



# U.S. CENSUS BUREAU

## 2020 Census: The 2014 Census Test Misses an Opportunity to Validate Cost Estimates and Establish Benchmarks for Progress

FINAL REPORT NO. OIG-15-044-A  
SEPTEMBER 30, 2015

U.S. Department of Commerce  
Office of Inspector General  
Office of Audit and Evaluation

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September 30, 2015

**MEMORANDUM FOR:** John H. Thompson  
Director, U.S. Census Bureau

*Carol N. Rice*

**FROM:** Carol N. Rice  
Assistant Inspector General for Economic  
and Statistical Program Assessment

**SUBJECT:** *2020 Census: The 2014 Census Test Misses An Opportunity to  
Validate Cost Estimates and Establish Benchmarks for Progress*  
Final Report No. OIG-15-044-A

Attached is our final report on the 2014 Census Site Test. We initiated this audit as part of our ongoing monitoring of the Census Bureau's efforts to redesign data collection strategies for the 2020 decennial. Specifically, we evaluated whether the 2013 test informed testing strategies for the 2014 Census Test. We also assessed whether project testing strategies included in the 2014 Census Test responded to originally developed research questions.

We found (1) the Bureau's cost estimate lacks adequate documentation and the 2014 Census Test was a missed opportunity to validate cost estimates, (2) project teams are not following project plan management and change control protocol, and (3) 2014 Census Test projects did not develop measurable success criteria. As a result, we are making recommendations that the Bureau ensure its cost estimate complies with established standards, and that documentation supporting cost estimates is retained. Further, we recommend that future tests be used to validate cost savings included in the estimate. We also recommend that the Bureau develop an improved process to ensure research teams document project plans and changes to those plans, as well as develop success criteria that complies with guidelines recommended by the Government Accountability Office and the Census Bureau.

In response to our draft report, the Bureau concurred with our recommendations and is taking steps to address our findings. We have summarized the Bureau's response and included its entire formal response in appendix B. The final report will be posted to OIG's website in pursuant to section 8M of the Inspector General Act of 1978, as amended.

In accordance with Department Administrative Order 213-5, please provide your action plan within 60 days of the date of this memorandum. We appreciate the assistance and courtesies extended to us by Bureau management and staff.

If you have any questions about this report, please contact me at (202) 482-6020 or Terry Storms, Audit Manager, at (202) 482-0055.

Attachment

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# Report in Brief

SEPTEMBER 30, 2015

## Background

The Census Bureau recognizes that fundamental changes must occur to the design, implementation, and management of the 2020 Census in order to conduct this census at a lower cost than the 2010 Census. There exist several challenges to a cost-efficient yet high-quality decennial census, including cost containment, quality, flexibility, innovation, and a disciplined and transparent acquisition decision process. The Bureau is now entering a critical stage of its research and testing (R&T) phase of the 2020 Census life cycle that will inform decisions that must be made by the end of fiscal year (FY) 2015 to apply to the 2020 Census.

## Why We Did This Review

In FY 2013, the Bureau—unable to complete all of its scheduled R&T—reassessed the Decennial Program's R&T effort. As a result of the reassessment, the 2014 Census Test was revised to include a self-response component, increased integration across modes, and optimized contact strategies for the nonresponse followup portion of the test. The 2014 Census Test was conducted in portions of Washington, DC, and Montgomery County, Maryland, and included approximately 190,000 housing units.

Our audit of the 2014 Census Test had two objectives: (1) to evaluate whether 2013 test results informed 2014 testing strategies and (2) examine whether projects' testing strategies included in the 2014 Census Test responded to the Bureau's original research questions.

## U.S. CENSUS BUREAU

### 2020 Census: The 2014 Census Test Misses an Opportunity to Validate Cost Estimates and Establish Benchmarks for Progress

OIG-15-044-A

## WHAT WE FOUND

**The Bureau's cost estimate lacks adequate documentation and the 2014 Census Test was a missed opportunity to validate cost estimates.** Currently, the Bureau still lacks an auditable cost estimation process, which calls into question the reliability of the Bureau's estimated \$5.1 billion savings for a redesigned 2020 Census.

