



March 2023

# 2020 CENSUS

## A More Complete Lessons Learned Process for Cost and Schedule Would Help the Next Decennial

Accessible Version

## Why GAO Did This Study

Conducting the census is an enormous, expensive, and complex undertaking. The Bureau spends years planning for it. Documenting program cost estimates and implementing good schedule management are essential to conducting a cost-effective, high-quality census within statutory time frames.

GAO was asked to review the Bureau's implementation of the 2020 Census. This report analyzes how (1) the Bureau's actual 2020 Census spending differed from plans, (2) the Bureau's actual schedule differed from plans, and (3) the Bureau is using lessons from the 2020 Census to inform 2030 planning. GAO analyzed the Bureau's 2020 cost and schedule data and reviewed prior related GAO and Bureau reporting. GAO reviewed documentation and interviewed Bureau officials about the lessons the Bureau learned from the 2020 Census.

## What GAO Recommends

GAO is making two recommendations to the Department of Commerce, including that the Bureau take steps during the 2030 Census to document and evaluate its lessons-learned process. The Department of Commerce agreed with GAO's findings and recommendations.

View [GAO-23-105819](#). For more information, contact Yvonne Jones at (202) 512-6806 or [JonesY@gao.gov](mailto:JonesY@gao.gov).

# 2020 CENSUS

## A More Complete Lessons Learned Process for Cost and Schedule Would Help the Next Decennial

### What GAO Found

The 2020 Census will have cost roughly \$13.7 billion by the time its activity ends in 2024. This falls below the Census Bureau's October 2017 estimate of \$15.6 billion. The Bureau allocated more than 80 percent of its 2020 Census spending to enumeration operations, infrastructure, and information technology. The largest area of spending was for enumeration projects such as following up with households that did not return their census forms and counting people who live in group quarters, such as skilled nursing and correctional facilities. The second largest spending area was for infrastructure to support various operations, such as hiring field staff and leasing office space. The third largest spending area was for census survey and engineering, which was mostly spent on IT.

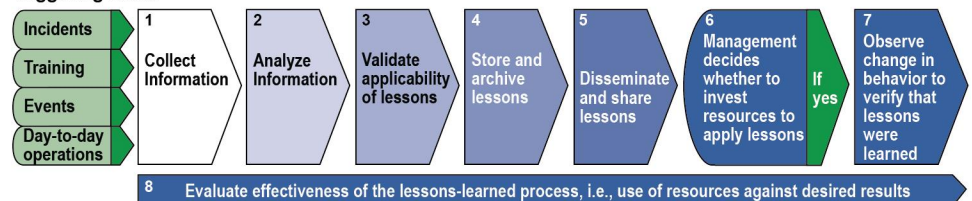
The actual cost of some census operations was higher than planned. Other operations cost less. For example, the Bureau reported it used technology to increase the productivity of field data collection above expectations. This, in turn, resulted in spending less than planned on activities such as following up with non-respondents. Conversely, the Bureau spent more than planned on temporary office space, which it used longer than expected because of the COVID-19 pandemic.

The Bureau delayed or extended census activity prior to and during the COVID-19 pandemic. For example, prior to the COVID-19 outbreak, Bureau hiring was delayed due to problems processing temporary staff background checks. The Bureau also had delays in integrating IT systems within their operations. Additionally, the Bureau paused, extended, or delayed several of its 2020 operations in response to the COVID-19 pandemic.

The Bureau is learning lessons from the 2020 decennial to be used for its early 2030 planning. It is using seven of the eight steps GAO has previously identified for a lessons-learned process. For example, in addition to collecting internal lessons, the Bureau stores and archives resulting recommendations, along with those from external oversight bodies. The Bureau's recommendation management plan describes many of these steps. However, neither the plan nor other decennial guidance refers to periodic evaluation of the process. Documenting and carrying out this process step for the 2030 Census can improve the Bureau's ability to build on prior successes and address future challenges.

### Eight Steps of a Lessons-Learned Process

Triggering event



Source: GAO analysis. | [GAO-23-105819](#)

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**Accessible Data for Eight Steps of a Lessons-Learned Process****Triggering event**

Incidents, training, events, day-to-day operations

1. Collect information
2. Analyze information
3. Validate applicability of lessons
4. Store and archive lessons
5. Disseminate and share lessons
6. Management decides whether to invest resources to apply lessons

If yes

7. Observe change in behavior to verify that lessons were learned
8. Evaluate effectiveness of the lessons-learned process, i.e., use of resources against desired results

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**Abbreviations**

ACO	Area Census Office
BEI	baseline execution index
Bureau	U.S. Census Bureau
MAF/TIGER	Master Address File/Topological Integrated Geographic Encoding and Referencing
NRFU	Non-Response Follow-up

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March 2, 2023

### Congressional Requesters

Conducting the census is an enormous, expensive, and complex undertaking. The U.S. Census Bureau (Bureau) spends years planning for it. Cost estimation and scheduling are both essential. The Bureau has to manage multiple resources to ensure the census operation is cost-effective, meets data quality standards, and is executed within the constitutionally mandated time frames.

A high-quality, reliable cost estimate is a key tool for budgeting, planning, and managing a program as large and complex as the 2020 Census. Without this capability, the Bureau could experience program cost overruns, missed deadlines, and performance shortfalls. Similarly, a reliable schedule helps ensure census operations proceed in concert with one another to avoid complications that can arise from delays.

Our prior work identified deficiencies in the Bureau's 2020 Census cost and schedule estimation practices. This prompted us to add the 2020 Census to our High-Risk List in 2017. In 2018, we found that the Bureau had improved its scheduling processes. In 2019, we found that the Bureau had met all the characteristics for producing a reliable cost estimate. Due to risk and uncertainty, there is always a chance that actual cost and schedule will differ from the estimate. For example, the COVID-19 pandemic significantly affected the 2020 Census cost and schedule. The Bureau has reported that its response to the pandemic cost about \$1.1 billion, or about 8 percent of the about \$99 per housing unit cost (in constant 2020 dollars) of the 2020 Census. Understanding the reasons for cost and schedule variances can improve estimation of future activities or help identify areas of additional potential cost savings.

You asked us to inform Congress about significant operational, management, or technological issues that arose during the 2020 Census of which Congress should be made aware. For this review, we discuss the key components of the 2020 Census cost and schedule and related lessons learned. This report analyzes (1) how the Bureau spent its 2020 Census appropriation and how the spending differed from plans; (2) the major components of the 2020 Census schedule and how they differed from plans; and (3) how the 2020 Census cost and schedule variances can inform 2030 planning.



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We conducted this performance audit from February 2022 to March 2023 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.

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## Background

To conduct the census, the Bureau managed 35 operations, which involved a wide range of interrelated activities. For example, the Bureau developed and acquired major IT systems and recruited and hired more than 300,000 staff to help update the address list and follow up with households that failed to respond to census mailings. In addition, it also prepared and distributed census questionnaires in multiple languages and evaluated the collected census data to ensure quality.

Our *Cost Estimating and Assessment Guide* states that the cost estimate summarizes individual cost elements, using established methods and valid data, to estimate the future costs of a program, based on what is known at that time.<sup>1</sup> Cost estimates are used to support decisions about funding one program over another, develop annual budget requests, evaluate resource requirements at key decision points, and develop performance measurement baselines.

The Bureau's 2020 Census cost estimate comprised eight frameworks or work areas, which broadly identify spending purposes that explain what the Bureau was trying to accomplish. For example, the response framework was focused on deliverables and activities required to access, maintain, and process the response data, such as activities directly related to counting the population. The infrastructure framework was focused on administrative functions, services, logistics, information technology, and operational support, such as acquiring office space in the various regions and providing IT support.

Each framework or work area comprised projects that detailed how the Bureau was conducting the work. For example, the response data framework included the Update Leave program. This program was a

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<sup>1</sup>GAO, *GAO Cost Estimating and Assessment Guide, Best Practices for Developing and Managing Capital Program Costs*, [GAO-09-3SP](#) (Washington, D.C.: March 2009).

special operation to deliver 2020 Census invitation packets to households in areas where the majority of households may not receive mail at their home's physical location. These areas may include small towns where mail is delivered only to post office boxes or areas recently affected by natural disasters. For budgeting and cost-tracking purposes, the Bureau classifies each project as either "IT" or "non-IT"-related. Work areas comprise projects of both types.

Bureau spending was also organized into object classes, or components of cost, which identified the goods and services acquired. The object classes include categories such as salary, overtime and leave, contractual services, and overhead. The object classes could cut across both the work areas and projects. Understanding variances in each of these facets of Bureau spending on the 2020 Census can provide possible lessons for strategizing spending in future decennials.

Furthermore, in conducting the 2020 Census, the Bureau carried out thousands of interrelated activities, which it managed with its integrated master schedule. The master schedule integrates the planned work, the resources necessary to accomplish that work, and the associated budget. Because census operations need to proceed in concert, significant delays can affect other activities and increase costs, reduce operational quality, or force the Bureau to change the design of the census to compensate for lost time.

Despite the Bureau's efforts to plan for the execution of the 2020 Census, deviations from the schedule occurred. According to our Schedule Assessment Guide, changes in resource availability, late or early key deliveries, unexpected additional work activities, and risks can contribute to deviations.<sup>2</sup> The 2020 Census faced challenges that prompted the Bureau to adjust its cost and schedule plans to minimize the impact on the population count. Prior to peak operations, the Bureau faced challenges such as delays in testing and implementing its major IT systems, as well as challenges hiring and onboarding the staff needed to conduct the population count. Additionally, in March 2020, as the Bureau was beginning to collect data for the decennial census, the COVID-19 pandemic caused the Bureau to pause, delay, or extend several operations that affected both the cost and schedule. In response to the

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<sup>2</sup>GAO, *Schedule Assessment Guide: Best Practices for Project Schedules*, [GAO-16-89G](#) (Washington, D.C.: December 2015).

pandemic, the Bureau adjusted its plans for the 2020 Census several times.

According to key practices we and others have identified for both program and project management, it is important to identify and apply lessons learned from programs, projects, and missions to limit the chance of recurrence of previous failures or difficulties. The use of lessons learned is a principal component of an organizational culture committed to continuous improvement. Lessons learned, serve to communicate knowledge more effectively and ensure that beneficial information is factored into planning, work processes, and activities.<sup>3</sup> Moreover, as we and others have previously found, agencies can learn lessons and use that knowledge to change behavior.<sup>4</sup>

The Bureau has already begun preparing for the next decennial census. It plans to develop key features of the design for the 2030 Census during the next 2 years. Within that time frame, the Bureau expects to have created a detailed master schedule, developed its initial cost estimate for the entire census life cycle, and selected major design features.

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<sup>3</sup>GAO, *Project Management: DOE and NASA Should Improve Their Lessons-Learned Process for Capital Asset Projects*, [GAO-19-25](#) (Washington, D.C.: December 21, 2018).

<sup>4</sup>GAO, *Telecommunications: GSA Needs to Share and Prioritize Lessons Learned to Avoid Future Transition Delays*, [GAO-14-63](#) (Washington, D.C.: Dec. 5, 2013); *Federal Real Property Security: Interagency Security Committee Should Implement A Lessons-Learned Process*, [GAO-12-901](#) (Washington, D.C.: Sept. 10, 2012); and *NASA: Better Mechanisms Needed for Sharing Lessons Learned*, [GAO-02-195](#) (Washington, D.C.: Jan. 30, 2002). We also identified lessons-learned practices from reports by both the Project Management Institute and the Center for Army Lessons Learned. Project Management Institute, Inc., *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Sixth Edition (2017) (PMBOK is a trademark of Project Management Institute); and Center for Army Lessons Learned, *Establishing a Lessons Learned Program*.

## 2020 Census Costs Were Concentrated on People and Technology, while Specific Activities Varied from Estimates

### Overall Spending Was Less than Recent Estimates

Bureau officials stated that the 2020 Census will have cost roughly \$13.7 billion by the time its activity ends in 2024.<sup>5</sup> This amount exceeds the initial October 2015 estimate of \$12.3 billion, but is below the Bureau’s October 2017 estimate of \$15.6 billion (see table 1).

**Table 1: The Census Bureau Expects the 2020 Census Will Cost Less than Its 2017 Estimate**  
Dollars in billions

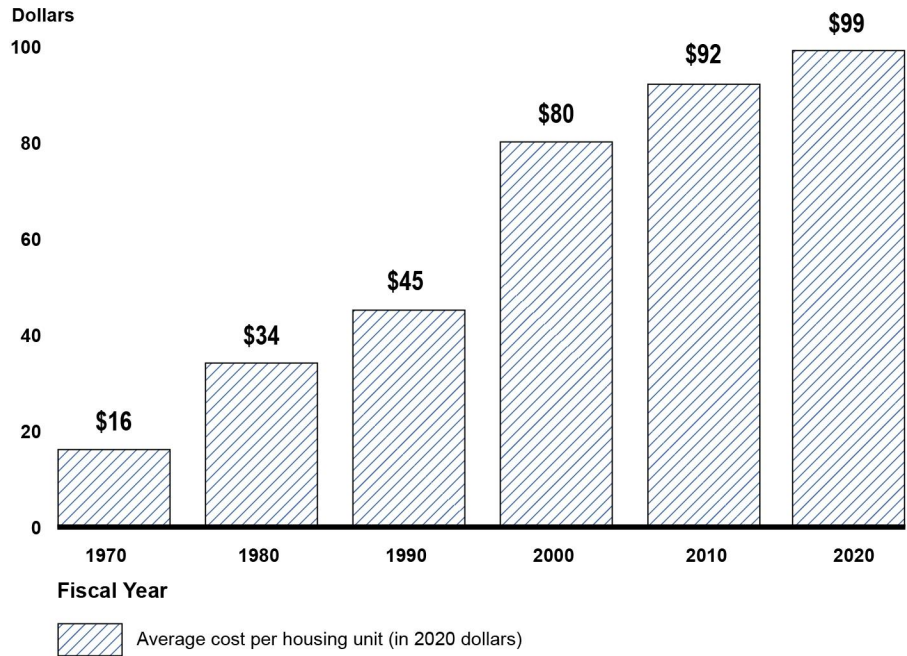
	October 2015 estimate	October 2017 estimate	Actual costs (thru September 2022)	Anticipated final costs as of February 2023
Amount fiscal year 2012-2023 nominal costs	12.3	15.6	13.5	13.7

Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

If the September 2022 estimate holds, the Bureau will have continued slowing the decennial rate of cost growth. For example, the per housing unit rate change between the 2010 Census and the 2020 Census was around 7.4 percent compared to the rate change between the 2000 Census and the 2010 Census, which was around 15 percent. The count in 2020 will cost roughly \$99 per household, compared to \$92 for 2010, \$80 for 2000, and \$45 for 1990 (in constant 2020 dollars) (see fig. 1).

<sup>5</sup>According to Bureau officials, while new appropriations cease after fiscal year 2023, they plan to use some carryover of appropriations to close out the 2020 Census in fiscal year 2024.

**Figure 1: Decennial Per-Housing Costs over Time**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 1: Decennial Per-Housing Costs over Time**

Fiscal Year	Average cost per housing unit (in 2020 dollars)
1970	\$16
1980	\$34
1990	\$45
2000	\$80
2010	\$92
2020	\$99

While overall spending was less than estimated, specific categories of spending varied from plans. For example, some activities, such as Non-Response Follow-Up (NRFU) and Address Canvassing In-Field operations, cost less than planned because of increased productivity, while other expenses, such as field office infrastructure, cost more than planned in large part due to the COVID-19 pandemic. We discuss these spending differences in more detail below.

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## The Bureau Allocated Most 2020 Census Spending to Enumeration Operations, IT, and Infrastructure

The Bureau's allocation of its 2020 Census appropriations can be presented in multiple ways. First, we report on how the Bureau's 2020 Census spending was allocated based on broad work areas. This allocation provides insight on the purposes of the spending and how the Bureau was conducting its work. Then, in the next section, we describe more specifically the goods and services on which the Bureau spent funds.

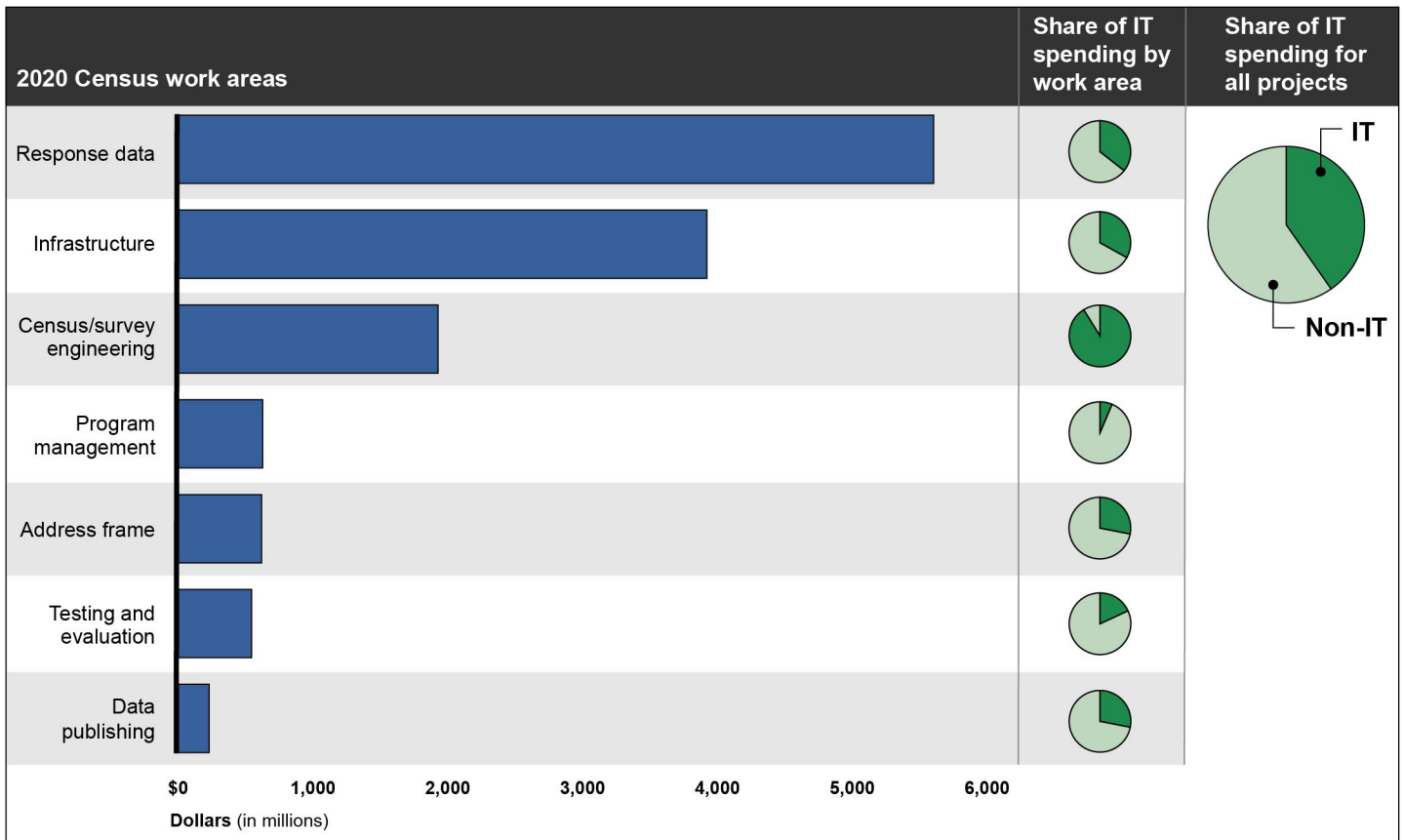
As of September 2022, the Bureau had obligated more than \$13.5 billion toward its projected total cost of \$13.7 billion for the 2020 Census<sup>6</sup>, which it tracked across eight broad functional work areas.<sup>7</sup> These work areas were program management, census survey and engineering, address frame, response data, published data, test and evaluation, infrastructure, and contingency. The Bureau also tracked IT spending amounts. About 40 percent of the expenditures were for IT-related projects (see fig. 2).

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<sup>6</sup>In our June 2021 report [GAO-21-478](#) we reported actual total costs through fiscal year 2021 at \$13.7 billion, a larger number than we are reporting here for actual costs through September 2022. As explained in that report, the earlier total was based on planned spending through the end of that fiscal year—spending that did not occur.

<sup>7</sup>The Bureau relies on a standardized structure, which identifies and outlines the major work of the 2020 Census program and describes the activities and deliverables at the project level where costs are tracked.

