2020 Census Life-cycle Cost Estimate Executive Summary

A New Design for the 21st Century

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United States™ Census Bureau

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1. Introduction

The goal of the 2020 Census is to count everyone once, only once, and in the right place. As the cost of completing this goal has significantly increased each decade since 1970 as the population becomes more challenging to count, the Census Bureau undertook a challenge this decade to design the 2020 Census to cost less per housing unit than the 2010 Census (when adjusted for inflation), while continuing to maintain high quality results. The cost of repeating the 2010 Census methodology in 2020 is $120 per housing unit and the 2020 Census, as currently designed, is expected to cost $107 per housing unit (including contingency)[1]. The Census Bureau plans to achieve this through the most automated, modern, and dynamic decennial census in history.

The 2020 Census embraces technology to ensure a fair and accurate count that will lay the framework for censuses for decades to come. The 2020 Census Operational Plan Version 3.0 released in October 2017 details plans for the first decennial census to update the Census Bureau's address frame using geographic information systems and aerial imagery instead of sending census employees to walk and physically check all 11 million census blocks; the first to encourage the population to respond to the 2020 Census using the Internet and over the telephone, reducing the need for expensive paper data capture; the first to use data the public has already provided to the government and data available from commercial sources to enable focusing of additional visits in areas that have traditionally been hard to enumerate; and the first to use sophisticated operational control systems to send Census Bureau employees to follow up with nonresponding housing units and to track daily progress.

1.1 Executive Summary Purpose

This executive summary of the 2020 Census Lifecycle Cost Estimate (LCCE) is intended to provide the public with a high-level overview of the November 2017 version of 2020 Census LCCE and the supporting 2020 Census LCCE Basis of Estimate (BoE) and related documentation artifacts. The executive summary does not contain a detailed breakout of the costs, assumptions, etc. Detailed documentation of the 2020 Census LCCE is contained in the BoE and its accompanying suite of artifacts. This suite is the detailed formal documentation of the cost estimate that is not published for the general public but rather is intended for official government use including for auditors and oversight bodies.

[1] Note that all costs are presented in then-year (also called current-year) dollars. Then-year dollars are those that have been inflated using an established inflation rate that are expressed in the year when the disbursements or expenditures are expected to occur. The 2020 Census uses the Chained Price Index (CPI) from the Office of Management and Budget's (OMB's) Table 10.1 entitled Gross Domestic Product and Deflators Used in the Historic Tables: 1940-2022.

2. Background

2.1 The 2020 Census

The purpose of the 2020 Census is to conduct a census of population and housing and disseminate the results to the President, the States, and the American people in keeping with Article I and the Fourteenth Amendment of the U.S. Constitution. To accomplish this, the Census Bureau must count everyone once, only once, and in the right place. As the 2020 Census draws near, the Census Bureau has designed a 2020 Census that ensures the coverage of the population and housing is as complete as possible. The design will serve to minimize the undercounting or overcounting the population, particularly as related to the differential impact on subgroups of the population.[2] The Census Bureau is fully committed to designing and conducting a 2020 Census that accurately counts every person residing in America.

The primary requirement served by the decennial census is the apportionment of seats allocated to the states for the House of Representatives. This requirement is mandated in the U.S. Constitution:

> Article I, Section 2, "The actual enumeration shall be made within three years after the first meeting of the Congress of the United States, and within every subsequent Term of ten Years"
>
> Fourteenth Amendment, Section 2, "Representatives shall be apportioned among the several States according to their respective numbers, counting the whole number of persons in each State"

2.2 Uses of Decennial Census Data

As discussed above, decennial data are used to apportion the number of seats in Congress among the states. Decennial data at the census block level are also used by governmental entities for redistricting, i.e., defining the representative boundaries for congressional districts, state legislative districts, school districts, and voting precincts. Additionally, decennial data are used to enforce voting rights and civil rights legislation.

The Census Bureau also uses the decennial census results to determine the statistical sampling frames for the American Community Survey (ACS), which replaced the long form in the decennial census, and the dozens of current household surveys conducted by the Census Bureau. The results of these surveys are used to support important functions, such as appropriating

[2] A detailed discussion of the quality implications of the 2020 Census design can be found in Chapter 7 of the *2020 Census Operational Plan Version 3.0*.

federal funds to local communities (an estimated $675 billion annually[3]); calculating monthly unemployment, crime, and poverty rates; and publishing health and education data.

Finally, Census Bureau data, including decennial data, play an increasingly important role in the United States economy. As people expand their use of data to make decisions at the local and national levels, they increasingly depend on data from the Census Bureau. Today, local businesses look at data provided by the Census Bureau on topics like population growth and income levels to make decisions about whether or where to locate their restaurants or stores. Similarly, a real estate investor, who is considering investing significant funds to develop a piece of land in the community relies on Census Bureau data to measure the demand for housing, predict future need, and review aggregate trends. Big businesses also rely heavily on Census Bureau data to make critical decisions that impact their success and shape the economy at the national level. As noted above, the decennial census is the foundation for the Census Bureau's demographic survey data.

2.3 Challenging Environmental Factors

Multiple environmental factors have the potential to impact the Census Bureau's ability to conduct a fair and accurate count. The Census Bureau is committed to proactively addressing the challenges outlined below in Figure 1 and further elucidated in greater detail in the section below.

[3] Marisa Hotchkiss and Jessica Phelan, *Uses of Census Bureau Data in Federal Funds Distribution: A New Design for the 21st Century*, Census Working Papers, 2017 (Washington, DC: U.S. Census Bureau, September 2017), p. 3.

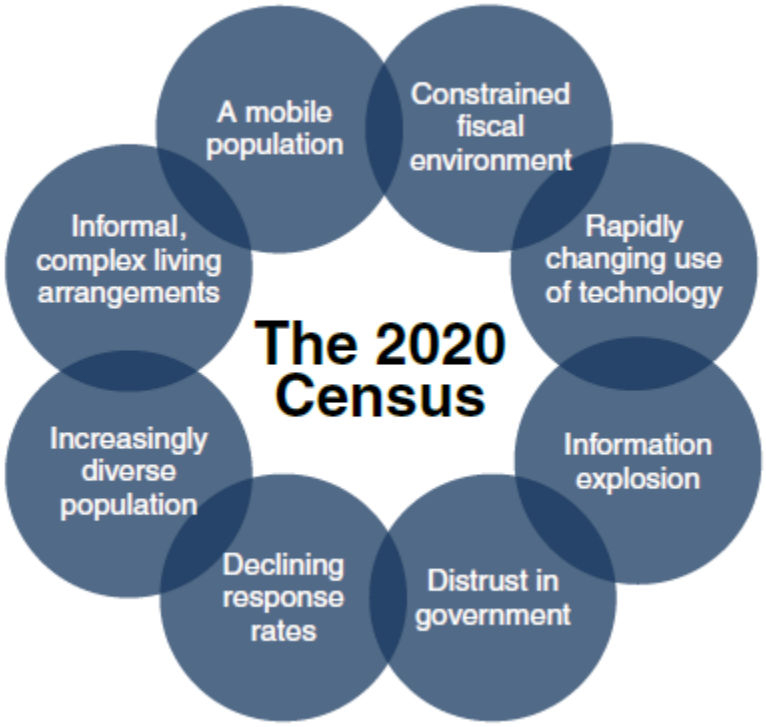


Figure 1: 2020 Census Environment

- **Constrained fiscal environment:** Discretionary caps and sequestration through 2021 have placed pressure on funding available for the research, testing, design and implementation work for the 2020 Census that is especially important during 2016 through 2018 to ensure successful innovation in the 2020 Census. Each fiscal year during the 2020 Census lifecycle, appropriated funding has been less than requested or not provided at the start of each fiscal year. The Census Bureau has had to reprioritize its projects, either by cancelling certain activities like field testing or postponing activities to later in the decade, increasing operational risk to the program.[4]

- **Rapidly changing use of technology:** Stakeholders expect the decennial census to leverage technological innovation, yet the rapid pace of change makes it challenging to plan for and adequately test the use of these technologies before they become obsolete.

- **Information explosion:** Rapid changes in information technology create stakeholder expectations for how the Census Bureau interacts with the public to obtain and disseminate data products. This creates the possibility of gaps between stakeholder

[4] A detailed discussion of the major program risks can be found in Chapter 6 of the *2020 Census Operational Plan*.

desires that the Census Bureau uses the latest technology and the program's ability to meet those expectations.

- **Declining response rates:** Response rates for Census Bureau surveys and for outside surveys have declined over the past few decades as people are overloaded with requests for information and become increasingly concerned about sharing information. The 2020 Census has a direct impact on cost because lower self-response rates require greater uses of expensive field operations to contact nonresponding households.

- **Distrust in government**: Concerns continue to grow about information security and privacy, the confidentiality of information given to the government, and how government programs will use the information collected. This makes it more difficult to collect important demographic survey information. This problem is magnified by the general concern around data security that is intensified whenever a high-profile data breach occurs. If a substantial segment of the public is not convinced that the Census Bureau can safeguard their response data against data breaches and unauthorized use, then response rates may be lower than projected, leading to an increase in cases for follow-up and costs.

- **Increasingly diverse population:** The demographic and cultural make-up of the United States continues to increase in complexity, including a growing number of households and individuals of limited English proficiency, who may experience language barriers to enumeration and varying levels of comfort with government involvement. The program is working to form partnerships with these communities to communicate the benefits of responding and engender their trust. In the absence of such partnerships, the program risks that these communities will not be fully covered by the 2020 Census.

- **Informal, complex living arrangements:** Households are becoming more diverse and dynamic, making it a challenge to associate an identified person with a single location. For example, blended families may include children who have two primary residences. Additionally, some households include multiple relationships and generations. This makes it more difficult for the Census Bureau to reach respondents, as well as creates a risk that people will either be missed by the census, or counted twice.

- **A mobile population:** The United States continues to be a highly mobile nation. Based on results from the 2015 American Community Survey, approximately 15 percent of the population moves in a given year. The continued growth in cellular telephone technology and the reduction in landline telephones tied to physical locations also make it more difficult for the Census Bureau to reach respondents, as

well as creates a risk that individuals will either be missed by the census, or counted twice.

2.4 A New Design for the 21st Century

The societal, demographic, and technological trends listed above can result in a population that is harder and more expensive to enumerate. The Census Bureau has, decade after decade, spent more money to maintain the same level of accuracy as previous censuses, as it has become more challenging to locate individuals and solicit their participation through traditional methods. The innovations described in the 2020 Census Operational Plan Version 3.0, estimates that cost avoidance can be realized relative to replicating a design similar to that of the 2010 Census. Estimates for expected total costs for the 2020 Census are approximately $17.5B in 2020 if the Census Bureau repeats the 2010 Census design and methods. With the innovations described below, as of October 2017 the Census Bureau estimates that it can conduct the 2020 Census for approximately $15.6B[5].

Field costs associated with Address Canvassing and Nonresponse Followup operations comprise the most expensive aspects of the 2020 Census. Four innovation areas are aimed at reducing the costs of fieldwork to support a complete and accurate count. A reengineered Address Canvassing operation is expected to reduce the field workload for address updating by 70 percent. Self-response innovations, which are aimed at generating the largest possible self-response rate, coupled with the use of administrative records and third-party data, are intended to reduce the field workload associated with Nonresponse Followup. Finally, the reengineered field operations are intended to increase the efficiency of those operations, allowing managers and fieldworkers to be more productive and effective.

Figure 2 describes at a high-level how the 2020 Census will be conducted. This design reflects a flexible approach that takes advantage of new technologies and data sources while minimizing risk.

[5] Note that all costs are presented in then-year (also called current-year) dollars. Then-year dollars are those that have been inflated using an established inflation rate that are expressed in the year when the disbursements or expenditures are expected to occur. The 2020 Census uses the Chained Price Index (CPI) from the Office of Management and Budget's (OMB's) Table 10.1 entitled Gross Domestic Product and Deflators Used in the Historic Tables: 1940-2022.