- *The 2020 Census cost estimate was not auditable.* The Bureau's Decennial Management Division, which calculates the cost estimate, neither obtained nor required supporting documentation when recording and updating input factors.
- *Cost estimate cannot be adjusted based on 2014 Census Test results.* The Bureau's cost estimate does not account for some design features that are included or dismissed as viable options for the 2020 Census.
- *2014 Census Test did not generate cost data that validates cost savings estimates.* Although the Bureau has a strategic objective to contain or reduce the cost of the 2020 Census, the 2014 Census Test did not provide cost data that can be used to validate cost savings estimates or compare the cost of various design strategies.

**Project teams are not following project plan management and change control protocol.** We could not identify whether scope changes occurred during the 2014 Census Test because the project teams could not provide the original project plan, or a project plan was not developed prior to the test.

**2014 Census Test projects did not develop measurable success criteria.** Six of the seven project teams included in the 2014 Census Test did not develop measurable success criteria with which to validate potential cost savings or establish benchmarks for a cost-benefit analysis of test results.

## WHAT WE RECOMMEND

We recommend the Director of the Census Bureau

1. Obtain and keep a record of documentation that supports the cost estimation process and results.
2. Implement a sufficiently robust cost modeling system, which includes all vital component variables, and incorporates cost updates as design decisions are reached, or quantifies the effect on the cost of design alternatives as needed.
3. Prior to testing activities, ensure that the cost information that will be collected is reliable and can be used to validate life-cycle estimates.
4. Develop an improved process for research project teams to document and maintain a complete history throughout each project's life cycle, and prepare updated project plans prior to the start of tests.
5. Develop test success criteria that are in compliance with the guidelines recommended by GAO and the Census Bureau.

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*COVER: Detail of fisheries pediment,  
U.S. Department of Commerce headquarters,  
by sculptor James Earle Fraser, 1934*

## Introduction

The Census Bureau recognizes that fundamental changes to the design, implementation, and management of the 2020 Census must occur in order to conduct the next decennial census at a lower cost (per household and adjusted for inflation) than the 2010 Census. The Bureau faces several challenges to a cost-efficient yet high-quality decennial census, including cost containment, quality, flexibility, innovation, and a disciplined and transparent acquisition decision process. The Bureau is now entering a critical stage of its research and testing (R&T) phase of the 2020 Census life cycle. R&T results will inform decisions that must be made by the end of fiscal year (FY) 2015 so that they can be applied to the 2020 Census. Evidence-based design decisions require building upon lessons learned from previous censuses and prior R&T, as well as effective subsequent R&T, to assess program progress, costs, benefits, and risks associated with the various unique combinations of 2020 Census design options currently under consideration.

FY 2015 research and testing includes a Master Address File test, an operational Census test, an optimizing self-response test, and a national content and self-response test. In FY 2016, the Bureau will conduct two more tests: (1) the 2016 Census Test, which will focus on self-response and nonresponse followup (NRFU), and (2) the 2016 Address Canvassing Test, which will focus on address canvassing. These two tests will inform the development of a FY 2017 Census Test which will determine how the various operations (e.g., NRFU and address canvassing) affect one another, and ensure integration between operations and systems. Findings from the 2017 Census Test will inform the development of the 2018 End-to-End Test of operations and systems. The 2018 test will be the Bureau's last chance to make adjustments to the decennial design prior to the 2020 Census.

Two directorates are responsible for conducting 2020 Census research—the Associate Director for Decennial Census Programs and the Associate Director for 2020 Census. These two directorates comprise what is referred to in this report as “the Decennial Program.” The 2020 Research and Planning Office (20RPO), a division within the Decennial Census Programs Directorate, is responsible for R&T governance (see figure 1).<sup>1</sup> The Decennial Program's R&T effort is tasked with developing design alternatives that will ultimately contain the cost of the 2020 Census while maintaining the accuracy and completeness of the decennial census count. In order to inform design decisions, the Decennial Program originally planned to conduct multiple small field tests that would result in preliminary design decisions by September 2014. In FY 2013, the Bureau—unable to complete all of its scheduled R&T—reassessed the Decennial Program's R&T effort, with a focus on redirecting research, development, and testing. As part of its reassessment, and in an effort to prioritize work and enable critical design decisions, the Bureau revised the field testing strategy, which included cancelling 13 field tests. According to the Decennial Program, testing cost \$3.9 million in FY 2013 and \$6.7 million in FY 2014; FY 2015 testing is projected to cost \$51.4 million. These tests will inform the preliminary 2020 Census design decisions scheduled for September 2015.