**Figure 2: Share of Spending on IT Projects in the 2020 Census Varied across Work Areas, as of September 2022**



Source: Census Bureau obligations data. | GAO-23-105819

**Accessible Data for Figure 2: Share of Spending on IT Projects in the 2020 Census Varied across Work Areas, as of September 2022**

2020 Census work areas	Dollars (in millions)	Share of IT spending by work area (IT)	Share of IT spending by work area (Non-IT)
Response data	\$5,603.96	35.8%	64.2%
Infrastructure	\$3,922.51	33.1%	66.9%
Census/survey engineering	\$1,928.12	91.3%	8.7%
Program management	\$626.22	6.5%	93.5%
Address frame	\$618.14	71.8%	71.8%
Testing and evaluation	\$544.64	18.1%	81.9%
Data publishing	\$229.6	28.2%	71.8%

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IT Share of IT spending for all projects (IT)	Non-IT Share of IT spending for all projects (Non-IT)
40.32%	59.68%

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The largest areas of spending were for projects related to obtaining response data for the census. Spending for the response-data work area included most of the Bureau’s enumeration operations. One operation—NRFU—involves the Bureau’s attempts to enumerate households that did not initially self-respond to the census. In another—Group Quarters—the Bureau enumerates people who live in college and university dorms, correctional facilities, and skilled nursing facilities, among other places. According to Bureau data, the Bureau spent approximately \$5.6 billion, or 41.4 percent, of total 2020 Census spending as of September 2022 on this work area. The \$5.6 billion is just over 2 percent more than the Bureau had estimated for the work area in October 2017.

The second largest spending area of work was infrastructure to support operations. This area included support for the Bureau’s overall field operations staff and the acquisition and leasing of office space in the field, including the 248 area census offices (ACO).<sup>8</sup> This area also incorporates the IT-related infrastructure support to the 2020 Census, including enterprise systems and applications, 2020 Census-specific applications, field IT infrastructure, mobile computing, and cloud computing. According to Bureau data, these activities cost approximately \$3.9 billion, or 29 percent of the total spending as of September 2022. The Bureau spent almost \$500 million more, or about 14 percent, on infrastructure activities than it had estimated it would in October 2017. Spending on projects in the top two areas—response data and infrastructure—comprised more than 70 percent of the total spending on the 2020 Census through September 2022.

The third largest spending area of work was census survey and engineering. According to Bureau data, the Bureau obligated approximately \$1.9 billion, or 14.3 percent, of the total 2020 Census cost expenditures as of September 2022 in this area. In addition, nearly all of the amount was for IT projects. This area included projects related to the Bureau’s systems engineering and integration operations, which

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<sup>8</sup>The Bureau implemented field operations through a nationwide network of 248 ACOs. ACOs oversee local recruiting and operations and are organizational subunits of offices in the Bureau’s six regions.



managed the delivery of the Bureau's integrated systems. This area also included the security, privacy, and confidentiality operation. This operation aimed to make sure that all operations and systems used in the 2020 Census adhered to laws, policies, and regulations that ensured appropriate systems and data security and protected respondent and employee privacy and confidentiality. The Bureau spent about \$130 million less, or about 6 percent, on engineering and integration activities than it had estimated it would in October 2017.

Spending on program management—the operation responsible for the overall 2020 Census program and project management policies, framework and control processes—was a little higher than \$600 million. It principally financed permanent Bureau staff. Spending on the address frame was also a little more than \$600 million. It was intended to build the Bureau's geographic and address database in preparation for decennial population data collection. Approximately 30 percent of address frame spending was for IT projects.

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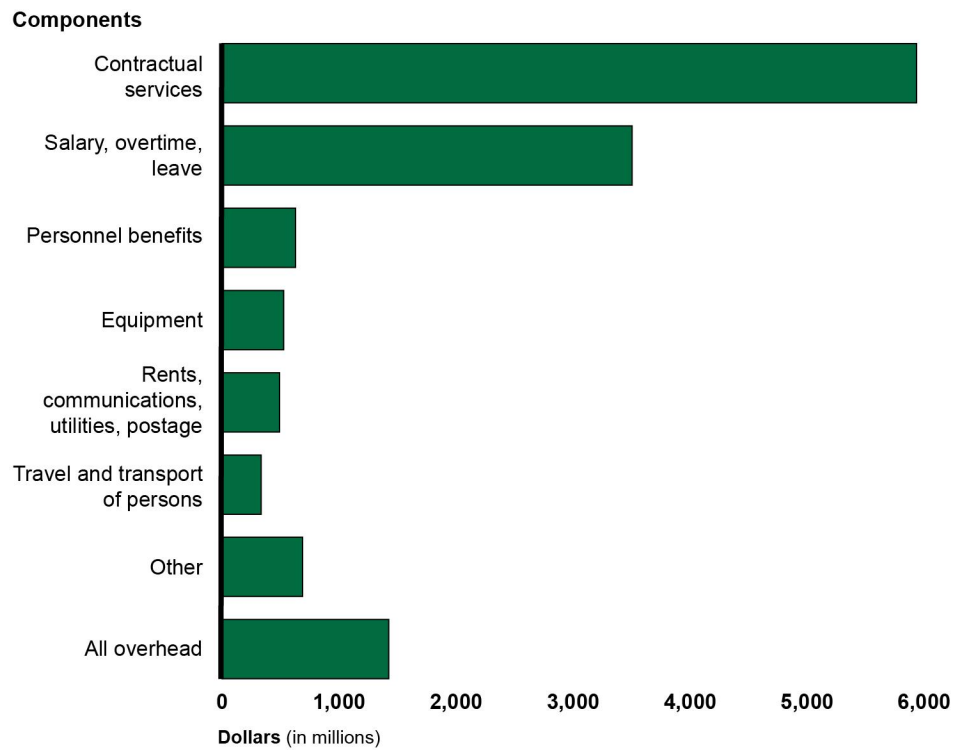
## Contractual Services for IT and Personnel Represented the Largest Goods and Services Expenditures

Bureau budget data also track the types of goods and services the Bureau purchased with obligated funds. The largest spending component of the 2020 Census was contractual services worth approximately \$5.9 billion, or nearly 44 percent of the total 2020 Census cost as of September 2022. For example, the Bureau relied on substantial contractor support to prepare the systems and technology for the 2020 Census. Contractors developed a number of the systems and components of the IT infrastructure. These systems include the IT platform used to collect data from households responding to the census survey via the internet and telephone and for NRFU activities.

The Bureau also relied on a contractor to integrate all of the key IT systems and infrastructure. This includes the IT platform used to collect data from households responding via the internet and telephone, and for NRFU activities. This contractor's responsibilities included, among other things, evaluating the systems and infrastructure and acquiring the infrastructure (e.g., cloud or data center) to meet the Bureau's needs for performance and ability to size the systems to operational scale. Additional contractor responsibilities included integrating all of the systems and assisting with technical, performance, and scalability, as well as operational testing activities.

This component also included Bureau contracts for staff training via private courses, university courses, or government-provided training, as well as agreements with other agencies, such as the United States Postal Service for postage. Figure 3 shows some of the goods and services the Bureau bought for the 2020 Census.

**Figure 3: What 2020 Census Spending Bought, as of September 2022**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 3: What 2020 Census Spending Bought, as of September 2022**

Components	Dollars (in millions)
Contractual services	\$5,933.35
Salary, overtime, leave	\$3,502.37
Personnel benefits	\$626.81
Equipment	\$525.57
Rents, communications, utilities, postage	\$490.34
Travel and transport of persons	\$333.34
Other	\$687.27
All overhead	\$1,423.92

The second largest component of expenditures of the 2020 Census was personnel. For the 2020 Census, the personnel cost was approximately \$4.1 billion—approximately 31 percent of the 2020 Census cost. This total includes salary, overtime and leave, as well as other personnel benefits, such as employer retirement contributions and health and life insurance. For the 2020 census field operations, the Bureau employed a workforce of more than 400,000 people. This workforce comprised temporary staff to conduct the Bureau’s address canvassing and NRFU field work who were hired solely to work on the decennial. It also included permanent staff across the Bureau’s six regions, headquarters, and temporary locations across the nation.

Other notable cost components of the 2020 Census were (1) equipment, which cost approximately \$525 million; (2) rent, communication, utilities, and postage, which cost about \$489 million; and (3) travel, which cost approximately \$333 million. Together those three components represent approximately 10 percent of the total spending as of September 2022. For the 2020 Census, some of this money was spent on the 248 ACOs and six regional census centers the Bureau opened to manage the 2020 Census field operations.

The Bureau’s October 2017 cost estimate did not include projections of purchases of goods and services across all of the components in the same way that the Bureau subsequently tracked actual spending. Thus, comparing spending to what was planned is not readily possible component-by-component. However, we were able to determine some additional differences in spending and their causes, which we describe in more detail below.

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### Increased Productivity Reduced Spending in Some Areas, while COVID-19 Increased Spending In Others

According to the Bureau, it spent less than planned on field data collection due to higher than expected productivity in both its NRFU and Address Canvassing In-Field operations. The Bureau attributed higher-than-expected productivity to its increased use of technology during the 2020 Census. For example, for the NRFU operation, the Bureau credited the implementation of its optimized case assignment and routing (a capability known as the “optimizer”) for the higher-than-expected

productivity for its enumerators.<sup>9</sup> Regarding NRFU, in March 2021, the Bureau reported that it had spent \$1.4 billion for the operation—11 percent under its planned budget of \$1.6 billion.

Similarly, the Bureau spent approximately \$78 million less than planned for its Address Canvassing In-Field operation—39 percent below the estimate. We previously reported that for this operation, the Bureau experienced higher than anticipated productivity from its address listers. This difference was due to efficiency gains from the Bureau's 2020 innovations, which included an automated time and attendance system.<sup>10</sup> We also reported on Bureau efficiency gains from the use of computer laptops to collect census data and a new operational control system that was used to electronically optimize assignments and transmit work to the address listers. Bureau officials stated that the high productivity also helped the operation come in under budget.

During fiscal years 2019 through 2022, the Bureau spent approximately \$66 million less than planned for supplies—55 percent below the estimate. According to the Bureau, NRFU and some other field operations needed fewer supplies than it had initially planned, because the Bureau had not fully adjusted downward its underlying cost estimate to account for higher productivity from its field modernization efforts. COVID-19 changes also affected supply needs. For example, fewer than planned in-field staff resulted in a reduced need for supplies such as writing utensils, clipboards, carrying cases, and other items.

Some adjustments to operations due to the pandemic also reduced some costs. For example, the Bureau spent approximately \$90 million less than planned for its Mobile Questionnaire Assistance program—81 percent below the estimate.<sup>11</sup> As a result of the COVID-19 pandemic, the Bureau

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<sup>9</sup>The optimizer assigns and routes cases to minimize enumerator travel and improve the timing of when households are contacted to when a respondent is expected to be at home. The optimizer uses a number of inputs to ensure efficient case assignment. These inputs include variables like the enumerator's starting address, work availability, the location of open cases, and best time to contact probabilities from administrative record modeling.

<sup>10</sup>GAO, *2020 Census: Bureau Generally Followed Its Plan for In-Field Address Canvassing*, [GAO-20-415](#) (Washington, D.C.: Mar. 12, 2020). Address listers are temporary census employees that go into the community to verify the address and geographic location of a housing unit in advance of enumeration activity.

<sup>11</sup>Mobile Questionnaire Assistance provides census staff at planned social events to help complete questionnaires and answer questions for populations with low self-response rates.

revised its strategy. It reduced planned social gatherings, increased virtual events, and met in less crowded physical locations, such as grocery stores.

Additionally, the Bureau changed the order of some operations in response to the pandemic that resulted in shifting costs across them. For example, the Bureau shifted approximately \$43 million, or 82 percent, of its planned spending for its Service-Based Enumeration operation to its Group Quarters Enumeration operation when its Service-Based Enumeration operation was delayed. The Bureau's Service-Based Enumeration operation counts people experiencing homelessness and others with unconventional living situations. The \$43 million had included all of the training for Group Quarters, which initially was to leverage the Service-Based Enumeration operation that had been scheduled to precede it. In March 2021, we reported that the Bureau implemented low-contact enumeration methods at emergency and transitional shelters in response to the pandemic. These contact methods required fewer enumerators and reduced the cost of the operation.

The Bureau also spent more than planned on some activities, largely because of delays caused by the COVID-19 pandemic. For example, the Bureau spent approximately \$22 million more than planned for ACO furniture and supplies—over twice the estimate; \$192 million more than planned for or ACO field staff—31 percent higher than the estimate; and \$30 million more than planned for ACO office space—17 percent higher than the estimate. The Bureau reported that it extended leases for office space and ACO staffing due to the pandemic.

The Bureau spent more on cash awards as it worked to incentivize field staff to work longer hours in addition to meeting productivity targets, and to travel out of state. During fiscal years 2019 through 2022, our analyses of its budget data shows that the Bureau spent approximately \$101 million more than planned—five times higher the estimate for cash awards.

The Bureau stated that it provided various cash awards in fiscal years 2020 and 2021 for field staff to ensure operational continuity and for the accelerated NRFU operation. For example, the NRFU Production Awards program provided cash awards as an incentive to enumerators and census field supervisors who exceeded the Bureau's weekly hours worked and satisfied their productivity targets. Late in 2020, the Bureau also offered cash awards to enumerators who would travel to complete NRFU in states experiencing production shortfalls.

## Major Components of the 2020 Census Schedule Included Testing and Data Collection, and Both Experienced Delays

### The Bureau Conducted Tests during Much of the 2020 Census Decennial Life Cycle

The Bureau began activities related to the 2020 Census operations early in the previous decade, while still conducting the 2010 Census. The earliest activity, analyzing possible design options for the 2020 Census, involved various summits, workshops, strategic planning, and input from some contractors. The latest activities in the decade involve tabulating and disseminating the population counts and demographic data, closing out and assessing field operations, and calculating and publishing estimates of census errors, all while ensuring nondisclosure of confidential data with public releases of data (see fig. 4).

**Figure 4: The 14-Year Life Cycle of the 2020 Census Had Five Phases**

2009–2011	2012–2014	2015–2018	2019–2023
Options analysis			
	Early research and testing	Supplemental research and testing	
		Operational development and systems testing	
			Readiness testing, execution, and close out

Source: U.S. Census Bureau. | GAO-23-105819

#### Accessible Data for Figure 4: The 14-Year Life Cycle of the 2020 Census Had Five Phases

2009-2011, Options analysis

2012-2014, Early research and testing

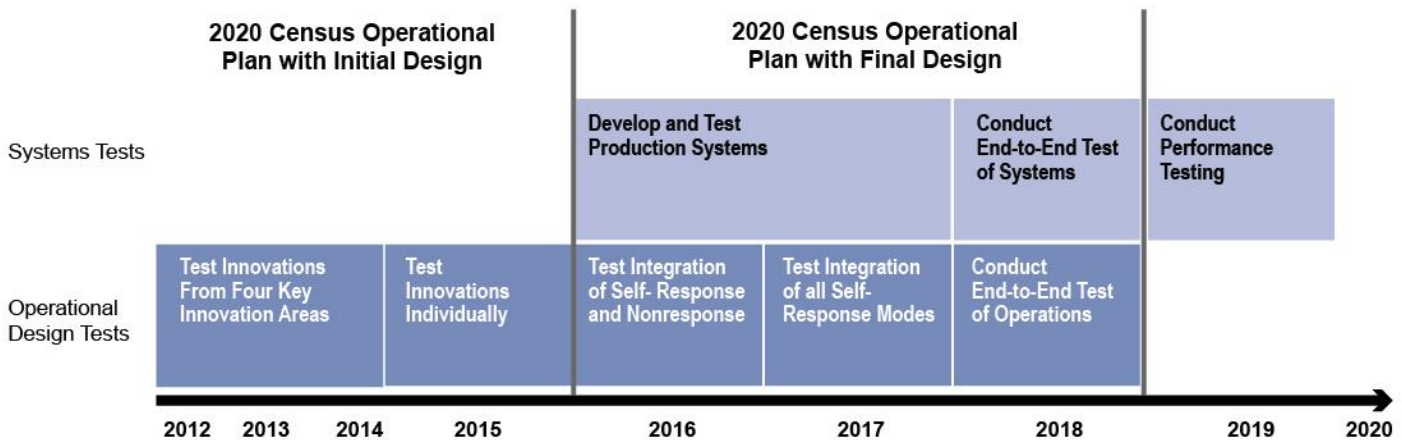
2015-2018, Supplemental research and testing and Operational development and systems testing

2019-2023, Readiness testing, execution, and close out

The Bureau conducted more than 20 tests preparing for the 2020 Census. They ranged from relatively small and quick demonstration tests of automated management tools to multi-year polling of the nation’s attitudes about certain census topics, such as the statistical uses of administrative records. Early in the decade (2012–2015), the Bureau conducted tests aimed at answering specific research questions to inform decisions in four key innovation areas.<sup>12</sup> Testing design ideas and concepts can help avoid failures later.

In 2016, the Bureau shifted its focus to validating and refining the design by testing the interactions across operations and determining the proposed methodology for the operation. For example, the 2016 Census Test focused on the integration of self-response and NRFU operations. The Bureau began testing its production systems in 2017 and continued through 2018 with final performance testing to ensure scalability occurred in 2019. The End-to-End Census Test in 2018 tested the integration of major operations and systems (see fig. 5).

**Figure 5: 2020 Census Testing Spanned Most of the Past Decade**



Source: U.S. Census Bureau. | GAO-23-105819

<sup>12</sup>The Bureau created these innovation areas to reduce cost and enhance data quality. The four key innovation areas were re-engineered address canvassing; optimized self-response; re-engineered field operations; and use of administrative records.

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## The Bureau Collected Data from the Public during a 6-Year Period of the 2020 Census

The official day of record for counting the population in the 2020 Census was April 1, 2020, which the Bureau refers to as Census Day. The census reaches its highest public profile then, because the data the Bureau collects from households includes their population as of Census Day regardless when households return census forms by mail, provide information online, or respond to the large NRFU operation.

However, the Bureau began several operations prior to that date, such as updating and verifying addresses prior to enumeration. For example, the Local Update of Census Addresses program began in January 2017. This program provided tribal, state, and local governments the opportunity to review and update the Bureau's residential list for their government prior to the decennial. The complete validation of the address updates occurred in March 2019. The In-Field Address Canvassing Operation sent address listers into the field to verify mailing addresses that could not be resolved in the office. This operation began on August 4, 2019, and was completed on October 11, 2019.

Census field operations ranged in length from 8 days to 775 days.<sup>13</sup> The longest field enumeration operation is Coverage Measurement. This operation measures the effectiveness of the census by collecting individual and housing information independent from the 2020 Census operations to estimate errors in the census.<sup>14</sup> The Bureau began this operation on January 16, 2020, and ended it on February 28, 2022.

The Service-Based Enumeration operation, which enumerates people experiencing homelessness, had the shortest duration. It started on September 22, 2020, and ended September 29, 2020. The NRFU operation, which is considered the Bureau's largest and most costly field

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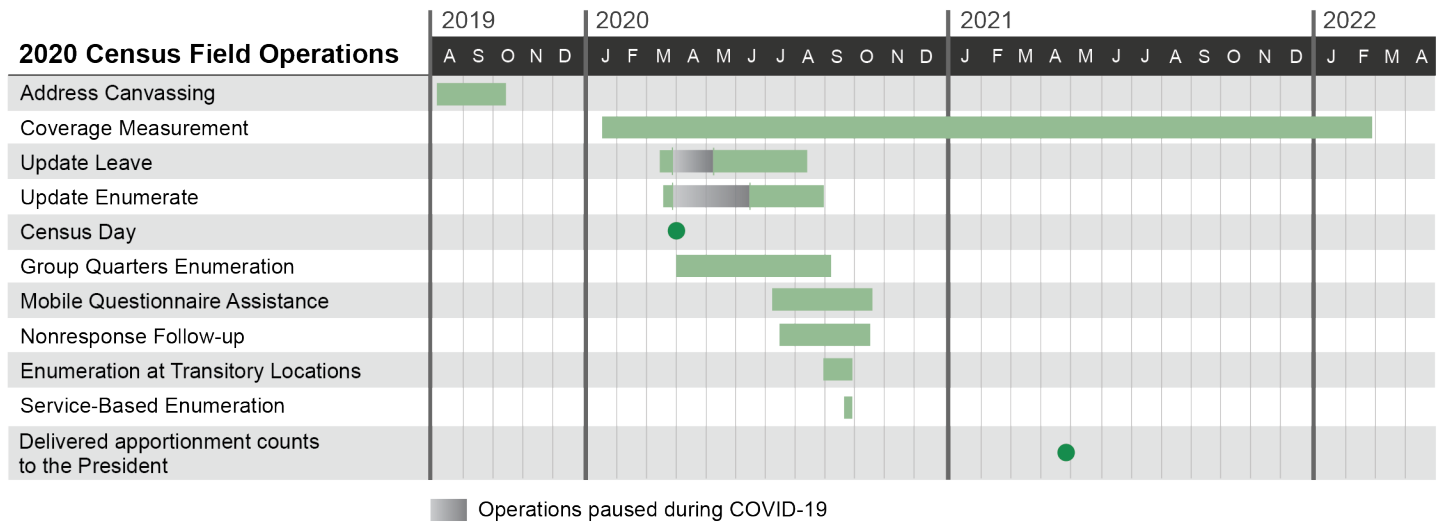
<sup>13</sup>We calculated the durations we present from the "start" and "finish" dates for operations we obtained from the Bureau. They may differ from those we or the Bureau have previously published. In February 2023, Bureau officials provided us a complete set of dates including those it had adjusted and updated on its website to account for "soft launches. Soft launches refer to pauses in operations during COVID-19 that may not have been fully captured in earlier published dates.

