadership, and federal agency stakeholders that it has developed a reliable way to track its progress in modernizing its IT.

Conclusions

NTIA depends extensively on an outdated combination of IT systems to carry out its mission of managing the federal government's use of spectrum, a limited natural resource that is facing increasing demand. Relying on these systems can contribute to inefficient processes, delays in frequency assignments, and potential security risks for NTIA and the federal agencies that need accurate and timely spectrum assignments. Since releasing its initial, high-level modernization plan in 2021, NTIA has implemented selected planning activities but has not fully incorporated four leading practices. Fully incorporating these practices—such as establishing performance measures to demonstrate progress and developing a schedule that includes the entire project—into NTIA's

⁴²See, for example, GAO, *Affordable Broadband: FCC Could Improve Performance Goals and Measures, Consumer Outreach, and Fraud Risk Management*, [GAO-23-105399](#) (Washington, D.C.: Jan. 18, 2023).

activities could benefit the modernization effort as NTIA enters the next phases of this high-profile IT investment.

Recommendations for Executive Action

We are making the following four recommendations to NTIA:

The Office of Spectrum Management should develop a high-quality reliable cost estimate that aligns with cost estimating best practices as defined in GAO's Cost Guide and Agile Guide for the IT modernization project. (Recommendation 1)

The Office of Spectrum Management should develop a reliable integrated master schedule that aligns with scheduling best practices as defined in GAO's Schedule Assessment Guide and Agile Guide for the IT modernization project. (Recommendation 2)

The Office of Spectrum Management should finalize its stakeholder management plan. The plan should document a regular meeting schedule for the IT modernization project to ensure covered agencies have the ability to request information and communicate on NTIA's IT modernization project. (Recommendation 3)

The Office of Spectrum Management should develop performance measures for the IT modernization project that clearly link with the project's established goals and have specified targets and time frames. (Recommendation 4)

Agency Comments

We provided a draft of this report to NTIA, DOD, FAA, NASA, NSF, and the other covered agencies for review and comment. DOD, FAA, NASA, and the other covered agencies had no comments on the draft report. NTIA and NSF provided technical comments, which we incorporated as appropriate. NTIA provided written comments, reprinted in appendix III.

In its written comments, NTIA concurred with our four recommendations and provided information about activities that NTIA would undertake to implement them. Specifically, in response to our first and fourth recommendations, NTIA stated that it is in the process of completing a cost estimate in accordance with GAO cost estimating best practices and developing performance measures for the IT modernization project. In response to our second recommendation, NTIA stated that it had developed an overall plan for the project and would establish an

integrated master schedule after it awards a contract for the IT modernization project. In providing its comments, NTIA also provided a stakeholder management plan that, according to officials, addresses our third recommendation. We will examine this document and close the recommendation as implemented if it meets the intention of the recommendation.

We are sending copies of this report to appropriate congressional committees and the Secretaries or Administrators of the covered agencies discussed in this report. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff members have any questions about this report, please contact me at (202) 512-2834 or vonaha@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.



Andrew Von Ah
Director, Physical Infrastructure Issues

List of Committees

The Honorable Jack Reed
Chairman
The Honorable Roger Wicker
Ranking Member
Committee on Armed Services
United States Senate

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

Letter

The Honorable Mike Rogers
Chairman

The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Cathy McMorris Rodgers
Chair

The Honorable Frank Pallone, Jr.
Ranking Member
Committee on Energy and Commerce
House of Representatives

Appendix I: Objectives, Scope, and Methodology

This report examines (1) the status of the National Telecommunications and Information Administration's (NTIA) and selected agencies' efforts to modernize their spectrum-related IT and (2) the extent to which NTIA's IT modernization project planning aligns with selected leading practices for effective IT modernization and project management.¹

To describe the status of NTIA's and selected agencies' efforts to modernize their spectrum-related IT, we reviewed NTIA's and covered agencies' initial plans to modernize their spectrum-related IT.² We used a data collection instrument to obtain covered agencies' responses to uniform questions, including whether agencies had their own IT to modernize (as opposed to those that rely exclusively on NTIA-provided IT).³ We reviewed additional relevant documentation from NTIA and four selected covered agencies that had their own IT to modernize—the Department of Defense (DOD), the Federal Aviation Administration (FAA), the National Aeronautics and Space Administration (NASA), and

¹For the purposes of this report, the term "agency" refers to either a federal agency or an agency's component, as consistent with the list of "covered agencies" for section 9203 of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (FY21 NDAA). See Pub. L. No. 116-283, § 9203(e)(1), 134 Stat. 3388, 4797 (2021).