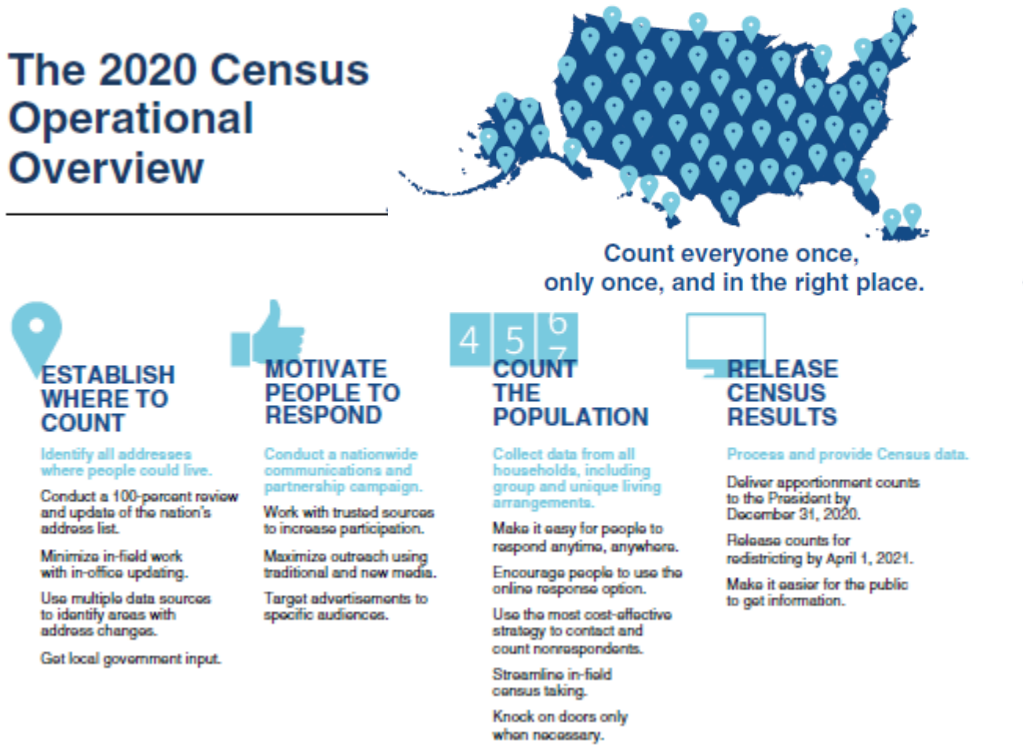


Figure 2: The 2020 Census - A New Design for the 21st Century

The first step in conducting the 2020 Census is to identify all of the addresses where people could live, or **Establish Where to Count**. An accurate address list helps ensure that everyone is counted. For the 2020 Census, the Census Bureau began an in-office review of 100 percent of the nation's addresses in September 2015 and is continually updating the address list based on data from multiple sources, including the U.S. Postal Service, tribal, state, and local governments, satellite imagery, and third-party data providers. The Census Bureau has already completed the first pass of the entire nation with this in-office Address Canvassing operation. This office work will also determine which parts of the country require fieldwork to verify address information. In-Field Address Canvassing will begin in 2019 and is anticipated to cover approximately 30 percent of all addresses where in-office address canvassing methods do not work well like where tree cover interferes with the use of imagery or in cities where high-rise construction makes address change difficult to detect using aerial imagery.

As discussed earlier, response rates to surveys and censuses have been declining. To **Motivate People to Respond**, the 2020 Census will include a nation-wide communications and partnership campaign. This campaign is focused on getting people to respond on their own (self-respond). It costs significantly less to process a response provided via the Internet or through a paper form than it does to send a fieldworker to someone's home to collect their response. Advertising will make heavy use of digital media, tailoring the message to the audience. The partnership program will use trusted voices in the community to explain the importance of the 2020 Census and encourage wide participation.

The Census Bureau **Counts the Population** by collecting information from all households, including those residing in group or unique living arrangements. The Census Bureau wants to make it easy for people to respond anytime and anywhere. To this end, the 2020 Census will offer the opportunity and encourage people to respond via the Internet and will encourage, but not require, people to enter a unique Census Identification with their response. Online responses will be accurate, secure, and convenient.

The goal for the 2020 Census is to reduce the average number of visits to nonresponding households relative to prior decennial censuses by using available data from government administrative records and third-party sources. The Census Bureau plans to use these data to identify vacant households, to determine the best time of day to visit a particular household, and to count the people and fill in the responses with existing high-quality data from trusted sources. These uses of government administrative records and third-party sources have shown promise during our testing throughout the decade and will be tested again in the 2018 End to End Census Test. Deploying our resources in the field in the most cost-effective ways allows the Census Bureau to focus time and manpower to maximize response rates across geographic areas and demographic groups.

In addition, the majority of fieldworkers will use mobile devices for collecting the data. Operations such as recruiting, training, and payroll will be automated, reducing the time required for these activities. New operational control centers will rely on automation to manage most of the fieldwork, enabling more efficient case assignment, automatic determination of optimal travel routes, and reduction of the number of physical offices. In general, a streamlined operation and management structure is expected to increase productivity and save costs, such that Census Bureau staff may focus on their core mission of conducting a complete and accurate count.

The last step in the 2020 Census is to **Release the 2020 Census Results**. The 2020 Census data will be processed and sent to the President for apportionment by December 31, 2020, to the states for redistricting by April 1, 2021, and to the public beginning in December 2021.

2.5 The Role of the LCCE

The LCCE is the estimated cost of developing, producing, deploying, maintaining, operating and disposing of a system or program over its entire lifespan. The LCCE is prepared to support and inform budget requirements, source selections, resource allocation trade-off analyses, program change decisions, and major program reviews. The LCCE provides the basis for the official projected cost for a system or program that is communicated to the Department of Commerce (DOC), the Office of Management and Budget (OMB), Congress, the Government Accountability Office (GAO) and the public.

As the basis for the official projected cost of the program, the LCCE provides Census Bureau and Department of Commerce leadership with critical information for making program decisions, establishing executable budgets, and proactively addressing financial issues.

Section 3 of this document provides an overview of the approach, methodology, major assumptions, cost drivers and cost profile of the 2020 Census LCCE.

2.6 Improving the LCCE

As discussed in Chapter 2 of the GAO Cost Estimation and Assessment Guide, entitled *Why Government Programs Need Cost Estimates and the Challenges in Developing Them*[6], developing a quality cost estimate is a significant challenge.

> Developing a good cost estimate requires stable program requirements, access to detailed documentation and historical data, well-trained and experienced cost analysts, a risk and uncertainty analysis, the identification of a range of confidence levels, and adequate contingency and management reserves. Even with the best of these circumstances, cost estimating is difficult. It requires both science and judgment. And, since answers are seldom if ever precise, the goal is to find a 'reasonable' answer.

In June 2016, the GAO released a report[7] on its May 2016 assessment of the 2020 Census LCCE and judged the estimate as "not reliable." GAO provided a set of recommendations for the Census Bureau to implement that would facilitate the improvement of the 2020 Census LCCE. Specifically, the GAO recommended that the 2020 Census LCCE ensure that:

1. The estimate includes all life-cycle costs and documents all cost-influencing assumptions.
2. The planned documentation plan captures the source data used; contains the calculations performed and the estimating methodologies used for each element; and describes step by step how the estimate was developed.
3. The estimating technique for each cost element is used appropriately and that variances between planned and actual cost are documented, explained, and reviewed.
4. The estimate includes a sensitivity analysis, major cost elements are cross-checked to see whether results are similar, and an independent cost estimate is conducted to determine whether other estimating methods produce similar results.

As a result, the Census Bureau developed a Cost Estimation Enhancement Plan to mature the 2020 Census LCCE and its associated processes via a series of three-month sprints. The action plan covers four enhancement areas. These areas are: 1) Documentation Enhancement, 2) Process Enhancement, 3) Cost Estimate Enhancement, and 4) Cost Integration Enhancement. The specific artifacts associated with the enhancement efforts are shown below.

- 2020 Census LCCE BoE – a document that describes, step by step, the scope of the estimate, the cost estimating process, and the data sources, assumptions, and methods used so that a cost analyst unfamiliar with the program could understand what was done

[6] GAO Cost Estimating and Assessment Guide, March 2009, GAO-09-SP, page 15.
[7] 2020 Census: Census Bureau Needs to Improve Its Life-Cycle Cost Estimating Process, June 30, 2016, GAO-16-628

and replicate it. This artifact directly addresses most of the GAO recommendations on the need for improved documentation.

- 2020 Decennial Census Program Cost Estimation and Assessment Process (CEAP) – a document that establishes a cost estimation and analysis process that will provide a common framework for planning, developing, and managing cost estimates in alignment with GAO and other best practices. This process directly addresses the GAO recommendations for improved cost estimation practices.
- Cost Center of Excellence (CCOE) Charter – charter that lays out roles and responsibilities for a body of 2020 Census Programs cost estimation subject matter experts and stakeholders. This body will support the improvement of cost estimation practices and usage across the program. This charter directly addresses the GAO recommendations for improved internal practices and internal controls.
- Decennial Directorate Cost Guidance – guidance document to support the implementation and governance associated with the CEAP and the CCOE. This guidance directly addresses the GAO recommendations for improved internal practices and internal controls.
- 2020 Census Work Breakdown Structure (WBS) Dictionary – document that defines the WBS elements and a platform to guide more effective understanding of how to categorize costs in a consistent manner. This artifact directly addresses the GAO recommendations for improved documentation and the need to ensure that the estimate covers the entire scope of the program.
- 2020 LCCE Version Control Plan – document that establishes a disciplined approach to cost estimate updates, changes and releases. This artifact directly addresses the GAO recommendation to improve documentation and internal controls.

In addition to reflecting GAO best practices, the revised 2020 Census Life Cycle Cost Estimate provided in this document reflects an extensive 2020 Census program management and cost assessment review conducted by Secretary Wilbur L. Ross and Under Secretary for Economic Affairs Karen Dunn Kelley during 2017. Additional details concerning this assessment can be found in the October 31, 2017 Senate Homeland Security and Governmental Affairs Committee testimony of Secretary Ross.[8]

3. Overview of the 2020 Census LCCE

The 2020 Census LCCE has been developed by a team within the Decennial Budget Office (DBO). This small team is comprised of certified cost estimators and experienced subject matter experts from the Census Bureau and supporting contractor resources. The team has consulted with independent cost estimators from the Department of Commerce in detail in developing the estimate.

Note that all costs are presented in then-year (also called current-year) dollars. Then-year dollars are those that have been inflated using an established inflation rate that are expressed in the year when the disbursements or expenditures are expected to occur. The 2020 Census uses the

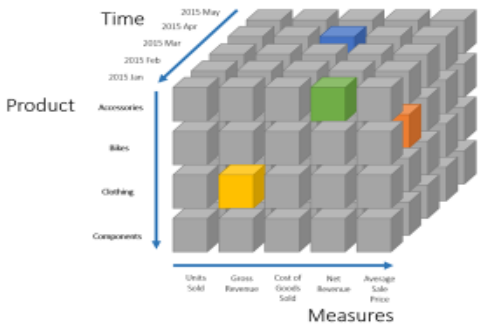
[8] This testimony can be reviewed at the following URL: http://www.hsgac.senate.gov/download/testimony-ross-2017-10-31

Chained Price Index (CPI) from the Office of Management and Budget's (OMB's) Table 10.1 entitled Gross Domestic Product and Deflators Used in the Historic Tables: 1940-2022.

The 2020 Census is a large and complex operation, and therefore the cost estimate that supports it is also large and complex. To accommodate the operation, the 2020 Census LCCE is built using a multi-dimensional database and data manipulation and reporting tools. The tool the 2020 Census LCCE is built upon is called the Decennial Budget Integration Tool (DBiT). DBiT is used by the Decennial Programs to develop cost estimates and to perform budgeting, planning, and execution management functions for the 2020 Census using the IBM Cognos TM1 platform. IBM Cognos TM1 is an enterprise planning software platform that can accommodate the entire planning cycle by taking advantage of advanced OLAP and reporting capabilities.[9] The current DBiT platform provides two major capabilities: i) Enterprise Planning, which is used by the DBO for cost modeling and estimation, budget planning, formulation and execution; and ii) Business Intelligence, which enables highly-capable analysis and interactive reporting. Within the 2020 Census LCCE there are 1,151 data cubes and over 1,859 inputs and assumptions. There are over 77,000 summary cost records.

The use of the IBM TM1 Cognos platform's data warehousing capabilities provides the 2020 Census LCCE with the ability to use multi-dimensional cubes to bring data sets to bear for calculations, analyses and reference. This has allowed for the Census Bureau to develop a cost estimate with a high degree of rigor and complexity while maintaining the ability to fully document and analyze the data and results. In the example cube shown in Figure 3 below, the dimensions of Time, Product and Measures are drawn into a cube that can then be used for variety of analyses.

- **Dimensional Model**: a database design technique for optimizing data querying
- **Online Analytical Processing (OLAP)**: category of software tools that perform calculations upon multi-dimensional data sets
- **Cube**: multi-dimensional array of data
- **Star schema**: a type of data warehousing schema that separates business data into facts and dimensions
- **Fact**: measurable, quantitative, additive values that act as independent variables by which descriptive attributes are analyzed
- **Dimension**: description attributes that provide structured labeling information for grouping and filtering data



[9] TM1 is an IBM tool that enables the generation of cost estimates with higher levels of dimensionality, precision, accountability, and reporting. The enterprise planning capabilities of TM1 are well-suited for detailed modeling of the cost of complex programs comprised of multiple products and operations, which require hundreds or thousands of variables. TM1 Performance Modeler can produce estimates under multiple model scenarios using groups of inputs that conform an internally-consistent regarding the estimate. TM1 Performance Modeler also supports cost model sensitivity and uncertainty analysis around key input variables by enabling the ingestion of parameters that define simple statistical distributions around a central estimate for each variable (i.e., minimum, median, and maximum), as well as an interface to support quick model re-estimation and Monte Carlo simulations.

Figure 3 Example Data Cube and Associated Concepts

3.1 Scope of the Estimate

The time frame covered by the 2020 Census LCCE is a 12-year period from fiscal years 2012 to 2023. The scope of the 2020 Census includes 35 operations.[10] The 2020 Census operations are organized into eight major areas that correspond with the Census Bureau standard WBS as shown in Figure 4 below.

