



January 2022

SPECTRUM MANAGEMENT NTIA Should Improve Spectrum Reallocation Planning and Assess Its Workforce

Accessible Version

GAO Highlight

Highlights of [GAO-22-104537](#), a report to the Committee on Energy and Commerce, House of Representatives

Why GAO Did This Study

Almost all spectrum has been allocated for the federal government, commercial sector, or other nonfederal use. However, the demand for spectrum continues to grow, especially from the commercial sector as it seeks to deploy and improve 5G mobile service. NTIA is responsible for managing the federal government's spectrum use and plays a key role alongside the Federal Communications Commission (FCC) and other federal agencies in helping to reallocate federal spectrum for commercial use.

GAO was asked to review NTIA's spectrum management activities. This report examines, among other objectives, the extent to which NTIA (1) has developed a planning process for spectrum reallocations and (2) identified and assessed the competencies needed to manage federal spectrum's use. GAO reviewed relevant NTIA documentation and compared it with applicable leading practices. GAO interviewed officials from NTIA and other agencies, representing a variety of non-generalizable viewpoints.

What GAO Recommends

GAO is making three recommendations, including that NTIA should develop plans for executing spectrum reallocations and assess its workforce for competency gaps in key spectrum management occupations. The Department of Commerce concurred with the recommendations.

View [GAO-22-104537](#). For more information, contact Andrew Von Ah at (202) 512-2834 or vonaha@gao.gov.

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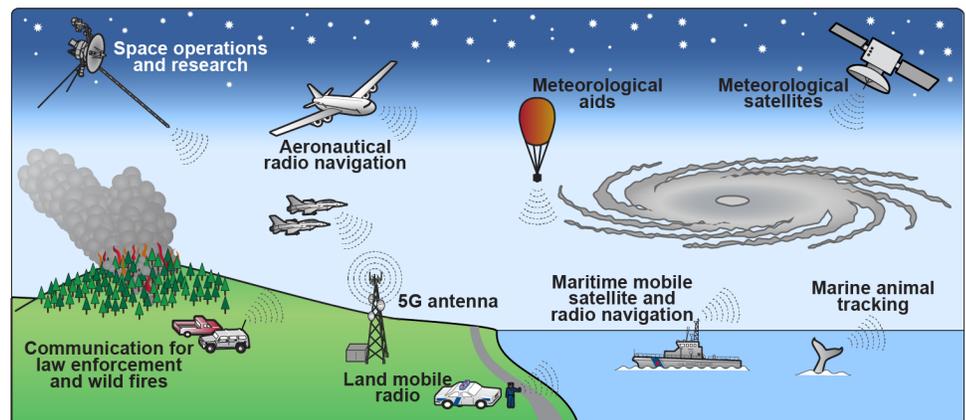
SPECTRUM MANAGEMENT

NTIA Should Improve Spectrum Reallocation Planning and Assess Its Workforce

What GAO Found

Spectrum is a finite natural resource that enables wireless communications and critical government operations, such as those shown in the figure below. Within the Department of Commerce, the National Telecommunications and Information Administration (NTIA) works with other agencies to execute spectrum reallocations, which involve making spectrum used by the federal government available to nonfederal users. However, GAO found NTIA lacks a formalized planning process for these reallocations, even though they can be complex, often lengthy undertakings involving many stakeholders and steps. For reallocations, NTIA typically collects input from those agencies whose use of spectrum would be affected by a proposed reallocation. NTIA may also help agencies conduct technical evaluations of a reallocation's potential effects on the agencies' spectrum-dependent operations. While NTIA follows some usual steps in conducting reallocations, GAO found that NTIA lacks plans with objectives and targets, integrated master schedules, and risk assessments. By following leading practices in program management, NTIA may be able to more effectively implement reallocations by considering necessary steps, risks, and the likely timeframes involved.

Examples of Federal and Nonfederal Spectrum Uses



Source: GAO analysis of National Telecommunications and Information Administration information. | GAO-22-104537

NTIA has identified the competencies needed to manage federal spectrum's use, but it has not fully assessed its workforce for competency gaps. NTIA relies on a highly skilled and specialized workforce to undertake its spectrum management responsibilities and especially relies on electronic engineers and telecommunications specialists. NTIA officials told GAO that NTIA annually assesses whether there are competency gaps for individual positions. However, NTIA does not aggregate individual-level competency assessments to determine whether gaps exist on an organization level, as called for by leading practices. By assessing organization-level gaps in critical competencies on a recurring basis and then addressing them through hiring, training, or other strategies, NTIA could better ensure its spectrum management workforce is capable of successfully achieving NTIA's mission.

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Abbreviations

| | |
|----------|---|
| CBRS | Citizens Broadband Radio Service |
| CSMAC | Commerce Spectrum Management Advisory Committee |
| DOD | Department of Defense |
| FCC | Federal Communications Commission |
| GMF | Government Master File |
| GPS | Global Positioning System |
| IMS | integrated master schedule |
| IRAC | Interdepartment Radio Advisory Committee |
| ITS | Institute for Telecommunication Sciences |
| MHz | megahertz |
| MOU | memorandum of understanding |
| NTIA | National Telecommunications and Information Administration |
| OMB | Office of Management and Budget |
| OSM | Office of Spectrum Management |
| PMI | Project Management Institute |
| PPSG | Policy and Plans Steering Group |
| Redbook | Manual of Regulations and Procedures for Federal Radio Frequency Management |
| spectrum | radio-frequency spectrum |

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January 27, 2022

The Honorable Frank Pallone, Jr.
Chairman
The Honorable Cathy McMorris Rodgers
Republican Leader
Committee on Energy and Commerce
House of Representatives

Radio-frequency spectrum (spectrum)¹ is a scarce natural resource that provides a wide array of services critical to the U.S. economy and a variety of government functions, including mobile telecommunications, broadband, the Global Positioning System (GPS)² and radar, among other uses. The use of spectrum is also growing exponentially, with some experts forecasting that between 25 to 50 billion devices will be competing for spectrum by 2025. With most usable spectrum already allocated for use,³ increasing demand for spectrum cannot be met without proper management and planning.

Within the U.S., the National Telecommunications and Information Administration (NTIA) regulates and manages spectrum use for federal government users, such as the Department of Defense and the Federal Aviation Administration. In managing federal spectrum use, NTIA must work with the Federal Communications Commission (FCC), which regulates and manages spectrum for nonfederal uses,⁴ such as wireless service provided over commercial mobile networks and state and local government uses.

¹The radio-frequency spectrum is the part of the natural spectrum of electromagnetic radiation lying between the frequency limits of 3 kilohertz (kHz) and 300 gigahertz (GHz).

²GPS is a satellite-based system that transmits positioning, navigation, and timing data to receivers used by military personnel, among others.

³Spectrum is allocated, or designated, for federal, nonfederal, or shared use.

⁴In this report, spectrum use for federal government users means that the spectrum is used by "radio stations or classes of radio stations belonging to and operated by the United States." 47 U.S.C. § 902(b)(2)(A). It does not include spectrum-based services provided to federal government users by stations owned and operated by other entities.

To manage federal spectrum use, NTIA undertakes a number of key activities including assigning spectrum to federal users⁵ and assessing the suitability of spectrum to be reallocated, especially from federal to nonfederal users.⁶ For example, in responding to statutory directives, NTIA has efforts under way to help reallocate spectrum from the federal government to the private sector and other nonfederal users to support building the nation's mobile networks, including 5G.⁷ NTIA is required by statute to ensure that the executive branch's views on telecommunications matters are effectively presented to FCC, such as when FCC considers repurposing spectrum that could affect federal spectrum users.⁸ Recently, however, some members of Congress raised concerns that some agencies have presented their views directly to FCC in public proceedings instead of presenting their views to FCC through NTIA, which is the typical process.

You asked us to review NTIA's management of federal spectrum use. For this report, we focused on NTIA's key spectrum management activities

⁵Assigning spectrum involves providing federal agencies with an authorization to use specific frequencies.

⁶Given that most spectrum is already allocated for federal, nonfederal, or shared use, in this report we refer to reallocations as the process by which bands of allocated frequencies are redesignated for new types of users.

⁷Enacted as part of the Consolidated Appropriations Act, 2021, the Beat China by Harnessing Important, National Airwaves for 5G Act of 2020 (Beat CHINA Act for 5G Act of 2020), requires NTIA to begin the process of withdrawing or modifying the assignments to the federal government of spectrum between the frequencies of 3450 megahertz and 3550 megahertz, Pub. L. No. 116-260, div. FF, tit. IX, § 905, 134 Stat. 1182, 3215. See *also*, Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, § 6401, 126 Stat. 156, 222-23 (codified at 47 U.S.C. § 1451) (directing NTIA to withdraw or modify 15 megahertz of federally assigned spectrum between 1675 megahertz and 1710 megahertz).

⁸47 U.S.C. § 902(b)(2)(J). Separately from reallocations, FCC has taken actions to expand the list of purposes some spectrum bands may be used for. For example, FCC repurposed spectrum in the "L-band," which refers to spectrum in the 1 to 2 GHz band, by including mobile telephony in addition to satellite transmissions among the uses acceptable in that band.

and its ability to ensure it has skilled staff to carry out these activities.⁹ Specifically, this report examines:

- the data NTIA collects and uses to assign spectrum to federal agencies to ensure the spectrum’s effective and efficient use;
- the extent to which NTIA has developed a planning process to guide its spectrum reallocation efforts;
- selected federal agencies’ perspectives on how NTIA presents executive branch agency views on spectrum matters to FCC and the extent to which NTIA has documented its process for collecting and considering agencies’ views; and
- the extent to which NTIA has identified the necessary competencies needed to manage federal spectrum use, and whether it has assessed its workforce for any gaps in those competencies.

We also present information on NTIA’s spectrum-related legal authorities (see app. I).

To address all objectives, we reviewed our relevant prior work on spectrum use and NTIA’s management of spectrum.¹⁰ In addition, we reviewed NTIA documentation, including NTIA’s *Manual of Regulations and Procedures for Federal Radio Frequency Management* (commonly referred to as the Redbook),¹¹ and interviewed NTIA officials. To obtain selected agencies’ perspectives on NTIA’s key spectrum management activities, including spectrum assignment and presenting executive

⁹We have identified strategic human capital management as a high-risk area for federal agencies, particularly because gaps in competencies—the skills, knowledge, and abilities employees need to successfully perform their work—can impede the government’s ability to serve the public and achieve results. See, GAO, *Aviation Safety: FAA’s Office of Aviation Safety Should Take Additional Actions to Ensure Its Workforce Has Needed Skills*, [GAO-21-94](#) (Washington, D.C.: Nov. 9, 2020)

¹⁰GAO, *Spectrum Management: Agencies Should Strengthen Collaborative Mechanisms and Processes to Address Potential Interference*, [GAO-21-474](#) (Washington, D.C.: June 29, 2021); *Spectrum Management: Federal Government’s Use of Spectrum and Preliminary Information on Spectrum Sharing*, [GAO-12-1018T](#) (Washington, D.C.: Sept. 13, 2012); and *Spectrum Management: NTIA Planning and Processes Need Strengthening to Promote the Efficient Use of Spectrum by Federal Agencies*, [GAO-11-352](#) (Washington, D.C.: April 12, 2011).

¹¹NTIA, *Manual of Regulations and Procedures for Federal Radio Frequency Management* (September 2017 rev.); see also, 47 C.F.R. § 300.1 (incorporating by reference NTIA’s Redbook into regulation).

branch views to FCC, we selected six federal agencies that use spectrum as case studies.¹² We selected agencies with a variety of missions; for ways they use spectrum (e.g., agencies that use spectrum for radar, communication, or GPS); and for agencies' sizes.

To determine the kinds of information NTIA needs to assign spectrum to federal agencies, we reviewed documents related to data NTIA collects and uses to make spectrum assignment decisions, and reviewed information on NTIA's efforts to collect additional data from federal agencies. We also reviewed documentation related to "Spectrum XXI," the spectrum management software most often used by federal agencies. In addition, we interviewed NTIA officials regarding the data they collect for making data-driven assignment decisions.

To examine the extent to which NTIA has developed a planning process to guide its reallocation efforts, we compared NTIA's spectrum-reallocation-planning documents and policies to leading practices for program management we previously developed based on the Project Management Institute's (PMI)¹³ *The Standard for Program Management*, Fourth Edition,¹⁴ with additional input from PMI representatives.¹⁵ From the set of nine leading practices we identified in prior work, we selected three leading practices related to developing a plan, developing a schedule, and conducting risk management given their relevance to planning, which is a part of reallocation efforts NTIA has been involved with. NTIA's reallocation work may be described as a program because it is a key means by which NTIA ensures the best possible and most efficient use of the nation's spectrum, and because individual

¹²We selected the following agencies to interview: Federal Aviation Administration; Departments of Energy, Navy, Transportation, and the Treasury; and the U.S. Agency for Global Media.

¹³PMI is a not-for-profit organization that has established standards for program and project management that are generally recognized as leading practices for most programs and projects. These standards are used worldwide and provide guidance on how to manage various aspects of projects, programs, and portfolios.

¹⁴*The Standard for Program Management*®, Fourth Edition (Newtown Square, PA: 2018).