²The FY21 NDAA required NTIA to develop and submit to Congress a plan to modernize its IT to more efficiently manage spectrum. § 9203(b), 134 Stat. at 4794. It also required other covered agencies, defined as the Department of Defense (DOD) and other federal entities designated by NTIA, to develop and submit to NTIA plans to modernize their own IT to ensure it is interoperable with NTIA's modernized IT. For the purpose of this report, we refer to these issued plans as "initial" plans because they generally described high-level topics that would be important for agencies to consider for their modernization planning activities. This review focuses on agency planning efforts after the issuance of these initial plans.

³NTIA designated the agencies that are part of the Interdepartment Radio Advisory Committee (IRAC) as the other covered agencies required to issue modernization plans. The IRAC consists of NTIA and the following 17 entities: Departments of Agriculture, Commerce, Defense (including the Air Force, Army, and Navy), Energy, Homeland Security, Interior, Justice, State, Transportation, Treasury, and Veterans Affairs, as well as the Federal Aviation Administration, National Aeronautics and Space Administration, National Science Foundation, U.S. Agency for Global Media, U.S. Coast Guard, and U.S. Postal Service. NTIA also designated the Federal Communications Commission, a liaison to the IRAC, as a covered agency. For the purpose of this report, we count DOD, Department of the Air Force (including Space Force), Department of the Army, and Department of the Navy (including Marine Corps) as one entity.

the National Science Foundation (NSF)—to identify progress made to date on their modernization efforts. For example, we reviewed various NTIA documents including its budget justification for the IT modernization project, a draft concept of operations document, and a contract order placed with MITRE to support acquisition planning activities. In addition, we reviewed the draft version of the Institute of Defense Analyses study provided to DOD on ways to improve its spectrum management IT and documents related to NSF’s supplemental award to fund its modernization project. To supplement this information, we also reviewed prior GAO reports to identify information on the legacy IT systems that NTIA and the selected agencies use to manage spectrum.⁴ We also interviewed officials from NTIA, DOD, FAA, NASA, and NSF to further understand the status of their modernization efforts.

To assess the extent to which NTIA’s IT modernization project planning aligned with selected leading practices for effective IT modernization and project management, we assessed NTIA’s project planning efforts after the issuance of its initial plan against selected leading practices for effective IT modernization and project management. We selected leading practices that we identified from various government and industry sources and that we have used in our prior work. These sources included our prior work on agency reforms and IT modernizations.⁵ The sources also included our best practices for cost estimating, schedule assessment, and Agile project management.⁶ We selected leading practices to reflect basic project planning and management principles relevant to the timing and

⁴See, for example, GAO, *Spectrum Management: Information Technologies for Managing Federal Use*, [GAO-22-105221](#) (Washington, D.C.: Feb. 17, 2022).

⁵GAO, *Information Technology: IRS Needs to Complete Modernization Plans and Fully Address Cloud Computing Requirements*, [GAO-23-104719](#) (Washington, D.C.: Jan. 12, 2023); *Government Reorganization: Key Questions to Assess Agency Reform Efforts*, [GAO-18-427](#) (Washington, D.C.: June 13, 2018); and *Information Technology: Critical Factors Underlying Successful Major Acquisitions*, [GAO-12-7](#) (Washington, D.C.: Oct. 21, 2011).

⁶GAO, *Agile Assessment Guide: Best Practices for Agile Adoption and Implementation*, [GAO-24-105506](#) (Washington, D.C.: November 2023); *Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Program Costs*, [GAO-20-195G](#) (Washington, D.C.: March 2020); and *Schedule Assessment Guide: Best Practices for Project Schedules*, [GAO-16-89G](#) (Washington, D.C.: December 2015).

progress of NTIA's IT modernization project.⁷ The following leading practices were selected: designate leadership and establish an implementation team; secure a funding source; establish outcome-oriented goals; establish processes for adapting plans and reporting progress to management; develop cost-estimates; develop a project plan and timelines; involve and communicate with external stakeholders in appropriate time intervals; and establish performance measures.