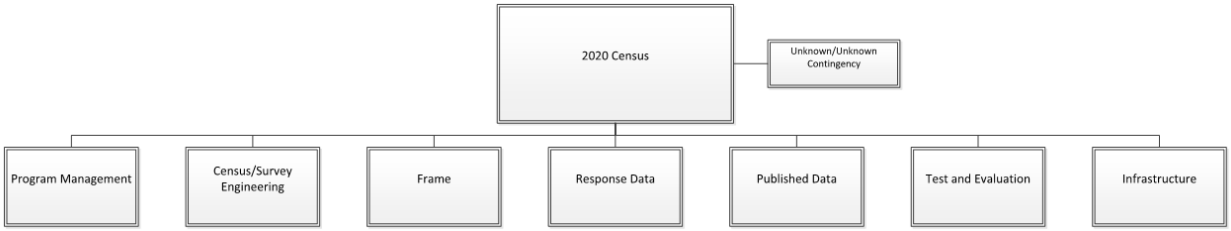


Figure 4: 2020 Census LCCE WBS Top-level WBS Elements

The 35 operations needed to conduct the 2020 Census are shown in Figure 5 later in this section. The graphic is organized into the major areas that correspond with the 2020 Census Program WBS shown above. Program Management, Census/Survey Engineering, and Infrastructure are combined into one general group called Support, which is shown at the top of the diagram. In addition, a separate area, Other Censuses, accounts for the Island Areas Censuses operation, which is unique to the Decennial Census programs.

[10] The term operation refers to both support and business functions. For example, Program Management is considered a support function, and Address Canvassing is considered a business function.

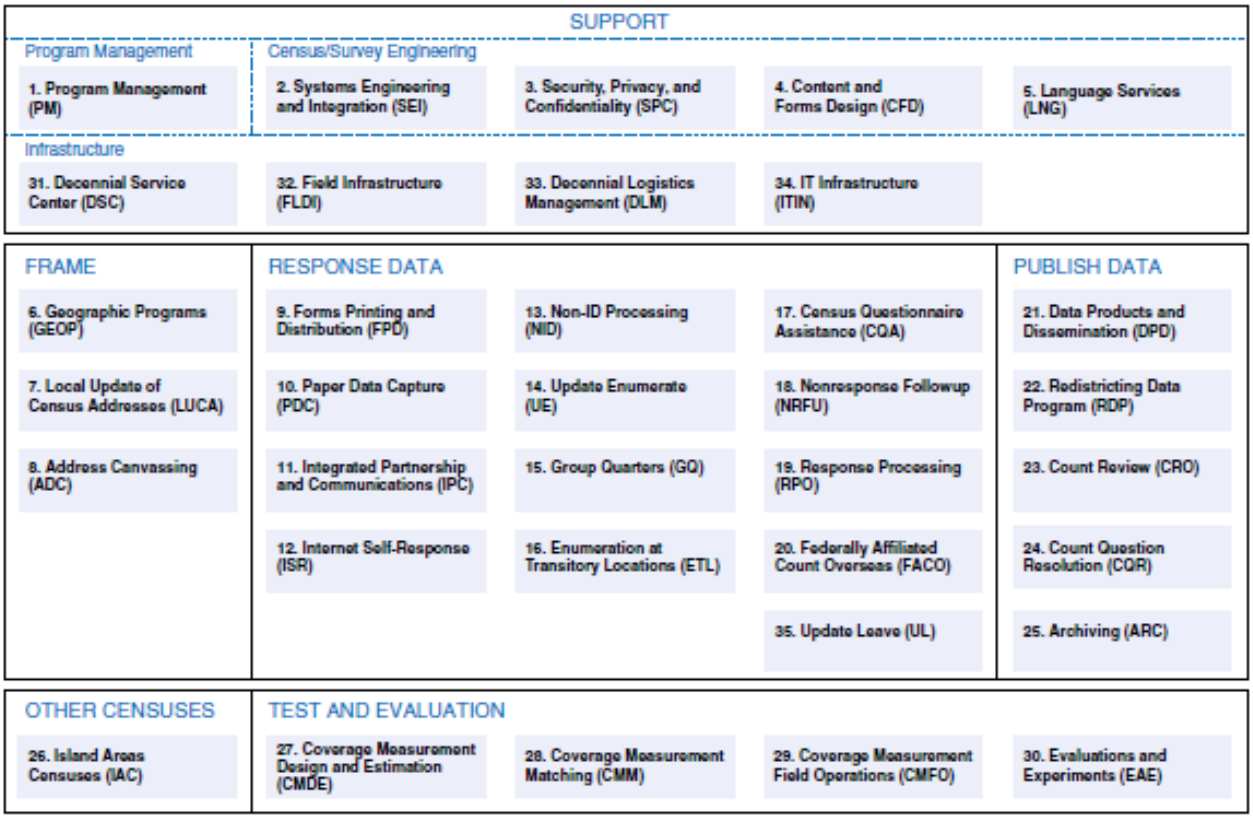


Figure 5: 2020 Census Operations

3.2 Cost Estimation Approach

The 2020 Census LCCE's methodology is primarily based on a bottoms-up cost estimation approach. Other methodologies (such as historical data, subject matter expertise, and analogous systems) are used when appropriate. The 2020 Census Program cost estimation team followed the guidance contained in the GAO's, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs* (GAO-09-3SP)[11]. Specifically, the 2020 Census LCCE's methodology aligns to GAO's 12-step Cost Estimating Process as shown in Figure 6 below (with the steps enumerated to better demonstrate the process flow).

[11] GAO Cost Estimating and Assessment Guide, March 2009, GAO-09-SP, page 8.

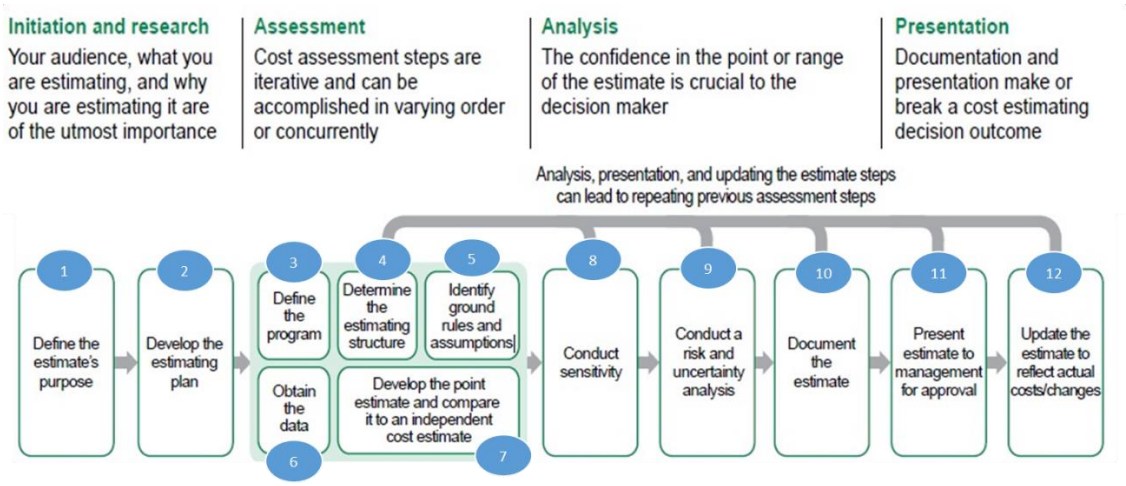


Figure 6: GAO 12-step Cost Estimation Process

The 2020 Census LCCE utilizes an approach designed to produce a quality cost estimate in line with best practices and GAO guidelines. This calculation flow enables a clear understanding to facilitate a line-of-sight of how the assumptions, the inputs, and the processes/calculations to the outputs/results. By following the cost estimate, the process can be effectively replicated and understood. An illustration of this approach along with a brief description of each of the four primary process areas is shown in Figure 7 below.

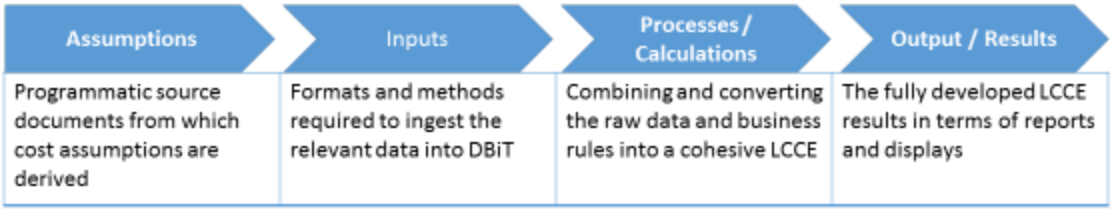


Figure 7: 2020 Census LCCE Documentation Approach

3.3 Cost Estimation Methodology

The 2020 Census Program cost estimators worked with subject matter experts to obtain data and document the variables that influence the cost of the 2020 Census. Subject matter experts aided the identification of parameters associated with each variable, including historical data collected from the 2010 Census, the American Community Survey, and the 2020 Census Research and Testing Program. The 2020 Census LCCE team used the inputs after reviewing them for relevancy and credibility in consultation with Decennial Programs leadership.

The parameters for the variables were entered into the Decennial Budget Integration Tool (DBiT).[12] The DBiT Enterprise Planning capability allows for modeling the cost of complex programs such as the 2020 Census. Hundreds of variables across the 35 operations were incorporated into the model to generate a total cost estimate for the 2020 Census. The cost model required three parameters for each variable (minimum, median, and maximum) derived from historical data, test results, or expert opinion. For example, one input parameter used to estimate the Nonresponse Followup workload included an estimated overall self-response rate after six weeks, using the following values: minimum of 55.5 percent, median of 60.5 percent and maximum of 65.5 percent. These values were based on findings from the 2010 Census, the American Community Survey, and the 2020 Census Research and Testing Program.

Major Assumptions

Table 1 lists the major assumptions, how they have changed from the December 2015 version of the LCCE, the reasons for the change, and the relative impact of the change on the overall cost.

Table 1: Major Assumptions and Impact of Changes

Item	Change	Reason	Impact
Overall Response Rate	**Decreased** from 63.5% to 60.5%	More conservative assumption due to increased burden for internet self-response including expectation that authentication steps will be added at the log in for internet self-response and the elimination of Save and Return functionality for self-response.	Major +
Major Contracts	**Increased** due to re-estimation	Updated cost data from contract award system, reconciliation with the DOC ICE and greater ability to define requirements at low levels.	Major +
NRFU Pay Rates	**Reduced** -$3.65 (in 2020) to $18.85 (was $22.50)	Updated pay analysis showed an expected lower pay rate.	Major -
AdCan Pay Rates	**Reduced**: -$5.35 (in 2019) to $17.06 (was $22.42)	Updated pay analysis showed an expected lower pay rate.	Major -
NRFU Productivity	**Decreased** as result of more conservative approach	Use of historical 2010 data rather than research and test data.	Major +

[12] DBiT is a system of applications developed on the IBM Cognos platform comprised of two major capabilities. Enterprise Planning is a modeling tool used for cost modeling and estimation, and the Business Intelligence capability is used to analyze and report cost information.

In-Field AdCan	**Increased** from 25% to 30%	Updated operational assumption based on stopping Active Block Resolution in in-office Address Canvassing.	Major +
CQA Call Volume	**Increased** by 5%	Expected increased calls to CQA due to elimination of Save and Return for internet self-response.	Major +
ACO Staffing	**Adjusted** assumed staff levels to match durations	Updated analysis of schedule to align work with task timing.	Major -
Early Census Area Offices	**Increased** 31 to 40	Updated for higher in-field Address Canvassing workload driven by pausing Active Block Resolution portion of In-Office Address Canvassing.	Minor +
ACO Office Size	**Increased** 890 square feet	Updated for re-planned operations, staff increases, and use of laptops.	Minor +
Device as a Service	**Switched** multiple operations from handhelds to laptops	Updated operational assumptions to align with updated operational plans.	Major -

To account for uncertainty around the various parameters, the cost estimators ran a Monte Carlo simulation. This method randomly samples parameters from a probability distribution for each variable (based on the minimum, median, and maximum) and then uses those values to calculate a cost estimate. Repeating this process thousands of times yields a distribution of cost estimates. Monte Carlo outputs (a cost estimated value) were identified at the 80th percentile level, a point estimate at which 80 percent of all the cost estimates were equal to or less than this estimate. This translates to an 80 percent probability that funding at this level will be adequate to conduct the 2020 Census.

Additionally, acknowledging the inherent uncertainty of many of these assumptions, funding has been added throughout the WBS to manage discrete risks. Known areas of risk that have been mitigated with this funding include the assumption for the response rate, the pay rates for temporary field staff, and the field supervisory-staff ratio. The 2020 Census program will manage the program to the estimates included in the LCCE, and will only need to utilize the additional funding, if these estimates prove to be incorrect. This is shown further in section 3.5.