¹⁵GAO, *Nuclear Waste Cleanup: DOE Could Improve Program and Project Management by Better Classifying Work and Following Leading Practices*, [GAO-19-223](#) (Washington, D.C.: Feb. 19, 2019). GAO identified relevant program management leading practices and shared these selected leading practices with PMI representatives and incorporated their feedback.

reallocations are projects that contribute toward attaining that goal.¹⁶ We reviewed NTIA documentation, including the Redbook and other relevant documents. In addition, we examined NTIA's planning for and documentation related to the Citizen's Broadband Radio Service (CBRS) reallocation,¹⁷ which NTIA officials told us was indicative of the usual steps they take for reallocations.

To obtain agencies' perspectives on how NTIA presents executive branch views on spectrum matters to FCC and the extent to which NTIA has documented its process for doing so, we interviewed select federal agency officials, as described above. In addition, we reviewed NTIA policies and documentation and evaluated them against *Standards for Internal Control in the Federal Government*,¹⁸ which states that management should develop and maintain documentation of procedures and externally communicate quality information. We also reviewed instances in which federal agencies shared their spectrum-related views on FCC proceedings directly with FCC and interviewed officials from three of these agencies¹⁹ to determine why this occurred. We also obtained information from FCC on this issue; and reviewed our prior work to understand challenges NTIA faces working with FCC and how those challenges might affect NTIA's presentation of executive branch views to FCC.²⁰

To evaluate the extent to which NTIA has identified the necessary skills to manage federal spectrum use and assess its workforce for competency gaps, we compared NTIA's workforce planning—as described in documentation and interviews—to components of our strategic workforce

¹⁶While NTIA does not explicitly refer to spectrum reallocation as a program, its overall reallocation work aligns with elements of PMI's definition of a program. Additionally, the term "program" as used in generally accepted government auditing standards includes processes, projects, studies, policies, operations, activities, entities, and functions.

¹⁷NTIA's spectrum reallocation over the past 20 years has included numerous individual reallocations, for example, Citizen's Broadband Radio Service (CBRS), which reallocated spectrum in the 3.5 GHz band and can be considered as a project.

¹⁸GAO, *Standards for Internal Control in the Federal Government*, [GAO-14-704G](#) (Washington, D.C.: Sept. 10, 2014).

¹⁹These agencies are Department of Defense, Department of Energy, and Department of Education.

²⁰GAO, *Spectrum Management: Agencies Should Strengthen Collaborative Mechanisms and Processes to Address Potential Interference*, [GAO-21-474](#) (Washington, D.C.: June 29, 2021).

planning criteria.²¹ We selected two of five leading workforce-planning practices because they are focused on identifying and assessing skill needs. These practices are (1) identifying the competencies an agency needs to carry out its mission and assessing for gaps in these competencies, and (2) developing strategies tailored to address these gaps. We then reviewed NTIA documentation, such as staffing data describing the number of employees in each position within the Office of Spectrum Management, and interviewed NTIA officials to understand which occupations are primarily responsible for undertaking spectrum management operations. We focused our analysis on the electronics engineer and telecommunication specialist positions because they were identified by NTIA officials as key positions involved in spectrum management and they comprise over 74 percent of the Office of Spectrum Management's workforce.

To develop appendix I, we reviewed applicable statutory provisions from the National Telecommunications and Information Administration Organization Act, as amended, 47 U.S.C. chapter 8. From these provisions, we identified those that are relevant to NTIA's spectrum management activities that are the focus of the objectives in this report—specifically spectrum use, assignment, and reallocation.

We conducted this performance audit from September 2020 to January 2022 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Overview of NTIA's Spectrum Management Organizational Structure

NTIA's legal authorities for managing the federal use of spectrum include the authority to establish policies concerning spectrum assignments and

²¹GAO, *Human Capital: Key Principles for Effective Strategic Workforce Planning*, [GAO-04-39](#) (Washington, D.C.: Dec. 11, 2003).

to promote the best possible and most efficient use of spectrum.²² Within NTIA, the Office of Spectrum Management (OSM) is the primary office responsible for acting on these responsibilities. OSM has about 80 employees, with the majority of them telecommunication specialists or electronics engineers. Also within NTIA, the Institute for Telecommunication Sciences (ITS) conducts studies of spectrum use, efficiency, and interference analysis. NTIA's Office of Policy Coordination and Management is responsible for workforce planning across the administration, including OSM. For assistance with its key spectrum management responsibilities, NTIA relies on the advice and input of several external committees and stakeholder groups, including:

- **The Interdepartment Radio Advisory Committee (IRAC).** NTIA chairs IRAC, which is composed of representatives from 19 federal agencies.²³ Specifically, IRAC is an advisory committee to NTIA's Assistant Secretary for Communications and Information. IRAC includes a variety of subcommittees that have specialized functions, such as assisting NTIA in assigning frequencies and in developing policies, procedures, and technical criteria for managing the federal use of spectrum. IRAC's bylaws are incorporated into NTIA's Redbook. FCC is not an IRAC member, but its staff are active in a liaison role.
- **The Policy and Plans Steering Group (PPSG).** This group consists of agencies' assistant secretaries (or the equivalent-level positions), and, along with its Spectrum Working Group, provides advice to NTIA on spectrum policies.
- **The Commerce Spectrum Management Advisory Committee (CSMAC).** This committee comprises representatives from outside the federal government who provide advice and recommendations on spectrum management issues.

²²See appendix I for more information on NTIA's spectrum-related legal authorities.

²³See 47 U.S.C. § 904(b). The members of IRAC are: Department of Agriculture, Air Force, Army, Coast Guard, Department of Commerce, Department of Energy, Federal Aviation Administration, Department of Homeland Security, Department of the Interior, Department of Justice, National Aeronautics and Space Administration, Navy, National Science Foundation, Department of State, Department of Transportation, Department of the Treasury, United States Agency for Global Media, United States Postal Service, and Department of Veterans Affairs. For the purposes of this report, we refer to these as "agencies."

Spectrum Assignment

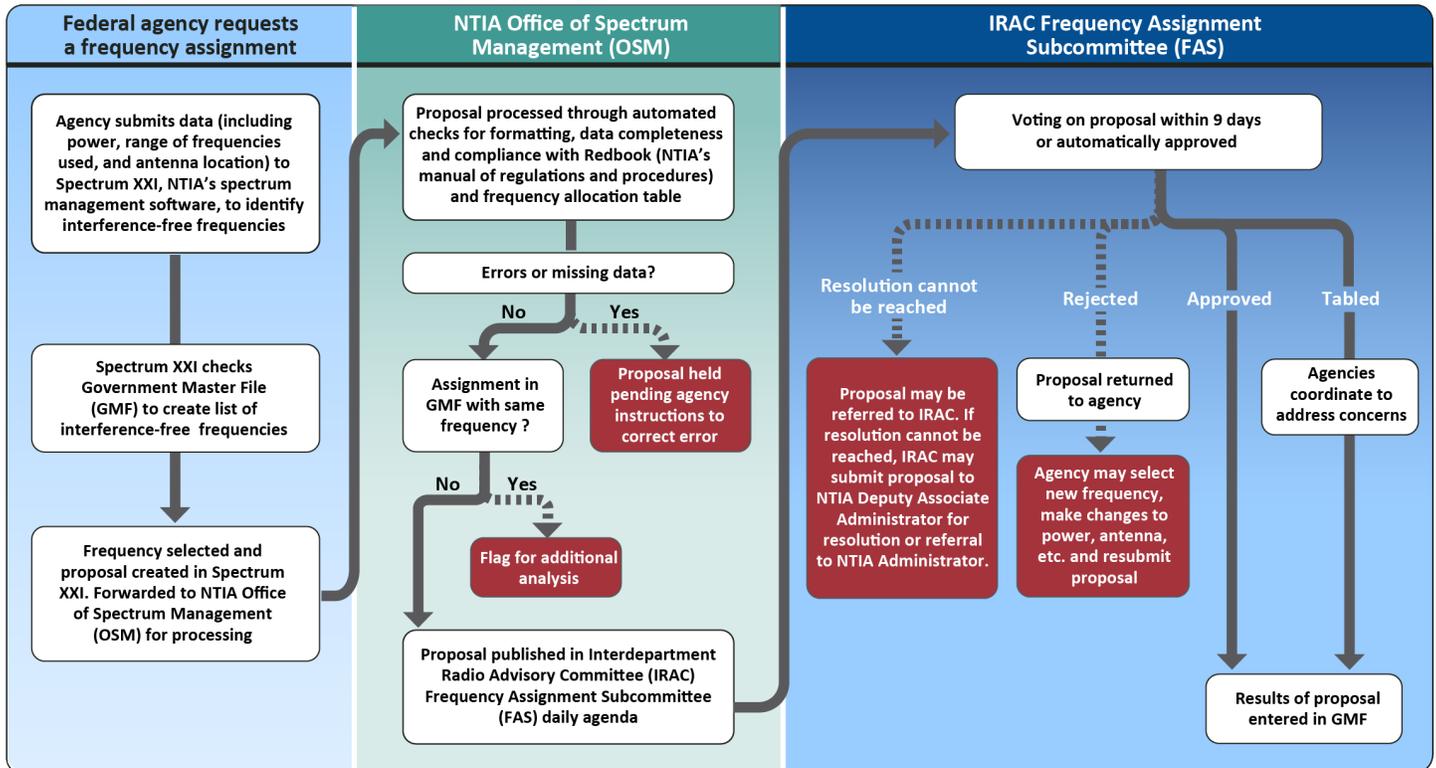
One of NTIA's key spectrum management activities is assigning spectrum to federal users, a process that involves providing federal agencies with an authorization to use frequencies from spectrum that typically is already allocated for federal use. Spectrum assignment helps avoid harmful interference, which may 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.²⁴ In doing so, NTIA processes new assignment requests, modifications to existing assignments, and renewals of existing assignments.²⁵ NTIA collects information from agencies about their spectrum assignment requests using various software tools, of which Spectrum XXI is the most commonly used.

Once an agency submits a spectrum assignment request through Spectrum XXI, it is electronically checked for errors, processed automatically, and recorded in a government-wide file, called the Government Master File, after a 9-day processing period. During that period, IRAC members have the opportunity to review all proposed spectrum assignments. If there are no objections, frequencies are then automatically assigned to the requesting agency. In some cases, proposed assignments may be flagged by an IRAC member due to concerns the assignment request may cause interference with the member's spectrum use. When this concern occurs, the relevant IRAC parties informally meet to find a mutually agreeable way to meet frequency assignment requirements. In cases where a compromise cannot be reached, the associate administrator of OSM will make a final determination. The assignment process is illustrated in figure 1.

²⁴Frequencies are properties of electromagnetic waves that describe how many wave patterns or cycles pass by in a period of time. Frequency is often measured in Hertz (Hz), where a wave with a frequency of 1 Hz will pass by at 1 cycle per second. The spectrum itself comprises frequencies.

²⁵NTIA requires federal agencies to conduct 5- or 10-year reviews of their assignments to ensure that assigned spectrum data are still accurate. In some cases, such as certain space systems and aeronautical assignments, NTIA requires that agencies review the assignment every 10 years.

Figure 1: NTIA’s Frequency Assignment Process



Source: GAO analysis of National Telecommunications and Information Administration (NTIA) information. | GAO-22-104537

Spectrum Reallocation

Another key spectrum management activity for NTIA is examining the suitability of spectrum bands to be reallocated from federal to nonfederal use. As mentioned, reallocation is the process by which one or more frequency bands—which are specific ranges of frequencies—are redesignated for new types of users.²⁶ NTIA’s reallocation efforts are

²⁶The three types of users are federal-only, nonfederal, and mixed federal and nonfederal use.

generally the result of either legislation or presidential mandate.²⁷ NTIA may be required to:

- identify a band for study for possible reallocation;
- conduct a detailed feasibility study;
- make a reallocation decision;
- provide input on behalf of the Executive Branch to FCC on reallocations; and
- report on and take actions to ensure the timely implementation of a reallocation.

Since almost all spectrum is currently allocated, NTIA works in coordination with FCC and affected agencies to examine the potential impact of a proposed reallocation on federal use. For example, NTIA is statutorily mandated to meet with FCC twice a year to, among other things, jointly plan future federal and nonfederal spectrum needs and the reallocations necessary to meet them.²⁸ The reallocation process may require that existing users in or adjacent to bands that are being reallocated either end or modify their spectrum use, move their affected services to other bands, or accommodate ongoing sharing through coordination with other users.²⁹ Reallocations are more complex and take longer than assignments but occur less frequently. In December 2020, NTIA reported it was studying additional mid-band spectrum³⁰ for potential reallocation due to these frequencies' importance for deploying 5G networks.³¹ Figure 2 shows examples of federal and nonfederal spectrum uses as well as portions of spectrum where reallocations have occurred or are under consideration for future reallocations.

²⁷*E.g.*, Beat CHINA Act for 5G Act of 2020, Pub. L. No. 116-260, 134 Stat. at 3215; Memorandum of June 28, 2010—Unleashing the Wireless Broadband Revolution, 75 Fed. Reg. 38385 (July 1, 2010). NTIA reported that its current remaining statutory reallocation obligation is to identify 30 megahertz below 3 GHz by January 2022. See Spectrum Pipeline Act of 2015, Pub. L. No. 114-74, tit. X, §1004(a), 129 Stat. 584, 624.