<sup>14</sup>In September 2017, the Bureau changed the name of its sub-operations related to Coverage Measurement to refer to the "Post-Enumeration Survey, in part to be more consistent with how similar activity was described in prior decennials. We use "coverage measurement" to refer to all of the sub-operations together.



operation, had a duration of 92 days. Figure 6 shows the duration of selected 2020 Census field enumeration operations.

**Figure 6: Census Field Operations Comprised More Than 2 Years of the 2020 Census**



Source: U.S. Census Bureau 2020 schedule data. | GAO-23-105819

**Accessible Data for Figure 6: Census Field Operations Comprised More Than 2 Years of the 2020 Census**

	Actual Start Date	Actual Finish Date	Actual Duration days
Address Canvassing	8/4/2019	10/11/2019	69
Coverage measurement	1/16/20	2/28/22	775
Update Leave	3/15/20	8/10/20	149
Update Enumerate	3/16/20	8/31/20	169
Census Day	5/1/20	5/1/20	
Group Quarters Enumeration	4/1/20	8/26/20	148
Mobile Questionnaire Assistance	7/13/20	10/15/20	95
Nonresponse Follow-up	8/9/20	10/15/20	68
Enumeration of Transitory Locations	8/31/20	9/29/20	30
Service-Based Enumeration	9/22/20	9/29/20	8
Delivered apportionment counts to the President		4/26/21	

After the field enumeration operations concluded, the Bureau collects other limited data from public sources. For example, the Count Question Resolution operation began on January 3, 2022 and is scheduled to end its public submission period on June 30, 2023. This operation provides an

opportunity for tribal, state, and local governments to request a review of their census counts and boundaries for accuracy. It also accepts evidence in support of requests to review and update already-published census counts.

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## The Bureau Experienced Schedule Delays and Other Challenges before and during the COVID-19 Pandemic

The Bureau relies on schedules to help monitor progress of its many interdependent activities. However, certain dates within the schedule could be subject to change or activities may be canceled due to time or budget constraints. For the 2020 Census, the Bureau faced challenges to its schedules prior to and because of the COVID-19 pandemic, which caused it to modify or adjust the timing of several operations or activities.

### Prior to the Pandemic, Schedule Delays Involved Onboarding Partnership Specialists and Hiring for Early Operations

**Delays in onboarding partnership specialists.** In May 2020, we reported that the Bureau experienced delays in onboarding partnership specialists, which resulted in less time to form partnerships.<sup>15</sup> It also meant less time for community engagement and education activities leading up to the census. While the Bureau increased the number of partnership specialists from roughly 800 in 2010, the Bureau did not get all of its more than 1,500 partnership specialists on board until November 2019—more than 4 months later than its initial goal. In locations with low partnership coverage, the Bureau had partners in adjacent locations reach out to provide services. These services included hosting recruiting events and providing questionnaire assistance.

**Delays in hiring for operations.** In October 2019, we reported that the Bureau experienced delays in hiring for its early operations, which raised concerns about hiring for peak operations.<sup>16</sup> The Bureau missed its target for hiring its address listers. It cited delays in processing background

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<sup>15</sup>GAO, *2020 Census: Update on the Census Bureau's Implementation of Partnership and Outreach Activities*, [GAO-20-496](#) (Washington, D.C.: May 13, 2020). Partnership specialists are temporary Bureau employees responsible for, among other things, establishing local partnerships with retail associations; tribal, state and local governments; local businesses; and nonprofit organizations, among others. Partnership specialists also engage those partners to host activities and events within the communities they serve.

<sup>16</sup>GAO, *2020 Census: Status Update on Early Operations*, [GAO-20-111R](#) (Washington, D.C.: Oct. 31, 2019).

clearances and greater-than-expected attrition as contributing factors to delays in hiring for early operations. The Bureau's hiring challenges persisted later in the Census operation. For example, by the end of NRFU field operations, the Bureau had hired 373,784 of the planned 435,000 enumerators—approximately 86 percent. Despite missing hiring targets, the Bureau experienced higher-than-expected productivity and completed its Address Canvassing operation on time. To complete the NRFU operation within its time frames, the Bureau relocated approximately 26,000 enumerators to hard-to-count areas during the 2020 Census.

**Delays in processing applicants.** In July 2019, we reported that the Bureau experienced a backlog of pre-employment background checks for personnel during the first wave of ACO openings.<sup>17</sup> To address the delays, the Bureau brought on an additional 130 temporary staff to assist in the background check process. The Bureau spent approximately \$34 million more than planned for this activity—33 percent higher than the estimate.

**Delays in IT operations and systems integration.** In February 2022, we reported how we had previously identified compressed or insufficient time frames for developing and testing systems raised serious concerns about the Bureau's ability to manage its system development.<sup>18</sup> For example, the Bureau faced significant challenges in managing its schedule for developing and testing systems for operational tests that occurred in 2017 and 2018. Delays compressed the time available for system and integration testing and security assessments. Because of the compressed schedule, the Bureau accepted cybersecurity risks and deployed systems for operational testing with an increased risk of cybersecurity weaknesses.

### The COVID-19 Pandemic Caused the Bureau to Delay or Extend Schedules for 2020 Census Operations

The COVID-19 pandemic caused the Bureau to pause, extend, or delay several of its 2020 operations. For example, the Bureau delayed its

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<sup>17</sup>GAO, *2020 Census: Bureau Is Making Progress Opening Offices and Recruiting, but Could Improve Its Ability to Evaluate Training*, [GAO-19-602](#) (Washington, D.C.: July 19, 2019).

<sup>18</sup>GAO, *2020 Census: Lessons Learned from Planning and Implementing the 2020 Census Offer Insights to Support 2030 Preparations*, [GAO-22-104357](#) (Washington, D.C.: February 2022).

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Enumeration at Transitory Locations operation by approximately 5 months. During this operation, the Bureau counts people living in housing such as RV parks, campgrounds, marinas, and temporary housing such as hotels and motels. Figure 7 shows selected 2020 Census operations and the pandemic's effect on their respective schedules.<sup>19</sup>

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<sup>19</sup>Dates we present may differ from those previously published for some of these decennial activities. In February 2023, Bureau officials provided us a complete set of dates including those it had adjusted and updated on its website to account for "soft launches".

**Figure 7: Adjustments to 2020 Census Field Operation Schedule Due to COVID-19**

Activity/Operation	2020												2021												Description of Adjustment	
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D		J
<b>Coverage Measurement:</b> Bureau operation to measure the accuracy of the census by independently surveying a sample of the population.	January 16 – June 11												January 16 – February 28												Operation extended about 260 days.	
<b>Self-Response:</b> Households responded online, by phone, or by mail.	March 12 – July 31												March 12 – October 15												Operation extended about 80 days.	
<b>Update Leave:</b> Field staff hand delivered questionnaires to the door in areas without postal service delivery.	March 15 – April 17												March 15 – August 13												Operation extended about 120 days, including 49-day pause during COVID-19.	
<b>Update Enumerate:</b> Field staff visited housing units and collected census data in remote areas.	March 16 – April 30												March 16 – August 31												Operation extended about 120 days, including 88-day pause during COVID-19.	
<b>Mobile Questionnaire Assistance:</b> Bureau staff assisted people responding online at places such as grocery stores and community centers.	March 24 – July 31												July 6 – October 15												Operation delayed about 100 days.	
<b>Service-Based Enumeration:</b> Field staff collected census data from persons using services such as soup kitchens and shelters. Field staff counted persons experiencing homelessness outdoors.	March 30 – April 1												September 22 – September 29												Operation delayed about 180 days.	
<b>Group Quarters Enumeration:</b> Field staff visited group housing (such as persons in nursing facilities) to collect census data.	April 1 – July 31												April 1 – September 3												Operation extended about 30 days.	
<b>Enumeration at Transitory Locations:</b> Field staff visited transitory locations (such as RV parks and motels) to collect census data.	April 9 – May 4												August 31 – September 29												Operation delayed about 140 days.	
<b>Nonresponse Follow-up:</b> Field staff visited nonresponding households to collect census data.	April 9 – July 31												July 16 – October 15												Operation delayed about 100 days.	
<b>Processed data for apportionment</b>	July 31 – December 31												October 15 – April 26												Processing delayed about 80 days.	
<b>Delivered apportionment counts to the President</b>	December 28, 2020												April 26, 2021												Delivery delayed about 120 days.	
<b>Delivered redistricting counts to the states</b>													March 31, 2021												Delivery delayed about 130 days.	

Extended   Delayed   Planned operation dates   Actual operation dates   Operations paused during COVID-19

Source: U.S. Census Bureau schedule data. | GAO-23-105819

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**Accessible Data for Figure 7: Adjustments to 2020 Census Field Operation Schedule Due to COVID-19**

Activity/Operation	Planned operation dates	Actual operation dates	Operations paused during COVID-19
Coverage Measurement: Bureau operation to measure the accuracy of the census by independently surveying a sample of the population.	January 16 – June 1	January 16 – February 28	Operation extended about 260 days.
Self-Response: Households responded online, by phone, or by mail.	March 12 – July 31	March 12 – October 15	Operation extended about 80 days.
Update Leave: Field staff hand delivered questionnaires to the door in areas without postal service delivery.	March 15 – April 17	March 15 – August 13	Operation extended about 120 days, including 49-day pause during COVID-19.
Update Enumerate: Field staff visited housing units and collected census data in remote areas.	March 16 – April 30	March 16 – August 31	Operation extended about 120 days, including 88-day pause during COVID-19.
Mobile Questionnaire Assistance: Bureau staff assisted people responding online at places such as grocery stores and community centers.	March 24 – July 31	July 6 – October 15	Operation delayed about 100 days.
Service-Based Enumeration: Field staff collected census data from persons using services such as soup kitchens and shelters. Field staff counted persons experiencing homelessness outdoors.	March 30 – April 1	September 22 – September 29	Operation delayed about 180 days.
Group Quarters Enumeration: Field staff visited group housing (such as persons in nursing facilities) to collect census data.	April 1 – July 31	April 1 – September 3	Operation extended about 30 days.
Enumeration at Transitory Locations: Field staff visited transitory locations (such as RV parks and motels) to collect census data.	April 9 – May 4	August 31 – September 29	Operation delayed about 140 days.
Nonresponse Follow-up: Field staff visited nonresponding households to collect census data.	April 9 – July 31	July 16 – October 15	Operation delayed about 100 days.
Processed data for apportionment	July 31– December 31	October 15 – April 26	Processing delayed about 80 days.
Delivered apportionment counts to the President	December 28, 2020	April 26, 2021	Delivery delayed about 120 days.
Delivered redistricting counts to the states	March 31, 2021	August 12, 2021	Delivery delayed about 130 days.

Delays and changes to 2020 Census operational schedules as a result of the COVID-19 pandemic affected the Bureau's plans to implement

privacy protections—known as differential privacy.<sup>20</sup> For example, the Bureau originally planned to make final decisions on differential privacy in December 2020. Because of changes to the data collection and data processing schedule, the Bureau made these decisions in June 2021—about 6 months later. Additionally, in September 2021, the Bureau provided a notional updated schedule for the disclosure avoidance steps it plans to take during the development of these data products.

However, this notional schedule lacked detail and did not provide specific dates for these disclosure avoidance activities. According to Bureau officials, the schedule did not include specific dates because they planned to update it in phases. In March 2022, we recommended that the Bureau update its schedule for these disclosure avoidance-related activities. As of September 2022, the Bureau had not yet done so.<sup>21</sup> In response to a draft of this report, Bureau officials informed us that they had updated parts of the schedule for selected releases of data and we await evidence of the updates of those and the entire schedule.

Furthermore, lawsuits and other concerns over the enumeration contributed to additional schedule changes during 2020. For example, on April 13, 2020, in response to COVID-19, the Bureau announced plans to (1) extend the self-response period through October 31, 2020; (2) conduct the NRFU operation through October 31, 2020; and (3) deliver apportionment data to the President by April 30, 2021. However, on August 3, 2020, the Bureau revised its plans, announcing that it would accelerate its operational time frames, as directed by the Secretary of Commerce, to deliver population counts for apportionment to the President by the statutory deadline of December 31, 2020, rather than April 30, 2021.

To meet the revised timeline, the Bureau announced the self-response period and the NRFU operation would end on September 30, 2020—1 month earlier than previously announced. In September 2020, however,

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<sup>20</sup>Differential privacy is a disclosure avoidance technique aimed at limiting statistical disclosure and controlling privacy risk by using an algorithm. According to the Bureau, using differential privacy means that publicly available data will include some statistical noise, or data inaccuracies, to protect the privacy of individuals. Differential privacy provides algorithms that allow policy makers to determine the trade-off between data accuracy and privacy.

<sup>21</sup>GAO, *2020 Census: Bureau Released Apportionment and Redistricting Data, but Needs to Finalize Plans for Future Data Products*, [GAO-22-105324](#) (Washington, D.C.: March 14, 2022).

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the U.S. District Court for the Northern District of California issued a preliminary injunction, staying the September 30 deadline for the completion of data collection and the December 31 deadline for delivering the population counts to the President. In doing so, the District Court ordered the Bureau to reinstate the previous deadline and continue data collection through October 31, 2020.

On appeal, the U.S. Court of Appeals for the Ninth Circuit affirmed that the Bureau was to continue data collection through the end of October. However, it stayed the injunction that prevented the Bureau from attempting to meet the December 31 deadline. On October 13, 2020, the U.S. Supreme Court granted a stay of the lower court's preliminary injunction of the September 30 deadline. In response, the Bureau ceased data collection on October 15, 2020. We previously recommended that, among other things, the Bureau assess the effect of the COVID-19 pandemic on data quality. Bureau official told us they expect to provide a report by the end of calendar year 2023.

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## The Bureau Tracks Lessons Learned but Could Do More to Ensure the Process is Effective

The Bureau has collected dozens of cost and schedule lessons from its 2020 Census experience. It also has a process in place for assessing their validity and tracking implementation of resulting recommendations as it prepares for the 2030 Census.

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## The Bureau Uses a Systematic Lessons-Learned Process, but Could Do More to Verify that Lessons Are Learned and the Process Is Effective

In September 2012, we identified eight individual practices that, in combination, can be considered steps within an overall lessons-learned process. This process provides a systematic means for agencies to learn from an event and make decisions about when and how to use that knowledge to change behavior.<sup>22</sup> These steps are summarized in figure 8.

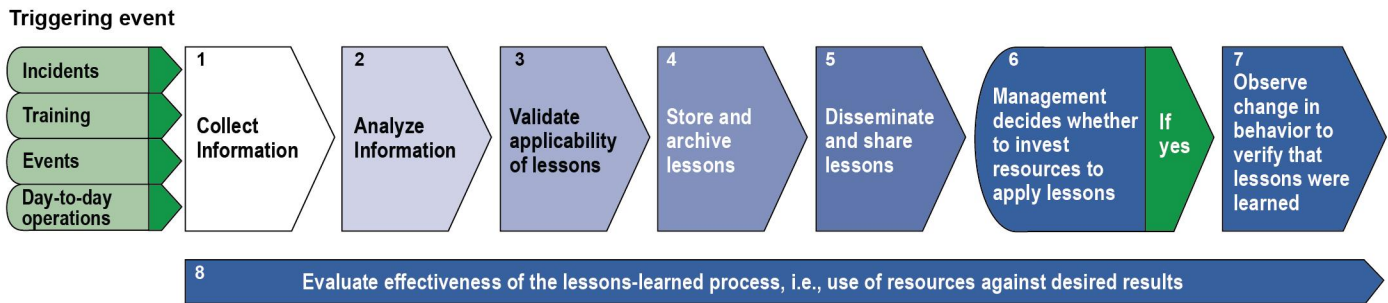
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<sup>22</sup>GAO, *Federal Real Property Security: Interagency Security Committee Should Implement a Lessons-Learned Process*, [GAO-12-901](#) (Washington, D.C.: September 2012).



In our review, we determined that the Bureau has either implemented or has planning documents in place to implement seven of the eight steps.

**Figure 8: Eight Steps an Agency Can Take in a Lessons-Learned Process**



Source: GAO analysis. | GAO-23-105819

**Accessible Data for Figure 8: Eight Steps an Agency Can Take in a Lessons-Learned Process**

**Triggering event**

Incidents, training, events, day-to-day operations

1. Collect information
2. Analyze information
3. Validate applicability of lessons
4. Store and archive lessons
5. Disseminate and share lessons
6. Management decides whether to invest resources to apply lessons

If yes

7. Observe change in behavior to verify that lessons were learned

Evaluate effectiveness of the lessons-learned process, i.e., use of resources against desired results

The Bureau’s process for learning operational and program management lessons from the 2020 Census aligns with these overlapping multiple steps:

**Collect information.** The Bureau conducted a focus group for each of more than 30 operations with the staff responsible for managing the 2020 Census. An independent team facilitated the data collection, assuring nondisclosure of the sources of comments, and collating comments into structured lists. The information collected included what worked well, what were the challenges for the 2020 Census, and recommended improvements for the 2030 Census.

**Analyze information.** A centralized team of decennial staff consolidated, unduplicated, and documented the information collected into a

constructive and actionable lessons-learned product. The team also identified those lessons that could be acted on directly, versus those that might require additional research or decision-making.

**Validate applicability of lessons.** The Bureau is relying on teams charged with conducting operational assessments of their respective operations to determine which lessons from the lists—or others— should be elevated to recommendations in their operational assessments. Decennial managers review each operational assessment before issuance.

**Archive lessons.** The Bureau stores lists of lessons learned from the focus groups in a centrally available repository. It also stores lessons elevated as recommendations from the operational assessments—such as those from census advisory committees, the Department of Commerce Office of Inspector General, ourselves, and others.

**Disseminate lessons.** According to the Bureau's recommendation management plan, the Bureau's "Recommendation Portal" provides a centrally accessed interface for assigning responsibility for, tracking the status of, and reporting on recommendations and their action plans. According to the Bureau's management plans, each recommendation included in the 2030 Census Design is to be assigned to the appropriate manager of a 2030 Census area to be accountable for addressing it.

**Management decides.** The Census Senior Leadership Team is to approve final recommendations to be included in the 2030 Census design. According to the Bureau, it has a target date of September 2024 to complete the related analysis, review, and approval.

**Observe change.** According to internal Bureau reporting documents, Bureau managers of decennial research for 2030 receive monthly and semi-annual reporting of metrics on the status of recommendations. Bureau officials say these metrics are used to gauge responsiveness of program managers on addressing recommendations.

**Evaluate the effectiveness of the lessons-learned process.** The Bureau has not yet needed to plan the last step in the process for 2030. Based on our review of 2020 Census documents and interviews with Bureau officials, this step was neither documented within management planning documents nor carried out systematically.

Bureau officials told us that while they have not directly assessed the effectiveness of their lessons learned process, their recommendation management plan is complemented by institutional memory and professional conduct of staff who take note of how well processes are working and make suggestions for improvement from time to time. Documentation of steps the Bureau takes or will take in the future would help ensure improvements to the process are sought out and made as current staff experience attrition over time.

Evaluating the effectiveness of the lessons-learned process will help reinforce and leverage Bureau investments in its knowledge-management efforts, demonstrating how decisions are evidence-based and contribute to continuous improvement in census cost and quality. A comprehensive lessons-learned process can help an agency build on prior successes and address future challenges.

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### The Bureau Preserves Schedule Baseline Data, Which Could Provide Additional Lessons for Management

Throughout much of the decennial census, the Bureau archived monthly snapshots of its master schedule file, in which it managed schedules for its active decennial projects. Early snapshots encompass prototype versions of the schedule when it was being developed. The snapshots largely contained relatively high-level milestones. Later snapshots were populated with more granular activity as project plans were developed, refined, and eventually executed. Bureau officials report that similar archiving is expected for the 2030 Census, as described in their 2020 Census schedule management plan. In our work with schedules from agencies across the federal government, we do not often see agencies preserving this potentially valuable information after respective projects are completed.

According to Bureau officials, the Bureau learned and documented lessons about its scheduling practices in near-real time during the census to help improve data manageability. Bureau scheduling staff described how and if project managers and the schedulers they worked with were seeing systematic under- or overestimation of time to execute their respective activities. For example, they gave corrective feedback to staff at that time. Also in real time, the schedule team would respond to the level of detail in the schedule. For example, when working with their counterparts in the IT projects tracking more than 30 steps leading to the “authority to operate” for more than 50 IT systems, schedule staff

described helping to simplify the schedule into the tracking of five higher-level milestones rather than the many more individual steps.