3.4 Independent Cost Reviews

The 2020 Census LCCE has been compared to two independent cost estimates (ICEs)[13] in its developmental history. GAO treats an ICE as a useful tool to determine the fidelity of a cost estimate. Specifically, the GAO states:

[13] An ICE is conducted by an independent organization using the same technical and procurement information used to develop the POE. The ICE provides an unbiased test of a LCCE's reasonableness in terms of cost, risk, etc.

> An ICE is considered one of the best and most reliable validation methods. ICEs are typically performed by organizations higher in the decision-making process than the office performing the baseline estimate. They provide an independent view of expected program costs that tests the program office's estimate for reasonableness. Therefore, ICEs can provide decision-makers with additional insight into a program's potential costs – in part, because they frequently use different methods and are less burdened with organizational bias. Moreover, ICEs tend to incorporate adequate risk and, therefore, tend to be more conservative in forecasting higher costs than the program office.[14]

In both comparisons of the cost estimates, there were differences in individual cost categories, but the overall (total) cost was similar between the ICE and the 2020 Census Program Office Estimate (POE).[15] The primary reason for the differences were the estimating method and the different application of contingency and uncertainty. The results of the ICE to POE comparisons are shown in **Error! Reference source not found.** below.

Following the completion of the first POE by the Decennial Budget Office in early 2016, the Census Bureau's Office of Cost Estimation and Assessment (OCEAA) conducted the first ICE beginning in FY 2015 and ending prior to the 2020 Census Milestone 2 Review in June 2016. The differences between the point estimate (direct cost) was approximately two percent. The OCEAA ICE used more conservative costs for mitigating risks and uncertainty, and therefore the difference for mitigating risk and uncertainty was just over 30 percent. The total delta between the May 2016 POE and the June 2016 ICE was 6.4 percent. The differences between the ICE and the POE were reconciled through a series of meetings between the OCEAA ICE team and the 2020 Census LCCE. The information from the reconciliation was used to update the POE.

The second comparison of the 2020 Census POE to an ICE was conducted during September 2017. The second ICE, which was completed in August of 2017, was conducted by the DOC's Office of Acquisition Management (OAM). Following reconcilitation with the 2020 Census POE, it informed the LCCE released by the Office of the Secretary (OS). The OAM ICE utilized a top-down approach that made use of newly available Census data on IT and contract costs. The difference in direct costs (the point estimate) was over nine percent; largely due to more direct reliance on 2010 Census historical operational assumptions. However, the OAM ICE assumed less costs to mitigate risk and uncertainty. The overall difference was approximately 4.2 percent.

Following reconciliation between the April 2017 POE and the August 2017 ICE, additional reconciliation occurred with the Office of the Secretary estimate in September 2017. The difference in risk and uncertainty between this latest estimate and the April 2017 POE accounted for the addition of $1.1B in Secretarial-controlled contingency. The results of the reconciliation

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[14] GAO Cost Estimating and Assessment Guide, March 2009, GAO-09-3SP, page 186

[15] A POE is the official projected cost for a system or program that is formally submitted to justify budget requirements to higher headquarters, Congress, GAO and others.

between the DOC OAM/OS ICE and the April 2017 version of the 2020 Census POE are shown in the bottom row of the table and became the November 2017 2020 Census POE being presented in this document. The delta between the two estimates is under one percent.

Date	Model	Developer	Direct Cost	Delta[16]	Risk & Uncertainty	Delta	Total Cost	Total Delta
May-16	POE	DBO	$ 10,989	-2%	$ 1,323	-31%	$12,312	-6%
Jun-16	ICE	OCEAA	$ 11,229	N/A	$ 1,931	N/A	$13,160	N/A
Apr-17	POE	DBO	$ 10,284	-10%	$ 3,196	106%	$13,480	-4%
Aug-17	ICE	DOC OAM	$ 11,406	N/A	$ 1,551	N/A	$14,074	N/A
Sep-17	ICE	DOC OAM/OS	$ 11,406	N/A	$ 4,218	N/A	$15,625	N/A
Nov-17	POE	DBO	$ 11,405	0%	$ 4,220	0%	$15,625	0%

Figure 8: Comparison to Independent Cost Estimates

3.5 Cost Sensitivity Analysis

After the updated point estimate was compared to the ICE (Step 7 of the GAO 12-step cost estimation process) and updated as a result, the point estimate cost was then adjusted for risk and uncertainty (to include contingency) in Step 8 and Step 9 of the GAO process. A description of the program risk and uncertainty in the form of Secretarial-Controlled Contingency is outlined below.

Program Risk

Program Risk comprises two areas of costs to mitigate risk in the estimate – Monte Carlo Uncertainty and Discrete Risks – and totals $1.42 billion spread across the WBS level 2 framework.

Monte Carlo Uncertainty

To account for uncertainty around the various parameters, the cost estimators ran a Monte Carlo simulation. This method randomly samples parameters from a probability distribution for each variable (based on the minimum, median, and maximum) and then uses those values to calculate a cost estimate. Monte Carlo uncertainty is applied to the Program Management WBS element. The Program Management WBS covers elements associated with the definition and implementation of program management policies, processes, and the control functions for

[16] Delta columns represent percent change for each POE relative to its proximal ICE.

planning and implementing the 2020 Census to ensure an efficient and well-managed program. The estimated costs for Monte Carlo uncertainty was approximately $292M.

Discrete Risks

Discrete risks are those specifically referenced in the 2020 Census Program Risk Register. Each of these official risks have their own risk range assigned to them in the LCCE. The following discrete program risks have been reflected in the risk-adjusted cost estimate via additional sensitivity analyses:

1. Self-response rates are critical variables with expected large impacts in the Response Data life-cycle costs. The self-response rate was assumed to decline below modeled levels, which causes an increase in the Nonresponse Followup Workload. The impact of this risk was estimated by decreasing self-response rates from 60.5% to 55.0%. The estimated cost for this risk was $247.6M.
2. The cost of field operations is considered sensitive to the size and cost of new recruits in specific geographic areas, so this risk models recruitment size and wage rate of the temporary workforce as not adequate for a given geographic area. This risk was modeled by increasing the wage rate of the temporary workforce by $0.50. The estimated cost for this risk was estimated to be $76.7M.
3. The Census Bureau has postulated a significant increase in the efficiency of field operations, with a higher Enumerator-to-Supervisor staffing ratio than in the 2010 Census. This assumption used to generate the point cost estimate is contingent on the proper implementation and management of resources, and the risk that planned efficiencies from field management staffing are inadequate to support the temporary workforce. The impact of this risk was estimated by assuming a decrease in the Enumerator-to-Management staffing ratio from 20:1 to 16:1. The cost for this risk was estimated to be $44.4M.
4. Risks identified in the 2020 Life-Cycle Risk Register were analyzed, quantified, integrated into the estimate; mitigations were also evaluated and incorporated in the estimate when relevant, as part of the 2020 LCCE process. The Census Bureau Enterprise Risk Management (ERM) process was followed to ensure the integration/linkage of the 2020 Decennial Program risks into the cost estimation process. The costs for these risks was estimated to be $763.5M. Examples of the risks in the risk register include cybersecurity incidents, system scalability, and internet data collection.

Careful research, testing and planning throughout the decade has led the Census Bureau to establish a higher self-response rate and operate effectively with a lower wage and higher supervisory ratio. However, due to the cost sensitivity of each of these assumptions, further evidence is needed before the Census Bureau can retire these risks and reduce the estimates appropriately and responsibly without endangering a high quality 2020 Census. The current supervisory to staffing ratio assumption is the assumption that can be refined the most through additional testing. As such, it will be managed to 20:1 in the 2018 End-to-End Census Test, and it is likely the observations and analysis of its effectiveness will inform and refine the estimates for this discrete risk.

Even with research, testing and planning, response rates and wages are more difficult to predict with precision, as the exact value for each that will be experienced in the 2020 Census lie further from the direct control of the 2020 Census program managers. The response rate could be affected unpredictably by both public and private data breaches, the public's overall opinion of the government, and the Census Bureau's commitment to confidentiality. Wage rates for a temporary work force are impacted by the strength of the economy and the competitiveness of the job market. As a result of these external factors, it is unlikely these risks could be retired and the corresponding estimates included for these discrete risks reduced until very late in the cycle. The Census Bureau will continue to manage the 2020 Census Program to the objective assumptions contained within the LCCE that is based on the higher threshold assumptions noted in items one through three above and be continuously monitoring external conditions and their impact on the self-response rate and wage rate assumptions.

Even though the program may carry these risks throughout the entire lifecycle, the Bureau is committed to managing this risk and minimizing the use of contingency funding. For example, the Census Bureau will invest in a robust communications and partnership program designed to promote self-response through accurate and timely information about data security and confidentiality.

Secretarial-Controlled Contingency

The Secretarial-Controlled Contingency represents the unknown-unknown category of risk to account for unforeseen risks, such as a natural disaster driving residents of an area away from their residences leading up to Census Day for the 2020 Census. This category is a 10 percent addition to the risk-adjusted cost. The Department of Commerce will only approve use of this contingency following a formal governance process involving the Department's oversight bodies. The cost assigned to the unknown-unknown risk was $1.2B.

At the end of the risk and uncertainty analyses, the risks and uncertainty were added to the point estimate to produce a total risk-adjusted cost estimate for the 2020 Census Program the life-cycle cost was determined to be approximately $15.6B.

4. LCCE Summary

4.1 The Cost Estimation Results

This section discusses the summary costs of the 2020 Census LCCE. The figure below presents estimated life-cycle cost for each of the WBS level-2 elements of the Census Bureau WBS. Response Data, which includes most costs associated with the actual collection of data by multiple means, and other supporting activities such as printing, distribution, and questionnaire support, accounts for over one third of the total cost of the 2020 Census at $5.8B. Infrastructure, with a cost of $3.8B, is the second largest cost component; this WBS element includes the required IT and field operations investments, as well as the infrastructure required to support

logistic management and service centers. Census Survey and Engineering, which includes systems engineering and integration, system security, content and forms design, and language services, comes third with $1.8B, followed by $1.3B in program management and $1.2B in contingencies. Note, the years FY12-FY16 are actuals from Commerce Business System (CBS) taken in August 2017. The cost estimate summary is shown in Table 2 below.

Table 2: Cost Estimate Summary ($K)

Fiscal Year	1 Program Management	2 Census / Survey Engineering	3 Frame	4 Response Data	5 Published Data	6 Test, Evaluation, Special Censuses	7 Infra-structure	8 Secretarial-Controlled Contingency	Grand Total
FY 2012	$8,553	$15,986	$3,114	$5,574	$1,082	$17,119	$11,584		**$63,012**
FY 2013	$8,256	$8,076	$3,946	$7,760	$3,428	$25,590	$41,481		**$98,537**
FY 2014	$19,660	$18,411	$26,613	$18,163	$11,175	$48,076	$85,330		**$227,427**
FY 2015	$40,651	$16,186	$26,133	$55,527	$14,830	$94,125	$92,838		**$340,289**
FY 2016	$84,797	$117,667	$82,232	$91,348	$31,940	$82,526	$159,132		**$649,641**
FY 2017[17]	$63,214	$199,902	$58,632	$246,285	$20,857	$39,080	$127,723		**$755,693**
FY 2018[18]	$60,210	$257,117	$98,402	$218,367	$18,078	$54,544	$281,355	$49,000	**$1,037,073**
FY 2019	$310,227	$356,264	$312,228	$1,088,377	$17,130	$76,265	$977,298	$314,000	**$3,451,788**
FY 2020	$486,771	$343,959	$64,104	$3,894,973	$13,191	$180,700	$1,710,421	$669,000	**$7,363,119**
FY 2021	$107,776	$263,227	$36,018	$118,368	$33,047	$122,594	$232,745	$91,000	**$1,004,776**
FY 2022	$48,561	$165,900	$14,017	$28,513	$36,679	$35,929	$59,771	$39,000	**$428,370**
FY 2023	$25,097	$59,770	$12,474	$17,819	$17,656	$16,060	$37,387	$19,000	**$205,263**
Grand Total	**$1,263,772**	**$1,822,466**	**$737,914**	**$5,791,073**	**$219,093**	**$792,608**	**$3,817,063**	**$1,181,000**	**$15,624,989**

4.2 Detailed Costs by WBS Category

The figures below chart the level-3 WBS elements that make up each of the level-2 WBS elements discussed above, along with one or more bullet points that stress the key recommendations or takeaways depicted in the charts.

As illustrated in Figure 9 below, $10.8B (close to 70 percent) of the projected $15.6B 2020 Census costs are expected to be incurred in FY19 to FY20; this highlights the significant concentration of expenditure in those years, as well as the importance of prior preparation to deploy investments and operations efficiently over this period of intense activity, and the potential for significant deviations in cost.

[17] FY17 reflects the enacted spending profile as of August 2017.
[18] FY18 reflects the $187M budget adjustment to the original $800.2M for an adjusted total of $987M. An approximately $50M was added for contingency for a total of $1,037M.