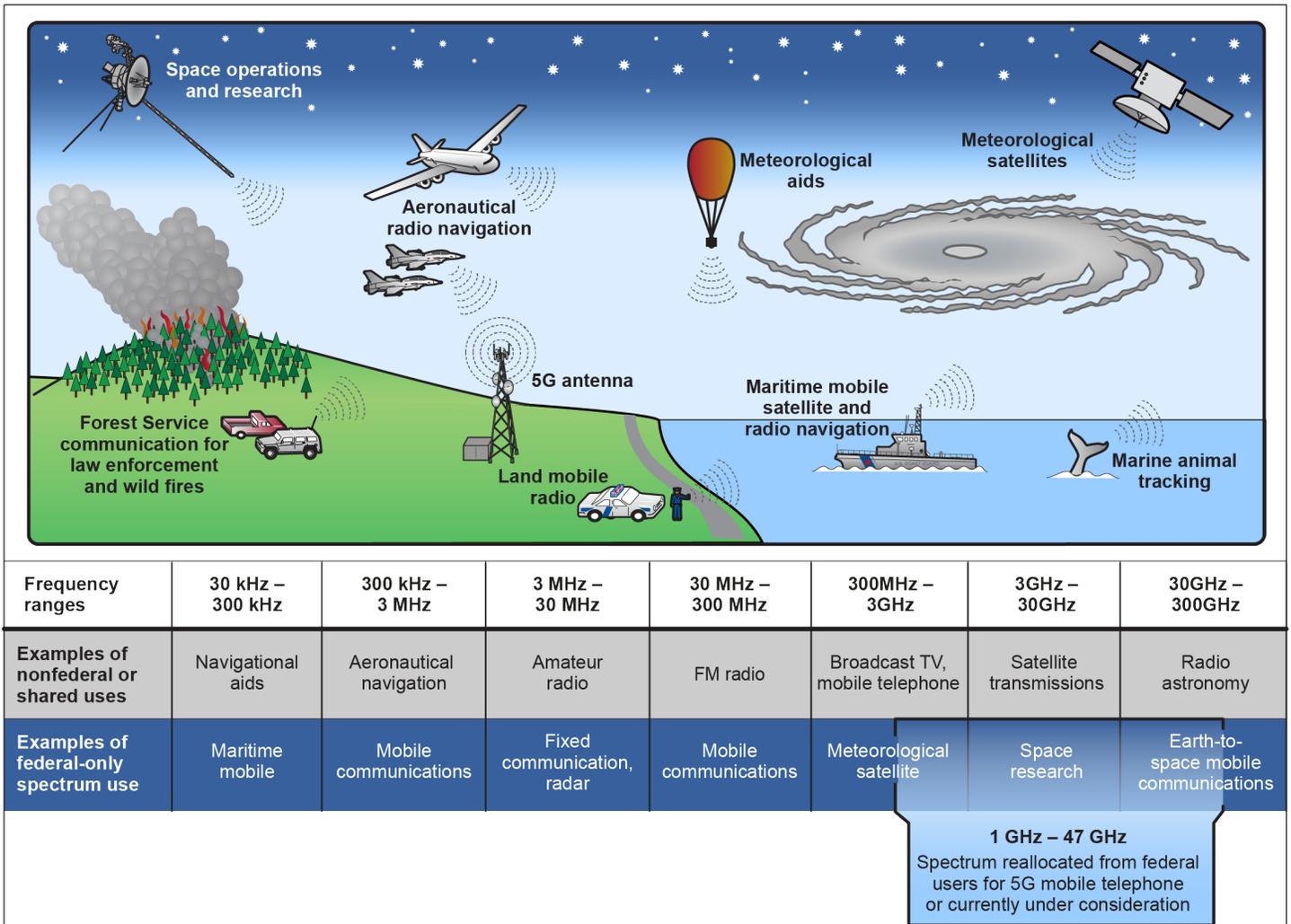
²⁸47 U.S.C. § 922; *see also*, 47 U.S.C. § 902(b)(2)(L)(i).

²⁹In general, a federal entity that incurs costs because of the reallocation of its assigned frequency is required to receive payment for such costs. 47 U.S.C. § 923(g).

³⁰NTIA defines low-band as spectrum below 1 GHz, mid-band as 1 GHz to 10 GHz, and high-band as 10 GHz and above.

³¹Department of Commerce, *Second Annual Report on the Status of Spectrum Repurposing*, (Washington, D.C.: Dec. 2020).

Figure 2: Examples of Federal and Nonfederal Spectrum Uses



Source: GAO analysis of National Telecommunications and Information Administration information. | GAO-22-104537

Accessible Data Table for Figure 2

| Frequency ranges | Examples of nonfederal or shared uses | Examples of federal-only spectrum use |
|------------------|--|---------------------------------------|
| 30 kHz – 300 kHz | Navigational aids | Maritime mobile |
| 300 kHz – 3 MHz | Aeronautical navigation | Mobile communications |
| 3 MHz – 30 MHz | Amateur radio | Fixed communication, radar |
| 30 MHz – 300 MHz | FM radio | Mobile communications |
| 300 MHz – 3 GHz | Broadcast TV, mobile telephone | Meteorological satellite |
| 3 GHz – 30 GHz | Satellite transmissions | Space research |
| 30 GHz – 300 GHz | Radio astronomy | Earth-to-space mobile communications |
| 1 GHz – 47 GHz | Spectrum reallocated from federal users for 5G mobile telephone or currently under consideration | |

When a list of potential spectrum bands to be reallocated for commercial use is identified, NTIA works through PPSG and IRAC to evaluate the potential impact that such a reallocation would have on the agencies operating in or near those bands. According to NTIA officials, proposed reallocations are generally first discussed in PPSG, which provides a forum for agencies to initially assess the feasibility of the proposal. Subsequently, IRAC agencies, in coordination with NTIA, hold discussions and may conduct technical studies, one band at a time, to consider the feasibility, cost, and length of time to move existing systems off the bands under consideration or develop sharing procedures. Following these steps, to fully complete and implement reallocation changes, agencies may need to transition their systems off the band(s) or otherwise modify their operations.³² FCC is involved throughout the reallocation process, including in the initial identification of bands for reallocation, the review of agencies' studies, and the collection of information from nonfederal entities.

³²This effort includes developing transition plans containing detailed cost estimates, identifying comparable spectrum bands in which to relocate systems, making the necessary technical changes to systems so they may operate in the new band, and ultimately moving these systems to the new band. Agencies' transition plans are reviewed by a technical panel within NTIA (with members appointed by the Office of Management and Budget, NTIA, and FCC.) The approved plans are made publicly available prior to the auction of reallocated frequencies and help inform an auction's reserve price (i.e., 110 percent of the estimates reimbursement for relocation and/or sharing, see 47 U.S.C. §§ 309(j)(16), 923(g)(2)). The technical panel was established by statute. 47 U.S.C. § 923(h)(3).

Communication of Executive Branch Views to FCC

In addition to the responsibility to make federal spectrum assignments and help determine the suitability of federal spectrum for reallocation, NTIA is required by statute to ensure that the executive branch views on telecommunications matters are effectively presented to FCC.³³ NTIA frequently presents the executive branch views to FCC in the form of comments to FCC proceedings related to reallocations. In doing so, NTIA generally reviews, collates, synthesizes, and evaluates different agency comments in light of the executive branch's spectrum management priorities to develop one consolidated executive branch view that it then submits to FCC. This effort may involve resolving differences in the positions of different federal agencies. In its capacity as the manager for the federal government's use of spectrum and the intermediary between the federal executive branch agencies and FCC, NTIA will also review the technical soundness or policy implications of agencies' comments and their consistency with the administration's spectrum policy prior to incorporating such comments into a unified executive branch view. In addition, NTIA may provide analysis to help agencies in this process.

NTIA Generally Collects Data Necessary for Spectrum Assignments and Plans to Collect Additional Data to Increase Spectrum Efficiency, which May Be Challenging

NTIA Generally Collects the Data It Needs to Make Spectrum Assignments to Federal Users

According to NTIA officials, NTIA currently collects most of the information that it deems essential to effectively assign spectrum, particularly for typical assignments, through the Spectrum XXI software. NTIA, acting jointly with IRAC, currently processes over 90,000 frequency assignment applications every year, including requests for new spectrum assignments and modifications to existing ones, which may include their deletion. While Spectrum XXI can collect over 80 data points per individual frequency assignment, NTIA officials told us that in practice

³³47 U.S.C. § 902(b)(2)(J). In addition, in coordination with the Office of Management and Budget, NITA has the responsibility to ensure that the views of the executive branch on telecommunications matters are effectively presented to the Congress.

federal agencies most often provide assignment data related to the system’s power, range of frequencies used, and antenna location. Table 1 provides a summary of some of the key data that NTIA collects through Spectrum XXI.

Table 1: Summary Information and Examples of Key Data Collected by NTIA’s Spectrum Management System from Federal Agencies Requesting New or Modifications to Spectrum Assignments

| Data point | Description | Example of agency data submission |
|------------------------|--|---|
| Signal characteristics | Includes frequency or bands of frequencies requested, including adjustments for frequencies tolerances, and the power levels at which such frequencies will be transmitted | Land mobile 406.1 through 420 megahertz (MHz) at 50 Watts power |
| Time of use | The percentage of time the frequency is anticipated to be in use | 10-50 percent of the time |
| Antenna location | Precise location of antenna transmitting (latitude and longitude coordinates at a precision up to 100 feet or finer, and, if applicable, the direction antennas point) | Location of antenna in latitude and longitude: 38.8951 and -77.0364 |
| User | Which agency or agency subcomponent will use the frequency | United States Navy |
| Interference potential | Narrative information relating to international coordination concerns, if applicable | Federal Aviation Administration identifies possible harmful interference in its spectrum assignment application |
| Type of use | Information related to the type of station’s broadcasting frequencies | Global Positioning System (GPS) |

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-22-104537

Officials from several IRAC member agencies told us that NTIA’s spectrum assignment process works well and that they believe NTIA generally has the necessary data to effectively make spectrum assignments and avoid interference. Officials said that harmful spectrum interference is rare. Interference can cause an interruption in services and therefore reduce the effectiveness of an agency’s spectrum assignment, but officials said that such instances among federal agencies are either rare or manageable. For example, one IRAC member agency we spoke with said that the last time the agency experienced an issue with interference with other federal agencies occurred in 2000. Another IRAC member agency told us that while it experiences interference with other federal agencies’ spectrum use, these interference issues are not related to any inadequacy in the data NTIA collects, but rather occur most frequently due to human error by staff or malfunctioning equipment from other agencies. The agency noted it is usually able to mitigate or eliminate sources of interference from other federal agencies rapidly by simply notifying other agencies of the interference and requesting that agencies check their systems to identify if they are the cause.

NTIA Is In the Process of Collecting Additional Data to Increase Spectrum Efficiency, but Some Agencies May Face Challenges Providing This Data

Although NTIA officials stated that the data collected for spectrum assignments are generally effective, they told us Spectrum XXI collects limited data on time and location. Enhanced time and location data could be used by NTIA to assign spectrum with greater efficiency. NTIA is therefore undertaking efforts to improve these data but faces challenges in doing so. NTIA officials told us, for example, that the timing data currently collected by Spectrum XXI do not include information about the specific times and days agencies use their assigned frequencies or bands of spectrum, but rather information about the percentage of the time the spectrum is in use.³⁴ Furthermore, while NTIA collects precise data on where the antennas are located, NTIA does not collect data on the area that the transmitted signals cover. Knowing this detailed information has become more important as spectrum has become more crowded and it becomes more important to assign spectrum efficiently.

In response to a 2018 presidential memorandum,³⁵ NTIA issued guidance to agencies to submit more granular time and location information about their spectrum assignments in specific bands of interest. Regarding timing data, NTIA required greater specificity regarding the exact times that the frequencies are used by agencies—the data include the months, days, and specific hours of each day that the frequencies are in use by each agency. Regarding location data, agencies are to provide polygons depicting the areas their frequencies cover. NTIA initially required this additional reporting from agencies operating in a limited number of bands (3100-3550 MHz and 7125-8400 MHz). NTIA received enhanced time-of-use data from the agencies on these bands.