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<sup>1</sup> The Bureau completed a reorganization on June 1, 2015, so its current organizational structure differs from the structure shown in figure 1.

**Figure I. U.S. Census Bureau Decennial Program**

Source: OIG analysis of U.S. Census Bureau information

As a result of the reassessment, the 2014 Census Test was revised to include a self-response component, increased integration across modes, and optimized contact strategies for the NRFU portion of the test. The 2014 Census Test was conducted in portions of Washington, DC, and Montgomery County, Maryland, and included approximately 190,000 housing units. Testing activities were conducted in the field between June and September 2014.

The Decennial Program's overall R&T efforts address five key research tracks:

1. encouraging self-response using multiple modes;
2. reengineering field infrastructure in order to reduce the need for a large labor force;
3. revamping the Bureau's information technology acquisition strategy<sup>2</sup>;
4. continuously updating the Bureau's address list; and
5. using administrative records to reduce NRFU.

<sup>2</sup>The IT acquisition strategy—identified as a research track specific to the 2020 decennial in the April 23, 2012, Business Plan—is now considered a corporate strategy rather than a research track.

The 2014 Census Test plan included seven projects related to research tracks 1, 2 and 5; each of the seven projects along with key activities associated with these projects are included in table I. One project—language research—was modified, and thus the 2014 Census Test did not include a test of questionnaire content in multiple languages nor was the data-collection device programmed for Spanish.

**Table I. 2014 Census Test Projects and Activities**

Track	Project	Activities
2	Automating Field Activities	Test the use of off-the-shelf telecommunications devices and the effectiveness of replacing traditional paper maps with Google Maps for locating housing units for enumeration activities.
1	Contact Frame	Provide and test alternative contact information, such as landline phone numbers, cell phone numbers, and email addresses.
1	Language Research	Prepare and evaluate materials and content for different language options and research and develop non-English questionnaire content and wording. Incorporate non-English languages into systems in order to conduct language research to help maximize response rates.
1	Non-ID Processing	For Internet and telephone questionnaire responses that lack an address identifier, use administrative records to enhance the address information and test matches against the addresses included in the Bureau's address list.
2	NRFU Design and Operations	Reduce and improve NRFU workload by (1) determining how successful new enumerators are at completing interviews by using telephone numbers included in the Bureau's databases; (2) understanding the relationship between type of contact attempt and successful enumeration, and response patterns within demographic groups or geographic areas; and (3) determining the cost and benefit of reducing the number of personal visits and utilizing telephone contact attempts and proxy interviews. Compare the data quality and cost of an adaptive design NRFU operation—as described above—to an approach similar to what was employed in 2010 in which enumerators were allowed up to six attempts. Accurately track and quantify the tasks performed by enumerators each day.
1	Optimizing Self Response	Assess different contact strategies—including pre-registration—to measure early engagement of respondents and the use of the Internet response option and telephone questionnaire assistance for enumeration.
5	Administrative Records Modeling	Use administrative records to determine (1) the occupancy of nonresponding households and (2) which households to exclude from NRFU fieldwork.

Source: OIG analysis of U.S. Census Bureau information

## Objectives, Findings, and Recommendations

Our audit of the 2014 Census Test had two objectives. First, we evaluated whether 2013 test results informed 2014 testing strategies. Second, we examined whether projects' testing strategies included in the 2014 Census Test responded to the Bureau's original research questions. For a further discussion of our scope and methodology, please refer to appendix A.

In addition to our original objectives—and because the Bureau is committed to conducting the 2020 Census at a lower per-household cost (adjusted for inflation) than the 2010 Census—we assessed the cost estimation practices that the Bureau is currently using to estimate the amount of cost savings that will result from the new design innovations being developed for the 2020 Census. The Bureau estimates that it can conduct a redesigned 2020 Census for approximately \$5.1 billion less than what it would cost to implement essentially the same design that has been in place since 1960.