In performing our assessment, we assessed NTIA's project planning efforts as aligned or not aligned based on documentation NTIA provided for each leading practice. An effort is aligned if the underlying activities generally reflected all or almost all of the key elements in the leading practice. An effort is not aligned if the underlying activities did not generally reflect all or almost all of the key elements in the leading practice or if the underlying activities were not fully completed. We shared our preliminary results with NTIA officials. Officials subsequently provided additional documentation and clarification. When warranted, we updated our analyses based on NTIA responses and the additional information provided.

We also reviewed relevant documents NTIA distributed to covered agencies through the IRAC and its Spectrum Policy and Plans Steering Group—which consists of representatives from agencies that provide advice to NTIA on spectrum policies—to understand how NTIA coordinated with agencies on its modernization project. For example, we reviewed briefing slides presented to agencies as well as agendas and meeting summaries. In addition, we interviewed officials from NTIA, DOD, FAA, NASA, and NSF for additional context and perspectives on NTIA's modernization efforts.

We conducted this performance audit from February 2023 to March 2024 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that

⁷We searched and cataloged relevant sources for appropriate criteria in the form of best practices, key elements, and leading principles. We then narrowed these sources down by assessing the criteria sets against multiple assessment measures, including reliability, measurability, and relevance. Of the criteria sets remaining, we further reviewed the practices and selected those that were applicable to the scope of the engagement. Additionally, the Project Management Institute, Inc., a not-for profit organization, has established standards for project management that reflected the practices that we selected as criteria. See Project Management Institute, Inc., *A Guide to the Project Management Body of Knowledge* (PMBOK® Guide)—Seventh Edition (Newtown Square, PA: 2021). PMBOK is a trademark of Project Management Institute, Inc.

**Appendix I: Objectives, Scope, and
Methodology**

the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Information Technology Systems Planned for Modernization by Selected Agencies

The Department of Defense (DOD), Federal Aviation Administration (FAA),¹ and National Aeronautics and Space Administration (NASA) identified the following spectrum-related IT systems as under consideration for modernization efforts (see table 3).

Table 3: Spectrum-Related IT Systems Considered for Modernization by the Department of Defense (DOD), Federal Aviation Administration (FAA), and National Aeronautics and Space Administration (NASA)

Agency	IT System	Description
DOD ^a	Electromagnetic Spectrum Enterprise Architecture (EMSEA)	A multi-tiered enterprise architecture that allows DOD to align spectrum capabilities and activities used at the strategic level with different architectures, activities, and spectrum data used by the DOD components and military services at the operational and tactical levels. DOD plans to consolidate spectrum data activities across the Department, components, and military services into one Department-wide enterprise architecture.
DOD ^a	Global Electromagnetic Spectrum Information System (GEMSIS)	DOD's joint program of record ^b that provides the following spectrum services and capabilities: the Integrated Spectrum Desktop, End-To-End Supportability System, Joint Spectrum Data Repository, and Spectrum XXI.
DOD ^a	End-To-End Supportability System (E2ESS)	A web-based application and database used for collecting data related to spectrum-dependent equipment. The database supports DOD spectrum equipment certification processes, such as creating, validating, processing, and approving spectrum certification requests and for coordinating the use of spectrum with host nations.
DOD ^a	Joint Spectrum Data Repository (JSDR)	A data-collection system that provides users access to spectrum frequency assignments, spectrum certifications, interference reports, and detailed engineering characteristics, and equipment information. The system provides business analysis tools to allow users to compare, quantify, and analyze data from several sources.

¹FAA is a component within the Department of Transportation. Because FAA was designated as a covered agency regarding modernization plans required by section 9203 of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, we refer to FAA as an agency in this report.