According to NTIA agency officials we interviewed, however, the enhanced time and location data are sometimes difficult for agencies to collect, in part due to limitations with information technology systems—some systems do not readily enable agencies to collect or share precise

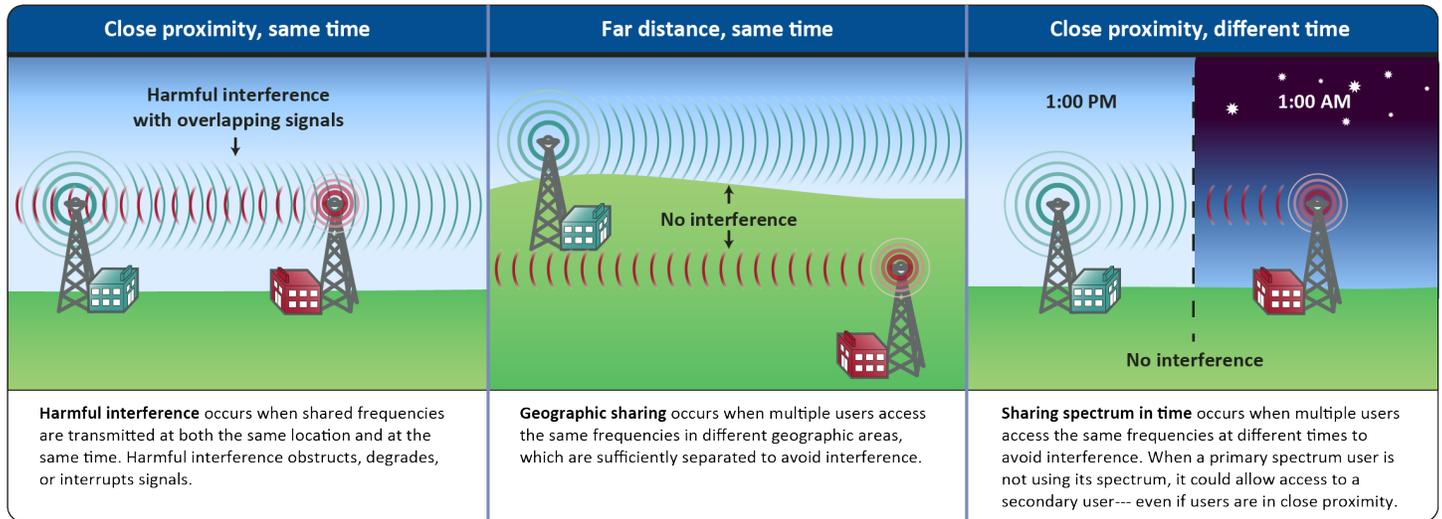
³⁴For all spectrum assignments above 29.89 megahertz (MHz), agencies report they either use spectrum: for constant or nearly (50-100 percent use); regular or frequent (10-50 percent use); intermittent (1-10 percent use); or sporadic/occasional (less than 1 percent use).”

³⁵Developing a Sustainable Spectrum Strategy for America’s Future, 83 Fed. Reg. 54513 (Oct. 30, 2018).

schedule and geographic data. NTIA noted that these challenges may be especially pronounced for agencies that have fewer resources for managing spectrum. In recognition of these difficulties, as mentioned, NTIA selected only a limited number of bands for agencies to initially report upon, and NTIA said that it is focusing its data collection for these enhanced data on bands that may be directly relevant to FCC proceedings.

These enhanced time and location data are important, in part, because they provide NTIA and agencies that use spectrum greater insight about the availability of potential spectrum-sharing opportunities, wherein two or more users may be assigned the same frequencies. As illustrated in figure 3, sharing the same frequency assignment is possible so long as the frequency is either not used at the same time or is not used in the same geographic location.

Figure 3: Spectrum Sharing Enabled by Time and Location Data



Source: GAO. | GAO-22-104537

Accessible Data Table for Figure 3

| Close proximity, same time | Far distance, same time | Close proximity, different time |
|--|--|--|
| Harmful interference occurs when shared frequencies are transmitted at both the same location and at the same time. Harmful interference obstructs, degrades, or interrupts signals. | Geographic sharing occurs when multiple users access the same frequencies in different geographic areas, which are sufficiently separated to avoid interference. | Sharing spectrum in time occurs when multiple users access the same frequencies at different times to avoid interference. When a primary spectrum user is not using its spectrum, it could allow access to a secondary user--- even if users are in close proximity. |

NTIA officials told us that NTIA is in the process of determining for which bands it will require agencies to submit these enhanced time and location data. For those bands it selects, NTIA plans to require agencies to provide enhanced time and location data when agencies review their spectrum assignments per NTIA’s 5- or 10-year recurring review requirement for each frequency held by agencies. To better track and use such data, NTIA is planning to adapt its guidance and software systems to process these types of data, since the software systems’ current designs do not enable agencies to submit the enhanced time and location data. In the two bands identified by NTIA, the agencies reported the enhanced time of use data outside of the Spectrum XXI system following separate reporting guidance from NTIA. In concert with these plans, NTIA and certain federal agencies have been directed by statute to develop modernization plans for the information technology systems they use to manage spectrum to improve collecting, tracking, and sharing data on when and where spectrum is being used, among other things.³⁶ We have ongoing work related to NTIA’s and other agencies’ statutorily mandated efforts to modernize their information technology systems.³⁷

³⁶The William M. (Mac.) Thornberry National Defense Authorization Act for Fiscal Year 2021 (FY2021 NDAA) requires NTIA and certain federal agencies to develop modernization plans for the infrastructure they use to manage spectrum assigned for federal use. Pub. L. No. 116-283, tit. XCII, § 9203, 134 Stat. 3388, 4793-97.

³⁷The FY2021 NDAA has a provision for GAO to report on federal agencies’ and NTIA’s modernization efforts. *Id.* at § 9203(d), 134 Stat. at 4796-97.

NTIA Lacks a Formalized Planning Process for Its Spectrum Reallocations, and Its Efforts Could Be Strengthened by Following Leading Practices

NTIA's spectrum reallocation efforts are complex and in some cases involve many stakeholders and steps. However, we found that NTIA does not have a comprehensive documented process in place to plan its reallocation efforts from start to finish. In particular, NTIA's Redbook—which serves as NTIA's manual of regulations and procedures for spectrum management—only details requirements related to the transition activities after the decision-making process to identify a band for reallocation has concluded and FCC has provided the required 18-month prior notification of its intent to commence an auction.³⁸ The decision-making process to identify a spectrum band for reallocation can be lengthy, and NTIA officials told us that no other guidance exists for this portion of reallocation process.

Program management leading practices emphasize the importance of establishing planning processes for the effective management of programs.³⁹ As described in table 2, we identified three leading practices for program management related to effective planning that are relevant to NTIA's spectrum reallocation efforts.⁴⁰ In particular, we believe these best practices are applicable to the many facets of the reallocation process that NTIA is responsible for, such processes as identifying spectrum bands for study for possible reallocation; conducting feasibility studies; providing input on behalf of the executive branch to FCC on reallocations; and taking actions to ensure the timely implementation of a reallocation.

³⁸Since 1994, FCC has used competitive bidding, or auctions, to assign licenses to commercial entities for their use of spectrum.

³⁹We have previously reported that there is no standard government definition of "program." A program can be defined in various ways for budgeting and policy-making purposes. Whether a program is defined as an activity, project, function, or policy, it must have an identifiable purpose or set of objectives. See GAO, *Designing Evaluations: 2012 Revision*, [GAO-12-208G](#) (Washington, D.C.: January 2012).

⁴⁰The Standard for Program Management®, Fourth Edition (Newtown Square, PA: 2018).

Table 2: Program Management Leading Practices from the Project Management Institute Related to Planning, Scheduling, and Risk Management for Complex Programs

| Program management leading practice | Description |
|---|--|
| Having a program management plan that is updated regularly | The program management plan formally expresses the organization’s concept, vision, mission, and expected benefits produced by the program; the plan also defines program-specific goals and objectives. The plan is the chronological representation that depicts key dependencies between major milestones; communicates the linkage between the business strategy and the planned, prioritized work; reveals and explains the gaps; and provides a high-level view of key milestones and decision points. |
| Having a reliable, integrated master schedule that is updated on a regular basis | A program’s integrated master schedule (IMS) is the top-level program document that defines the individual component schedules and dependencies between program components (individual project, site, and program level activities) required to achieve the program goal. As a document that integrates the planned work, the resources necessary to accomplish that work, and the associated budget, the IMS should be the focal point of program management. An IMS constitutes a program schedule that includes the entire required scope of effort, including the effort necessary from all government, contractor, and other key parties for a program’s successful execution from start to finish. |
| Conducting program risk management throughout the life of the program | A program risk is an event or series of events or conditions that, if they occur, may affect the success of the program. The program risk identification activity determines which risks might affect the program, documents their characteristics, and prepares for their successful management. Risk management means actively identifying, monitoring, analyzing, accepting, mitigating, avoiding, or retiring program risk. |

Source: GAO summary of *The Standard for Program Management*[®], Fourth Edition and prior GAO work. | GAO-22-104537

In comparing NTIA’s approach to reallocations with these best practices we found that NTIA’s efforts could have benefited from following such practices, as follows:

- Having a program management plan that is updated regularly.**
 We found NTIA did not maintain a complete plan that covered all its reallocation efforts, although NTIA did develop some plans for some of its reallocations. For example, NTIA developed a plan that included several reallocations it undertook, such as the CBRS reallocation, but this plan did not cover all of NTIA’s reallocation efforts.⁴¹ Additionally, the plan was not regularly updated, and according to NTIA officials, NTIA stopped using the plan altogether in 2018, even though CBRS and other reallocation efforts continued to last through 2020. Without

⁴¹In October 2010 in response to a presidential memorandum calling for NTIA and FCC to make available a total of 500 MHz of spectrum over the next 10 years, NTIA identified spectrum in the 3.5 gigahertz (GHz) band—known as CBRS—for reallocation from federal to mixed federal and commercial use. See 75 Fed. Reg. at 38388. This reallocation and transition effort lasted 10 years and involved complex technical challenges related to sharing spectrum between the US Navy and the private sector, which were only addressed through the development of new technologies. The CBRS reallocation effort largely concluded in 2020 with auctions of 150 megahertz of spectrum for commercial wireless communications.

maintaining a complete plan and regularly updating it, NTIA and other stakeholders, including federal agencies, may not have assurance that the many steps involved in reallocating spectrum are being anticipated and prepared for. Moreover, a lack of a complete plan might result in NTIA not having a clear picture of its necessary work and therefore of the data it needs from federal agencies. For example, an agency official we interviewed said that NTIA's information requests are often overly broad, resulting in significant back and forth between the agencies that cost them time and resources.

- **Having a reliable, integrated master schedule that is updated on a regular basis.** While NTIA's plan for CBRS included a general timetable, there was no plan that contained nor integrated the individual, component schedules of CBRS and NTIA's other reallocations, as called for by leading practices. Similarly, according to NTIA officials, planning documentation developed for the AWS-3 reallocation included a schedule, but it was a standalone schedule that was not integrated into a master schedule.⁴² Without an integrated master schedule to guide reallocation efforts, there is no baseline for NTIA or others to measure NTIA's actual overall spectrum reallocation timeline against, meaning there is no basis to judge whether work could have been performed faster. Further, an integrated master schedule would enhance NTIA's ability to manage tradeoffs among cost, schedule, and scope; to decide among different courses of action and help predict their effects; and to forecast the effects of delayed, deleted, and added activities, as well as possible avenues for time and cost recovery.
- **Conducting program risk management throughout the life of the program.** NTIA did not incorporate risk management in any formal way into its planning processes for its reallocation efforts. For example, while the planning documentation for the CBRS and other reallocations briefly mentions the need to minimize risk, it does not identify specific risks. The documentation further does not contain any subsequent risk analysis, as called for by leading practices, such as steps NTIA could take to prepare for risks' occurrence. When programs involve many steps and stakeholders, the potential risks increase. Without full consideration of these risks, NTIA may not be able to respond effectively to them as they arise or to help or represent federal agencies in dealing with them. Officials from one agency we interviewed emphasized the importance of NTIA taking into account the risks and uncertainties agencies face, including time

⁴²AWS-3 refers to spectrum in the 1695 to 2180 MHz band. AWS-3 is currently used in providing 4G mobile service.

and resource constraints, as they conduct studies needed for reallocations.

According to NTIA officials, NTIA does not have more clearly established planning processes for reallocations because each reallocation is unique and requires an ad-hoc approach. Addressing issues on an ad-hoc basis may be necessary in some cases, given that each reallocation has unique technical considerations. However, regardless of the particulars of each reallocation, these leading practices remain relevant, and by incorporating these leading practices into NTIA's reallocation-related practices, NTIA may be able to more effectively help implement reallocations by thinking through necessary steps, risks, and the likely timeframes involved with these technical considerations. Additionally, NTIA officials noted that many of the tasks associated with a reallocation are not solely NTIA's responsibility, because for example, they include actions needed from FCC and other agencies. Nevertheless, NTIA is responsible for managing federal use of spectrum and taking actions as necessary to ensure the timely relocation of federal agencies' spectrum-related operations from frequencies reallocated from federal use to nonfederal or shared use.⁴³ While FCC and other stakeholders play a major role in spectrum reallocations, this does not preclude NTIA from incorporating leading practices into its planning efforts. In fact, many programs involve components that rely on entities external to the organization that is planning the effort, and incorporating leading practices into planning can help the organization understand the risks associated with these external entities, anticipate when early coordination would be helpful, and work with external entities to try to make schedule adjustments as needed.

⁴³47 U.S.C. § 923(g)(6). If NTIA determines that the federal entity has unreasonably failed to comply with the timeline for relocation or sharing, NTIA is to terminate the entity's authorization.