While there was no facilitated focus group dedicated to schedule lessons, scheduling lessons were raised across the more than 30 feedback sessions with staff and collated into a theme. This included a specific list of lessons provided directly to the schedule management team. The lessons have yet to be decided on by managers in the sixth step of the lesson learned process we describe. The preliminary list includes lessons related to: (1) streamlining procedures, such as for the schedule change control process; (2) changing the granularity of activity tracked in specific areas; (3) allowing more time for certain testing before production; and (4) resolving inconsistencies in schedules across different tools or documentation.

As one of the comments from the Bureau's preliminary lessons for scheduling described, analyzing schedule changes over time could help planning the next decennial. Our *Schedule Assessment Guide* states that comparing the final schedule to the original schedule can help assess lessons learned.<sup>23</sup> The Program Management Book of Knowledge describes how data analyses, such as trend and variance analyses, can help with lessons learned at project closure.<sup>24</sup>

The Bureau's schedule management plan makes no references to assessing the schedule efforts, practices, or data after the census activity is complete. According to the schedule staff who managed the 2020 Census master schedule, they are already scheduling and planning for the 2030 Census while closing out the schedule of 2020 Census projects. According to Bureau officials, the last closeout of 2020 Census activity is expected in fiscal year 2024. They said that since staff had not already planned for it, it would be difficult to allocate time to mobilize a formal or systematic review of the various baselines of the 2020 Census schedules. In addition, they pointed out that the disruption of the pandemic during the census and the different re-baselining of the schedule done in response to the events of 2020 could complicate interpreting schedule variances across the baselines.

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<sup>23</sup>[GAO-16-89G](#).

<sup>24</sup>*A Guide to the Program Management Book of Knowledge, PMBOK® Guide*, Sixth Edition.

We recognize the difficulty in mobilizing an unplanned-for systematic review of the 2020 Census schedule and the complexity that it would introduce, given the Bureau's re-baselining due to the events of 2020. Yet when an agency has well-documented baseline data in conjunction with final schedules, scheduling and data presentation tools can provide visualizations of the data enabling ready identification of patterns or trends that may prompt or help answer questions management can consider for the program. In appendix II, we present numerous charts illustrating systematic analyses of selected 2020 Census projects' schedule data that we think can help managers learn lessons from the 2030 Census. We also present illustrative questions that, based on our experience working with schedules across the federal government, we believe could help inform managers about such analyses.

Trend analysis of schedule start and finish dates in a schedule can provide valuable information about how a program is performing. Knowing what has caused problems in the past can help determine whether they will continue. In our work with schedules across federal agencies, we do not often see programs keep meaningful baselines or any baselines at all. The Bureau's planned archive of schedule snapshots for the 2030 Census promises to provide a wealth of data describing what early schedulers think about what may happen, and a record of how thinking about the schedule for the 2030 Census evolves over time, much as the current archive of schedules does for the prior census.

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## The Bureau Is Leveraging Other Cost and Schedule Lessons for 2030 Census

**Soft launches.** Bureau staff reported to us during the 2020 Census that they plan to repeat reliance on what they referred to as a "soft launch" of various field operations activities during future census planning. Similar to a pilot, a soft launch begins actual census activity, such as data collection, on a limited scale and likely in a limited area. This provides an opportunity for census managers and other staff to gain early experience to help discover and address any remaining problems before enlarging the activity.

**Budget uncertainty.** As we previously reported, in 2013, the Bureau canceled 14 of its originally scheduled 24 field tests that were planned for fiscal years 2013-2014 to research new address listing and enumeration methods. The Bureau also reduced the scope of other later tests, citing budget uncertainty at the time. In February 2022, we recommended that

the Bureau better plan for budget uncertainty.<sup>25</sup> The Bureau agreed with the recommendation and, as of September 2022, it has outlined outcome management procedures implemented prior to the 2030 Census program inception that it believes are helping manage risk to its research agenda. We are continuing to monitor Bureau actions toward the open recommendation.

**Design change cost.** In June 2021, we recommended that the Bureau track its future design innovations within its cost estimation and budget execution framework.<sup>26</sup> The Bureau agreed with the recommendation and piloted an approach to have program managers approximate cost allocations to specific areas being researched and tested for the 2030 Census. In December 2022, Bureau officials reported that the pilot had been fully implemented and that in January 2023 they would receive their first annual assessment of the percentages of planned spending against the actual spending for fiscal year 2022. They also plan for the assessment to include baselines for fiscal years 2023 and 2024. These are the first full years of the program in which all of the research projects will be formally established, staffed, and started. We are continuing to monitor Bureau actions toward the open recommendation.

**Response-processing schedule.** In June 2021, we recommended that the Bureau research and test how innovations or design changes affect the methodologies and the time required for post-data collection steps, which experienced related delays in 2020. The Bureau agreed with the recommendation. It is collecting lessons learned from response processing and related operations to inform 2030 planning. It also noted that an enhancement area being discussed for the 2030 Census involves integrating data collection, response processing, and data analysis to better address any data anomalies in near-real time.

**Adequate time for integration testing.** Leading up to the 2020 Census, we reported that the Bureau delayed key IT-related decisions, compressing the time available to develop and test systems.<sup>27</sup> The Bureau then faced significant challenges in managing the schedule for developing and testing IT systems, due to issues experienced during

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<sup>25</sup>[GAO-22-104357](#).

<sup>26</sup>[GAO-21-478](#).

<sup>27</sup>[GAO-14-389](#) and [GAO-16-205T](#).

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systems development. In response to schedule management challenges, the Bureau revised its schedule in October 2018, including re-organizing its schedule from tracking 52 separate systems into assessing 16 combined operational deliveries.<sup>28</sup> Some of the Bureau's own operational assessments have recommended defining specifications and awarding related contracts earlier and allowing more time for testing.

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## Conclusions

The Bureau has conducted several steps of a process to learn lessons from its cost estimation and scheduling as well as other aspects of the 2020 Census. This will set the stage for leveraging documented successes and navigating future challenges. Following through with the remaining step of the process—documenting and evaluating the process—for the 2030 Census can further improve the Bureau's knowledge management. It can also position it to demonstrate how its activity is guided by evidence-based decision-making and commitment to continuous improvement more efficiently and transparently.

As a result of its schedule management practices, the Bureau has retained a large number of snapshots of its integrated master schedule. These snapshots provide opportunities for systematic reviews of data across time and events. The repeated nature of the decennial census prompts questions for management about what lessons can be learned from systematic review of the data. By including the requirement for structured analyses of the archived snapshots of its schedule in Bureau management plans for future censuses, the Bureau will be better able to plan for, allocate resources to, and carry out the learning of lessons from its scheduling efforts.

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## Recommendations for Executive Action

We are making the following two recommendations to the Department of Commerce:

The Secretary of Commerce should ensure that the Director of the Census Bureau document and take steps during the 2030 Census to

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<sup>28</sup>[GAO-19-588T](#).

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evaluate the Bureau's comprehensive lessons-learned process.  
(Recommendation 1)

The Secretary of Commerce should ensure that the Director of the Census Bureau include steps in its 2030 schedule management plans for learning lessons from systematic ex-post evaluation of the Bureau's extensive decennial and related schedule data.  
(Recommendation 2)

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## Agency Comments and Our Evaluation

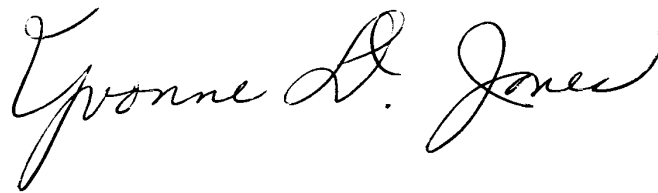
We provided a draft of this report to the Department of Commerce. In its written comments, reproduced in appendix IV, Commerce agreed with our findings and recommendations. The Bureau also provided updated information about dates of 2020 Census field operations resulting from its recent review of them, and other technical comments. We incorporated this information as appropriate.

We are sending copies of this report to the Secretary of Commerce, the Undersecretary of Economic Affairs, the Director of the U.S. Census Bureau, and the appropriate congressional committees. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.



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If you or your staff have any questions about this report please contact Yvonne D. Jones at (202) 512-6806 or by email at [jonesy@gao.gov](mailto:jonesy@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix V.

A handwritten signature in black ink that reads "Yvonne D. Jones". The signature is written in a cursive style with a large, stylized initial "Y".

Yvonne D. Jones  
Director, Strategic Issues

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*List of Requesters*

The Honorable Gary C. Peters  
Chairman  
Committee on Homeland Security and Governmental Affairs  
United States Senate

The Honorable Ron Johnson  
Ranking Member  
Permanent Subcommittee on Investigations  
Committee on Homeland Security and Governmental Affairs  
United States Senate

The Honorable James Comer  
Chairman  
The Honorable Jamie B. Raskin  
Ranking Member  
Committee on Oversight and Accountability  
House of Representatives

The Honorable Judy Chu  
House of Representatives

The Honorable Gerald E. Connolly  
House of Representatives

The Honorable Steven Horsford  
House of Representatives

The Honorable Jim Jordan  
House of Representatives

The Honorable Chip Roy  
House of Representatives

The Honorable Raul Ruiz  
House of Representatives

## Appendix I: Objective, Scope, and Methodology

This report (1) describes how the Census Bureau spent its appropriation on the 2020 Census and how spending differed from what was planned; (2) describes the major components of the 2020 Census schedule and how they differed from what was planned; and (3) assesses how the Bureau is planning to use 2020 cost and schedule data to inform research priorities or cost and schedule estimation for the 2030 Census.

For the first objective, we analyzed the Bureau's 2020 Census planned and actual budget data extracted from the Bureau's Decennial Budget Integration Tool for fiscal years 2012 through 2022. We summed and compared for each year the planned and actual obligations by

- work area, or framework, which broadly identifies the spending purpose (i.e., what the Bureau was trying to accomplish);
- project, which identifies the specific operation or activity that the Bureau spent funds executing; and
- component, or object class, which identifies what the Bureau bought (i.e., what goods or services were acquired).

We also reviewed our prior work and Bureau documentation, such as operational plans. In addition, we interviewed Bureau officials for their perspective on spending patterns as well as causes of variances from what was planned. Since the Bureau re-baselined its spending plans for the 2020 Census at least annually, we relied on the Bureau's September 2017 cost estimate to determine variances for the largest spending areas, or frameworks.

For the second objective, we reviewed our prior reports and Bureau 2020 Census planning documents and memorandums. We did this to identify 2020 Census operations and other activities that exhibited the longest durations. We interviewed schedule officials for their perspective on key schedule operations and other activities. To identify differences between 2020 Census schedule estimates and actual schedule execution, we reviewed and analyzed Bureau documentation and our prior reporting on planned and actual dates for selected 2020 Census operations and

activities. We reviewed Bureau documentation and our prior reports to identify possible factors or causes for the differences between the actual and planned schedule. We also discussed with the Bureau its efforts to determine start and finish dates reflecting soft launches and closeout of quality control activity that may not have been fully recorded in its master schedule.

For the third objective, we reviewed and analyzed Bureau documentation on lessons learned from the 2020 Census and how the Bureau intends to use those lessons learned for 2030 Census planning. We also reviewed our prior reports on best practices for learning lessons and determined the extent the Bureau was incorporating those best practices. We interviewed Bureau officials to obtain their views on the Bureau's plans to use 2020 Census cost and schedule data in 2030 Census planning.

We conducted this performance audit from February 2022 to March 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

## Appendix II: Examples of ex-post Schedule Analyses, and Related Management Questions

In this appendix, we provide examples of variance analyses that can be conducted using valid baseline data, as well as potential questions management and planners may pose in the course of an ex post analysis. Establishing a baseline schedule is essential to effective management. A baseline schedule represents the original configuration of the program plan and signifies the consensus of all stakeholders regarding the required sequence of events, resource assignments, and acceptable dates for key deliverables. It is consistent with both the program plan and the program budget plan. It also clearly defines the responsibilities of program performers.

Schedules deviate from the baseline as a program is executed. Changes in resource availability, late or early key deliveries, unexpected additional work activities, and risks can contribute to deviation. As we note in our Schedule Assessment Guide:

Comparing the current status of the schedule to the baseline schedule can help managers identify the cause of the deviation, thereby allowing them to target specific areas such as resource assignments, network logic, and other factors for immediate mitigation. Without a formally established baseline schedule to measure performance against, management lacks the ability to identify and mitigate the effects of unfavorable performance.

The final version of the current schedule—the “as-built” schedule—represents the plan as executed to completion. Particular care should be taken to archive this final version. Once the project has been completed, the as-built schedule becomes a database of the actual sequence of events, activity durations, required resources, and resource productivity. These can be compared to the original plan for an assessment of lessons

learned, and the data become a valuable basis of estimate input for schedule estimates of analogous projects.<sup>1</sup>

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## Schedule Baseline Trend Analysis

When an agency has well-documented baseline data in conjunction with final schedules, scheduling and data presentation tools can provide visualizations of the data. This, in turn, enables ready identification of patterns or trends that may prompt or help answer questions management can consider for the scheduled program. The use of graphics should be chosen based on the circumstances of the projects and program being scrutinized. These graphics shown below are intended only as illustrative examples.

In addition, variances are to be expected and do not by themselves indicate weakness in schedule planning. As we state in the Schedule Guide:

Although they are often perceived as something bad, negative variances provide valuable insight into program risk and its causes. Positive variances can indicate problems as well. For example, early starts may cause issues with out-of-sequence logic and can disrupt the scheduling of future resources.

Understanding the types of activities that have started earlier or later than planned is vital as well. For instance, positive variances may not be desirable if only relatively easily accomplished activities are completed early while critical activities are delayed. Variances empower management to decide how best to handle risks. Schedule deviations from the baseline plan give management at all levels information about whether corrections will bring the program back on track or completion dates need updating.

A schedule variance does not necessarily mean program delay; it means that work was not completed as planned. Negative schedule variances should be investigated to see if the effort is on the critical path. If it is, then the whole program will be delayed. In

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<sup>1</sup>GAO, *Schedule Assessment Guide: Best Practices for Project Schedules*, [GAO-16-89G](#) (Washington, D.C.: December 2015).

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

addition, activities that vary significantly from their baseline may create a new critical path or near-critical path.<sup>2</sup>

Finally, not all variances are of interest to management. The threshold for reporting variances varies by program size, complexity, and risk. Also, threshold guidance should take into account the number of days the activity is delayed as well as the time available for the activity to be delayed before it delays the project finish date (known as total float).

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## Methodology

We collected current and baseline data for the six 2020 Decennial Census projects listed in table 2. We chose projects drawn from different work areas of the decennial activity. We used schedule files with a status date of July 1, 2022. The associated baselines for those schedule files are dated May 2021. According to the Bureau, they represent the revised baseline due to COVID-19 delays.<sup>3</sup> We present numerous charts illustrative of the systematic analyses of the projects' schedule data that we think can help managers learn lessons from the experience of their programs. Based on our experience working with schedules across the federal government, we also present illustrative questions we believe that it could help managers to ask about the displayed results from these analyses.

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**Table 2: Selected Schedules for Illustrative Baseline Analysis**

<b>Project</b>	<b>Project start</b>	<b>Project finish</b>
2020 Census Address Canvassing	12/31/2014	3/18/2022
2020 Census Internet Self Response	6/24/2016	4/17/2023*
2020 Census Master Address File / Topologically Integrated Geographic Encoding and Referencing	4/7/2014	3/24/2023*
2020 Census Non-Response Follow-up	6/24/2016	5/26/2023*
2020 Census Response Processing	7/14/2017	1/27/2023*
2020 Census Systems Engineering and Integration	3/9/2017	3/28/2025*

Source: GAO analysis of US Census Bureau data. | GAO-23-105819

Note: an asterisk denotes a date forecasted within the Bureau's master schedule.

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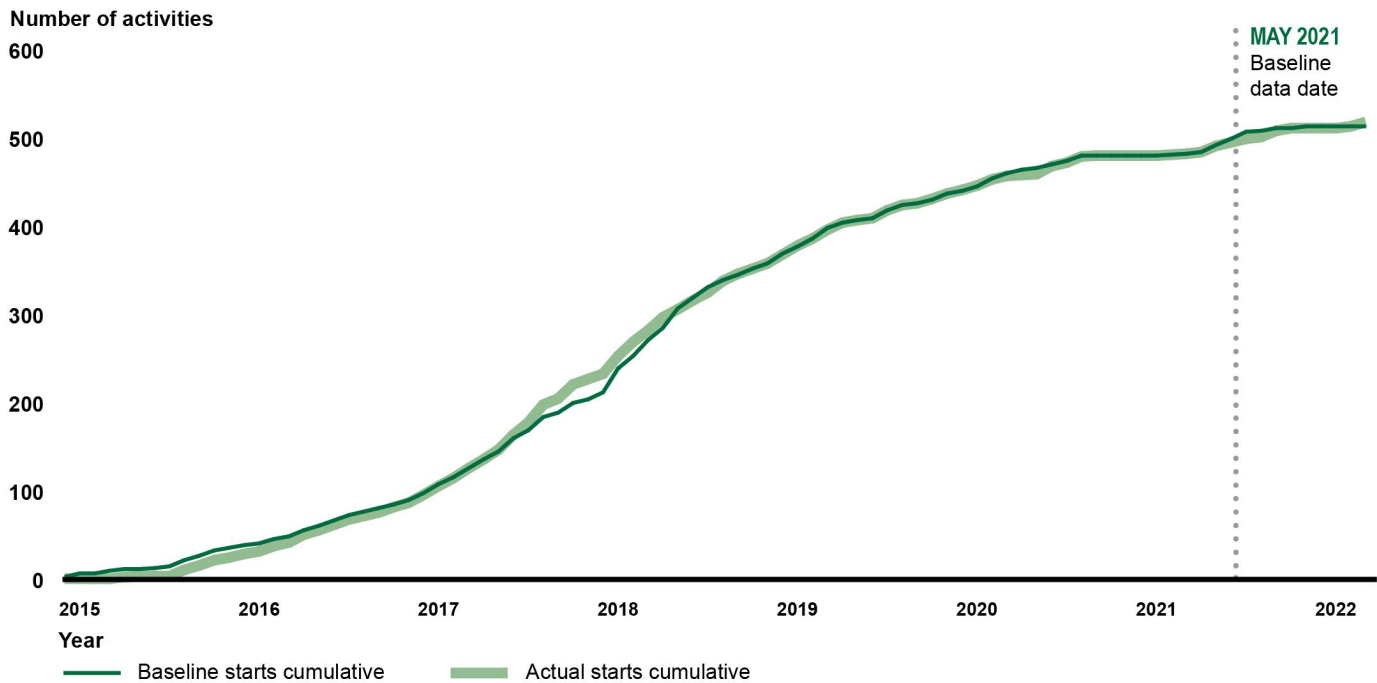
<sup>2</sup>GAO-16-89G.

<sup>3</sup>The purpose of schedule re-baselining is to restore management's control of the remaining effort by providing a meaningful basis for performance management.

## Examples of systematic schedule analyses.

One project that may be considered final, or an “as-built” schedule is that for 2020 Census Address Canvassing. The finish milestone for this schedule project, “Finish Address Canvassing Operation for 2020 Census Project,” occurred on March 18, 2022—4 months prior to the current status date in the data we examined. Figure 9 shows the cumulative number of baseline start dates and actual starts dates by month. The gray vertical line shows the date of the re-baselined schedule. Displaying the cumulative variation can show at a glance periods of time when the scheduled project had relatively aggressive or passive activity starts.<sup>4</sup>

**Figure 9: Example of Cumulative Variation of Actual from Baseline Starts, by Month for 2020 Census Project Titled: Address Canvassing**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

<sup>4</sup>The Bureau has re-baselined the project schedules after May 2021, including monthly re-baselines at times up to August 2022. We selected the May 2021 re-baseline as representative of a major re-baseline that captured a significant amount of historical data while still preserving a large amount of projected dates relative to May 2021.