Because changes in project scope may impact whether these savings can be realized, we obtained an understanding of the method and inputs used to develop the estimated cost savings and assessed whether the cost savings model can be used to adjust the estimate as design alternatives are deemed viable or removed from consideration. However, we found that the Decennial Program has not developed a cost model that complies with best practices, as recommended in prior audit reports (see finding I.A.), and that the calculations used to estimate the \$5.1 billion in potential savings are not well-supported. In addition, the Bureau's current cost estimation is not sufficiently robust to be updated as design decisions are determined to be viable or eliminated (see finding I.B.). Although the primary objective of the Decennial Program is to count the population, the Bureau has a strategic challenge to contain, or reduce, the cost of the 2020 Census while producing quality results. However, neither the self-response component nor the nonresponse component of the 2014 Census Test produced cost data that can be used to validate cost-savings estimates for stakeholders, compare costs of various design strategies, or make informed design decisions (see finding I.C.).

Although formal 2013 test results were not available until after planning for the 2014 Census Test had begun, preliminary results from the 2013 test informed the testing strategy for the 2014 test. In reviewing the projects included in the 2014 Census Test, we found that project teams neither (1) created approved baselined project plans, nor (2) followed project plan management and change control protocols, which require all changes to the baselined plan to be documented and approved (see finding II). Without a baselined plan as an internal control to detect and document change, a project could potentially deviate from its original plan and fail to answer its original research questions. Additionally, six of the seven project teams did not develop sufficiently quantifiable (or otherwise measurable) success criteria that could be used to validate potential cost savings, establish benchmarks for success, or perform a cost-benefit analysis of test results (see finding III). Insufficient success criteria prohibit the Bureau from measuring the success of individual projects and the entire 2014 Census Test. A lack of change control, combined with insufficient success criteria could potentially prevent the Decennial Program from answering its research questions or achieving its cost and quality goals for the 2020 Census.

## I. The Bureau's Cost Estimate Lacks Adequate Documentation and the 2014 Census Test Was a Missed Opportunity to Validate Cost Estimates

In June 2008, the Government Accountability Office (GAO) recommended that the Bureau improve the credibility and accuracy of its cost estimation for decennial censuses and develop a life-cycle cost estimate that complies with GAO standards. Specifically, GAO found “the Bureau’s 2010 Census life cycle cost estimate is not reliable because it lacks adequate documentation and is not comprehensive, accurate, or credible. The Bureau could not provide detailed documentation on data sources, significant assumptions, or changes in assumptions for the cost estimate.”<sup>3</sup>

Likewise, during this audit, we found that the Bureau still currently lacks an auditable cost estimation process, which calls into question the reliability of the Bureau’s estimated \$5.1 billion savings for a redesigned 2020 Census. Additionally, the Bureau’s cost estimation cannot be updated to reflect changes to potential cost savings as design options are deemed viable or eliminated from consideration. Finally, due to the limitations experienced during the 2014 Census Test, the Bureau missed an opportunity to produce cost data, which would get it closer to making informed decisions about the design of the 2020 Census.

### A. The 2020 Census Cost Estimate Was Not Auditable

In 2008, GAO recommended that the Bureau develop a cost estimation model that complies with its best practices for developing and managing capital program costs.<sup>4</sup> In 2009, GAO issued a *Cost Estimation and Assessment Guide*, which identified 12 steps for a high-quality cost estimation process, including (1) clear identification of tasks—including a well-documented estimate, (2) broad participation in estimation methodology, (3) a standardized structure for the estimate, (4) revisions of estimates after significant program changes, and (5) an independent review of the estimate.<sup>5</sup> GAO also requires certain documentation for a high-quality cost estimate, such as the steps used to develop the cost estimate, as well as auditable and traceable data sources used for each cost element.

During this audit, we found that the Bureau used the Monte Carlo simulation method to estimate the range of possible 2020 Census costs, which GAO identified as an acceptable method to develop a confidence interval around a point estimate.<sup>6</sup> Using an Excel spreadsheet,

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<sup>3</sup> See “Highlights” section of U.S. Government Accountability Office, June 2008. *2010 CENSUS: Census Should Take Action to Improve the Credibility and Accuracy of Its Cost Estimate for the Decennial Census*, GAO-08-554. Washington, DC: GAO.