NTIA Lacks Documented Procedures to Present Executive Branch Views to FCC, and Some Agencies Identified Weaknesses in NTIA's Efforts

NTIA Lacks Documented Procedures for Presenting Executive Branch Views to FCC

As part of its key spectrum management activities, NTIA is required by statute to ensure that the executive branch's views on spectrum-related matters are effectively presented to FCC; however, NTIA lacks documented procedures for doing so.⁴⁴ To fulfill this responsibility, NTIA primarily coordinates with executive branch agencies through IRAC, one of the key venues for consultation with the interagency spectrum community. Per a memorandum of understanding (MOU) established between FCC and NTIA, FCC provides draft proceeding documents, including notices of proposed rulemakings, to NTIA.⁴⁵ NTIA officials told us that NTIA distributes these materials to IRAC member agencies for review. In addition, these officials added that an FCC representative briefs IRAC agencies on proposed actions under consideration during periodic meetings. Further, NTIA officials said IRAC member agencies may provide comments, to include data and the results of technical studies, to NTIA on these proposed actions. These officials added that NTIA reviews and considers agency comments, works with agencies to resolve competing views, and files a response with FCC on behalf of the executive branch.⁴⁶

⁴⁴47 U.S.C. § 902(b)(2)(J).

⁴⁵The MOU establishes a framework for NTIA and FCC to carry out their statutory responsibilities under 47 U.S.C. § 922, to conduct joint spectrum planning with respect to specified issues. The MOU formalizes collaboration practices between the agencies with the intention to promote efficient spectrum use, increase commercial access, and prevent harmful interference. In particular, the MOU states that FCC and NTIA are to provide each other advance notice of actions and work together to resolve technical and policy differences by consensus whenever possible. The MOU also outlines ongoing communication requirements the two agencies are to maintain.

⁴⁶NTIA officials told us that in rare instances when agencies have competing views, they work with the agencies to arrive at a position in the best interest of executive branch agencies as a whole. However, ultimately an agency may not agree with this position.

While selected agencies we interviewed described the process by which they communicate their views to NTIA and these views are then conveyed to FCC as part of NTIA's response on behalf of the executive branch, currently no documentation of this process exists. In particular, NTIA has not developed and disseminated policies and procedures to guide how it collects, considers, and communicates the views of the executive branch on spectrum matters to FCC. According to NTIA officials, the Redbook, which serves as NTIA's manual of regulations and procedures for spectrum management, describes the process by which agencies can communicate their views on spectrum-related matters to NTIA. However, while the Redbook describes IRAC and its subcommittees that serve as conduits for agencies to communicate their views to NTIA, it does not contain specific policies and procedures describing the process by which agencies are to do so. Furthermore, it does not describe the process for how NTIA collects and considers agency views to present the view of the executive branch to FCC.

According to federal internal control standards, documentation is a necessary part of an effective internal control system and management should develop and maintain documentation of organizational procedures.⁴⁷ Further, these standards state that management should externally communicate quality information to achieve the entity's objectives.⁴⁸ Documentation of NTIA's policies and procedures may better enable agencies to respond to FCC proceedings. Specifically, documenting and disseminating these policies and procedures could provide agencies with a more comprehensive understanding of how NTIA collects and considers agency views in order to present the view of the executive branch to FCC. Such documentation could provide clarity on the level of technical detail that agencies should be submitting to NTIA, reasons for why an agency's comments are or are not incorporated into the final submission to FCC, and anticipated timeframes for reviewing draft FCC proceedings, among other things.

⁴⁷[GAO-14-704G](#).

⁴⁸[GAO-14-704G](#).

Some Agencies Agreed NTIA Effectively Communicates Their Views to FCC on Most Spectrum Matters but Identified Weaknesses in These Efforts

Officials representing four of the six IRAC agencies we interviewed told us that NTIA generally communicates their views on spectrum-related matters effectively to FCC in most cases. Specifically, officials from one agency said that NTIA often includes the agency's comments directly as part the executive branch comments filed with FCC. An official from another agency expressed satisfaction with NTIA's process and added that it offers them the opportunity to comment on issues of specific concern to the agency while also providing NTIA valuable insight into the agency's views on spectrum matters. For example, during the Spectrum

Weaknesses in the National Telecommunications and Information Administration (NTIA) and Federal Communications Commission's (FCC) Memorandum of Understanding

Our recent work⁴⁹ examining a dispute over spectrum identified a number of challenges that NTIA and FCC face in collaborating to regulate and manage spectrum for federal and nonfederal use. These challenges may affect how federal agencies' views are considered during FCC's spectrum proceedings. Among other things, we found that the memorandum of understanding between NTIA and FCC lacks a process for resolution when NTIA and FCC cannot reach an agreement. Instead, FCC may take action without the approval of NTIA and in spite of executive branch views.⁵⁰ We recommended that FCC work with NTIA to develop a mutually agreeable decision-making process for when consensus cannot be reached. The agencies generally agreed to implement the recommendation.

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) interviews and documentation. | GAO 22-104537

⁴⁹[GAO-21-474](#).

⁵⁰Likewise, the MOU also states that NTIA action does not require approval of FCC. The two agencies' decisions may not always comport with the views of specific spectrum users, which may have competing priorities.

Frontiers proceeding,⁵¹ NTIA submitted a letter to FCC ahead of a scheduled vote on a report and order. Among other things, this letter expressed concern with the potential impact of FCC's decision on Department of Defense operations that support national defense and homeland security and urged FCC not to change certain existing allocations out of concern that such changes could constrain future Defense operations. Officials from two other agencies also agreed that NTIA effectively communicates their agencies' views to FCC, with one of these officials noting that the process allows NTIA to provide a unified executive branch view on spectrum matters. However, officials representing the two remaining agencies we interviewed did not agree that NTIA effectively communicates agency views on spectrum matters to FCC in most cases. One of these officials also added that even when NTIA does effectively communicate executive branch views, FCC may make decisions related to the repurposing of spectrum that are contrary to the views' filed by NTIA on behalf of the executive branch. We recently found this issue is in part due to weaknesses in NTIA and FCC's memorandum of understanding (see sidebar).⁵²

Officials from three agencies we interviewed also identified some potential weaknesses with the process by which NTIA communicates executive branch views to FCC. For example, officials representing one of these agencies noted that during one FCC proceeding NTIA did not do enough to communicate the agency's technical concerns before FCC issued a report and order. An official from another agency added that the high-level response sent to FCC on behalf of the executive branch did not always adequately capture all of the technical concerns specific to their agency. NTIA officials said that there are a number of possible reasons why an agency may have that perspective, including a possible disagreement between NTIA and the agency regarding technical or policy issues, or the need to reconcile differing agency views. An official representing another agency said that agencies did not always have enough time to review and respond to draft FCC rulemakings. NTIA

⁵¹The Spectrum Frontiers proceeding began in October 2014 and examined the potential for the provision of mobile services (particularly 5G) in various spectrum bands, including the 24 and 37 GHz band. In re Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, Notice of Inquiry, FCC 14-154, paras. 3, 46-55 (Oct. 17, 2014).

⁵² FCC is an independent federal regulatory agency and is governed by applicable statutes. FCC has authority to regulate, allocate, and assign spectrum for nonfederal use through the notice-and-comment rulemaking process, a process by which FCC proposes and adopts rules with input from the public

officials acknowledged that agencies often have inadequate time and resources to respond to notices of pending FCC draft proceedings,⁵³ but added that they work closely with FCC staff on rulemakings and hold regular meetings to provide insight into what is FCC considering.⁵⁴ However, NTIA officials added that ultimately, FCC's Chair determines which items are considered and when. Finally, an official from one of these agencies also noted that the process for NTIA to collect and synthesize agency views into a single executive branch position is often lengthy and that there may be significant changes to FCC's proceedings during that time. NTIA acknowledged that this situation can be the case, particularly for contentious matters.

Officials representing two agencies also added that NTIA's location within Commerce might make it difficult in some instances for NTIA to effectively communicate agencies' views to FCC. Specifically, these agencies noted that NTIA might face challenges balancing its competing roles advocating on behalf of the executive branch on spectrum matters and promoting economic growth, which is the mission of Commerce. A CSMAC working group, comprising representatives from outside the federal government who advise NTIA on spectrum management issues, recently studied whether the U.S. should consider a new spectrum management structure. In the working group's July 2020 final report, this group concluded that the current spectrum management structure would benefit from reform and described a series of options including unifying spectrum management decisions under one new agency, broadening the jurisdiction of NTIA or FCC, or updating the current interagency MOU between NTIA and FCC, among other options.⁵⁵

⁵³Per the MOU between FCC and NTIA, where possible, FCC will provide NTIA a minimum of 15 business days prior to final action for all proposed actions that could potentially cause interference. According to NTIA officials, FCC is not always able to provide the full 15 business days. According to FCC officials, the MOU also provides that NTIA and FCC may agree on a different review period and FCC has often agreed to provide NTIA with additional time.

⁵⁴NTIA and FCC hold biannual spectrum planning meetings, which are required by statute, however, NTIA officials noted that these meetings tend to be high level and are not necessarily a venue to discuss upcoming items under consideration at FCC. According to FCC officials, NTIA officials regularly convene with FCC staff through both standing and ad hoc meetings to discuss spectrum-related policy matters.

⁵⁵Commerce Spectrum Management Advisory Committee (CSMAC), *Working Group 1 Governance: Final Report* (July 30, 2020).

While agencies almost exclusively communicate their views on spectrum matters through NTIA using the process described above, some agencies we interviewed, however, have found value in communicating their views directly to FCC in specific instances.⁵⁶ For example, in recent years, the Departments of Education, Energy, and Defense have each submitted letters directly to FCC.⁵⁷ These agencies filed comments directly with FCC for a variety of reasons. For example, Defense officials told us that, while they believe NTIA accurately and effectively communicated their views during the L-band's repurposing, senior officials felt compelled to present their case directly to FCC to reinforce that view, because of the significance of the issue and potential impacts on GPS systems.⁵⁸ Department of Energy officials told us that despite NTIA effectively communicating their views to FCC, the department's Office of Electricity made an administrative decision to send a letter directly to FCC concerning proposed use of the 6 GHz band for unlicensed use. Finally,

⁵⁶While NTIA is tasked by statute with ensuring the views of the executive branch on telecommunication matters are effectively presented to the FCC, we did not identify an explicit prohibition on agencies submitting their views separately to FCC, either in statute or in the Redbook. According to NTIA officials, because agencies doing so could prevent NTIA from performing this function, it has been a longstanding administration policy that agencies must coordinate with NTIA on formal communications with FCC. See Memorandum from Todd Parker, White House Chief Technology Officer to Agency Chiefs of Staff, *Filing Public Comments Regarding Telecommunications and Information Policy With the Federal Communications Commission or Other Independent Agencies* (Feb. 14, 2013). (instructing agencies to coordinate the content and timing of public comments in matters relating to telecommunications and information policy with NTIA before they are filed with FCC).

⁵⁷Letter from Assistant Secretary Jim Blew, U.S. Department of Education, to Secretary Marlene H. Dortch, Federal Communications Commission (June 7, 2019); letter from Assistant Secretary Bruce Walker, U.S. Department of Energy, to Chairman Ajit Pai, Federal Communications Commission (Sept. 3, 2019); letter from Acting Secretary, Department of Defense, to Chairman Ajit Pai, Federal Communications Commission (June 7, 2019); and Letter from Secretary Mark Esper, U.S. Department of Defense, to Chairman Ajit Pai, Federal Communications Commission (Nov. 18, 2019).

⁵⁸As noted above, the L-band refers to spectrum in the 1 to 2 GHz band. While Defense officials presented their views to FCC, according to FCC officials, they did not provide detailed technical information to the FCC's record that would inform FCC's decision. All GPS signals are in the L-band of the frequency spectrum because L-band waves penetrate clouds, fog, rain, storms, and vegetation. GPS units can receive accurate data in all weather conditions, day or night.

Education officials said a policy decision⁵⁹ was made to send comments to FCC directly in response to the 2.5 GHz band proceeding.⁶⁰

NTIA Has Identified Critical Competencies for Key Spectrum Management Positions but Has Taken Limited Action to Assess for Competency Gaps in its Workforce

NTIA requires a skilled workforce to undertake the spectrum management activities described above, including assigning and reallocating spectrum. To ensure the workforce has the necessary skills, our key principles for effective strategic workforce planning call for agencies to identify the competencies their workforces need to achieve their missions; assess the extent to which their workforces possess these competencies; and address any identified competency gaps through training, hiring, or other strategies.⁶¹ We found that NTIA has identified the critical competencies needed for key occupations involved in spectrum management but does not perform recurring organization-wide competency gap assessments for its workforce, and therefore cannot target existing strategies to address any gaps identified.⁶² See figure 4 for a comparison of NTIA's efforts with these principles for effective workforce planning.

⁵⁹As a non-member of IRAC, Education officials told us they have had limited experience working with NTIA.

⁶⁰The proceeding focused on the portion of the 2.5 GHz band that has been used by schools and other eligible entities to transmit educational materials electronically.

⁶¹[GAO-04-39](#).

⁶²A competency gap occurs when an agency has individuals without the appropriate skills, abilities, or behaviors to successfully perform the work, whereas a staffing gap occurs when an agency has an insufficient number of individuals to complete its work. For the purposes of this report, we are focused on competency gaps. See GAO, *Federal Workforce: OPM and Agencies Need to Strengthen Efforts to Identify and Close Mission-Critical Skills Gaps*, GAO -15-223 (Washington, DC: Jan. 30, 2015).