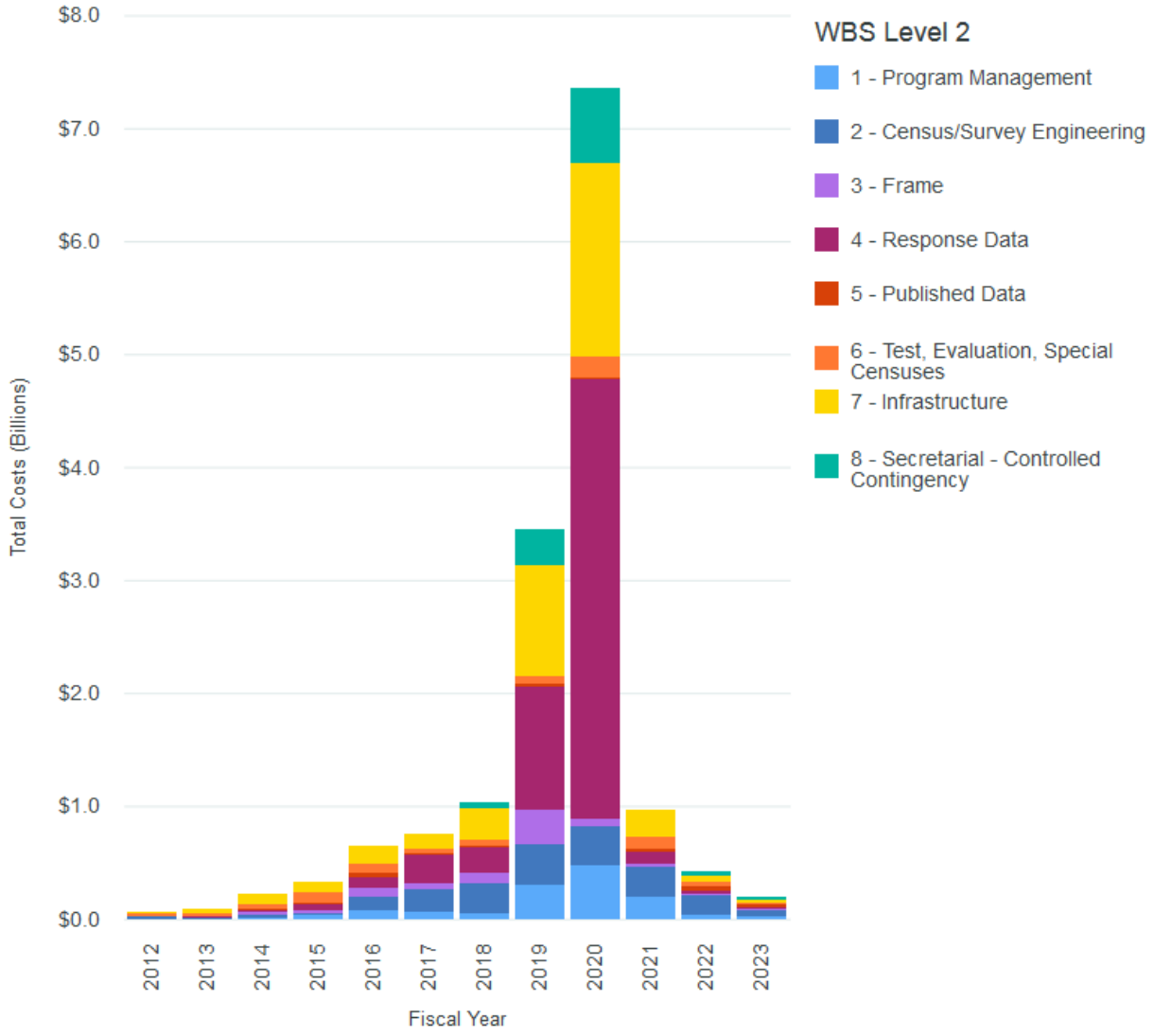

Figure 9: 2020 LCCE Costs by Level-2 WBS

Program Management Costs

The program management element, which includes all activities that implement and support policies, processes, and control functions oriented to improve the efficiency of operations and management of the program, accounts for $1.26B over the lifespan of the 2020 Census Program (above eight percent of total program cost). The program management costs are shown in Figure 10 below.

Program management costs to mitigate risk and uncertainty are the largest program management cost and are especially high during the program implementation phase (FY19-FY20). This area includes the Monte Carlo uncertainty funding, as well as certain discrete risks from the risk

register that could require the inclusion of additional program oversight, scheduling, or similar program management efforts.

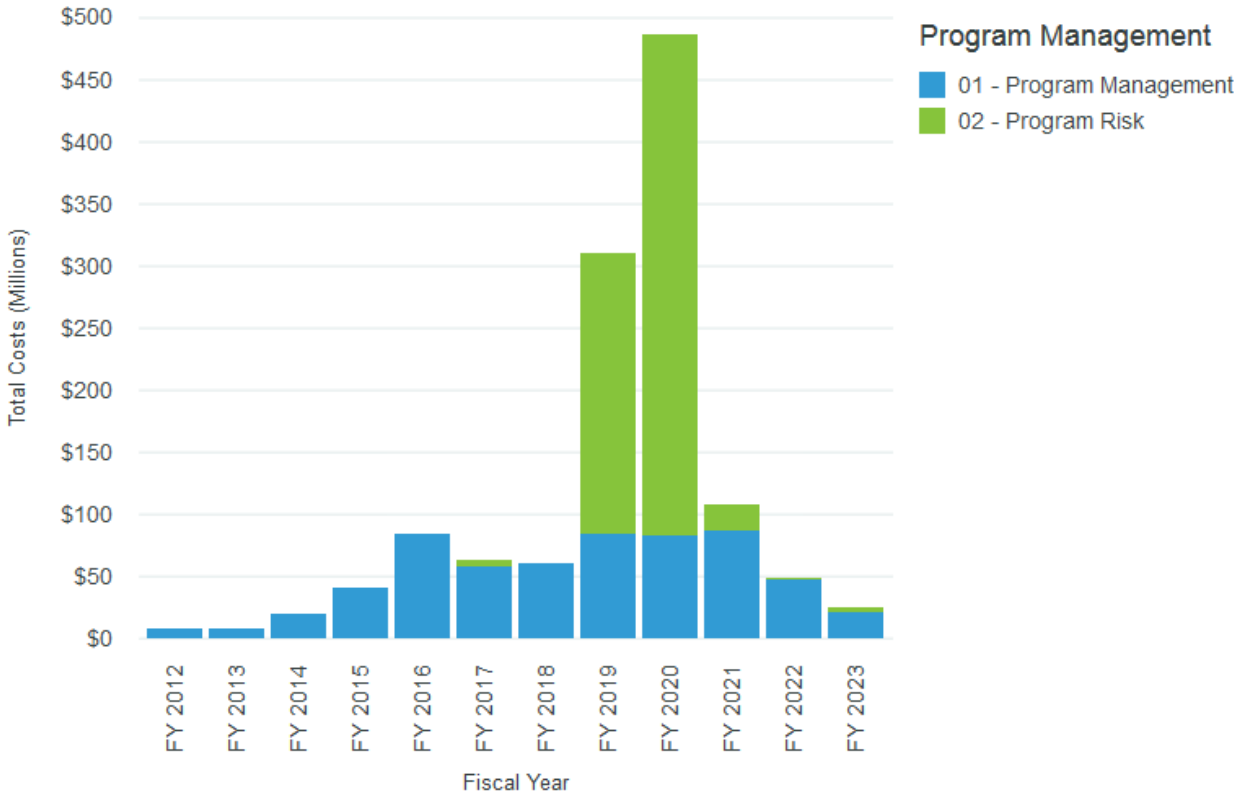

Figure 10: Program Management Costs by WBS Level 3

Census / Survey Engineering Costs

Census/Survey Engineering costs are estimated at $1.8B over the lifespan of the 2020 Census Program, representing around 12 percent of the life-cycle cost of the program. An overview of the Census / Survey Engineering costs is shown below in Figure 11.

Systems Design and Integration (SEI) is by far the main driver of program costs associated with Census/Survey Engineering. This is consistent with expectations for a program of this size, which is developing an integrated system-of-systems to complete its innovative redesign. The concentration of SEI costs around the implementation phase of the program is indicative of potential high technical integration and testing costs and risks to deliver the 2020 Census system of systems. The total life-cycle cost for the Technical Integration contract in the LCCE is $1.5B (including overhead).

Census/Survey design is the second component of costs under this WBS category. Though much smaller than SEI, it includes the operational (readiness, integration, and testing) and demographic (content and forms) design of surveys.

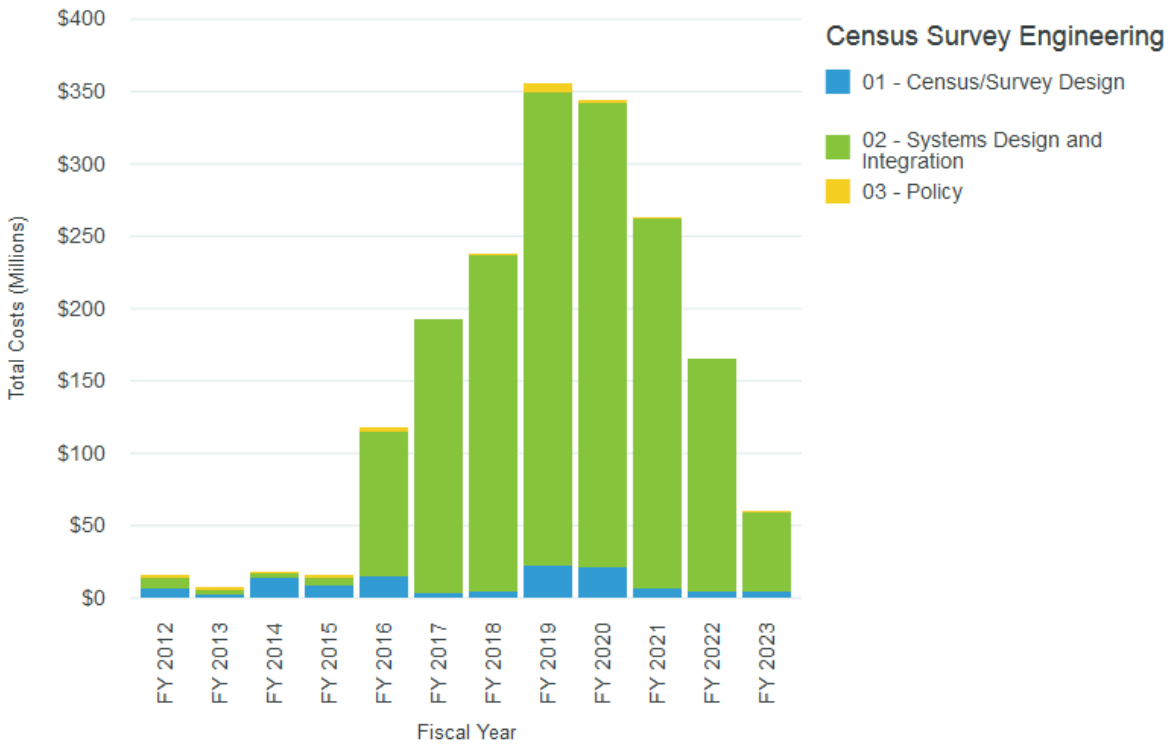

Figure 11: Census / Survey Engineering Costs by WBS Level 3

Frame Costs

Frame activities are expected to cost the Decennial Program around $738M, which represent 4.7 percent of the life-cycle cost of the program. These are the costs spent by the program with the goal of developing a high-quality address and geospatial frame that serves as the universe for the enumeration activities. Figure 12 below provides an overview of the Frame costs.

Address frame, the delivery of a complete and accurate address list and spatial database for enumeration, including the type and characteristics of each living quarter, is the main driver of the cost associated with frame activities, followed by geospatial frame, which provides the geographic foundation to support data collection and tabulation activities.

The spike in address frame in FY19 is associated with in-field address canvassing executed prior to the deployment of 2020 Census field enumeration operations.