**Appendix II: Information Technology Systems
Planned for Modernization by Selected
Agencies**

Agency	IT System	Description
DOD ^a	Spectrum XXI (SXXI)	A software system that is used across DOD for operational planning and management of the radio frequency spectrum, including conducting spectrum management analysis, fielding requests and assigning frequencies, and performing engineering tasks. Federal agencies use this system for submitting frequency assignment requests to the National Telecommunications and Information Administration (NTIA).
DOD ^a	Joint Spectrum Interference Resolution Online (JSIRO)	A classified web-based database that enables the reporting of electromagnetic interference events. Users may use the system to submit interference reports, conduct searches in the database for interference events or related reports, and confirm the status of updates logged regarding interference events.
DOD ^a	Modeling and Simulation Software	A set of software tools to assess waveform performance and to complete spectrum cohabitation and coexistence analyses and studies. Specifically, the tools include commercially available software such as Visualyse, RFarchitect, and Terrain-Integrated Rough-Earth Model.
DOD ^a	Electromagnetic Battle Management (EMBM) Tool	A tool, in the early stages of development, that is planned for dynamic monitoring, assessing, planning, and directing spectrum operations to support combatant commands. The tool is designed to use data sources to provide situational awareness, support decisions, enable command and control, and interface with other command and control systems and networks.
DOD ^a	Joint EMS Information Analysis and Fusion (JEMSIAF)	A system used to create analytic products that support Combatant Command spectrum efforts. DOD uses this system to aggregate spectrum-related data from multiple sources and spectrum dependent systems to produce analytic products and incorporate the aggregated data into the suite of tools for electromagnetic battle management.
FAA	Web Automated Frequency Manager (WebAFM)	A web-based application developed by the FAA as the main platform for spectrum management. It includes engineering models to perform analysis to protect air-to-ground communication and navigational aids frequencies. It can also be used to conduct interference analysis of pending or proposed frequency assignments. It contains a copy of data from the Government Master File, NTIA's record of all federal frequency assignments, and is the interface FAA uses to vote on NTIA's spectrum agendas and for daily exchanges with NTIA.
FAA	Internet Radio Coverage Analysis System (iRCAS)	An FAA propagation tool for air-to-ground communication and navigational aids frequency coverage analysis.
NASA	NASA Electronic Radio Data Base System (NERDS)	A spectrum IT environment that contains NASA's core spectrum management capabilities. A comprehensive collection of databases; document repository; interfaces for data entry; reporting capabilities to support NTIA, Interdepartment Radio Advisory Committee, and International Telecommunications Union processes; and assisting NASA Center spectrum managers.

Source: GAO analysis of documentation from DOD, FAA, and NASA. | GAO-24-106634

^aAccording to DOD officials, DOD is currently reviewing an update to a policy that would standardize all electromagnetic spectrum related data used across the Department. Spectrum-related data are used for various purposes including spectrum management and certification, geo-location information, electromagnetic warfare, electromagnetic battle management, host nation coordination, and regulatory purposes.

^bDOD defines a program of record as an acquisition program that is currently funded or has successfully achieved formal program initiation.

Appendix III: Comments from the U.S. Department of Commerce

**Appendix III: Comments from the U.S.
Department of Commerce**



UNITED STATES DEPARTMENT OF COMMERCE
Office of the Chief Financial Officer and
Assistant Secretary for Administration
Washington, D.C. 20230

February 29, 2024

Mr. Andrew Von Ah
Director, Physical Infrastructure Issues
U.S. Government Accountability Office
441 G Street NW
Washington, DC 20548

Dear Mr. Von Ah:

Thank you for the opportunity to respond to the GAO draft report entitled GAO-24-106634, *Spectrum IT Modernization: Incorporating Leading Practices Could Improve Planning Effort*. The U.S. Department of Commerce (Department) appreciates the work that GAO has done to evaluate the spectrum IT modernization effort and how the National Telecommunications and Information Administration (NTIA) is establishing a spectrum IT modernization program in accordance with recommended practices.