**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

**Accessible Data for Figure 9: Example of Cumulative Variation of Actual from Baseline Starts, by Month for 2020 Census Project Titled: Address Canvassing**

<b>Year</b>	<b>Number of Activities (Baseline starts cumulative)</b>	<b>Number of Activities (Actual starts cumulative)</b>
2015-01	4	2
2015-02	8	2
2015-03	8	2
2015-04	11	2
2015-05	13	4
2015-06	13	5
2015-07	14	5
2015-08	16	5
2015-09	23	12
2015-10	28	17
2015-11	34	23
2015-12	37	26
2016-01	40	30
2016-02	42	33
2016-03	47	39
2016-04	50	43
2016-05	57	52
2016-06	62	57
2016-07	68	63
2016-08	74	69
2016-09	78	73
2016-10	82	77
2016-11	86	83
2016-12	91	88
2017-01	99	97
2017-02	109	107
2017-03	117	116
2017-04	127	127
2017-05	137	137
2017-06	146	148
2017-07	161	165
2017-08	170	179
2017-09	185	199
2017-10	190	206

**Appendix II: Examples of ex-post  
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<b>Year</b>	<b>Number of Activities (Baseline starts cumulative)</b>	<b>Number of Activities (Actual starts cumulative)</b>
2017-11	201	222
2017-12	205	228
2018-01	213	234
2018-02	240	254
2018-03	254	270
2018-04	272	283
2018-05	286	298
2018-06	308	307
2018-07	320	317
2018-08	332	326
2018-09	340	339
2018-10	346	347
2018-11	353	353
2018-12	359	359
2019-01	370	369
2019-02	378	379
2019-03	387	387
2019-04	399	397
2019-05	405	405
2019-06	408	408
2019-07	410	410
2019-08	419	419
2019-09	425	425
2019-10	427	427
2019-11	431	432
2019-12	438	438
2020-01	441	442
2020-02	446	447
2020-03	455	454
2020-04	461	458
2020-05	465	459
2020-06	467	460
2020-07	471	469
2020-08	475	473
2020-09	481	480
2020-10	481	481

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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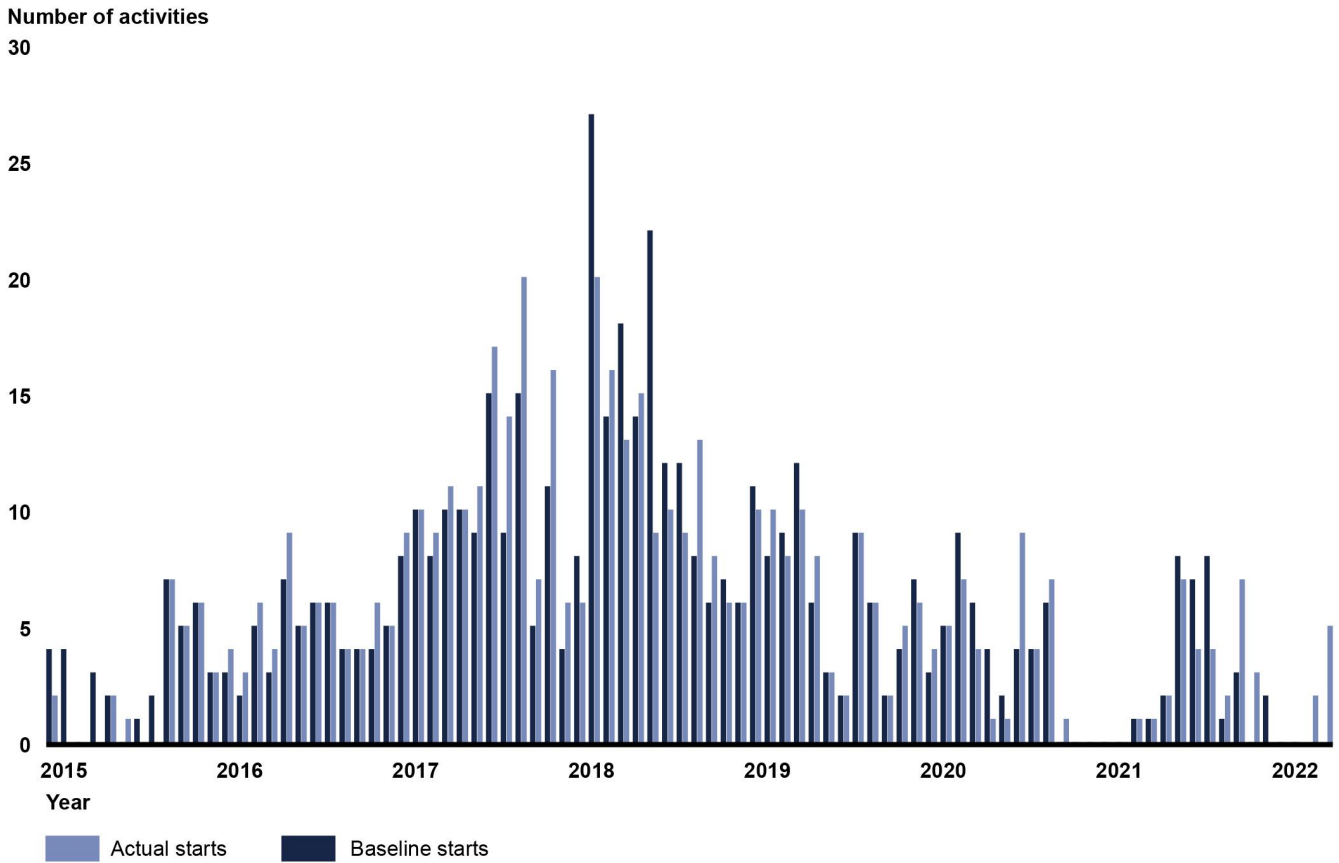
<b>Year</b>	<b>Number of Activities (Baseline starts cumulative)</b>	<b>Number of Activities (Actual starts cumulative)</b>
2020-11	481	481
2020-12	481	481
2021-01	481	481
2021-02	481	481
2021-03	482	482
2021-04	483	483
2021-05	485	485
2021-06	493	492
2021-07	500	496
2021-08	508	500
2021-09	509	502
2021-10	512	509
2021-11	512	512
2021-12	514	512
2022-01	514	512
2022-02	514	512
2022-03	514	514
2022-04	514	519

Figure 9 shows two notable periods with general deviations of planned and actual starts: roughly between the beginning of 2015 and 2016, and between the middle of 2017 and 2018. In the former period, Address Canvassing activities started at a slower pace than planned, while in the latter, more activities started than were planned.

Figure 10 shows the same schedule data but by month only, not cumulatively.

Appendix II: Examples of ex-post  
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**Figure 10: Example of Month-by-Month Variation of Actual from Baseline Starts for 2020 Census Project Titled: Address Canvassing**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 10: Example of Month-by-Month Variation of Actual from Baseline Starts for 2020 Census Project Titled: Address Canvassing**

Month	Number of Activities (Baseline Starts)	Number of Activities (Actual Starts)
2015-01	4	0
2015-02	0	0
2015-03	3	0
2015-04	2	2
2015-05	0	1
2015-06	1	0
2015-07	2	0
2015-08	7	7
2015-09	5	5

**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Number of Activities (Baseline Starts)</b>	<b>Number of Activities (Actual Starts)</b>
2015-10	6	6
2015-11	3	3
2015-12	3	4
2016-01	2	3
2016-02	5	6
2016-03	3	4
2016-04	7	9
2016-05	5	5
2016-06	6	6
2016-07	6	6
2016-08	4	4
2016-09	4	4
2016-10	4	6
2016-11	5	5
2016-12	8	9
2017-01	10	10
2017-02	8	9
2017-03	10	11
2017-04	10	10
2017-05	9	11
2017-06	15	17
2017-07	9	14
2017-08	15	20
2017-09	5	7
2017-10	11	16
2017-11	4	6
2017-12	8	6
2018-01	27	20
2018-02	14	16
2018-03	18	13
2018-04	14	15
2018-05	22	9
2018-06	12	10
2018-07	12	9
2018-08	8	13
2018-09	6	8
2018-10	7	6

**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Number of Activities (Baseline Starts)</b>	<b>Number of Activities (Actual Starts)</b>
2018-11	6	6
2018-12	11	10
2019-01	8	10
2019-02	9	8
2019-03	12	10
2019-04	6	8
2019-05	3	3
2019-06	2	2
2019-07	9	9
2019-08	6	6
2019-09	2	2
2019-10	4	5
2019-11	7	6
2019-12	3	4
2020-01	5	5
2020-02	9	7
2020-03	6	4
2020-04	4	1
2020-05	2	1
2020-06	4	9
2020-07	4	4
2020-08	6	7
2020-09	0	1
2020-10	0	0
2020-11	0	0
2020-12	0	0
2021-01	0	0
2021-02	1	1
2021-03	1	1
2021-04	2	2
2021-05	8	7
2021-06	7	4
2021-07	8	4
2021-08	1	2
2021-09	3	7
2021-10	0	3
2021-11	2	0

**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Number of Activities (Baseline Starts)</b>	<b>Number of Activities (Actual Starts)</b>
2021-12	0	0
2022-01	0	0
2022-02	0	2
2022-03	0	5

Using the month view, we can more clearly observe the majority of effort occurring in the middle of the scheduled project, but with a decrease of work at the end of 2017. The deviations in planned and actual starts are visible at the start of the project, as well as the increase in actual starts between June 2017 and June 2018. We can also see a portion of Address Canvassing work ramping up and back down again between March and November 2021.

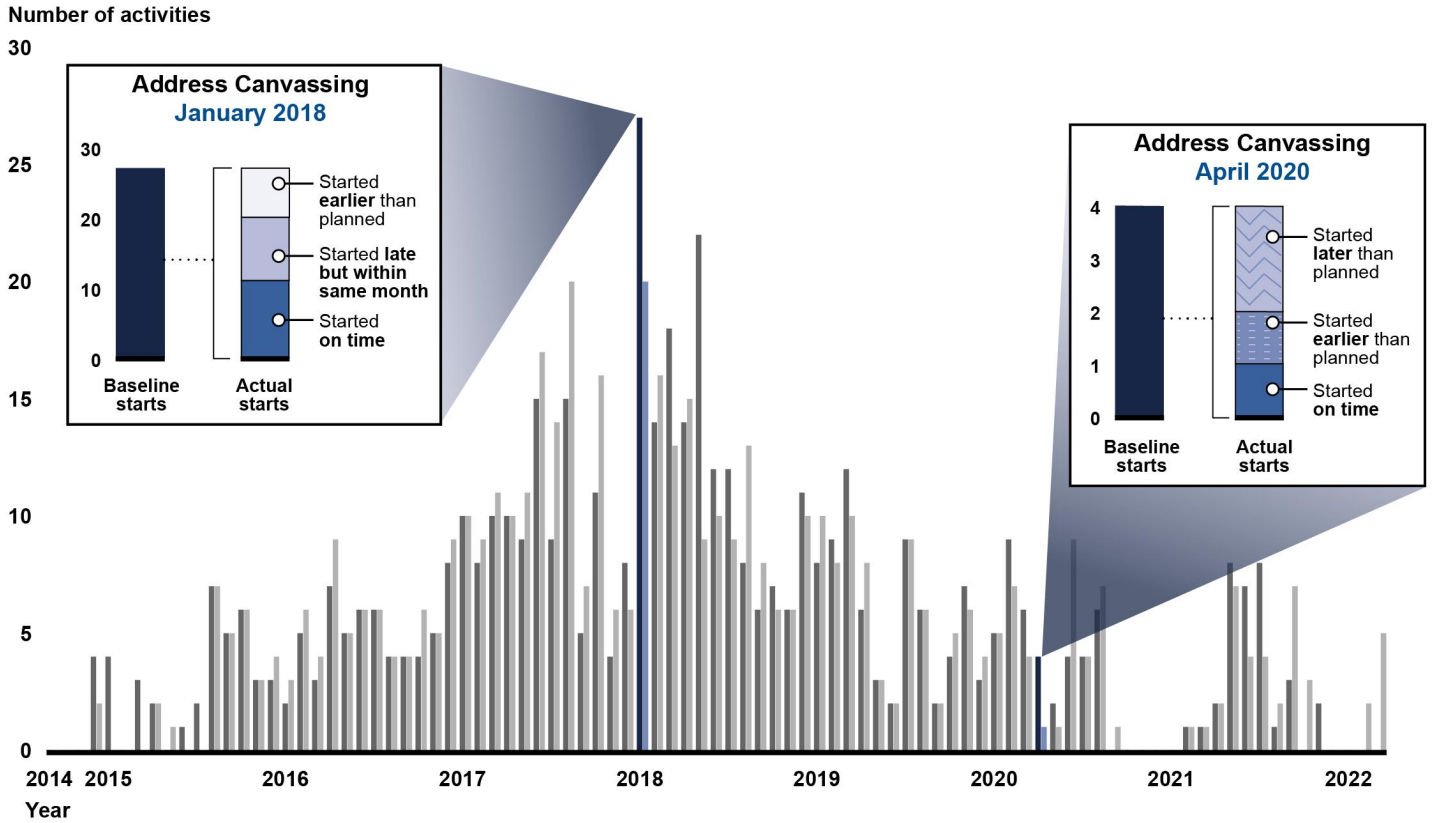
**Potential questions for management to ask include the following:**

- When fewer activities start than planned, is it because planned resources were unavailable at that time or did hand-offs from other projects not occur as expected?
- How, if at all, does a slower pace at periods earlier in a project affect later planned effort?
- What phenomena occur that allow activities to start at a higher rate than planned, and is it something to be leveraged in the future?
- Does the shape of such curves reveals more or less front-loading (most of the effort occurs at the beginning) or back loading (most of the effort occurs at the end) of activity starts in the project's timeline? If so, is this the most desirable resource allocation in concert with other activity for which those resources are needed?

Figures 8 and 9 do not convey information on which activities started or finished in any given month. For example, an activity that did not start on its planned start date may have started the next month, or it may have started 3 months earlier.

The value of figure 11 is to reveal the more granular possible causes of the observed variances. A closer look at the deviations between planned and actuals in any given month shows that differences can be explained by three types of activities: those that started on time, those that started later than planned, and those that started earlier than planned.

Figure 11: Three Types of Activities Explaining Variation of Actual from Baseline Starts for 2020 Census Project Titled: Address Canvassing



Source: U.S. Census Bureau. | GAO-23-105819

Accessible Data for Figure 11: Three Types of Activities Explaining Variation of Actual from Baseline Starts for 2020 Census Project Titled: Address Canvassing

Date	Baseline start dates	Actual start dates	Start date status
January 2018	27	11	Started on time
January 2018	0	9	Started late but within same month
January 2018	0	7	Started earlier than planned
Date	Baseline start dates	Actual start dates	Start date status
April 2020	4	1	Started on time
April 2020	0	1	Started earlier than planned
April 2020	0	2	Started later than planned



For example, in January 2018, 27 activities were planned to start and 20 activities actually started in the scheduled project. Eleven activities planned to start that month started on time, nine started late but within the same month, and seven started months earlier. In April 2020, four activities were planned to start and one activity started in the scheduled project. Of the four planned to start that month, one started on time, one started a month earlier, and two started several months later.

**Potential questions for management to ask include the following:**

- What are the underlying causes driving notable delays in starts?
- If there are notable patterns in the mix of the types of activities explaining variances in starts, are they what is expected?
- If there are persistent patterns in the mix of the types of activities explaining variances in starts, how, if at all, might those inform scheduling assumptions in the future?

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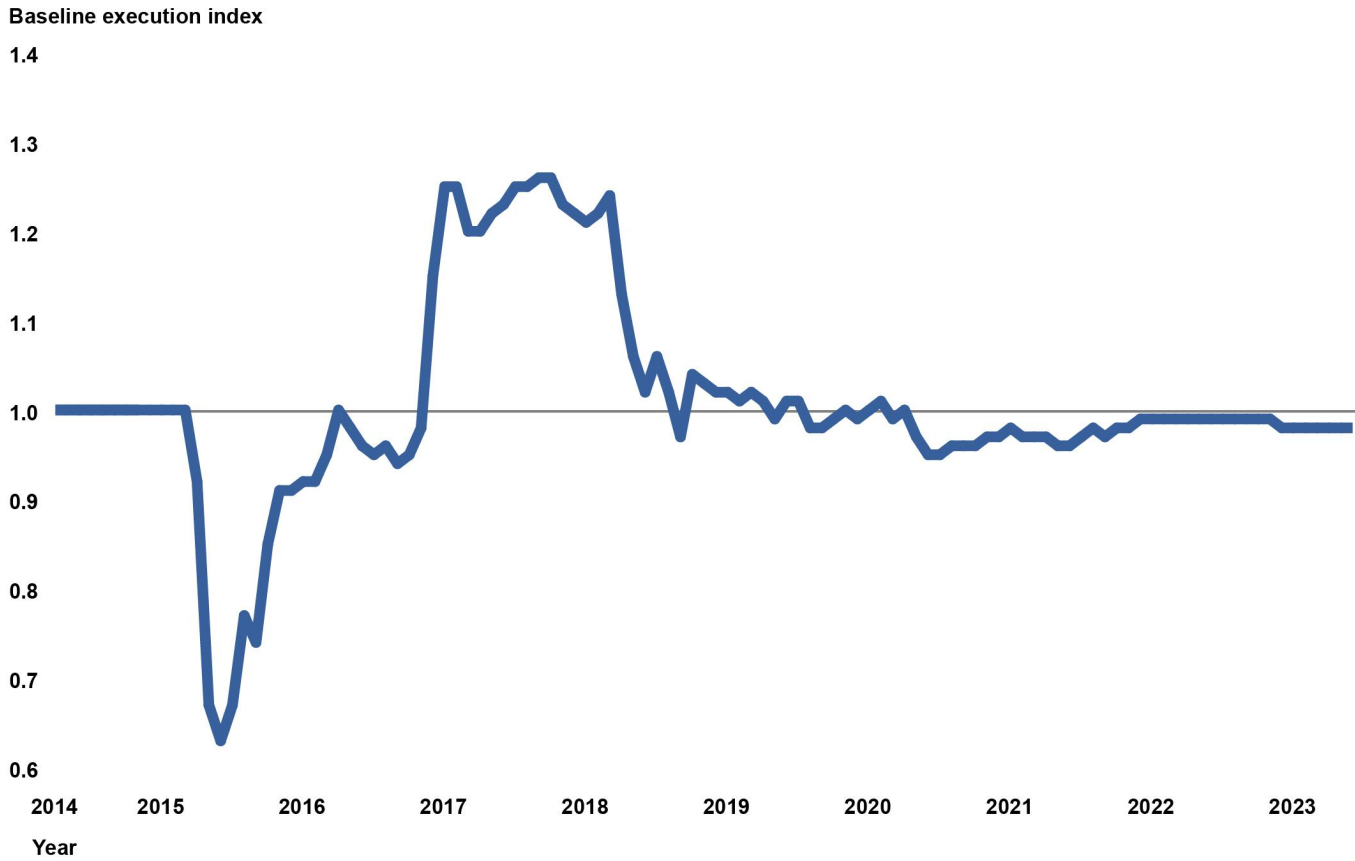
**Baseline execution index.**

The baseline execution index (BEI) is the ratio of the number of detail activities that were completed to the number of detail activities that should have been completed by the status date. A BEI of 1 indicates that the project is performing according to plan. A BEI less than 1 indicates that, in general, fewer activities are being completed than planned. A BEI greater than 1 indicates that, in general, more activities are being completed than planned. The BEI is always 1 at the end of a project if, eventually, all activities are completed. Figures 12 and 13 depict a version of the cumulative baseline execution index for the Master Address File/Topologically Integrated Geographic Encoding and Referencing (MAF/TIGER) project schedule.<sup>5</sup>

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<sup>5</sup>The BEI is generally calculated for an ongoing project as of the status date. To provide additional insight, the BEI can be calculated against any group of activities—Work-Breakdown-Structure level, resource group, or activity duration. It can also be calculated for different periods of time. To create our “retrospective” cumulative BEI chart, we calculated the BEI for each month across all detail work activities. We treated each successive month end as the status date. That is, for any given month, our BEI is the number of tasks actually completed from project start to that month, inclusive, divided by the number of tasks with baseline dates from project start to that month, inclusive.