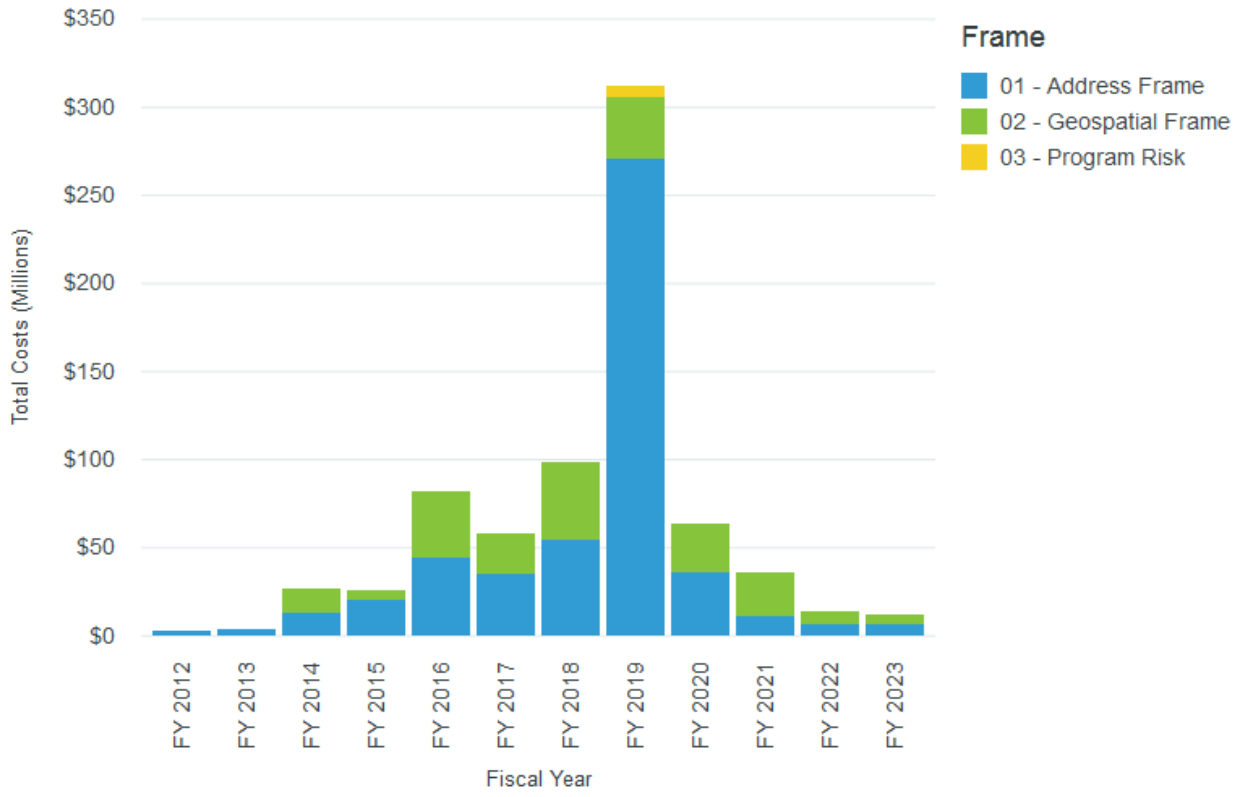

Figure 12: Frame Costs by WBS Level 3

Response Data Costs

The Response Data, a cost of $5.8B (approximately 37 percent of the total 2020 Census estimate), is the largest driver of costs for the Decennial Census Program. It consists of activities to perform the collection of information from 2020 Census respondents by multiple means of communication, including; all operations associated with the gathering of responses, management of cases, and initial processing of the data. Figure 13 below provides an overview of the Response Data costs. One of the larger cost drivers of this area are the costs for Census Questionnaire Assistance (CQA). The life-cycle cost of CQA contract is included in the LCCE is $817M (including overhead).

The concentration of expected expenses in FY20 reflects the nature of Response Data, which comprises a large portion of the activities connected to the actual deployment of resources in the field to perform the collection of Census data.

Over half of the Response Data cost in FY20 correspond to computer-assisted personal interviewing (CAPI) files, which includes nonresponse followup; one of the costliest activities of the 2020 Census. Computer-assisted telephone interviewing (CATI) files, or the initial response processing (which includes Census questionnaire assistance), is the second largest cost in FY20.

This is followed by advertising and partnerships campaigns grouped under Respondent Outreach activities. The costs for advertising and partnership in the LCCE is $822M (including overhead).

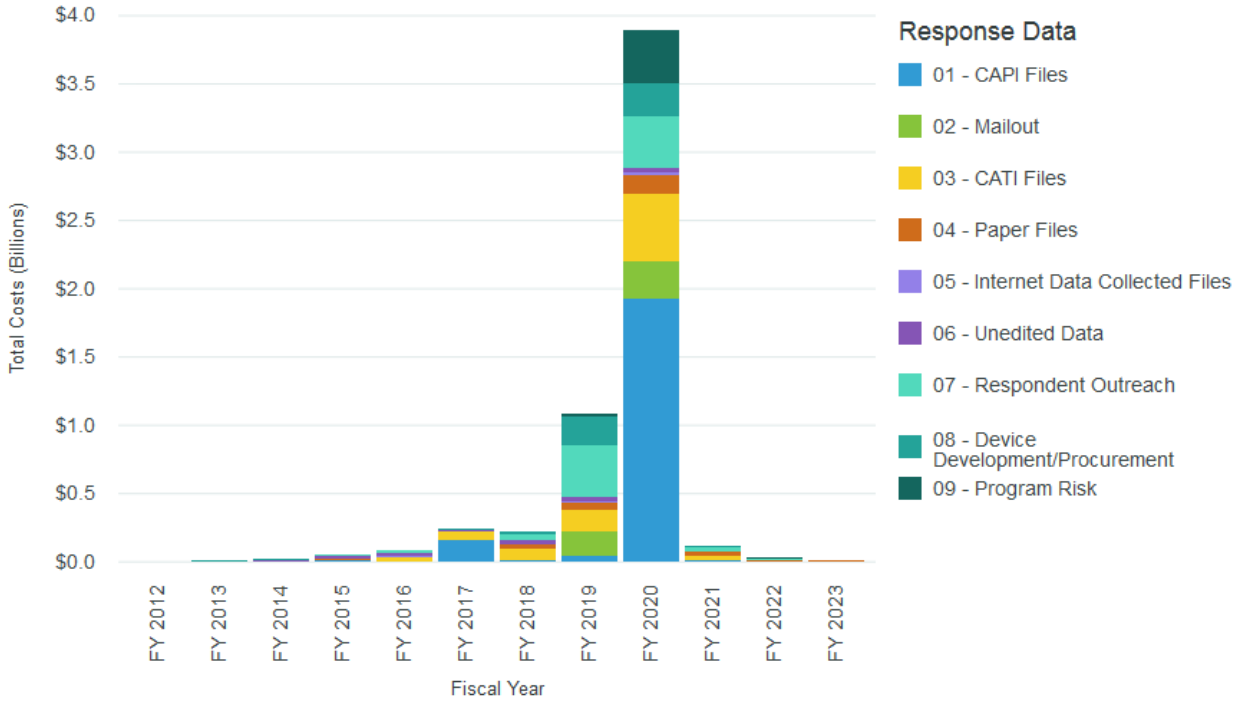

Figure 13: Response Data Costs by WBS Level 3

Published Data Costs

Published Data is the least expensive level-2 WBS activity with life-cycle costs of $219M, which represents less than 1.5 percent of the 2020 Census life-cycle cost. Even though Published Data is a relatively inexpensive component, it is a high-value one that includes activities that support imputation of data and adjustments, data review and analysis, tabulation, and data product dissemination. An overview of the Published Data costs is shown in Figure 14 below.

The highest cost within Published Data is Data Products, which includes the preparation, review, approval, and dissemination of final data products; it spikes in FY16 and FY22, when the most relevant intermediate and final products are completed and released. Tabbed data, which includes data reviews, analysis, and tabulation is the second highest cost within this category; its time profile is smoother than Data Products given the more continuous nature of the activities under it.

CEDSCI, the system that will be used to disseminate the 2020 Census data, is not part of this cost estimate. CEDSCI is an enterprise system. Its separate cost estimate is maturing as the requirements are further defined as supporting contracts are awarded.

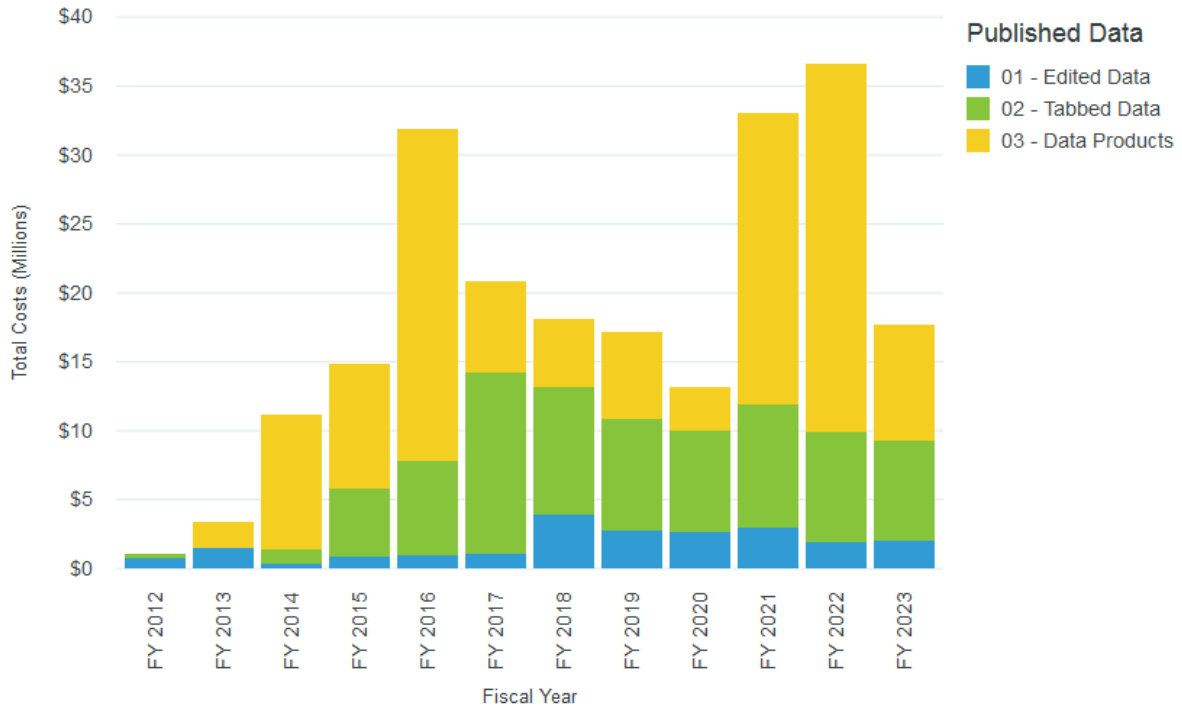

Figure 14: Published Data Costs by WBS Level 3

Test, Evaluation and Special Census Costs

Test, Evaluation, and Special Censuses is a level-2 WBS that account for costs that approach $793M or five percent of the 2020 Census life-cycle cost. This level-2 WBS element comprises two relatively unrelated sets of activities: Test and Evaluation, and Special Censuses. Figure 15 illustrates the Test and Evaluation, and Special Censuses costs.

Test and Evaluation assesses the quality of the 2020 Census and prepares the Decennial Program for the 2030 Census. It includes coverage measurement, as well as evaluations and experiments. It covers the post-enumeration survey and sample, the identification of matches between the 2020 Census and the survey, an independent collection of information for the coverage measurement sample, the development of measures of success, and the early planning activities to support the transition and design of the 2030 Census. Test and Evaluation accounts for the large majority of the $793M in costs associated with this level-2 WBS element. Coverage measurement, Census tests, and research and planning are the activities that require the largest uses of funds within Test and Evaluation.

Special Censuses, includes the enumeration of residents of Islands Areas including American Samoa, Northern Mariana, Guam, and Virgin Islands. The cost of Special Censuses is a relatively small portion of the total cost of this level-2 WBS element.

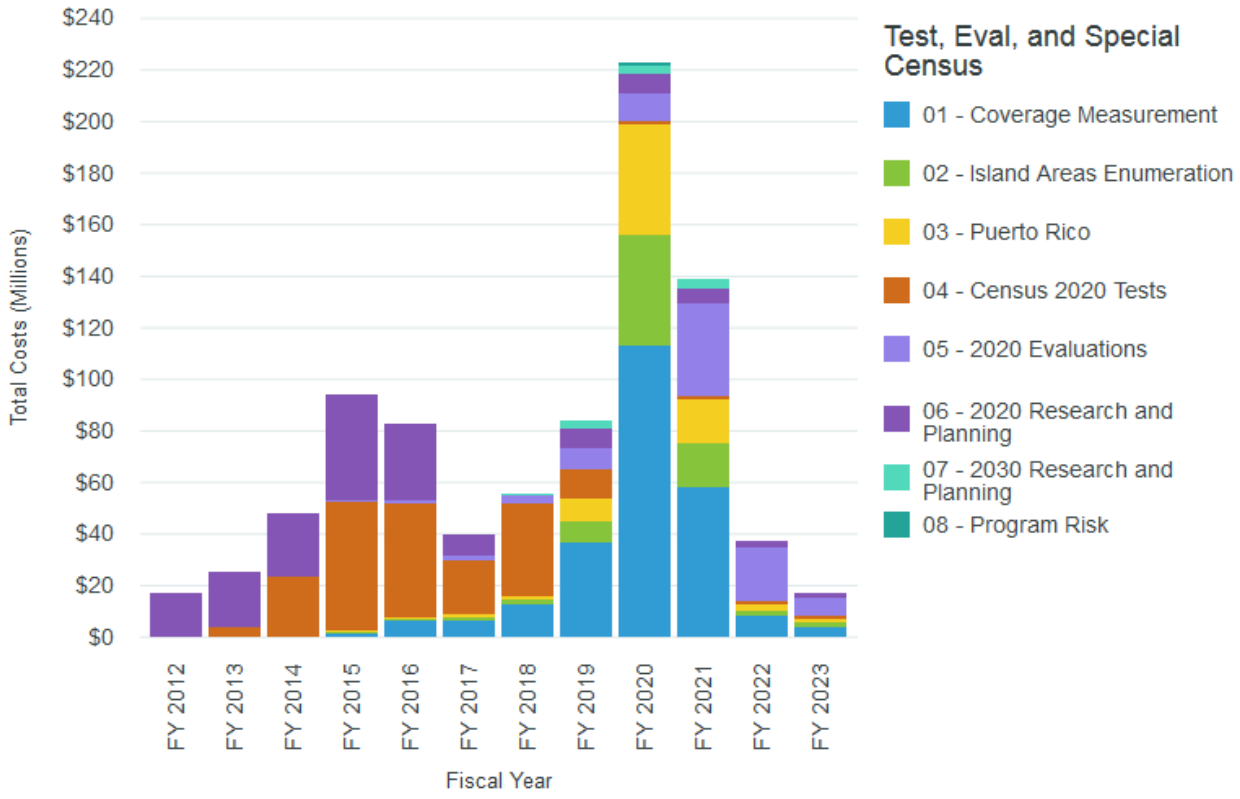

Figure 15: Test, Evaluation, and Special Censuses Costs by WBS Level 3

Infrastructure Costs

Infrastructure is the second highest cost element at the level-2 of the WBS with total costs that exceed $3.8B or almost one quarter of the 2020 Census life-cycle cost. Approximately half of those costs are expected to be incurred in FY20 when field office infrastructure[19], staff, office space, and equipment uses peaked, along with non-HQ staffing operations, such as training, recruiting, and onboarding. This includes the cost of the Field IT infrastructure contract, which has yet to be awarded. The lifecycle cost for this contract in the LCCE is $416M (including overhead). Figure 16 below shows the Infrastructure costs.