GAO made four recommendations in this report. The NTIA response that addresses the specific GAO recommendations is enclosed. NTIA notes that the GAO biennial evaluation of the spectrum IT modernization effort in November 2023, came during the planning phase and thus not all steps in the planning phase had been completed. Consequently, actions to address GAO recommendations 1 and 3 pertaining to a cost estimate and a stakeholder management plan have now largely been completed. The Department and NTIA agree with the GAO about the importance of establishing an integrated master schedule and performance measures governing the spectrum IT modernization program. The Department and NTIA agree with the GAO recommendations and are taking appropriate steps to implement them.

If you have any questions, please contact MaryAnn Mausser, Department GAO Audit Liaison, at (202) 482-8120 or mmausser@doc.gov.

Sincerely,

JEREMY PELTER Digitally signed by JEREMY
PELTER
Date: 2024.02.29 16:41:46 -05'00'

Jeremy Pelter

Deputy Assistant Secretary for
Administration, performing the non-
exclusive functions and duties of the Chief
Financial Officer and Assistant Secretary of
Commerce for Administration

Enclosure: NTIA Response to Recommendations

**RESPONSE OF THE NATIONAL
TELECOMMUNICATIONS AND
INFORMATION
ADMINISTRATION TO RECOMMENDATIONS**

GAO REPORT 24-106634

Recommendation 1. The Office of Spectrum Management should develop a high-quality reliable cost estimate that aligns with cost estimating best practices as defined in GOA's *Cost Guide* and *Agile Guide* for the IT modernization project.

Response:

NTIA agrees with this recommendation and is near completion on a cost estimate in accordance with GAO best practices due for delivery in February 2024. Unfortunately, due to the timing of GOA's biennial review in November 2023 while planning work for the IT Modernization was underway, the cost estimate was not complete at that time for review.

Recommendation 2. The Office of Spectrum Management should develop a reliable integrated master schedule that aligns with scheduling best practices as defined in GAO's *Schedule Assessment Guide* and *Agile Guide* for the IT modernization project.

Response:

NTIA agrees with this recommendation. NTIA is planning to award a contract for the IT Modernization in FY24 and is planning to establish a detailed integrated master schedule that conforms to GAO best practices. NTIA does maintain a schedule for its planning activities and an overall plan for the modernization, however the detailed integrated master schedule will be established under the to be awarded contract.

Recommendation 3. The Office of Spectrum Management should finalize its stakeholder management plan. The plan should document a regular meeting schedule for the IT modernization project to ensure covered agencies have the ability to request information and communicate on NTIA's IT modernization project.

Response:

NTIA agrees with this recommendation and completed a stakeholder management plan. Unfortunately, due to the timing of GOA's biennial review in November 2023, while planning work was underway, the stakeholder management plan was not complete at that time for review.

Recommendation 4. The Office of Spectrum Management should develop performance measures for the IT modernization project that clearly link the projects established goals and have specified targets and timeframes.

Response:

NTIA agrees with this recommendation. NTIA has begun work to establish overall metrics for the IT Modernization that links the projects established goals with specified targets and timeframes.

Accessible Text for Appendix III: Comments from the U.S. Department of Commerce

February 29, 2024

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Director, Physical Infrastructure Issues
U.S. Government Accountability Office
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Washington, DC 20548

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Date: 2024.02.29 16:41:46 -05'00'

Jeremy Pelter

Deputy Assistant Secretary for Administration, performing the non-exclusive functions and duties of the Chief Financial Officer and Assistant Secretary of Commerce for Administration

Enclosure: NTIA Response to Recommendations

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TELECOMMUNICATIONS AND
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ADMINISTRATION TO RECOMMENDATIONS**

GAO REPORT 24-106634

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Appendix IV: GAO Contact and Staff Acknowledgements

GAO Contact

Andrew Von Ah, (202) 512-2834 or vonaha@gao.gov

Staff Acknowledgments

In addition to the individual named above, the following staff made key contributions to this report: Nalylee Padilla (Assistant Director), Michael Sweet (Analyst-in-Charge), Patricia Palao Da Costa, and Joshua Parr. Also contributing to this report were Thomas E. Baril Jr., Saar Dagani, Melanie Diemel, Rich Hung, Jennifer Leotta, Benjamin Licht, Sally Moino, Amy Rosewarne, Michael Soressi, Andrew Stavisky, Alicia Wilson, and Tatiana Winger.

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