Figure 4: Comparison of NTIA’s Practices with GAO’s Principles of Effective Workforce Planning Related to Identifying Competencies and Assessing and Addressing Competency Gaps

| Principle of effective workforce planning | NTIA workforce planning practices | GAO assessment |
|--|---|---|
| Agencies can benefit from identifying the critical competencies workforces need to successfully achieve their missions and goals | NTIA developed critical competencies for key spectrum management positions. |  |
| Agencies can benefit from assessing the extent to which employees possess critical competencies needed for mission success | NTIA has taken limited action to assess for competency gaps within key spectrum management positions. |  |
| Agencies can benefit from developing strategies tailored to address gaps in critical skills and competencies | Because NTIA has taken limited action to assess for competency gaps within key spectrum management positions, it is unable to develop strategies to address any organization-wide gaps. |  |

-  Workforce planning practices fully met key principle
-  Workforce planning practices partially met key principle
-  Workforce planning practices did not meet key principle

Source: GAO analysis of National Telecommunications and Information Administration (NTIA) documentation. | GAO-22-104537

Accessible Data Table for Figure 4

| Principle of effective workforce planning | NTIA workforce planning practices | GAO assessment |
|--|---|--|
| Agencies can benefit from identifying the critical competencies workforces need to successfully achieve their missions and goals | NTIA developed critical competencies for key spectrum management positions. | Workforce planning practices fully met key principle |
| Agencies can benefit from assessing the extent to which employees possess critical competencies needed for mission success | NTIA has taken limited action to assess for competency gaps within key spectrum management positions. | Workforce planning practices partially met key principle |
| Agencies can benefit from developing strategies tailored to address gaps in critical skills and competencies | Because NTIA has taken limited action to assess for competency gaps within key spectrum management positions, it is unable to develop strategies to address any organization-wide gaps. | Workforce planning practices did not meet key principle |

NTIA developed critical competencies for two key positions in the Office of Spectrum Management (OSM) that play a pivotal role in helping NTIA manage federal spectrum use. These positions—electronics engineers and telecommunications specialists—comprise 74 percent of OSM’s workforce and are primarily responsible for undertaking NTIA’s daily

spectrum management operations.⁶³ These tasks include reviewing agencies' spectrum assignment proposals for compliance and technical conflicts, employing spectrum-engineering principles, and contributing to the development of spectrum policy, among other things. In 2015, NTIA began an effort to identify critical competencies needed for employees in these positions. As part of this effort, NTIA reached out to subject matter experts and managers across OSM to determine the competencies needed to perform successfully in both the electronics engineer and telecommunications specialist occupations. These competencies include technical areas such as an understanding of electromagnetic communications, radio systems, and interference, and knowledge and understanding of the United States Table of Frequency Allocations⁶⁴ and the Redbook. The competencies also include non-technical areas such as strategic planning and policy development. According to NTIA officials, competencies are updated periodically, most recently in 2021, to account for new technologies and skills based on input from subject matter experts across OSM, and studies developed by ITS and IRAC.

These critical competencies serve as a basis for both hiring and training electronics engineers and telecommunications specialists that, according to officials, are the primary means through which OSM ensures it has the skillsets needed to manage federal spectrum use. For example, competencies are incorporated into positions descriptions used to recruit and hire staff in these positions. OSM also incorporates these competencies into a professional development guide that is updated every 5 years. Among other things, this guide describes the competencies required for positions involved with managing spectrum and outlines training and professional development opportunities available to staff to acquire and update their skillsets, including on-the-job experiences, training, and course opportunities.

Although NTIA has identified critical competencies needed for its electronics engineer and telecommunications specialist workforces, it has

⁶³In addition, according to NTIA officials, NTIA determined that economic and policy skills are needed to manage federal spectrum use. Specifically, NTIA determined it needed to hire economists to better understand the value of spectrum held by federal users and policy analysts to respond to overall policy changes in the federal regulatory landscape. Currently NTIA is taking steps to hire staff in these positions.

⁶⁴This table sets out, among other things, whether bands are allocated to federal, non-federal, or mixed federal and nonfederal users. 47 C.F.R. § 2.106. The table is subdivided into the Federal Table of Frequency Allocations and the Nonfederal Table of Frequency Allocations. 47 C.F.R. § 2.105.

taken limited action to assess for organization-wide competency gaps within these positions. According to officials, OSM managers assess the performance of their respective employees individually on an annual basis. This assessment allows managers to identify deviations between an employee's current and required performance levels in each of these competencies. While these assessments provide insight into individual skill gaps, OSM does not aggregate the results of these assessments across positions and does not have a way to provide an organization-wide view of whether there are gaps, and the extent of these gaps, in the competencies necessary to manage federal spectrum. Further, while OSM uses the critical competencies to guide individual hiring decisions and has developed training and other developmental opportunities linked to these competencies as described above, it cannot properly target its OSM-wide hiring and training efforts without information on what, if any, gaps exist across the organization.

Key principles for effective strategic workforce planning state that agencies can benefit from assessing the extent to which employees possess critical competencies needed for mission success.⁶⁵ To identify gaps, agencies can develop an organization-wide, consolidated inventory of the relevant competencies the workforce is thought to possess, conduct surveys of employees, or use other approaches.⁶⁶ Furthermore, assessing organization-wide gaps in critical competencies on a recurring basis and then addressing them through hiring, training, or other strategies can help agencies ensure that their workforces successfully achieve their missions.⁶⁷ Without information on the extent to which its electronics engineers and telecommunications specialists possess critical competencies, OSM is limited in its ability to implement appropriate strategies for addressing any organization-wide competency gaps in its workforce. For example, without knowing the extent to which its electronics engineer and telecommunication specialist workforces have gaps in understanding of electromagnetic communications, OSM may not know the extent to which it should hire or train employees with this skill set.

⁶⁵[GAO-04-39](#).

⁶⁶GAO, *Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government*, [GAO-04-546G](#) (Washington, D.C.: Mar. 1, 2004).

⁶⁷[GAO-04-39](#).

Conclusion

Effective spectrum management is critical given the importance of spectrum's role in ensuring the nation's security and communications. NTIA is able to process over 90,000 frequency assignment applications for federal users each year and has recently facilitated a complex, multi-stakeholder spectrum reallocation to free up spectrum critical for mobile services. However, by following program management leading practices related to planning, particularly for creating a plan, developing an integrated master schedule, and anticipating risks, NTIA could better ensure that reallocations are executed in a timely fashion and that potential challenges and risks are addressed before they arise. Furthermore, with a documented internal plan inclusive of all anticipated NTIA reallocation work, NTIA could more effectively coordinate with FCC in the decision-making processes related to overall national spectrum planning, and understand how NTIA resource limitations may constrain various options.

Moreover, by establishing a documented process to inform how NTIA collects and synthesizes agency viewpoints to develop and communicate the executive branch view to FCC, NTIA could mitigate confusion on its role and the expectations of federal agencies involved and bolster the transparency of how and why NTIA provides the final information to FCC that it does. Ultimately, NTIA's efforts to fulfill its statutory obligations to conduct these and other tasks is dependent on NTIA having a qualified staff. While NTIA collects some information about its employees' annual performance, NTIA could be better informed of potential human capital skill gaps by conducting organizational skill-gap assessments. By following leading practices related to program management, policy documentation, and human capital management, NTIA could strengthen its ability to effectively manage federal spectrum.

Recommendations for Executive Action

We are making three recommendations to NTIA:

- The NTIA Administrator should align its spectrum reallocation-planning efforts with leading practices for program management by developing a plan, analyzing risks, and creating and updating a schedule for NTIA's ongoing and future reallocation efforts. (Recommendation 1)
- The NTIA Administrator should document and disseminate to federal agencies policies and procedures describing how it collects and considers agencies' views on spectrum-related matters to present the views of the executive branch to FCC. (Recommendation 2)
- The NTIA Administrator should assess for organization-wide competency gaps in key occupations that manage federal spectrum use and develop and implement a plan to address any identified gaps. (Recommendation 3)

Agency Comments

We provided a draft of this report to Commerce and NTIA for review and comment. In written comments, reprinted in appendix II, Commerce concurred with our recommendations. NTIA also provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Assistant Secretary of NTIA, and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff 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 III.

Letter

A handwritten signature in black ink, appearing to read "Andrew Von Ah". The signature is fluid and cursive, with a long horizontal stroke at the end.

Andrew Von Ah
Director, Physical Infrastructure

Appendix I: Key Spectrum-Related Statutory Authorities and Responsibilities of NTIA

The figure below contains statutory provisions from the National Telecommunications and Information Administration (NTIA) Organization Act, as amended, 47 U.S.C. chapter 8, that we identified as NTIA's key authorities and responsibilities related to federal spectrum use, assignment, and reallocation. Included are also provisions from the act that relate to the Federal Communications Commission (FCC); Interdepartment Radio Advisory Committee (IRAC); Office of Management and Budget (OMB); and other agencies to the extent those provisions pertain to NTIA's spectrum management activities.

Appendix I: Key Spectrum-Related Statutory Authorities and Responsibilities of NTIA

Figure 5: Key Spectrum-Related Statutory Authorities and Responsibilities of the National Telecommunications and Information Administration (NTIA)

| Cite | Provision | Appendix Figure: 1 of 3 |
|--|--|--|
| General authorities & responsibilities | | |
| Setting spectrum policy 47 U.S.C. §§ 901(c)(4), 902(b)(2)(K), (L)(i), (U) | <ul style="list-style-type: none"> NTIA is required to seek to advance the policy of fostering full and efficient use of telecommunications resources, including effective use of the radio spectrum by the federal government, in a manner that encourages the most beneficial uses thereof in the public interest. | <ul style="list-style-type: none"> NTIA has the responsibility to promote the best possible and most efficient use of electromagnetic spectrum resources across the federal government, subject to and consistent with the needs and missions of federal agencies. NTIA has the authority to establish policies concerning spectrum assignments and use by radio stations belonging to and operated by the United States. NTIA is responsible for developing, in cooperation with the Federal Communications Commission (FCC), a comprehensive long-range plan for improved management of all electromagnetic spectrum resources. |
| Coordination with and presenting the views of the executive branch 47 U.S.C. § 902(b)(2)(C)(v), (H), (J) | <ul style="list-style-type: none"> NTIA has the authority to help attain coordinated and efficient use of the electromagnetic spectrum. | <ul style="list-style-type: none"> NTIA has the authority to provide for the coordination of the telecommunications activities of the executive branch and assist in the formulation of policies and standards for those activities, including (but not limited to) considerations of interoperability, privacy, security, spectrum use, and emergency readiness. NTIA has the responsibility to ensure that the views of the executive branch on telecommunications matters are effectively presented to FCC and, in coordination with the Director of the Office of Management and Budget (OMB), to the Congress. |
| Research and related functions 47 U.S.C. § 902(b)(2)(L)(ii)-(iv) | NTIA is assigned functions that involve: <ul style="list-style-type: none"> Performing analysis, engineering, and administrative functions, including the maintenance of necessary files and data bases, as necessary for the performance of assigned functions for the management of electromagnetic spectrum resources. | <ul style="list-style-type: none"> Conducting research and analysis of electromagnetic propagation, radio systems characteristics, and operating techniques affecting the utilization of the electromagnetic spectrum in coordination with specialized, related research and analysis performed by other federal agencies in their areas of responsibility. Conducting research and analysis in the general field of telecommunications sciences in support of assigned functions and in support of other government agencies. |
| Assignment 47 U.S.C. § 902(b)(2)(A) 47 U.S.C. § 903(d)(1)-(2) | <ul style="list-style-type: none"> NTIA has the authority to assign frequencies to radio stations or classes of radio stations belonging to and operated by the United States, including the authority to amend, modify, or revoke such assignments, but not including the authority to make final disposition of appeals from frequency assignments. | <ul style="list-style-type: none"> In assigning frequencies for mobile radio services and other radio services, NTIA must promote efficient and cost-effective use of the spectrum to the maximum extent feasible. NTIA has the authority to withhold or refuse to assign frequencies for mobile radio service or other radio service in order to further the goal of making efficient and cost-effective use of the spectrum. |
| Sharing 47 U.S.C. § 927(b) | <ul style="list-style-type: none"> NTIA may, consistent with specified FCC licensing requirements, at any time allow frequencies allocated on a primary basis for federal government use to be used by non-federal licensees on a mixed-use basis for the purpose of facilitating the prompt implementation of new technologies or services and for other purposes. | |
| Advisory committees 47 U.S.C. § 904(b) | <ul style="list-style-type: none"> The Interdepartment Radio Advisory Committee (IRAC) has the authority to serve as an advisory committee to NTIA. NTIA also has the authority to establish additional telecommunications or information advisory committees composed of experts in the telecommunications and/or information areas outside the government. NTIA is permitted to informally consult with industry as appropriate to carry out the most effective performance of its functions. | |
| Issuance of regulations 47 U.S.C. § 904(c)(1) | <ul style="list-style-type: none"> NTIA has authority issue such regulations as may be necessary to carry out the functions assigned under this chapter (chapter 8 of title 47 of the U.S. Code). | |
| Federal agency responsibilities | | |
| Agency consultation 47 U.S.C. § 904(a)(1) | <ul style="list-style-type: none"> Federal agencies are required consult with NTIA to ensure that the conduct of telecommunications activities by such agencies is consistent with NTIA's policies concerning spectrum assignments and use by radio stations belonging to and operated by the United States. | |
| Agency cooperation 47 U.S.C. § 904(c)(2) | <ul style="list-style-type: none"> All executive agencies are authorized and directed to cooperate with NTIA and to furnish it with such information, support, and assistance, not inconsistent with law, as it may require in the performance of its functions. | |