Consistent with the peak infrastructure spending in FY20, Program Risk is included in the prior-years to mititgate potential operational risks described previously. Program Risk costs are projected in FY19 and FY20 to account for the risks with deployment and execution.

IT infrastructure, though not as significant as other Infrastructure components, peaks earlier than those (in FY16 and FY18), as it needs to be ready for deployment before the additional staff is hired and the space and other infrastructure is fielded.

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[19] This includes Area Census Offices (ACO) and Regional Census Centers (RCC)

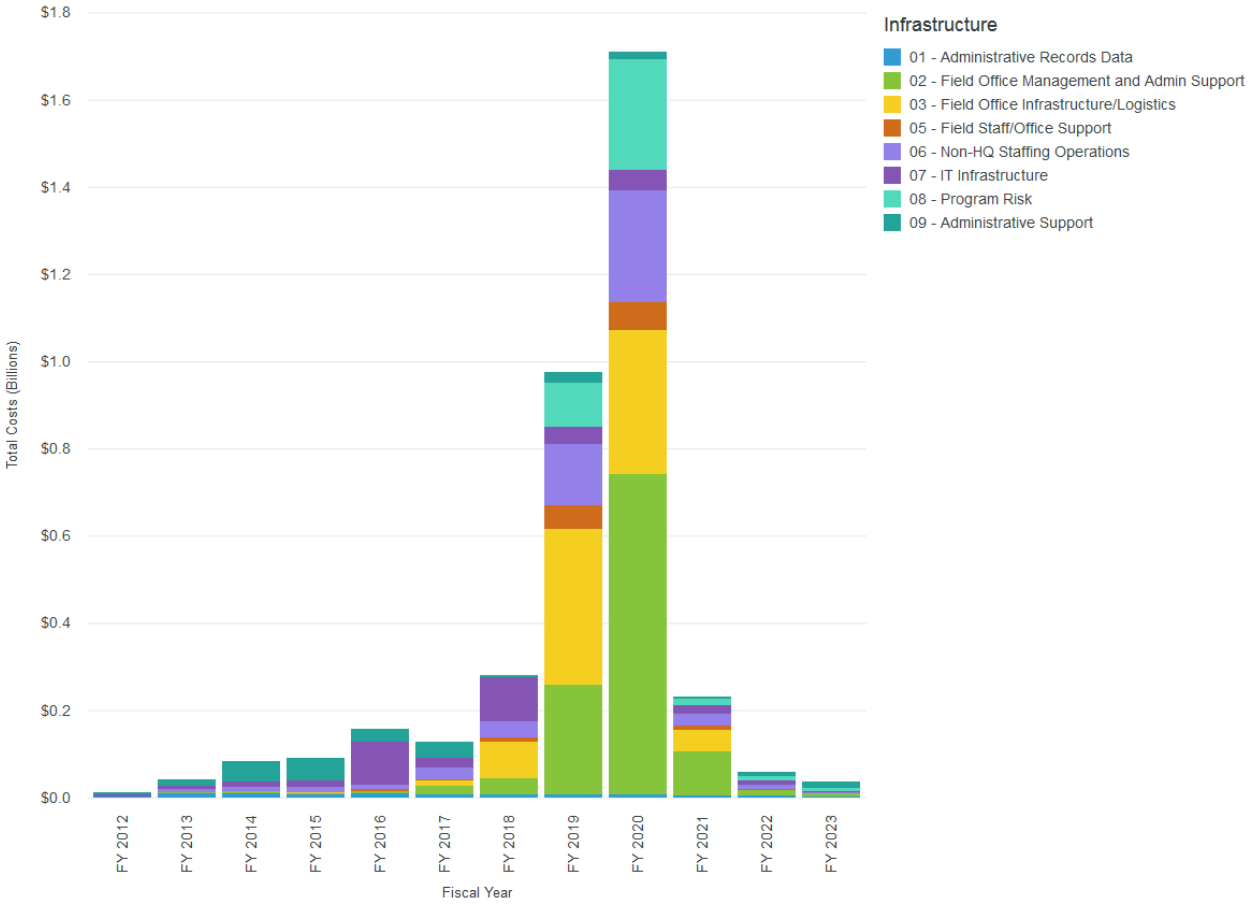

Figure 16: Infrastructure Costs by WBS Level 3

Secretarial-Controlled Contingency Costs

The DOC has established a contingency cost element to account for unknown-unknown risks, which would include the impact to the 2020 Census operations of an unforeseen event, such as a natural disaster significantly affecting a large area of the country driving up the costs of accurately enumerating those areas. Figure 17 provides an overview of the scale and time frame in which the Secretarial-Controlled Contingency costs are allotted in the 2020 Census LCCE.

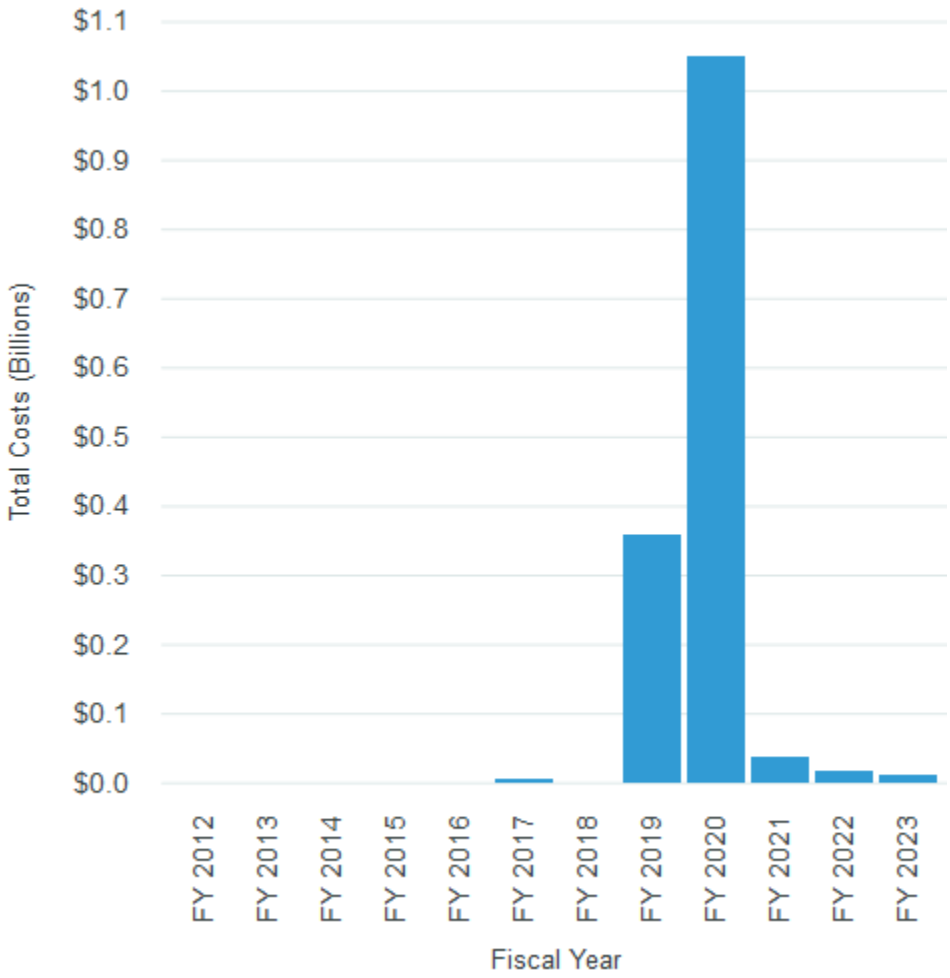

Figure 17: Secretarial Controlled Contingency Costs

4.3 IT Costs

IT costs are spread throughout the 2020 Census WBS. A cross cut of the IT cost in the 2020 Census is described in this section.

The cost estimators developed a multi-step process to estimate the IT components of each operation and WBS element. This process does not apply uniformly to all IT components, but includes the integration of past execution data, as well as cost estimates produced parametrically and/or by analogy with past estimates or similar systems. The LCCE team utilized the list of 52 systems developed by Census Bureau's Enterprise Architecture Group (EAG), along with other IT elements to achieve a comprehensive estimate of all IT costs in the 2020 Census. To describe this, two categories were developed by the LCCE team to align the IT costs to the LCCE WBS. These categories and their descriptions are shown in Figure 18 below.

Please note that all the costs shown in this section includes overhead.

IT Cost Category	Description
2020 IT Systems and Services	Systems on the EAG's 52 systems list that support the 2020 census and the service contracts that support IT development, maintenance, etc. (such as the Technical Integration contract)
2020 CEDCaP	An enterprise system for data collection and processing that is being developed to support data collection and response processing first for the 2020 census and later other Census Bureau surveys and censuses

Figure 18: 2020 Census IT Cost Categories

The graph below in Figure 19 illustrates the breakout of costs by 2020 IT Services and Systems and 2020 CEDCaP costs. In this graph, the 2020 IT Services and Systems costs are the largest element of IT costs in the 2020 Census LCCE.

The total estimated cost for the IT costs is $4.97B.

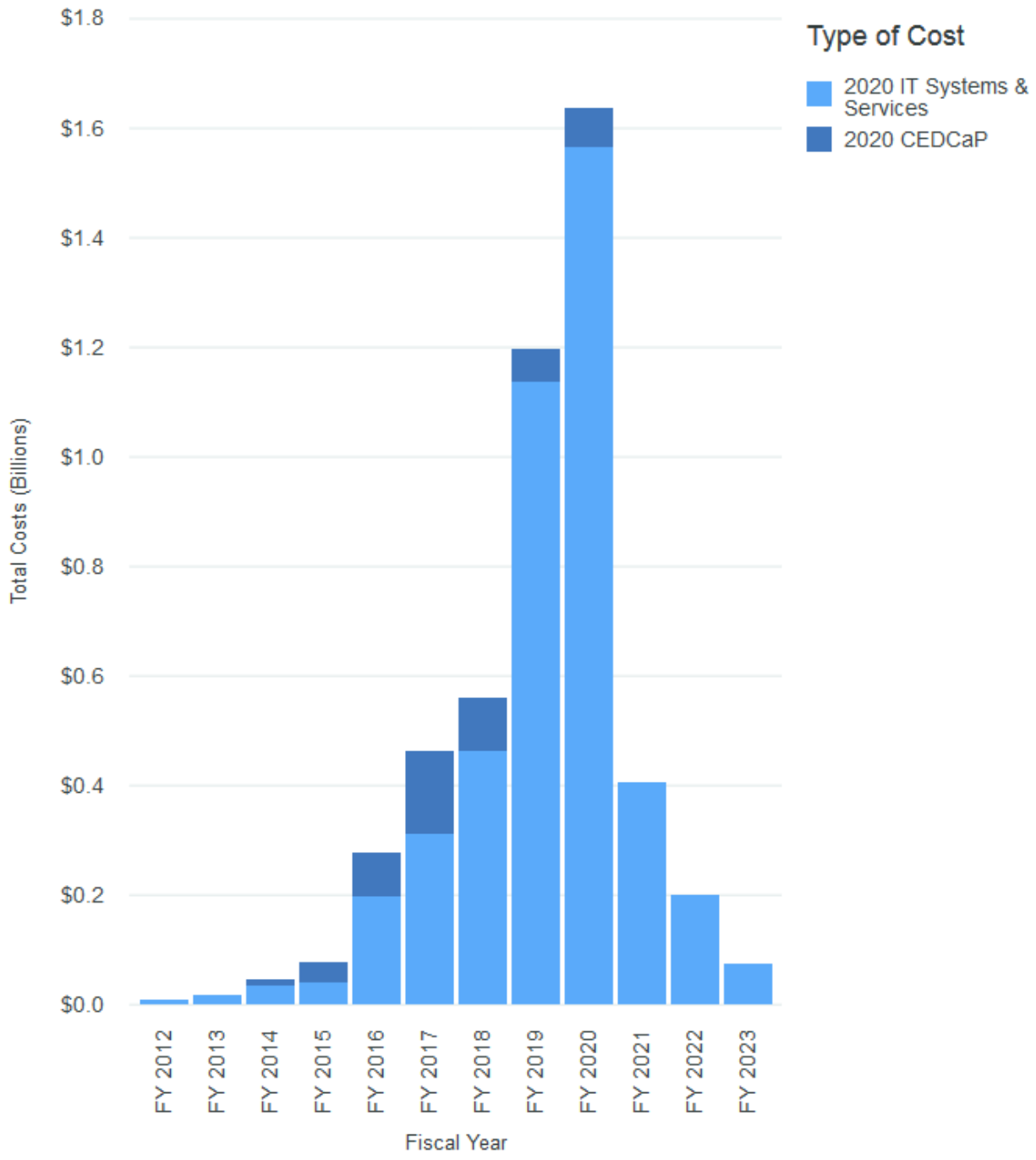

Figure 19: IT Costs by Fiscal Year

2020 IT Systems and Services Cost Details

The 2020 IT Systems represent system capabilities funded by the 2020 Census. These 52 systems include many small and relatively inexpensive systems, including Decennial Response Processing System and Integrated Logistics Management System, but also includes larger and more expensive systems, including Census Schedule A Hiring, Recruiting and Payroll System, Geographic imagery and matching systems, and the Decennial Tabulation System.