**Figure 12: Example of Baseline Execution Index, Month by Month for the 2020 Census Project Titled: Master Address File / Topologically Integrated Geographic Encoding and Referencing**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 12: Example of Baseline Execution Index, Month by Month for the 2020 Census Project Titled: Master Address File / Topologically Integrated Geographic Encoding and Referencing**

Month	Baseline execution index, finish dates	Reference Line
2014-05	1.00	1
2014-06	1.00	1
2014-07	1.00	1
2014-08	1.00	1
2014-09	1.00	1
2014-10	1.00	1
2014-11	1.00	1
2014-12	1.00	1
2015-01	1.00	1

**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Baseline execution index, finish dates</b>	<b>Reference Line</b>
2015-02	1.00	1
2015-03	1.00	1
2015-04	1.00	1
2015-05	0.92	1
2015-06	0.67	1
2015-07	0.63	1
2015-08	0.67	1
2015-09	0.77	1
2015-10	0.74	1
2015-11	0.85	1
2015-12	0.91	1
2016-01	0.91	1
2016-02	0.92	1
2016-03	0.92	1
2016-04	0.95	1
2016-05	1.00	1
2016-06	0.98	1
2016-07	0.96	1
2016-08	0.95	1
2016-09	0.96	1
2016-10	0.94	1
2016-11	0.95	1
2016-12	0.98	1
2017-01	1.15	1
2017-02	1.25	1
2017-03	1.25	1
2017-04	1.20	1
2017-05	1.20	1
2017-06	1.22	1
2017-07	1.23	1
2017-08	1.25	1
2017-09	1.25	1
2017-10	1.26	1
2017-11	1.26	1
2017-12	1.23	1
2018-01	1.22	1
2018-02	1.21	1

**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Baseline execution index, finish dates</b>	<b>Reference Line</b>
2018-03	1.22	1
2018-04	1.24	1
2018-05	1.13	1
2018-06	1.06	1
2018-07	1.02	1
2018-08	1.06	1
2018-09	1.02	1
2018-10	0.97	1
2018-11	1.04	1
2018-12	1.03	1
2019-01	1.02	1
2019-02	1.02	1
2019-03	1.01	1
2019-04	1.02	1
2019-05	1.01	1
2019-06	0.99	1
2019-07	1.01	1
2019-08	1.01	1
2019-09	0.98	1
2019-10	0.98	1
2019-11	0.99	1
2019-12	1.00	1
2020-01	0.99	1
2020-02	1.00	1
2020-03	1.01	1
2020-04	0.99	1
2020-05	1.00	1
2020-06	0.97	1
2020-07	0.95	1
2020-08	0.95	1
2020-09	0.96	1
2020-10	0.96	1
2020-11	0.96	1
2020-12	0.97	1
2021-01	0.97	1
2021-02	0.98	1
2021-03	0.97	1

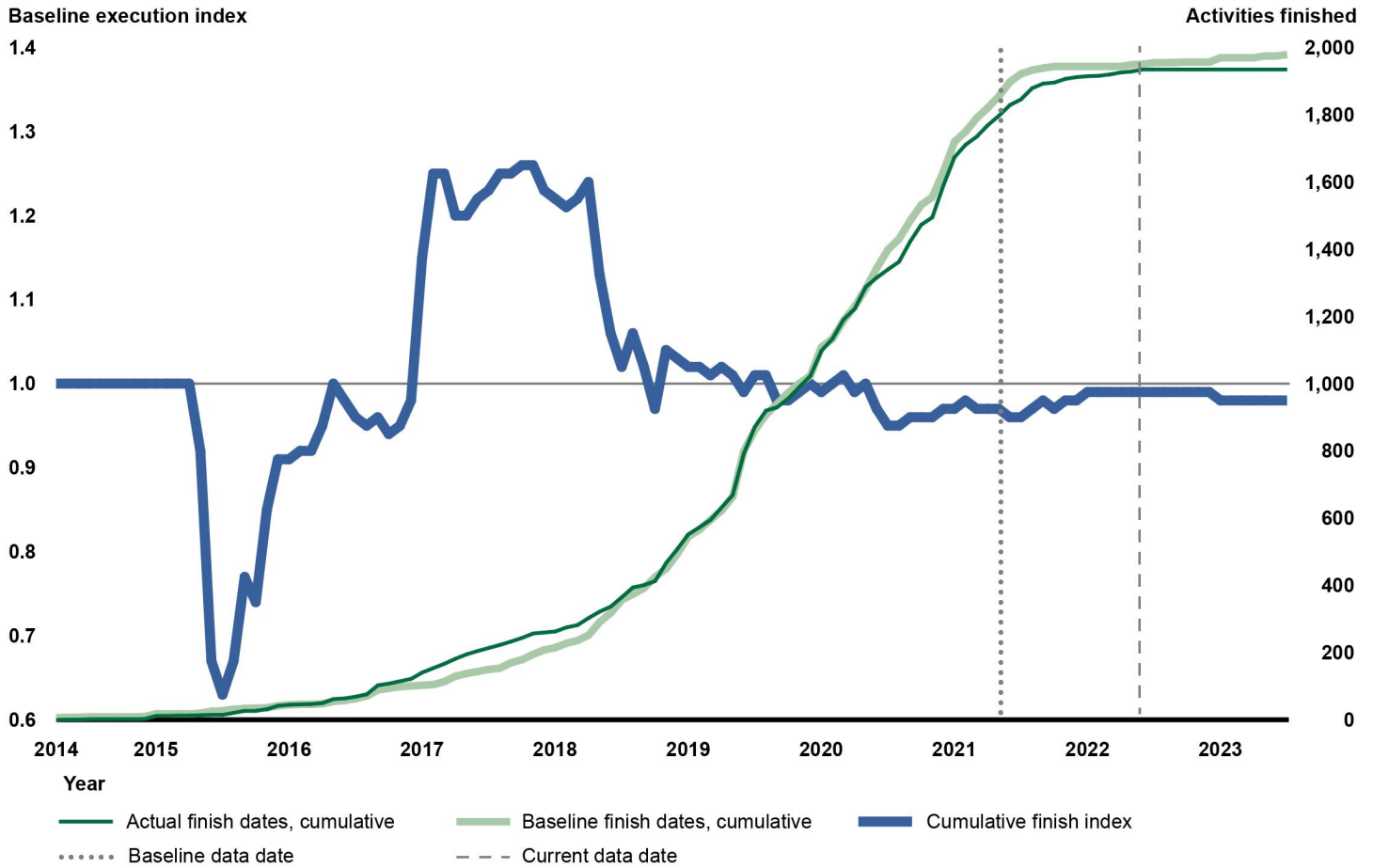
**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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<b>Month</b>	<b>Baseline execution index, finish dates</b>	<b>Reference Line</b>
2021-04	0.97	1
2021-05	0.97	1
2021-06	0.96	1
2021-07	0.96	1
2021-08	0.97	1
2021-09	0.98	1
2021-10	0.97	1
2021-11	0.98	1
2021-12	0.98	1
2022-01	0.99	1
2022-02	0.99	1
2022-03	0.99	1
2022-04	0.99	1
2022-05	0.99	1
2022-06	0.99	1

The BEI is an objective measure of overall schedule efficiency, because it compares actual completions to planned completions. However, it is a summary measure (e.g., it neither provides insight into why activities are not being completed according to plan nor takes into account the importance of the activities not being completed according to plan). For example, delayed activities that are on the critical path or on near-critical paths are given weight equal to delayed activities that have free float available.

Figure 13 overlays the BEI over the cumulative counts of baseline and actual finishes for the same project. The BEI mirrors the deviations between the actual and baseline dates. At the start of the project, actual finishes lagged planned finishes. However, by early 2017 through the first quarter of 2018, MAF/TIGER activities were finishing at a higher rate than planned. This higher rate of actual finishes is reflected by the BEI greater than 1 through the period. In mid-2020 actual finishes lagged behind planned finishes again. The cumulative BEI dipped below 1. By the current status date, the BEI converged mathematically to the number 1 as cumulative actual finishes got closer to cumulative planned finishes. After the current data date—the green vertical line that represents the last update to the current schedule—actual finishes do not occur. Baseline finishes continued to accumulate until the last activity scheduled to finish in July 2023.

**Figure 13: Illustration of How Baseline Execution Index Mirrors Cumulative Starts and Finishes Month by Month for 2020 Census Project Titled: Master Address File / Topologically Integrated Geographic Encoding and Referencing**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 13: Illustration of How Baseline Execution Index Mirrors Cumulative Starts and Finishes Month by Month for 2020 Census Project Titled: Master Address File / Topologically Integrated Geographic Encoding and Referencing**

Month	Cumulative finish index	Reference Line	Baseline finish dates, cumulative	Actual finish dates, cumulative
2014-04		1	6	0
2014-05	1.00	1	8	1
2014-06	1.00	1	8	1
2014-07	1.00	1	9	2
2014-08	1.00	1	9	2
2014-09	1.00	1	9	2
2014-10	1.00	1	9	2

**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Cumulative finish index</b>	<b>Reference Line</b>	<b>Baseline finish dates, cumulative</b>	<b>Actual finish dates, cumulative</b>
2014-11	1.00	1	9	2
2014-12	1.00	1	10	3
2015-01	1.00	1	18	12
2015-02	1.00	1	18	12
2015-03	1.00	1	18	13
2015-04	1.00	1	18	13
2015-05	0.92	1	20	14
2015-06	0.67	1	26	15
2015-07	0.63	1	27	15
2015-08	0.67	1	32	21
2015-09	0.77	1	34	27
2015-10	0.74	1	35	27
2015-11	0.85	1	36	32
2015-12	0.91	1	42	42
2016-01	0.91	1	45	45
2016-02	0.92	1	46	46
2016-03	0.92	1	46	47
2016-04	0.95	1	48	50
2016-05	1.00	1	55	62
2016-06	0.98	1	58	64
2016-07	0.96	1	63	69
2016-08	0.95	1	71	76
2016-09	0.96	1	89	103
2016-10	0.94	1	94	108
2016-11	0.95	1	99	115
2016-12	0.98	1	101	122
2017-01	1.15	1	103	141
2017-02	1.25	1	105	154
2017-03	1.25	1	114	167
2017-04	1.20	1	130	182
2017-05	1.20	1	138	195
2017-06	1.22	1	144	205
2017-07	1.23	1	150	214
2017-08	1.25	1	154	223
2017-09	1.25	1	170	233
2017-10	1.26	1	179	244

**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Cumulative finish index</b>	<b>Reference Line</b>	<b>Baseline finish dates, cumulative</b>	<b>Actual finish dates, cumulative</b>
2017-11	1.26	1	195	257
2017-12	1.23	1	208	260
2018-01	1.22	1	215	263
2018-02	1.21	1	228	275
2018-03	1.22	1	236	282
2018-04	1.24	1	252	303
2018-05	1.13	1	291	322
2018-06	1.06	1	318	337
2018-07	1.02	1	357	365
2018-08	1.06	1	374	394
2018-09	1.02	1	392	401
2018-10	0.97	1	425	413
2018-11	1.04	1	450	467
2018-12	1.03	1	494	508
2019-01	1.02	1	545	552
2019-02	1.02	1	566	573
2019-03	1.01	1	595	595
2019-04	1.02	1	623	632
2019-05	1.01	1	664	669
2019-06	0.99	1	800	792
2019-07	1.01	1	862	872
2019-08	1.01	1	908	920
2019-09	0.98	1	940	930
2019-10	0.98	1	973	956
2019-11	0.99	1	1001	990
2019-12	1.00	1	1024	1023
2020-01	0.99	1	1109	1098
2020-02	1.00	1	1134	1134
2020-03	1.01	1	1188	1191
2020-04	0.99	1	1230	1223
2020-05	1.00	1	1283	1288
2020-06	0.97	1	1345	1316
2020-07	0.95	1	1399	1340
2020-08	0.95	1	1431	1363
2020-09	0.96	1	1485	1423
2020-10	0.96	1	1532	1473



**Appendix II: Examples of ex-post  
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<b>Month</b>	<b>Cumulative finish index</b>	<b>Reference Line</b>	<b>Baseline finish dates, cumulative</b>	<b>Actual finish dates, cumulative</b>
2020-11	0.96	1	1555	1495
2020-12	0.97	1	1631	1590
2021-01	0.97	1	1720	1674
2021-02	0.98	1	1750	1711
2021-03	0.97	1	1790	1735
2021-04	0.97	1	1821	1769
2021-05	0.97	1	1855	1797
2021-06	0.96	1	1898	1829
2021-07	0.96	1	1922	1846
2021-08	0.97	1	1933	1879
2021-09	0.98	1	1939	1893
2021-10	0.97	1	1944	1896
2021-11	0.98	1	1944	1907
2021-12	0.98	1	1944	1912
2022-01	0.99	1	1944	1915
2022-02	0.99	1	1944	1916
2022-03	0.99	1	1944	1920
2022-04	0.99	1	1944	1926
2022-05	0.99	1	1949	1929
2022-06	0.99	1	1951	1935
2022-07	0.99	1	1955	1935
2022-08	0.99	1	1955	1935
2022-09	0.99	1	1956	1935
2022-10	0.99	1	1957	1935
2022-11	0.99	1	1957	1935
2022-12	0.99	1	1957	1935
2023-01	0.98	1	1970	1935
2023-02	0.98	1	1970	1935
2023-03	0.98	1	1970	1935
2023-04	0.98	1	1970	1935
2023-05	0.98	1	1975	1935
2023-06	0.98	1	1975	1935
2023-07	0.98	1	1979	1935
2023-08	0.98	1	1979	1935

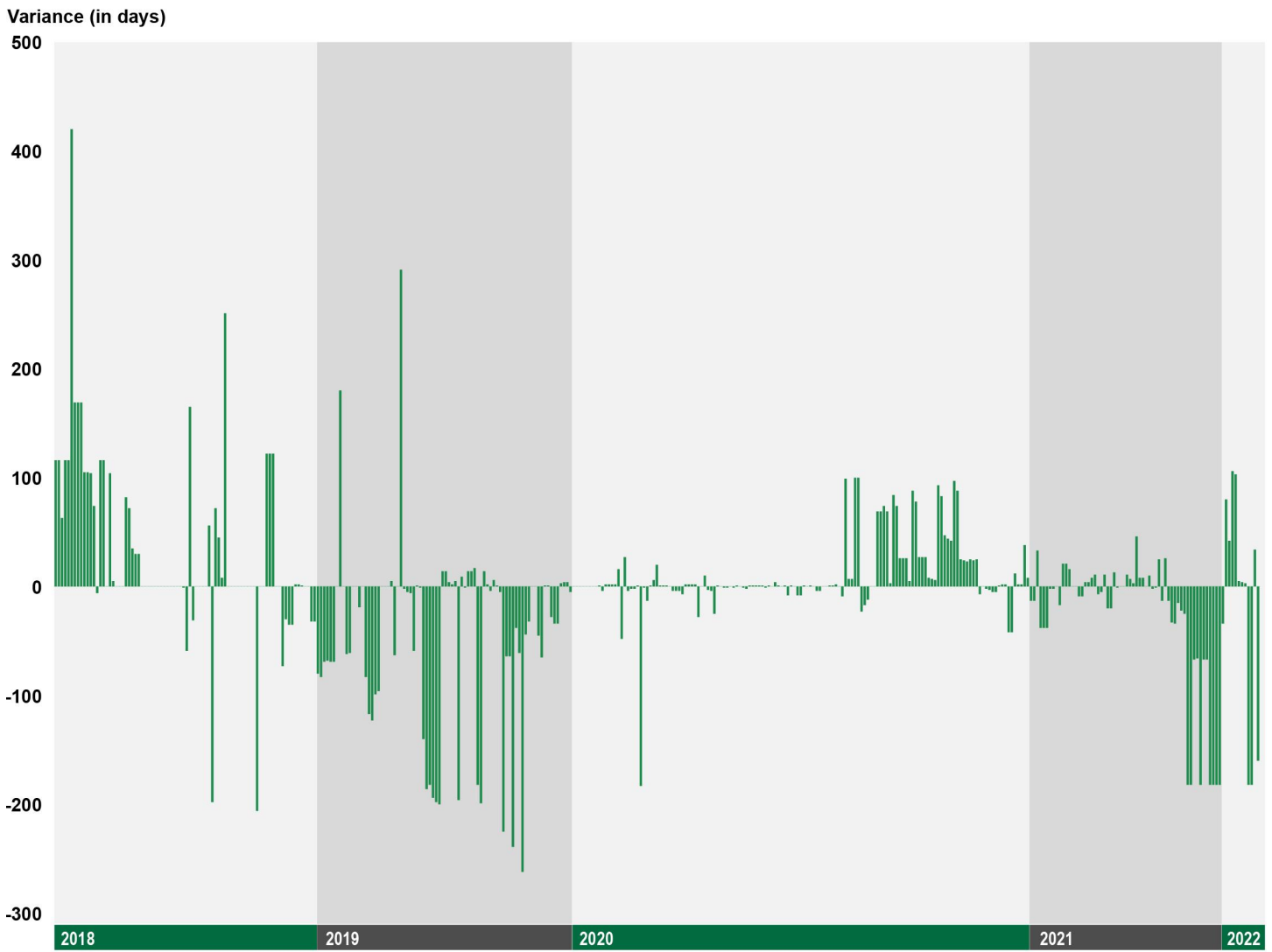
**Potential questions for management to ask include the following:**

- What effect did an irregular BEI have on a given project's ability to allocate resources as the project was executed?
- Were there any discernable differences in availability of resources, realized risks, external influences, or management decision making between the periods where the cumulative BEI may be less than 1, near 1, or more than 1?
- Do observed patterns of progress in a given project correlate with whether the project achieved project goals or program results? If so, what mitigations, if any, might help?

The same variances in dates can alternatively be expressed as numbers of days rather than numbers of activities. Figure 14 shows start variances for the Response Processing Operation over time. This shows where start variance is the difference between planned start date and actual start date.

Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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**Figure 14: Example of Project Activity Starts over Time for 2020 Census Project Titled: Response Processing**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 14: Example of Project Activity Starts over Time for 2020 Census Project Titled: Response Processing**

Baseline start date	Start variance
1/2/2018	116
1/2/2018	116
1/3/2018	63

Appendix II: Examples of ex-post Schedule Analyses, and Related Management Questions

Baseline start date	Start variance
1/23/2018	116
1/23/2018	116
2/5/2018	420
2/5/2018	169
2/5/2018	169
2/5/2018	169
2/5/2018	105
2/5/2018	105
2/5/2018	104
2/5/2018	74
2/5/2018	-6
2/21/2018	116
3/2/2018	116
3/5/2018	0
3/19/2018	104
3/19/2018	5
3/19/2018	0
4/13/2018	0
4/16/2018	0
4/30/2018	82
4/30/2018	72
4/30/2018	35
4/30/2018	30
4/30/2018	30
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0
4/30/2018	0

**Appendix II: Examples of ex-post  
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<b>Baseline start date</b>	<b>Start variance</b>
4/30/2018	-1
4/30/2018	-59
5/1/2018	165
5/1/2018	-31
5/11/2018	0
5/14/2018	0
5/14/2018	0
5/21/2018	0
5/29/2018	56
5/29/2018	-198
5/31/2018	72
6/19/2018	45
7/26/2018	8
7/27/2018	251
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	0
7/27/2018	-206
9/7/2018	0
9/25/2018	0
10/19/2018	122
10/19/2018	122
10/19/2018	122
10/25/2018	0
11/14/2018	0
11/14/2018	-73
12/26/2018	-30
12/26/2018	-35
12/26/2018	-35
12/28/2018	2
12/31/2018	2

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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<b>Baseline start date</b>	<b>Start variance</b>
12/31/2018	1
12/31/2018	0
12/31/2018	0
12/31/2018	-32
12/31/2018	-32
1/8/2019	-80
1/8/2019	-83
1/15/2019	-69
1/16/2019	-68
1/16/2019	-69
1/16/2019	-69
1/25/2019	0
2/1/2019	180
2/1/2019	0
2/6/2019	-62
2/7/2019	-61
2/11/2019	0
2/11/2019	0
2/14/2019	-19
2/15/2019	0
2/22/2019	-83
2/22/2019	-117
2/22/2019	-123
2/25/2019	-99
2/26/2019	-96
3/18/2019	0
4/15/2019	0
4/15/2019	0
5/13/2019	5
5/13/2019	-63
5/31/2019	0
6/20/2019	291
7/1/2019	-2
7/2/2019	-5
7/2/2019	-6
7/9/2019	-59
7/10/2019	1

**Appendix II: Examples of ex-post  
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<b>Baseline start date</b>	<b>Start variance</b>
7/10/2019	-1
7/16/2019	-140
7/17/2019	-186
7/24/2019	-182
7/31/2019	-194
8/1/2019	-198
8/2/2019	-200
8/5/2019	14
8/5/2019	14
8/6/2019	4
8/6/2019	2
8/7/2019	5
8/9/2019	-196
8/13/2019	9
8/13/2019	-1
8/19/2019	14
8/19/2019	14
9/4/2019	17
9/4/2019	-182
9/5/2019	-199
9/10/2019	14
9/11/2019	2
9/17/2019	-4
9/18/2019	6
9/26/2019	1
9/26/2019	-5
9/26/2019	-225
9/27/2019	-64
9/27/2019	-64
9/27/2019	-239
10/2/2019	-38
10/2/2019	-61
10/2/2019	-262
10/16/2019	-44
10/22/2019	-32
10/24/2019	0
10/24/2019	0

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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<b>Baseline start date</b>	<b>Start variance</b>
10/25/2019	-45
10/25/2019	-65
10/30/2019	1
10/30/2019	1
11/6/2019	-28
11/12/2019	-34
11/29/2019	3
12/11/2019	4
12/12/2019	4
12/24/2019	-5
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/3/2020	1
1/3/2020	-4
1/6/2020	2
1/6/2020	2
1/6/2020	2
1/6/2020	2
1/13/2020	16
1/13/2020	-48
1/16/2020	27
1/17/2020	-4
1/27/2020	-2
1/27/2020	-2
1/30/2020	1
1/30/2020	-183
1/31/2020	-1
2/3/2020	-13
2/4/2020	1
2/6/2020	6
11/29/2019	3