**Appendix I: Key Spectrum-Related Statutory
Authorities and Responsibilities of NTIA**

| Cite | Provision | Appendix Figure: 2 of 3 |
|---|---|-------------------------|
| Federal agency responsibilities (Con'td) | | |
| Reimbursement to NTIA Consolidated Appropriations Resolution, 2003, Pub. L. No. 108-7, div. B, tit. II, 117 Stat. 11, 71 (47 U.S.C. § 903 note) | <ul style="list-style-type: none"> • NTIA cannot authorize spectrum use or provide any spectrum functions to any federal entity without reimbursement as required by NTIA for such spectrum management costs, and federal entities withholding payment of such cost are not permitted to use spectrum. | |
| Coordination with FCC | | |
| Joint spectrum planning 47 U.S.C. § 922 | <p>The Assistant Secretary for Communications and Information and the Chairman of FCC are required to meet, at least biannually, to conduct joint spectrum planning with respect to the following issues:</p> <ul style="list-style-type: none"> • The extent to which licenses for spectrum use can be issued pursuant to FCC's competitive-bidding procedures to increase federal revenues. • The future spectrum requirements for public and private uses, including state and local government public safety agencies. • The spectrum allocation actions necessary to accommodate those uses. • Actions necessary to promote the efficient use of the spectrum, including spectrum management techniques to promote increased shared use of the spectrum that does not cause harmful interference as a means of increasing commercial access. | |
| Long-range plan 47 U.S.C. § 902(b)(2)(L)(i) | <ul style="list-style-type: none"> • NTIA is also responsible for developing, in cooperation with FCC, a comprehensive long-range plan for improved management of spectrum resources. | |
| Reallocation | | |
| Relocation or sharing costs 47 U.S.C. § 923(g)(1)-(3) | <ul style="list-style-type: none"> • Federal entities that incur relocation or sharing costs because of planning for an auction of eligible spectrum frequencies^a or the reallocation of eligible spectrum frequencies from federal use to exclusive nonfederal use or to shared use must receive payment for those costs from the Spectrum Relocation Fund,^b in accordance with applicable provisions. • Relocation or sharing costs include those incurred by a federal entity in connection with the auction of spectrum frequencies or the sharing of spectrum frequencies in order to achieve comparable capability of systems as before the relocation or sharing arrangement. • They include specified types of costs, such as, modification or replacement of equipment; engineering, equipment, software, site acquisition, and construction; staff necessary to carry out the relocation or sharing activities; and research, engineering studies, and economic analyses, among many other types of costs. | |
| Submission of costs and timelines 47 U.S.C. § 923(g)(4)-(5) | <ul style="list-style-type: none"> • FCC is required to notify NTIA at least 18 months prior to the commencement of any auction of eligible frequencies.^a At least 6 months prior to the commencement of the auction, NTIA, on behalf of applicable federal entities and after review by OMB, is required to notify FCC of estimated relocation or sharing costs and timelines for such relocation or sharing. • When requested by a federal entity, NTIA is required to provide information regarding an alternative frequency assignment or assignments to which the entity's radiocommunications operations could be relocated for purposes of calculating the estimated relocation or sharing costs and timelines to be submitted to FCC. • NTIA is also required to submit the initial estimate of relocation or sharing costs and the timeline for relocation or sharing to the Committees on Appropriations and on Energy and Commerce of the House of Representatives for approval, to the Committees on Appropriations and on Commerce, Science, and Transportation of the Senate for approval, and to the Comptroller General. Unless disapproved within 30 days, the estimate shall be approved. If disapproved, NTIA may resubmit a revised initial estimate. | |
| Ensuring timely relocation 47 U.S.C. § 923(g)(6) | <ul style="list-style-type: none"> • NTIA is required to take such actions as necessary to ensure the timely relocation of applicable federal entities' spectrum-related operations from reallocated frequencies^a to frequencies or facilities of comparable capability and to ensure the timely implementation of arrangements for the sharing of frequencies. • Upon a finding by NTIA that a federal entity has achieved comparable capability of systems, NTIA is to terminate or limit the entity's authorization and notify FCC that the entity's relocation has been completed or sharing arrangement has been implemented. • NTIA is also to terminate the applicable federal entity's authorization if NTIA determines that the entity has unreasonably failed to comply with the timeline for relocation or sharing submitted by the Director of OMB to specified committees of Congress and the Comptroller General. This submission by OMB is to include a detailed plan describing specifically how the sums transferred from the Spectrum Relocation Fund will be used to pay relocation or sharing costs in accordance with applicable provisions and the timeline for relocation or sharing. | |

**Appendix I: Key Spectrum-Related Statutory
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Accessible Data Table for Figure 5

| Cite | Provision |
|---|--|
| General authorities & responsibilities | |
| Setting spectrum policy 47 U.S.C. §§ 901(c)(4), 902(b)(2)(K), (L)(i), (U) | <p>NTIA is required to seek to advance the policy of fostering full and efficient use of telecommunications resources, including effective use of the radio spectrum by the federal government, in a manner that encourages the most beneficial uses thereof in the public interest.</p> <p>NTIA has the responsibility to promote the best possible and most efficient use of electromagnetic spectrum resources across the federal government, subject to and consistent with the needs and missions of federal agencies.</p> <p>NTIA has the authority to establish policies concerning spectrum assignments and use by radio stations belonging to and operated by the United States.</p> <p>NTIA is responsible for developing, in cooperation with the Federal Communications Commission (FCC), a comprehensive long-range plan for improved management of all electromagnetic spectrum resources.</p> |
| Coordination with and presenting the views of the executive branch 47 U.S.C. § 902(b)(2)(C)(v), (H), (J) | <p>NTIA has the authority to help attain coordinated and efficient use of the electromagnetic spectrum.</p> <p>NTIA has the authority to provide for the coordination of the telecommunications activities of the executive branch and assist in the formulation of policies and standards for those activities, including (but not limited to) considerations of interoperability, privacy, security, spectrum use, and emergency readiness.</p> <ul style="list-style-type: none"> • NTIA has the responsibility to ensure that the views of the executive branch on telecommunications matters are effectively presented to FCC and, in coordination with the Director of the Office of Management and Budget (OMB), to the Congress. |
| Research and related functions 47 U.S.C. § 902(b)(2)(L)(ii)-(iv) | <p>NTIA is assigned functions that involve:</p> <p>Performing analysis, engineering, and administrative functions, including the maintenance of necessary files and data bases, as necessary for the performance of assigned functions for the management of electromagnetic spectrum resources.</p> <p>Conducting research and analysis of electromagnetic propagation, radio systems characteristics, and operating techniques affecting the utilization of the electromagnetic spectrum in coordination with specialized, related research and analysis performed by other federal agencies in their areas of responsibility.</p> <p>Conducting research and analysis in the general field of telecommunications sciences in support of assigned functions and in support of other government agencies.</p> |

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Authorities and Responsibilities of NTIA**

| Cite | Provision |
|--|---|
| General authorities & responsibilities | |
| Assignment 47 U.S.C. § 902(b)(2)(A) 47 U.S.C. § 903(d)(1)-(2) | <p>NTIA has the authority to assign frequencies to radio stations or classes of radio stations belonging to and operated by the United States, including the authority to amend, modify, or revoke such assignments, but not including the authority to make final disposition of appeals from frequency assignments.</p> <p>In assigning frequencies for mobile radio services and other radio services, NTIA must promote efficient and cost-effective use of the spectrum to the maximum extent feasible.</p> <p>NTIA has the authority to withhold or refuse to assign frequencies for mobile radio service or other radio service in order to further the goal of making efficient and cost-effective use of the spectrum.</p> |
| Sharing 47 U.S.C. § 927(b) | NTIA may, consistent with specified FCC licensing requirements, at any time allow frequencies allocated on a primary basis for federal government use to be used by non-federal licensees on a mixed-use basis for the purpose of facilitating the prompt implementation of new technologies or services and for other purposes. |
| Advisory committees 47 U.S.C. § 904(b) | The Interdepartment Radio Advisory Committee (IRAC) has the authority to serve as an advisory committee to NTIA. NTIA also has the authority to establish additional telecommunications or information advisory committees composed of experts in the telecommunications and/or information areas outside the government. NTIA is permitted to informally consult with industry as appropriate to carry out the most effective performance of its functions. |
| Issuance of regulations 47 U.S.C. § 904(c)(1) | NTIA has authority issue such regulations as may be necessary to carry out the functions assigned under this chapter (chapter 8 of title 47 of the U.S. Code). |
| Federal agency responsibilities | |
| Agency consultation 47 U.S.C. § 904(a)(1) | Federal agencies are required consult with NTIA to ensure that the conduct of telecommunications activities by such agencies is consistent with NTIA's policies concerning spectrum assignments and use by radio stations belonging to and operated by the United States. |
| Agency cooperation 47 U.S.C. § 904(c)(2) | All executive agencies are authorized and directed to cooperate with NTIA and to furnish it with such information, support, and assistance, not inconsistent with law, as it may require in the performance of its functions. |
| Reimbursement to NTIA Consolidated Appropriations Resolution, 2003, Pub. L. No. 108-7, div. B, tit. II, 117 Stat. 11, 71 (47 U.S.C. § 903 note) | NTIA cannot authorize spectrum use or provide any spectrum functions to any federal entity without reimbursement as required by NTIA for such spectrum management costs, and federal entities withholding payment of such cost are not permitted to use spectrum. |

**Appendix I: Key Spectrum-Related Statutory
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| Cite | Provision |
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| General authorities & responsibilities | |
| Coordination with FCC | |
| Joint spectrum planning 47 U.S.C. § 922 | <p>The Assistant Secretary for Communications and Information and the Chairman of FCC are required to meet, at least biannually, to conduct joint spectrum planning with respect to the following issues:</p> <p>The extent to which licenses for spectrum use can be issued pursuant to FCC's competitive-bidding procedures to increase federal revenues.</p> <p>The future spectrum requirements for public and private uses, including state and local government public safety agencies.</p> <p>The spectrum allocation actions necessary to accommodate those uses.</p> <p>Actions necessary to promote the efficient use of the spectrum, including spectrum management techniques to promote increased shared use of the spectrum that does not cause harmful interference as a means of increasing commercial access.</p> |
| Long-range plan 47 U.S.C. § 902(b)(2)(L)(i) | NTIA is also responsible for developing, in cooperation with FCC, a comprehensive long-range plan for improved management of spectrum resources. |
| Reallocation | |
| Relocation or sharing costs 47 U.S.C. § 923(g)(1)-(3) | <p>Federal entities that incur relocation or sharing costs because of planning for an auction of eligible spectrum frequencies^a or the reallocation of eligible spectrum frequencies from federal use to exclusive nonfederal use or to shared use must receive payment for those costs from the Spectrum Relocation Fund,^b in accordance with applicable provisions.</p> <p>Relocation or sharing costs include those incurred by a federal entity in connection with the auction of spectrum frequencies or the sharing of spectrum frequencies in order to achieve comparable capability of systems as before the relocation or sharing arrangement.</p> <p>They include specified types of costs, such as, modification or replacement of equipment; engineering, equipment, software, site acquisition, and construction; staff necessary to carry out the relocation or sharing activities; and research, engineering studies, and economic analyses, among many other types of costs.</p> |

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| Cite | Provision |
|--|--|
| General authorities & responsibilities | |
| Submission of costs and timelines 47 U.S.C. § 923(g)(4)-(5) | <p>FCC is required to notify NTIA at least 18 months prior to the commencement of any auction of eligible frequencies.^a At least 6 months prior to the commencement of the auction, NTIA, on behalf of applicable federal entities and after review by OMB, is required to notify FCC of estimated relocation or sharing costs and timelines for such relocation or sharing.</p> <p>When requested by a federal entity, NTIA is required to provide information regarding an alternative frequency assignment or assignments to which the entity's radiocommunications operations could be relocated for purposes of calculating the estimated relocation or sharing costs and timelines to be submitted to FCC.</p> <p>NTIA is also required to submit the initial estimate of relocation or sharing costs and the timeline for relocation or sharing to the Committees on Appropriations and on Energy and Commerce of the House of Representatives for approval, to the Committees on Appropriations and on Commerce, Science, and Transportation of the Senate for approval, and to the Comptroller General. Unless disapproved within 30 days, the estimate shall be approved. If disapproved, NTIA may resubmit a revised initial estimate.</p> |
| Ensuring timely relocation 47 U.S.C. § 923(g)(6) | <p>NTIA is required to take such actions as necessary to ensure the timely relocation of applicable federal entities' spectrum-related operations from reallocated frequencies^a to frequencies or facilities of comparable capability and to ensure the timely implementation of arrangements for the sharing of frequencies.</p> <p>Upon a finding by NTIA that a federal entity has achieved comparable capability of systems, NTIA is to terminate or limit the entity's authorization and notify FCC that the entity's relocation has been completed or sharing arrangement has been implemented.</p> <p>NTIA is also to terminate the applicable federal entity's authorization if NTIA determines that the entity has unreasonably failed to comply with the timeline for relocation or sharing submitted by the Director of OMB to specified committees of Congress and the Comptroller General. This submission by OMB is to include a detailed plan describing specifically how the sums transferred from the Spectrum Relocation Fund will be used to pay relocation or sharing costs in accordance with applicable provisions and the timeline for relocation or sharing.</p> |