Supporting the development and integration of these systems are the 2020 IT Services, which largely contain contract costs, but also includes infrastructure costs. The major contracts in this category include Decennial Device as a Service (DaaS), Field IT Deployment, FITd, and Technical Integration. It also includes the cost of IT infrastructure provided in the Census Bureau's data center related to the 2020 Census and the costs related to security assessment and testing prior to the issuance of an authority to operate.

CEDCaP Cost Details

CEDCaP is the enterprise system that supports data collection for not only the decennial census but other censuses as well. This is a major investment that peaks in FY17 and FY18 to support the 2018 End-to-End Test and lay the foundation for the ramp up to the 2020 decennial census. The CEDCaP program includes the development of key systems for the 2020 Census, including the Operational Control Systems, Internet Self-Response, and the Enumeration instrument for Nonresponse Followup. These are key to modernization of the 2020 Census and represent the future of how decennial censuses will be conducted. The lifecycle cost of the CEDCaP program has been estimated separately from the rest of the 2020 Census by certified cost estimators in the program office, and is an input to the 2020 Census lifecycle cost estimate.

4.4 LCCE Major Cost Drivers

The cost of the 2020 Census LCCE are largely driven by a relatively few areas. The primary cost drivers are those associated with Major Contracts and CEDCaP, Field Operations, Overhead (nonCEDCaP), Program Risks and Secretarial-Controlled Contingency. This is illustrated in Figure 20 below that shows the individual and cumulative percent of costs. Note that the 18 remaining cost categories account for a small portion (approximately 20 percent) of the total cost.

Cost Category	Cost ($K)	Percent	Cumulative Percent
04. Major Contracts and CEDCaP	$ 4,056,500	25.9%	25.9%
02. Field Operations	$ 2,050,400	13.1%	39.0%
03. Overhead (nonCEDCaP)	$ 1,477,200	9.4%	48.5%
01. Program Risk	$ 1,426,900	9.1%	57.6%
01. Secretarial-Controlled Contingency	$ 1,181,000	7.6%	65.2%
09. HQ LOE	$ 757,900	4.8%	70.0%
05. ACO Staffing	$ 696,700	4.5%	74.5%
06. Program Management	$ 515,600	3.3%	77.8%
07. Staffing Operations - CSHarP	$ 500,900	3.2%	81.0%
08. Other	$ 2,978,500	19.0%	100.0%

Figure 20: 2020 Census LCCE Major Cost Drivers

Figure 21 below provides a summary of the top level-3 WBS cost elements across the program. This chart highlights the mission-oriented nature of the 2020 Census in that Response Data-related cost elements (as denoted by the number 4 before the cost element title) figure prominently in the top cost elements at level-3 of the WBS. The other major cost elements are Census Survey Engineering and Program Management. This fact demonstrates the scope and scale of the design and management challenges associated with the 2020 Census operations.

Note that in the figure below, the costs contain overhead.

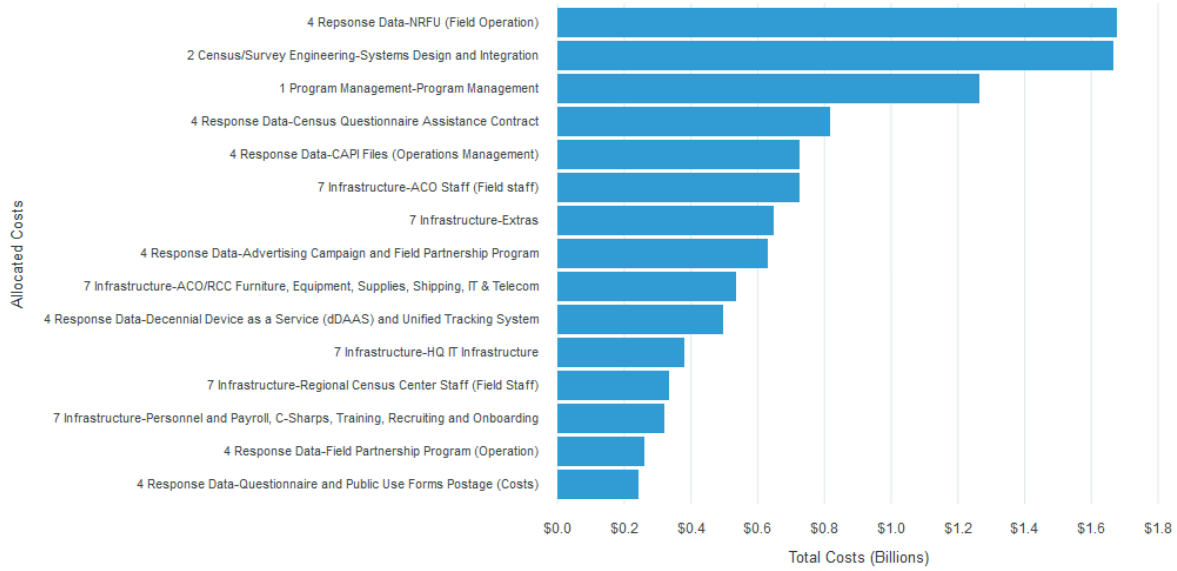

Figure 21: Top WBS Level 3 Cost Elements

Costs Drivers by Budget Object Class

The federal government's standard chart of accounts utilizes a standard set of budget categories called Budget Object Classes (BOC). Funds are allocated using BOC. The BOC provide a view of the 2020 Census LCCE costs by resource category. Figure 22 below provides the top-five costs by BOC.

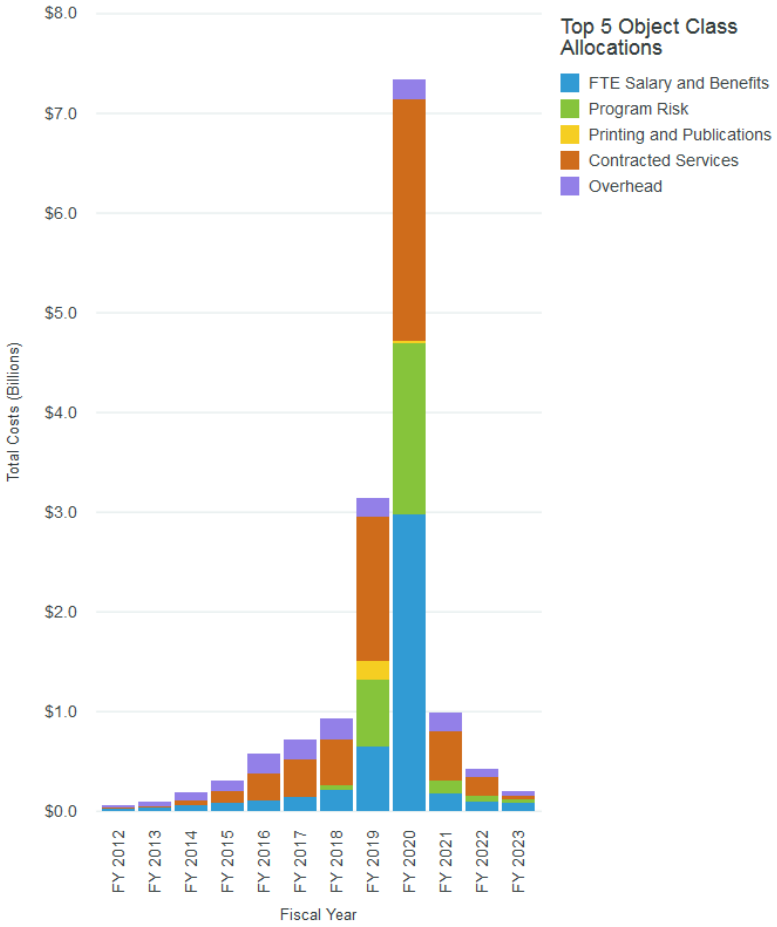

Figure 22: Top Lifecycle Costs by Object Class & Fiscal Year

Another view of the major cost elements by BOC is shown in Figure 23 below. This graph highlights the cost significance of contracted services within the 2020 Census LCCE.

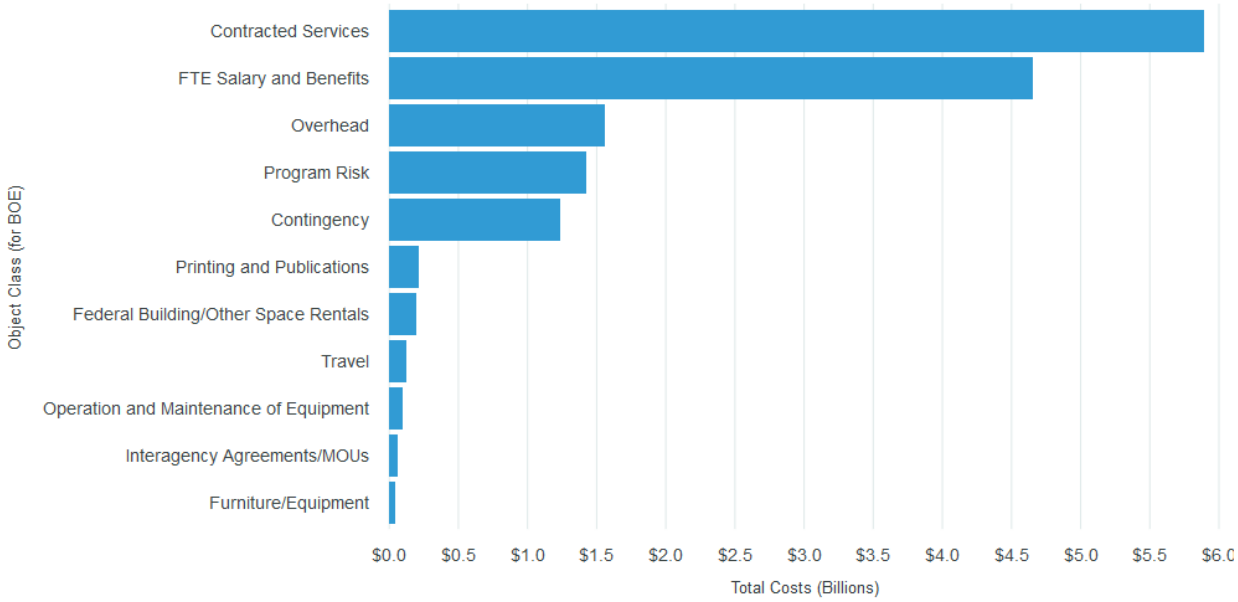

Figure 23: Top Life-cycle Costs by Object Class

5. Conclusion

The 2020 Decennial Census is a large and complex program that has a 12-year life-cycle and a projected total cost of $15.6B. The estimate includes the mobilization of space, people and infrastructure across the entire United States and its territories.

The 2020 Census LCCE is a key tool for management to justify budget requirements, support resource allocation decisions, and to develop an informed understanding of the projected costs and risks of their programs. A reliable LCCE will increase the probability of program success. The Census Bureau will be using the 2020 Census LCCE to focus on delivering a cost-effective and high-quality census.

Despite the challenges of developing, improving and maintaining a reliable cost estimate for a program as large and complex as the 2020 Decennial census, the Census Bureau is using certified cost estimators, independent cost estimators, advanced tool sets, and ongoing enhancements to internal controls to continuously improve the cost estimate. This commitment is underscored by the close working relationship that the Decennial Programs Directorate has established with both GAO and the DOC. The Census Bureau will continue to build upon the current version of the 2020 Census LCCE and will be regularly updating the cost estimate with further refined data and further strengthened internal controls.