**Appendix II: Examples of ex-post  
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<b>Baseline start date</b>	<b>Start variance</b>
12/11/2019	4
12/12/2019	4
12/24/2019	-5
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/2/2020	0
1/3/2020	1
1/3/2020	-4
1/6/2020	2
1/6/2020	2
1/6/2020	2
1/6/2020	2
1/13/2020	16
1/13/2020	-48
1/16/2020	27
1/17/2020	-4
1/27/2020	-2
1/27/2020	-2
1/30/2020	1
1/30/2020	-183
1/31/2020	-1
2/3/2020	-13
2/4/2020	1
2/6/2020	6
2/7/2020	20
2/7/2020	1
2/7/2020	1
2/7/2020	1
2/7/2020	0
2/7/2020	-4
2/7/2020	-4
2/7/2020	-4

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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<b>Baseline start date</b>	<b>Start variance</b>
2/7/2020	-7
2/8/2020	2
2/8/2020	2
2/8/2020	2
2/8/2020	2
2/11/2020	-28
2/18/2020	0
3/9/2020	10
3/10/2020	-3
3/10/2020	-4
3/16/2020	-25
3/17/2020	1
3/17/2020	0
3/17/2020	-1
3/17/2020	-1
3/18/2020	0
3/18/2020	-1
3/25/2020	1
3/25/2020	0
3/25/2020	-1
3/25/2020	-2
3/27/2020	1
3/27/2020	1
3/27/2020	1
3/27/2020	1
3/29/2020	1
3/29/2020	-1
3/31/2020	1
3/31/2020	0
4/3/2020	4
4/4/2020	1
4/4/2020	0
4/7/2020	1
4/7/2020	-8
4/8/2020	1
4/8/2020	0
4/8/2020	-8

**Appendix II: Examples of ex-post  
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<b>Baseline start date</b>	<b>Start variance</b>
4/8/2020	-8
4/10/2020	1
4/10/2020	0
4/11/2020	1
4/11/2020	0
4/13/2020	-4
4/13/2020	-4
4/17/2020	0
4/17/2020	0
4/18/2020	1
4/18/2020	1
4/20/2020	2
4/20/2020	0
4/20/2020	-9
5/26/2020	99
5/28/2020	7
5/28/2020	7
4/3/2020	4
4/4/2020	1
4/4/2020	0
4/7/2020	1
4/7/2020	-8
4/8/2020	1
4/8/2020	0
4/8/2020	-8
4/8/2020	-8
4/10/2020	1
4/10/2020	0
4/11/2020	1
4/11/2020	0
4/13/2020	-4
4/13/2020	-4
4/17/2020	0
4/17/2020	0
4/18/2020	1
4/18/2020	1
4/20/2020	2

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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<b>Baseline start date</b>	<b>Start variance</b>
4/20/2020	0
4/20/2020	-9
5/26/2020	99
5/28/2020	7
5/28/2020	7
7/1/2020	100
7/1/2020	100
7/15/2020	-23
7/23/2020	-17
7/31/2020	-12
8/11/2020	0
8/11/2020	0
8/20/2020	69
8/20/2020	69
8/27/2020	74
8/27/2020	69
8/28/2020	3
9/3/2020	84
9/3/2020	74
9/9/2020	26
9/9/2020	26
9/9/2020	26
9/9/2020	5
9/10/2020	88
9/10/2020	78
9/10/2020	27
9/10/2020	27
9/10/2020	27
9/15/2020	8
9/15/2020	7
9/15/2020	6
9/17/2020	93
9/17/2020	83
9/17/2020	47
9/17/2020	44
9/17/2020	42
9/24/2020	97

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
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<b>Baseline start date</b>	<b>Start variance</b>
9/24/2020	88
9/26/2020	25
9/26/2020	24
9/26/2020	23
9/28/2020	25
9/28/2020	24
9/29/2020	25
10/20/2020	-7
10/26/2020	0
10/26/2020	-2
10/26/2020	-3
10/26/2020	-5
10/26/2020	-5
10/29/2020	1
10/30/2020	2
10/30/2020	2
11/17/2020	-42
12/3/2020	12
12/7/2020	2
12/9/2020	2
12/16/2020	38
12/18/2020	8
2/19/2021	-13
2/19/2021	-13
2/21/2021	33
2/23/2021	-38
2/23/2021	-38
2/23/2021	-38
2/25/2021	-2
2/25/2021	-2
3/4/2021	0
3/22/2021	-17
3/25/2021	21
3/25/2021	21
3/26/2021	16
3/26/2021	0
3/26/2021	0

**Appendix II: Examples of ex-post  
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<b>Baseline start date</b>	<b>Start variance</b>
3/30/2021	-9
3/30/2021	-9
4/5/2021	4
4/5/2021	4
4/6/2021	8
4/12/2021	11
4/12/2021	-7
4/14/2021	-5
4/19/2021	11
4/21/2021	-20
12/3/2020	12
12/7/2020	2
12/9/2020	2
12/16/2020	38
12/18/2020	8
2/19/2021	-13
2/19/2021	-13
2/21/2021	33
2/23/2021	-38
2/23/2021	-38
2/23/2021	-38
2/25/2021	-2
2/25/2021	-2
3/4/2021	0
3/22/2021	-17
3/25/2021	21
3/25/2021	21
3/26/2021	16
3/26/2021	0
3/26/2021	0
3/30/2021	-9
3/30/2021	-9
4/5/2021	4
4/5/2021	4
4/6/2021	8
4/12/2021	11
4/12/2021	-7

**Appendix II: Examples of ex-post  
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<b>Baseline start date</b>	<b>Start variance</b>
4/14/2021	-5
4/19/2021	11
4/21/2021	-20
4/21/2021	-20
4/30/2021	13
5/28/2021	-1
6/1/2021	0
6/23/2021	0
6/25/2021	11
6/25/2021	7
7/7/2021	3
7/19/2021	46
7/22/2021	8
7/22/2021	8
7/26/2021	0
8/9/2021	10
8/23/2021	-2
8/30/2021	-1
9/14/2021	25
9/14/2021	-13
9/15/2021	26
9/15/2021	-13
9/20/2021	-33
9/20/2021	-34
9/24/2021	-15
10/6/2021	-22
10/6/2021	-25
10/7/2021	-182
10/22/2021	-182
11/4/2021	-67
11/5/2021	-66
11/5/2021	-182
11/8/2021	-67
11/8/2021	-67
11/8/2021	-182
12/15/2021	-182
12/16/2021	-182

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

<b>Baseline start date</b>	<b>Start variance</b>
12/21/2021	-182
1/10/2022	-34
1/12/2022	80
1/12/2022	42
2/24/2022	106
2/25/2022	103
4/20/2022	5
4/20/2022	4
4/20/2022	3
5/2/2022	-182
5/3/2022	-182
6/3/2022	34
6/6/2022	-160
12/21/2021	-182
1/10/2022	-34
1/12/2022	80
1/12/2022	42
2/24/2022	106
2/25/2022	103
4/20/2022	5
4/20/2022	4
4/20/2022	3
5/2/2022	-182
5/3/2022	-182
6/3/2022	34
6/6/2022	-160

A negative variance in the bottom half of Figure 14 indicates the activity started later than planned. A positive variance above the middle line indicates that the activity started earlier than planned. In this example, while the overall trend in variances is unclear, once again we see portions of effort starting earlier or later than planned. This chart includes only completed tasks and milestones for Response Processing that have start baseline dates.

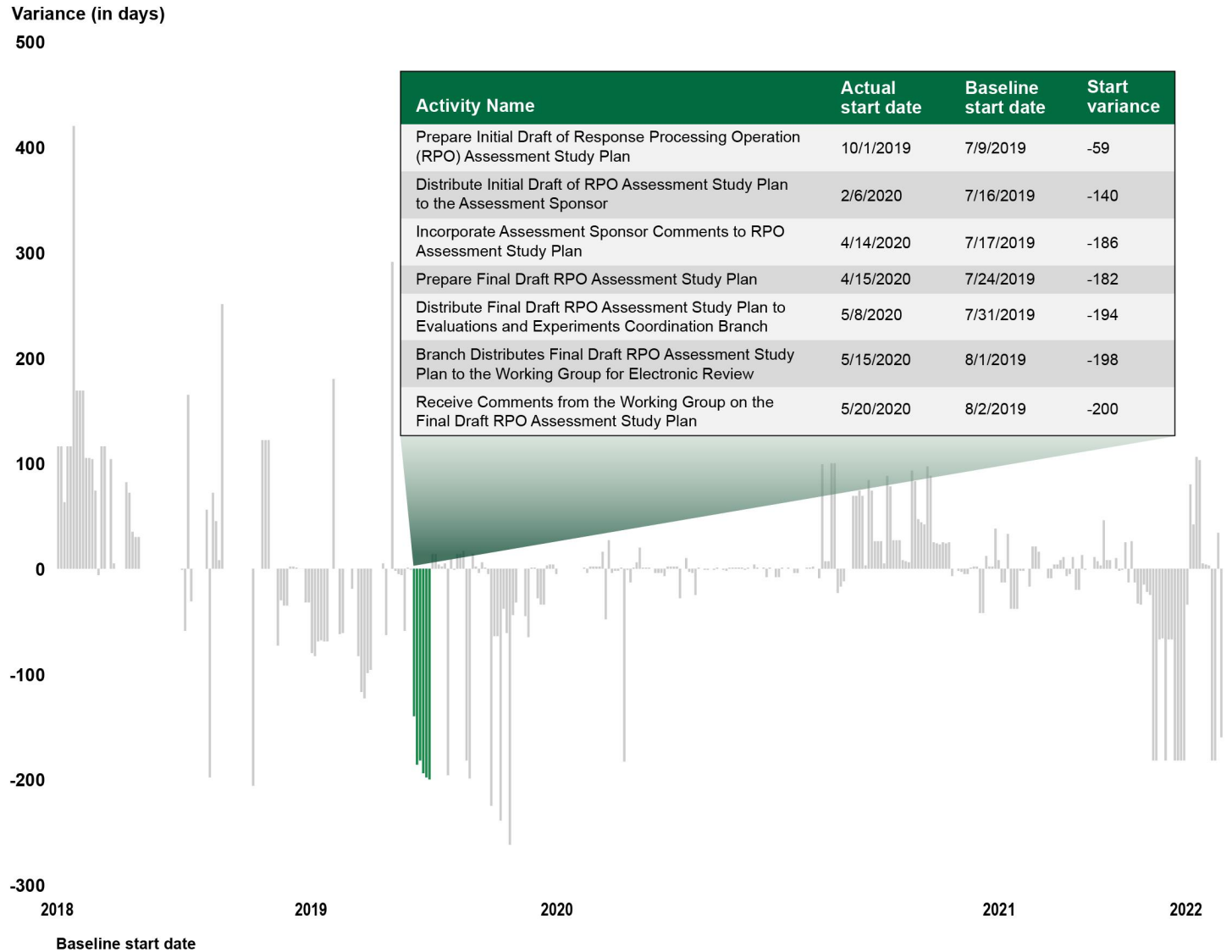
From looking at specific activities within the Bureau’s integrated master schedule, we know that at least some groups of variances within this



**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

project were due to sequencing logic in the schedule. For example, in the call out in Figure 15, the activities severely delayed in the second half of 2019 are a sequence of activities related to preparing, commenting, and distributing a study plan. As time goes on, the work related to the assessment becomes more delayed, resulting in the grouping of variances visible in the above figure.

**Figure 15: Example of Variances Caused by Sequencing for 2020 Census Project Titled: Response Processing**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

**Accessible Data for Figure 15: Example of Variances Caused by Sequencing for 2020 Census Project Titled: Response Processing**

<b>Activity Name</b>	<b>Actual start date</b>	<b>Baseline start date</b>	<b>Start variance</b>
Prepare Initial Draft of Response Processing Operation (RPO) Assessment Study Plan	10/1/2019	7/9/2019	-59
Distribute Initial Draft of RPO Assessment Study Plan to the Assessment Sponsor	2/6/2020	7/16/2019	-140
Incorporate Assessment Sponsor Comments to RPO Assessment Study Plan	4/14/2020	7/17/2019	-186
Prepare Final Draft RPO Assessment Study Plan	4/15/2020	7/24/2019	-182
Distribute Final Draft RPO Assessment Study Plan to Evaluations & Experiments Coordination Branch	5/8/2020	7/31/2019	-194
Branch Distributes Final Draft RPO Assessment Study Plan to the Working Group for Electronic Review	5/15/2020	8/1/2019	-198
Receive Comments from the Working Group on the Final Draft RPO Assessment Study Plan-	5/20/2020	8/2/2019	-200

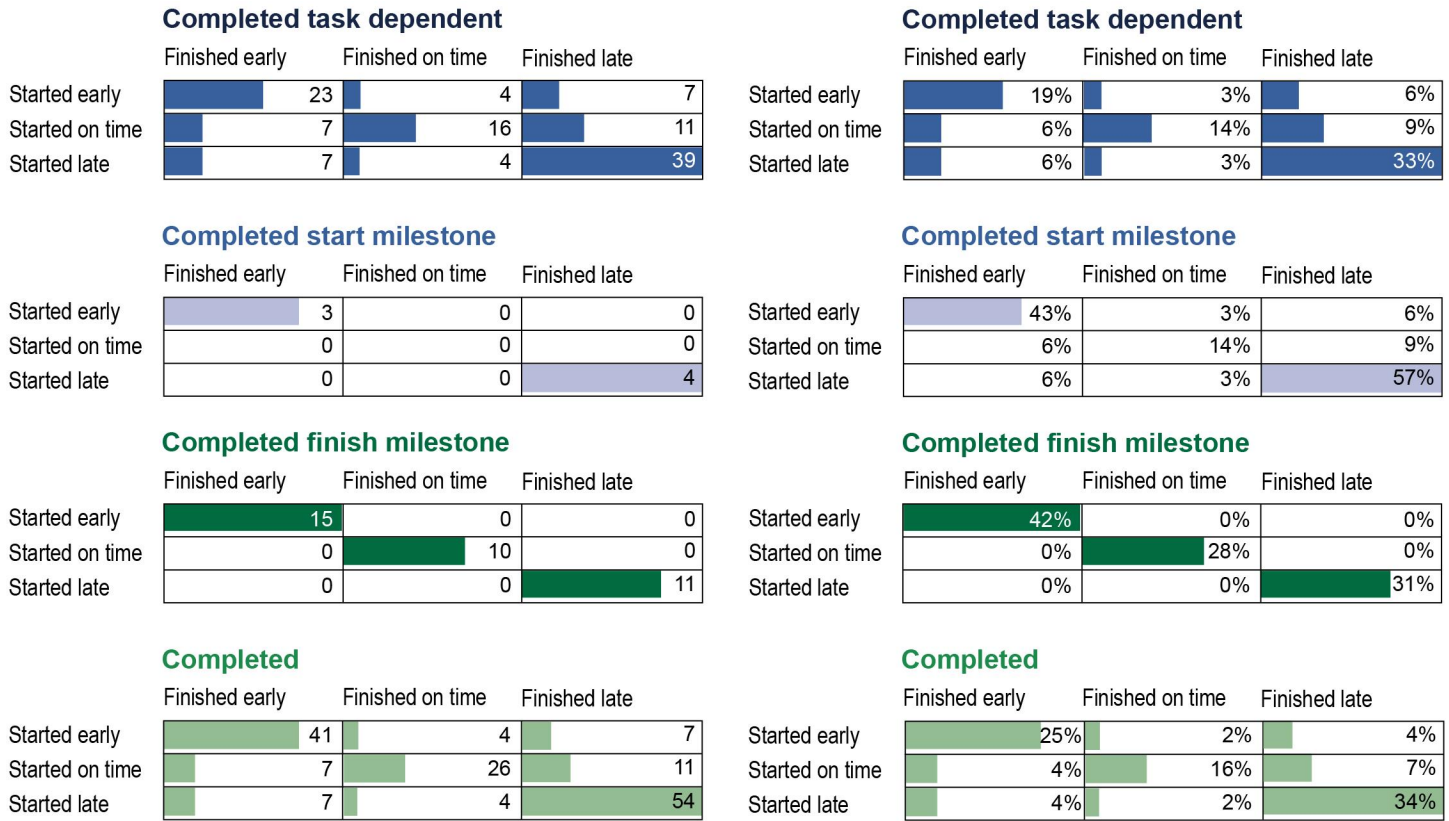
**Potential questions for management to ask include the following:**

- What causes groups of activities to start earlier or later than planned?
- Are groups of variances from activities related by sequencing logic, so that one variance causes succeeding activities to also start earlier or later than planned? Or are groups of relatively unrelated activities starting earlier or later than planned because of external influences on the project?
- What external events either contribute to or may be affected by such patterns of variances, and if there are any adverse effects either way on the program, what mitigations may exist?

Variances may also be summarized by type and status in tables for those who prefer this type of visualization. Figure 16 for Non-Response Follow-up, the tables show counts and relative percentages of tasks and milestones that have started and finished early, on time, and late according to the baseline. For a project schedule that had every activity's actual start and finish date align perfectly with its respective planned dates, all cells in each table below would contain zeroes except the center cells in each that would contain 100 percent of the activities. Note that these counts only include completed tasks and milestones that have baseline dates.

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

**Figure 16: Example of Schedule Variance Summary Measures for 2020 Census Project Titled: Non-Response Follow-up**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 16: Example of Schedule Variance Summary Measures for 2020 Census Project Titled: Non-Response Follow-up**

**Completed task dependent**

	Finished early	Finished on time	Finished late
Started early	23	4	7
Started on time	7	16	11
Started late	7	4	39

**Completed start milestone**

	Finished early	Finished on time	Finished late
Started early	3	0	0
Started on time	0	0	0
Started late	0	0	4

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

**Completed finish milestone**

	<b>Finished early</b>	<b>Finished on time</b>	<b>Finished late</b>
Started early	15	0	0
Started on time	0	10	0
Started late	0	0	11

**Completed**

	<b>Finished early</b>	<b>Finished on time</b>	<b>Finished late</b>
Started early	41	4	7
Started on time	7	26	11
Started late	7	4	54

**Completed task dependent**

	<b>Finished early</b>	<b>Finished on time</b>	<b>Finished late</b>
Started early	19%	3%	6%
Started on time	6%	14%	9%
Started late	6%	3%	33%

**Completed start milestone**

	<b>Finished early</b>	<b>Finished on time</b>	<b>Finished late</b>
Started early	43%	0%	0%
Started on time	0%	0%	0%
Started late	0%	0%	57%

**Completed finish milestone**

	<b>Finished early</b>	<b>Finished on time</b>	<b>Finished late</b>
Started early	42%	0%	0%
Started on time	0%	28%	0%
Started late	0%	0%	31%

**Completed**

	<b>Finished early</b>	<b>Finished on time</b>	<b>Finished late</b>
Started early	25%	2%	4%
Started on time	4%	16%	7%
Started late	4%	2%	34%

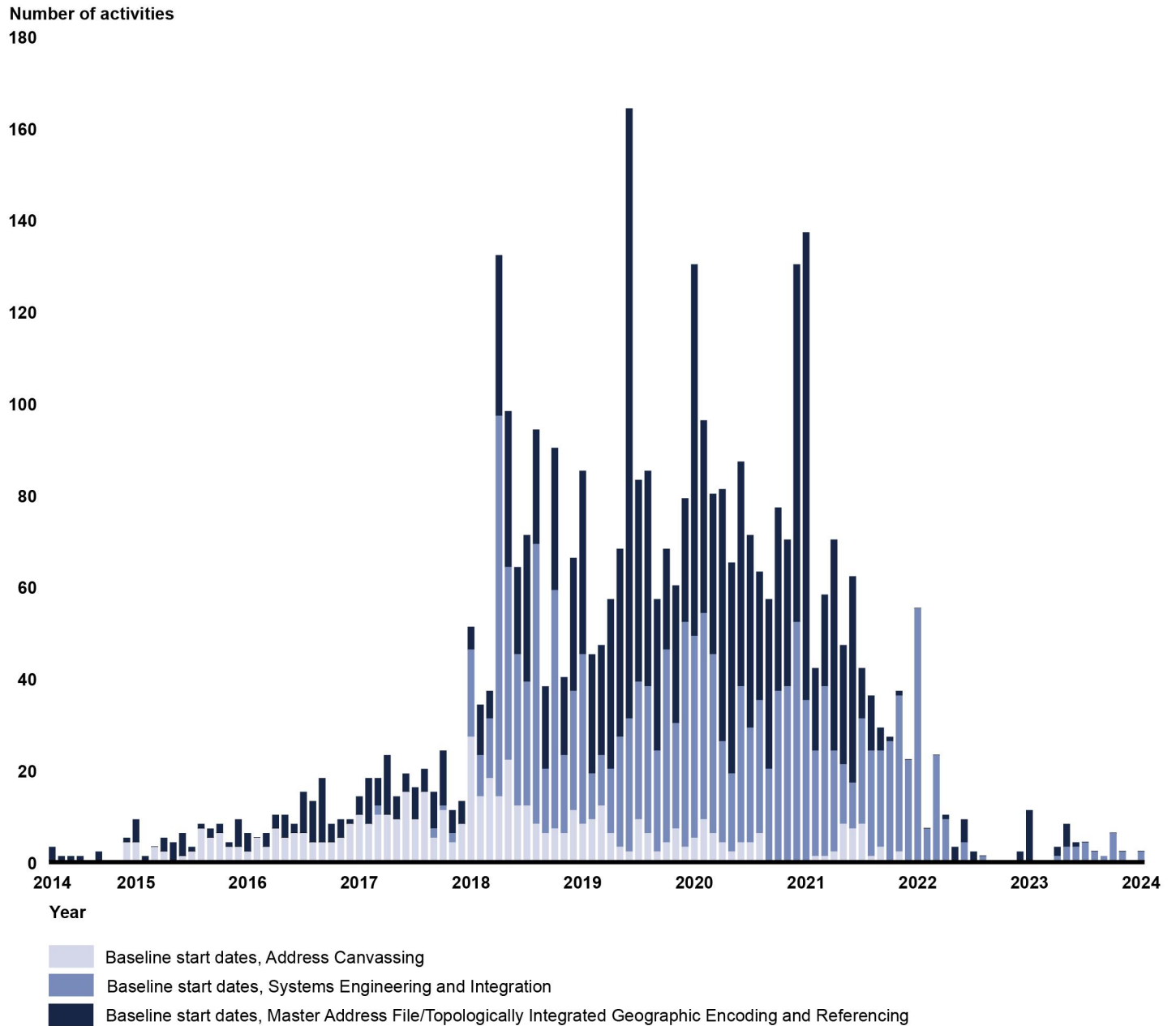
**Potential questions for management to ask include the following:**

- What, if anything, is a measure of success using these data? From a planning perspective, are the counts and percentages of activities and milestones outside the “timely” box (in the bottom row or last column) acceptable or should they be improved?
- How did starting and finishing activities and milestones early affect other projects within the overall program? Was it necessary to accelerate the work, or could resources have been allocated elsewhere to projects that were behind schedule?