**Appendix I: Key Spectrum-Related Statutory
Authorities and Responsibilities of NTIA**

| Cite | Provision |
|---|---|
| General authorities & responsibilities | |
| Relocation or sharing transition plans 47 U.S.C. § 923(h)(1)-(6) | <p>Not later than 240 days before the commencement of any auction of eligible frequencies,^a a federal entity must submit to NTIA and to the Technical Panel a transition plan for its implementation of the relocation or sharing arrangement, using a common format developed by NTIA after public input.</p> <p>The Technical Panel is established within NTIA and is composed of 3 uncompensated members who are radio engineers or technical experts: one member to be appointed by the Director of OMB, one member to be appointed by the Assistant Secretary for Communications and Information, and one member to be appointed by the Chairman of FCC.</p> <p>The plan is required to include, for example:</p> <ul style="list-style-type: none"> The use by the federal entity of the eligible frequencies to be auctioned. The geographic location of the federal entity's facilities or systems that use such frequencies. The steps to be taken by the federal entity to relocate its spectrum use from such frequencies or to share such frequencies, including timelines for specific geographic locations in sufficient detail to indicate when use of such frequencies at such locations will be discontinued or shared. The specific interactions between the eligible federal entity and NTIA needed to implement the transition plan. Factors that could hinder fulfillment of the transition plan by the federal entity. <p>Not later than 30 days after this plan is submitted, the Technical Panel must submit a report to NTIA and the applicable federal entity on the sufficiency of the plan, including whether it includes the information required, and an assessment of the reasonableness of the proposed timelines and estimated relocation or sharing costs, including the costs of any proposed expansion of the capabilities of a federal system in connection with relocation or sharing.</p> <p>If the Technical Panel finds the plan insufficient, the applicable federal entity must submit a revised plan within 90 days. Federal entities are required to periodically update their plans to reflect any changed circumstances, including changes in estimated relocation or sharing costs or the timeline for relocation or sharing.</p> <p>Not later than 120 days before the commencement of the FCC auction, NTIA must make the transition plan publicly available on its website, including updates to the plan.</p> |

**Appendix I: Key Spectrum-Related Statutory
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| Cite | Provision |
|---|---|
| General authorities & responsibilities | |
| Annual report Commercial Spectrum Enhancement Act, Pub. L. No. 108-494, tit. II, § 207, 118 Stat. 3986, 3996 (2004) (47 U.S.C. § 928 note) | NTIA is required to submit an annual report to the Committees on Appropriations and Energy and Commerce of the House of Representatives, the Committees on Appropriations and Commerce, Science, and Transportation of the Senate, and the Comptroller General on: The progress made in adhering to the timelines applicable to relocation from eligible frequencies, separately stated on a communication system-by-system basis and on an auction-by-auction basis, and with respect to each relocated communication system and auction, a statement of the estimate of relocation costs, the actual relocations costs incurred, and the amount of such costs paid from the Spectrum Relocation Fund. |
| Procedures for surrender of DOD spectrum National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65, div. A, tit. X, § 1062(b), 113 Stat. 512, 768 (1999) (47 U.S.C. § 921 note) | Subject to certain exceptions, if the Department of Defense (DOD) is required to surrender use of a band of frequencies for which it is a primary user in order to make it available for other use, it cannot surrender use of the band of frequencies until: NTIA, in consultation with FCC, identifies and makes available to DOD for its primary use, if necessary, an alternative band or bands of frequencies as a replacement for the band to be surrendered. The Secretary of Commerce, the Secretary of Defense, and the Chairman of the Joint Chiefs of Staff jointly certify to the Committee on Armed Services and the Committee on Commerce, Science, and Transportation of the Senate, and the Committee on Armed Services and the Committee on Energy and Commerce of the House of Representatives, that such alternative band or bands provides comparable technical characteristics to restore essential military capability that will be lost as a result of the band of frequencies to be so surrendered. |

^aBands of eligible frequencies include those reallocated from federal use to nonfederal use or to shared use after January 1, 2003, that are assigned by competitive bidding pursuant to section 309(j) of the Communications Act of 1934 (47 U.S.C. 309(j)). 47 U.S.C. § 923(g)(2).

^bThe Spectrum Relocation Fund is established under 47 U.S.C. § 928 and is authorized to be used to pay relocation or sharing costs of an eligible federal entity incurring such costs with respect to relocation from or sharing of those frequencies.

Appendix II: Comments from the Department of Commerce



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

Mr. Andrew Von Ah
Director
United States Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Von Ah:

Thank you for the opportunity to review the Government Accountability Office (GAO) draft report entitled *NTIA Should Improve Spectrum Reallocation Planning and Assess Its Workforce* (GAO-22-104537). The Department of Commerce appreciates the work the GAO has done to understand the challenges involved in managing federal spectrum. We are proud of the many accomplishments of the National Telecommunications and Information Administration (NTIA) in this regard, but we are always mindful that there is room for improvement. The Department generally concurs with your recommendations; indeed, for the most part, the recommendations are to formalize activities that we routinely do informally. At the same time, however, please note that establishing more formal processes can require additional resources and, depending on the level of effort, may not be justified in terms of additional benefits. This is particularly the case with spectrum management, inasmuch as the more difficult cases often present unique challenges that may require unique approaches. Moreover, resolving those difficult cases typically requires the cooperation and resources of the federal agencies that operate the systems that depend on the spectrum we manage but are outside of our control.

NTIA is responsible for overall management of Federal spectrum use. NTIA serves as the President's principal advisor on telecommunications and information policy and manages Federally allocated spectrum, including preparing for, participating in, and implementing the results of international radio conferences, as well as conducting extensive research and technical studies through its research and engineering laboratory, the Institute for Telecommunication Sciences. NTIA's record of success is well-established. As your report notes, NTIA

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

successfully processes tens of thousands of frequency assignments every year. Over the past twenty years, it has made more than 2,460 megahertz of federal spectrum available for commercial use on either an exclusive or shared basis, pioneering new technology and policies for spectrum sharing.

In carrying out its mission, NTIA constantly consults and collaborates, formally and informally, with the federal agencies that use spectrum, as well as with the Federal Communications Commission (FCC), which manages non-Federal spectrum use, and with the Department of State (State), which represents the United States internationally. NTIA chairs the Interdepartment Radio Advisory Committee (IRAC), which is comprised of representatives from the federal agencies that are the primary users of federally allocated spectrum and who advise NTIA with respect to federal spectrum management matters. It also chairs the Policy and Plans Steering Group (PPSG), another interagency body comprised of senior officials that advises NTIA on spectrum management and policy. These advisory bodies and their subcommittees or working groups are key elements of the collaborative process.

Your report highlights some of the challenges that can occur in the effort to manage federal spectrum. One of these can be the potential for disagreement with federal agencies that may have their own unique perspectives and priorities. Another may be a lack of agency resources to provide and process all the data that may be useful to making difficult technical and policy decisions.

On behalf of the Department of Commerce, I have enclosed comments to the proposed report from NTIA that address the specific GAO recommendations. The Department agrees with the three recommendations for NTIA. I understand that NTIA has provided technical comments on the draft report directly to GAO.

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

Again, thank you for the opportunity to review the draft report. The Department is committed to working with the agencies in reviewing the recommendations and taking appropriate action. Should you have any questions, please contact MaryAnn Mausser, Commerce Audit Liaison, at 202-482-8120.

Sincerely,

WYNN COGGINS Digitally signed by WYNN
COGGINS
Date: 2022.01.06 15:17:14 -0500

Wynn W. Coggins
Acting Chief Financial Officer
and Assistant Secretary for Administration

Enclosure: NTIA Response to Recommendations

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

GAO REPORT 22-104537

Recommendation 1. The NTIA Administrator should align its spectrum reallocation planning efforts with program management leading practices by developing a plan, analyzing risks, and creating and updating a schedule for its ongoing and future reallocation efforts.

Response: NTIA already does much of this, both with respect to the overall reallocation process and specific reallocation projects, sharing this information with the federal agencies and the FCC through the IRAC and PPSG but it agrees to make this process more formal, consistent with an appropriate allocation of resources.

Recommendation 2. The NTIA Administrator should document and disseminate to federal agencies policies and procedures describing how it collects and considers agency views on spectrum-related matters to present the view of the executive branch to FCC.

Response: The NTIA *Manual* contains basic information about the process used by the IRAC to collect and consider agency views on spectrum-related matters. We are aware, however, that this documentation may need clarification, particularly with respect to the handling of contentious matters. Consistent with the need to reserve some discretion and flexibility to manage and resolve unique issues with new approaches, we are pleased to undertake that review and provide further clarification.

Recommendation 3. The NTIA Administrator should assess for organization-wide competency gaps in key occupations that manage federal spectrum use and develop and implement a plan to address any identified gaps.

Response: NTIA's Office of Spectrum Management already makes this kind of assessment as an ongoing matter, manifest most recently in our efforts to hire additional spectrum policy advisors and an economist. Nonetheless, in the interest of adhering to best practices, we are prepared to formalize that process.

Agency Comment Letter

Text of Appendix II: Comments from the Department of Commerce

Page 1

Mr. Andrew Von Ah
Director
United States Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Von Ah:

Thank you for the opportunity to review the Government Accountability Office (GAO) draft report entitled *NTIA Should Improve Spectrum Reallocation Planning and Assess Its Workforce* (GAO-22-104537). The Department of Commerce appreciates the work the GAO has done to understand the challenges involved in managing federal spectrum. We are proud of the many accomplishments of the National Telecommunications and Information Administration (NTIA) in this regard, but we are always mindful that there is room for improvement. The Department generally concurs with your recommendations; indeed, for the most part, the recommendations are to formalize activities that we routinely do informally. At the same time, however, please note that establishing more formal processes can require additional resources and, depending on the level of effort, may not be justified in terms of additional benefits. This is particularly the case with spectrum management, inasmuch as the more difficult cases often present unique challenges that may require unique approaches. Moreover, resolving those difficult cases typically requires the cooperation and resources of the federal agencies that operate the systems that depend on the spectrum we manage but are outside of our control.

NTIA is responsible for overall management of Federal spectrum use. NTIA serves as the President's principal advisor on telecommunications and information policy and manages Federally allocated spectrum, including preparing for, participating in, and implementing the results of international radio conferences, as well as conducting extensive research and technical studies through its research and engineering laboratory, the Institute for Telecommunication Sciences. NTIA's record of success is well-established. As your report notes, NTIA

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successfully processes tens of thousands of frequency assignments every year. Over the past twenty years, it has made more than 2,460 megahertz of federal spectrum available for commercial use on either an exclusive or shared basis, pioneering new technology and policies for spectrum sharing.

In carrying out its mission, NTIA constantly consults and collaborates, formally and informally, with the federal agencies that use spectrum, as well as with the Federal Communications Commission (FCC), which manages non-Federal spectrum use, and with the Department of State (State), which represents the United States internationally. NTIA chairs the Interdepartment Radio Advisory Committee (IRAC), which is comprised of representatives from the federal agencies that are the primary users of federally allocated spectrum and who advise NTIA with respect to federal spectrum management matters. It also chairs the Policy and Plans Steering Group (PPSG), another interagency body comprised of senior officials that advises NTIA on spectrum management and policy. These advisory bodies and their subcommittees or working groups are key elements of the collaborative process.

Your report highlights some of the challenges that can occur in the effort to manage federal spectrum. One of these can be the potential for disagreement with federal agencies that may have their own unique perspectives and priorities. Another may be a lack of agency resources to provide and process all the data that may be useful to making difficult technical and policy decisions.

On behalf of the Department of Commerce, I have enclosed comments to the proposed report from NTIA that address the specific GAO recommendations. The Department agrees with the three recommendations for NTIA. I understand that NTIA has provided technical comments on the draft report directly to GAO.

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Sincerely,
Wynn W. Coggins
Acting Chief Financial Officer
and Assistant Secretary for Administration

Enclosure: NTIA Response to Recommendations

Page 4

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GAO REPORT 22-104537

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Appendix III: GAO Contacts and Staff Acknowledgments

GAO Contacts

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

Staff Acknowledgments

In addition to the contact named above, Sally Moino (Assistant Director); Sean Standley (Analyst in Charge); Amy Abramowitz; Oluwaseun Ajayi; Thomas Baril, Sue Bernstein; David Best; Saar Dagani; Kristen Farole; Jon Felbinger; Yvette Gutierrez; Jason Lee; Steven Lozano; Brian Mazanec; Claire McLellan; Nalylee Padilla; Steven Putansu; Malika Rice; Andrew Stavisky; James Tallon; Janet Temko-Blinder; Hai Tran; Alwynne Wilbur; and Teresa Yost made key contributions to this report.

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