Finally, stacking the schedule data across multiple projects in the program can provide managers with oversight on patterns of the total resources and effort needed. For example, baseline starts can be stacked across projects to show total planned resource allocation for the program. Figure 17 combines planned starts for three of the six projects we examined. These three are only a portion of the total projects planned and executed for the 2020 Decennial Census. Figure 17 also shows a portion of the large ramp-up of resources required to execute the program.

Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions

Figure 17: Example of Planned Activity Starts Stacked across Three Selected 2020 Census Projects



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

**Accessible Data for Figure 17: Example of Planned Activity Starts Stacked across Three Selected 2020 Census Projects**

<b>Month</b>	<b>Baseline start dates, Address Canvassing</b>	<b>Baseline start dates, Systems Engineering and Integration</b>	<b>Baseline start dates, Master Address File/Topologically Integrated Geographic Encoding and Referencing</b>
2014-04	0	0	3
2014-05	0	0	1
2014-06	0	0	1
2014-07	0	0	1
2014-08	0	0	0
2014-09	0	0	2
2014-10	0	0	0
2014-11	0	0	0
2014-12	4	0	1
2015-01	4	0	5
2015-02	0	0	1
2015-03	3	0	0
2015-04	2	0	3
2015-05	0	0	4
2015-06	1	0	5
2015-07	2	0	1
2015-08	7	0	1
2015-09	5	0	2
2015-10	6	0	2
2015-11	3	0	1
2015-12	3	0	6
2016-01	2	0	4
2016-02	5	0	0
2016-03	3	0	3
2016-04	7	0	3
2016-05	5	0	5
2016-06	6	0	2
2016-07	6	0	9
2016-08	4	0	9
2016-09	4	0	14
2016-10	4	0	4
2016-11	5	0	4
2016-12	8	0	1
2017-01	10	0	4

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

<b>Month</b>	<b>Baseline start dates, Address Canvassing</b>	<b>Baseline start dates, Systems Engineering and Integration</b>	<b>Baseline start dates, Master Address File/Topologically Integrated Geographic Encoding and Referencing</b>
2017-02	8	0	10
2017-03	10	2	6
2017-04	10	0	13
2017-05	9	0	5
2017-06	15	0	4
2017-07	9	0	7
2017-08	15	0	5
2017-09	5	2	8
2017-10	11	1	12
2017-11	4	2	5
2017-12	8	0	5
2018-01	27	19	5
2018-02	14	9	11
2018-03	18	13	6
2018-04	14	83	35
2018-05	22	42	34
2018-06	12	33	19
2018-07	12	27	32
2018-08	8	61	25
2018-09	6	14	18
2018-10	7	52	31
2018-11	6	17	17
2018-12	11	26	29
2019-01	8	37	40
2019-02	9	10	26
2019-03	12	11	24
2019-04	6	14	37
2019-05	3	24	41
2019-06	2	29	133
2019-07	9	30	44
2019-08	6	32	47
2019-09	2	22	33
2019-10	4	42	22
2019-11	7	23	30
2019-12	3	49	27
2020-01	5	44	81



**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

<b>Month</b>	<b>Baseline start dates, Address Canvassing</b>	<b>Baseline start dates, Systems Engineering and Integration</b>	<b>Baseline start dates, Master Address File/Topologically Integrated Geographic Encoding and Referencing</b>
2020-02	9	45	42
2020-03	6	39	35
2020-04	4	22	55
2020-05	2	17	46
2020-06	4	34	49
2020-07	4	25	42
2020-08	6	29	28
2020-09	0	20	37
2020-10	0	37	40
2020-11	0	38	32
2020-12	0	52	78
2021-01	0	35	102
2021-02	1	23	18
2021-03	1	37	20
2021-04	2	22	46
2021-05	8	13	26
2021-06	7	10	45
2021-07	8	23	11
2021-08	1	23	12
2021-09	3	21	5
2021-10	0	26	1
2021-11	2	34	1
2021-12	0	22	0
2022-01	0	55	0
2022-02	0	7	0
2022-03	0	23	0
2022-04	0	9	1
2022-05	0	0	3
2022-06	0	4	5
2022-07	0	0	2
2022-08	0	1	0
2022-09	0	0	0
2022-10	0	0	0
2022-11	0	0	0
2022-12	0	0	2
2023-01	0	0	11

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

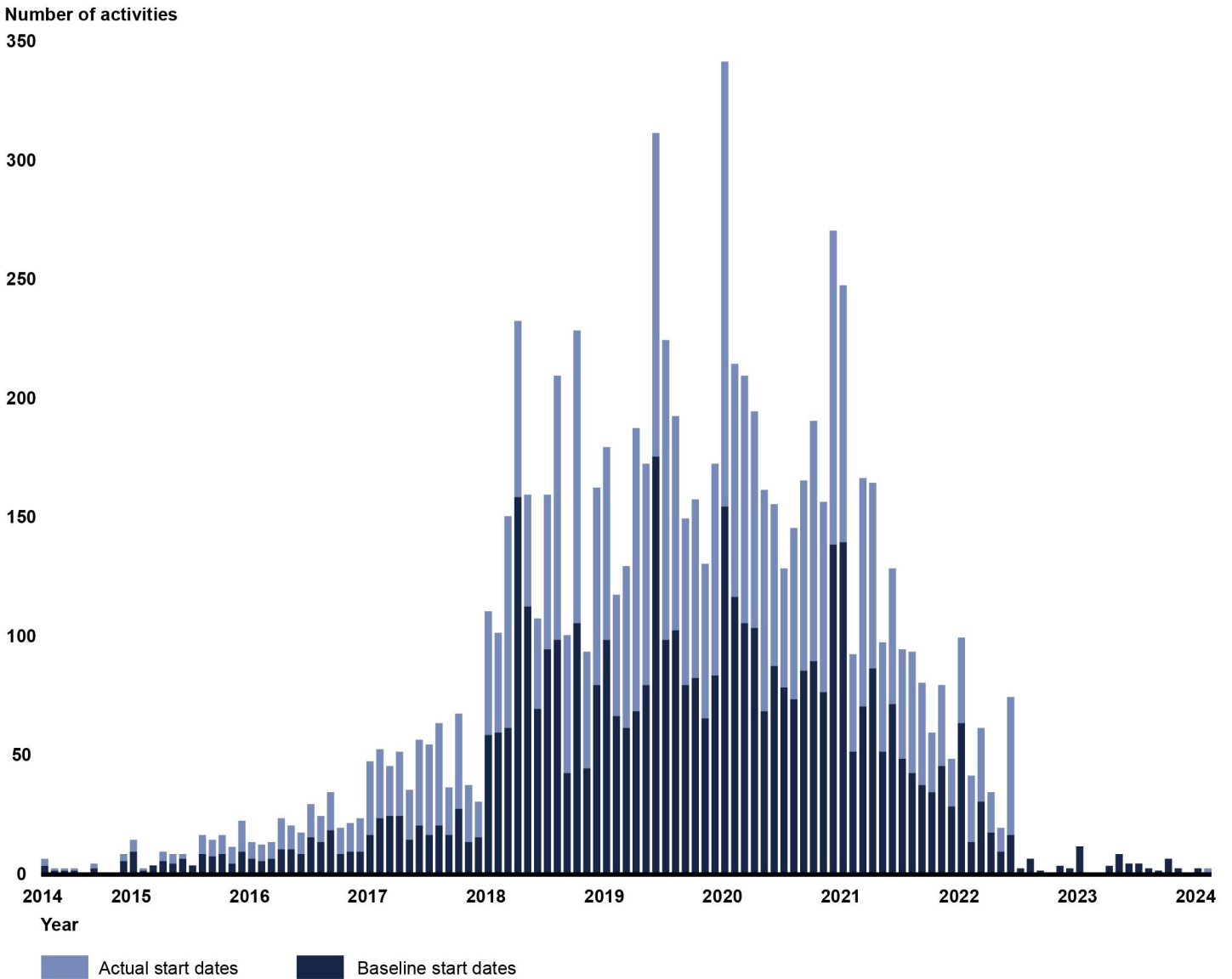
<b>Month</b>	<b>Baseline start dates, Address Canvassing</b>	<b>Baseline start dates, Systems Engineering and Integration</b>	<b>Baseline start dates, Master Address File/Topologically Integrated Geographic Encoding and Referencing</b>
2023-02	0	0	0
2023-03	0	0	0
2023-04	0	1	2
2023-05	0	3	5
2023-06	0	3	1
2023-07	0	4	0
2023-08	0	2	0
2023-09	0	1	0
2023-10	0	6	0
2023-11	0	2	0
2023-12	0	0	0
2024-01	0	2	0

We see that there are frequent peaks and troughs in resource requirements for three of our six projects. Such a pattern could indicate frequent mobilization and demobilization of resources. Program managers familiar with the projects would know the extent to which this may or may not reflect inefficient use of resources.

In addition, figure 18 shows the combined planned starts summed across all six projects compared to their aggregate number of actual starts. This visualization focuses on the respective total counts of activities. These counts may be preferable over the preceding chart when combining a large number of projects.

Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions

**Figure 18: Example of Planned and Actual Activity Starts Stacked across Six Selected 2020 Census Projects**



Source: GAO analysis of U.S. Census Bureau data. | GAO-23-105819

**Accessible Data for Figure 18: Example of Planned and Actual Activity Starts Stacked across Six Selected 2020 Census Projects**

Month	Baseline start dates	Actual start dates
2014-04	3	3
2014-05	1	1

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

<b>Month</b>	<b>Baseline start dates</b>	<b>Actual start dates</b>
2014-06	1	1
2014-07	1	1
2014-08	0	0
2014-09	2	2
2014-10	0	0
2014-11	0	0
2014-12	5	3
2015-01	9	5
2015-02	1	1
2015-03	3	0
2015-04	5	4
2015-05	4	4
2015-06	6	2
2015-07	3	0
2015-08	8	8
2015-09	7	7
2015-10	8	8
2015-11	4	7
2015-12	9	13
2016-01	6	7
2016-02	5	7
2016-03	6	7
2016-04	10	13
2016-05	10	10
2016-06	8	9
2016-07	15	14
2016-08	13	11
2016-09	18	16
2016-10	8	11
2016-11	9	12
2016-12	9	14
2017-01	16	31
2017-02	23	29
2017-03	24	21
2017-04	24	27
2017-05	14	21
2017-06	20	36

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

<b>Month</b>	<b>Baseline start dates</b>	<b>Actual start dates</b>
2017-07	16	38
2017-08	20	43
2017-09	16	20
2017-10	27	40
2017-11	13	24
2017-12	15	15
2018-01	58	52
2018-02	59	42
2018-03	61	89
2018-04	158	74
2018-05	112	47
2018-06	69	38
2018-07	94	65
2018-08	98	111
2018-09	42	58
2018-10	105	123
2018-11	44	49
2018-12	79	83
2019-01	98	81
2019-02	66	51
2019-03	61	68
2019-04	68	119
2019-05	79	93
2019-06	175	136
2019-07	98	126
2019-08	102	90
2019-09	79	70
2019-10	82	75
2019-11	65	65
2019-12	83	89
2020-01	154	187
2020-02	116	98
2020-03	105	104
2020-04	103	91
2020-05	68	93
2020-06	87	68
2020-07	78	50

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

<b>Month</b>	<b>Baseline start dates</b>	<b>Actual start dates</b>
2020-08	73	72
2020-09	85	80
2020-10	89	101
2020-11	76	80
2020-12	138	132
2021-01	139	108
2021-02	51	41
2021-03	70	96
2021-04	86	78
2021-05	51	46
2021-06	71	57
2021-07	48	46
2021-08	42	51
2021-09	37	43
2021-10	34	25
2021-11	45	34
2021-12	28	20
2022-01	63	36
2022-02	13	28
2022-03	30	31
2022-04	17	17
2022-05	9	10
2022-06	16	58
2022-07	2	0
2022-08	6	0
2022-09	1	0
2022-10	0	0
2022-11	3	0
2022-12	2	0
2023-01	11	0
2023-02	0	0
2023-03	0	0
2023-04	3	0
2023-05	8	0
2023-06	4	0
2023-07	4	0
2023-08	2	0

**Appendix II: Examples of ex-post  
Schedule Analyses, and Related  
Management Questions**

<b>Month</b>	<b>Baseline start dates</b>	<b>Actual start dates</b>
2023-09	1	0
2023-10	6	0
2023-11	2	0
2023-12	0	0
2024-01	2	0

As shown in the distribution of actual starts, resource requirements actually spiked in certain months.

**Potential questions for management to ask include the following:**

- Did the program experience difficulties or inefficiencies in resource mobilization?
- If there were difficulties with sudden ramp-ups and ramp-downs of effort throughout the program, is there a way to smooth the peaks and valleys of planned effort for the project?

**Potential crosscutting questions for management to ask include the following:**

- What patterns, if any, exist across projects that may indicate systemic effects on either project planning or execution that may warrant further attention?
- What known conditions affecting the program at points in time have noticeable effects on projects' execution and may warrant attention to mitigate?
- When examined across multiple projects and in conjunction with what is known about their implementation circumstances, is there a profile—or a range of profiles—of these measures or metrics that might lend itself to a near real-time warning sign for additional attention?
- What granularity, such as weekly, monthly, or quarterly on the time scale is most relevant for managers to probe?
- How much did variance seem to matter, and might either validate or suggest reconsideration of thresholds for reporting on variance?

## Appendix III: Glossary of Report Terms

Term	Definition
Address Frame	The list of addresses the Census Bureau has identified to conduct its enumeration operations.
Area Census Office (ACO)	Bureau conducted field operations out of 248 census offices across the United States and Puerto Rico.
Address Listers	Temporary census employees sent to neighborhoods to update and verify addresses as part of the In-Field Address Canvassing Operation.
Count Question Resolution	Bureau operation which allows state, local and tribal governments to request that the Census Bureau review their boundaries or housing counts and potential challenge to official census results.
Enumeration at Transitory Locations	Enumerate individuals in occupied units at transitory locations who do not have a usual home elsewhere.
Group Quarters Enumeration Operation	Bureau operation that counts people living or staying in group housing such as college/university housing, nursing homes and correctional facilities
In-Field Address Canvassing	Bureau operation in which temporary staff (address listers) go into neighborhoods to verify and update the addresses and geographic location of housing units.
Mobile Questionnaire Assistance	A nationwide operation in which Bureau staff promote the census and assist residents of low-response areas in filling out the census.
Non-Response Follow-up (NRFU)	Bureau operation in which staff (enumerators) personally visits households that do not respond to the census in order to enumerate the household.
Object Class or Components	Identify specific areas in which the funds were spent in term of goods and services (e.g., salaries, contracts, overhead, equipment and supplies, etc.). This category of spending is crosscutting and can be a component of any of the projects.
Partnership Specialists	Temporary Bureau employees who, among other things, establish local partnerships and engage those partners to host activities and events within the communities they serve, including primarily targeting hard-to-count communities.
Post Enumeration Survey	Bureau operation to measure the accuracy of the census by independently surveying a sample of the population.
Projects	Identify activities and efforts on how the Bureau was conducting the work (e.g., Address Canvassing, Nonresponse Follow-up, Area Census Office cost, etc.). Each project is associated with a specific framework/work area (e.g., Non-Response Follow-up is associated with the Response framework/work area).
Response Processing Operation	Bureau operation which, among other things, run post-data collection processing actions in preparation for producing the final 2020 Census results, and check for suspicious returns.
Service-Based Enumeration	Bureau operation that counts individuals experiencing homelessness or utilizing transitional shelters, soup kitchens, regularly scheduled mobile food vans, and targeted non-sheltered outdoor locations



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**Appendix III: Glossary of Report  
Terms**

<b>Term</b>	<b>Definition</b>
Update Enumerate	Bureau operation to update the address and enumerate respondents in person, particularly in remote geographic areas that had unique challenges associated with accessibility.
Update Leave	Bureau operation in which staff leave a questionnaire package at the housing unit to allow the household to self-respond, specifically in areas where the majority of housing units do not have a city-style address to receive mail.
Work areas	Identify broadly what the Bureau spending was trying to do (e.g., Response, Infrastructure, Program Management, etc.).
Work Breakdown Structure	Outlines the major work of the program and describes the activities and deliverables at the project level where cost are tracked.

Source: GAO analysis of U.S. Census Bureau information. | GAO-23-105819

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# Appendix IV: Comments from the Department of Commerce

**Appendix IV: 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

February 23, 2023

Ms. Yvonne Jones  
Director, Strategic Issues  
U.S. Government Accountability Office  
441 G Street, NW  
Washington, DC 20548

Dear Ms. Jones:

The U.S. Census Bureau appreciates the opportunity to comment on the U.S. Government Accountability Office (GAO) draft report entitled, "2020 Census: A More Complete Lessons-Learned Process for Cost and Schedule Would Help the Next Decennial" (GAO-23-105819).

The Census Bureau concurs with the recommendations in the report to take steps during the 2030 Census to document and evaluate the lessons-learned process. The Census Bureau will prepare a formal action plan addressing these recommendations upon GAO's issuance of the final report.

Thank you for your continued interest in and efforts toward increasing the benefits from the 2020 Census and improving future census planning for 2030.

Sincerely,

**JEREMY  
PELTER**

Digitally signed by  
JEREMY PELTER  
Date: 2023.02.23  
18:15:49 -05'00'

Jeremy Pelter  
Acting Chief Financial Officer  
and Assistant Secretary for Administration

# Accessible Text for Appendix IV: Comments from the Department of Commerce

February 23, 2023

Ms. Yvonne Jones  
Director, Strategic Issues  
U.S. Government Accountability Office  
441 G Street, NW  
Washington, DC 20548

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Thank you for your continued interest in and efforts toward increasing the benefits from the 2020 Census and improving future census planning for 2030.

Sincerely,

Jeremy Pelter  
Acting Chief Financial Officer and Assistant Secretary for Administration

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# Appendix V: GAO Contact and Staff Acknowledgements

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## GAO Contact

Yvonne D. Jones, (202) 512-2717 or [jonesy@gao.gov](mailto:jonesy@gao.gov)

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## Staff Acknowledgments

In addition to the contact named above, Ty Mitchell (Assistant Director), Mark Abraham (Analyst-in-Charge), Juaná Collymore, Alan Daigle, Emile Ettedgui, Rob Gebhart, Lisa Hardman, Jason T. Lee, Lisa Pearson, Steven Putansu, Kate Sharkey, Dylan Stagner, Peter Verchinski, Shawn Ward, and Alicia White made key contributions to this report.

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## Public Affairs

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