<sup>4</sup> GAO, June 2008, *Census Bureau Should Take Action to Improve the Credibility and Accuracy of Its Cost Estimate for the Decennial Census*, GAO-08-554. Washington, DC: GAO.

<sup>5</sup> GAO, March 2009, *GAO Cost Estimation and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP. Washington, DC: GAO.

<sup>6</sup> Monte Carlo simulation is an uncertainty analysis. The output illustrates (1) the likelihood of achieving the program’s cost objectives, given the current plan and risks as they are known and quantified; (2) the likelihood of other possible outcomes, which can be a way to determine the cost value that has an acceptable probability of

the Decennial Program identified major decennial activities, such as space leasing and NRFU, as well as the “input factors” or types of costs associated by activity (e.g., average cost per office and self-response rate), and estimated minimum and maximum values per input factor. We attempted to verify the accuracy of the input factors by tracing them to their source and underlying documentation; however, the Bureau’s Decennial Management Division (DMD), which is responsible for calculating the cost estimate, neither obtained nor required supporting documentation when recording and updating input factors. As a result, DMD staff neither verified the reliability of the life-cycle cost variables (including those calculated from 2010 Census data), nor did they review the supporting documentation of subject matter experts who defined some of the variables. Furthermore, the Bureau could not specifically identify the subject matter experts. According to Census Bureau management, the development of assumptions was largely a group effort. Thus, the subject matter expert inputs were actually based on various informal discussions between DMD staff and members of the Decennial, Field, Research and Methodology, and Information Technology Directorates. However, the rationale for reaching input decisions was not documented. Similar to our finding, GAO noted in a recent report that the Bureau’s cost estimate for the Internet response option is not reliable because its estimate did not conform to best practices.<sup>7</sup>

In response to our initial findings, DMD management stated that, following initial efforts to establish which life-cycle variables to include in the cost estimation, “a series of briefings was held to review this work in detail with the external experts and Census Bureau leadership, including the Director, who has extensive experience in managing both decennial-census and private sector survey collection efforts.” Although we do not dispute the level of knowledge provided by these experts, the Bureau was unable to produce documentation supporting its decisions. Bureau officials claimed that the Excel spreadsheet they created was itself the documentation and that they did not think they needed documentation beyond it. The lack of traceable data sources for each cost element precluded an audit of the validity and accuracy of the estimated cost savings that the Bureau has reported to its stakeholders.

### *B. Cost Estimate Cannot Be Adjusted Based on 2014 Census Test Results*

The Bureau’s cost estimate does not account for some design features that are included or dismissed as viable options for the 2020 Census. Historically, the Bureau has demanded the highest response rate during NRFU until either time or money was depleted. Going forward, the Bureau plans to increase efficiency and reduce cost by implementing an adaptive design approach to data collection. This will utilize rapidly developing new technologies to increase efficiency by eschewing the traditional “fixed design” approach, which strives for the greatest amount of responses until resources are exhausted. Through adaptive design, the Bureau will (1) employ real-time, automated business rules, such as automated assignments and automatic transitions from one mode of contact to another (e.g., telephone to personal visit, or vice versa), and (2) collect continuous process data during field activities by monitoring data

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being exceeded; and (3) by sensitivity, the high-priority risks or Work Breakdown Structure elements as a guide to effective risk mitigation.

<sup>7</sup> GAO, February 2015. *2020 Census: Key Challenges Need to Be Addressed to Successfully Enable Internet Response*, GAO-15-225. Washington, DC: GAO.

collection activities and costs, using a model to calculate response propensity (i.e., prioritizing outstanding NRFU cases based on the expected difficulty of enumeration), and measuring survey progress. This adaptive design approach is part of the Bureau's effort to make informed decisions about when to stop enumeration efforts—to avoid diminishing returns and, ultimately, to save money.

In order to reduce NRFU costs, the Bureau is redesigning NRFU operations and including variables, such as a propensity model, related to this redesign in its cost savings estimate. However, according to the Bureau, it was later determined that building a propensity model to reduce NRFU cost is not a viable option for the 2020 Census.<sup>8</sup> The Bureau was unable to quantify the impact of removing the propensity model from consideration because it was unable to break out individual projects or efforts—referred to as “micro decisions”—and instead focused on cost drivers. By not updating all variables that influence cost, the Bureau cannot predict what effect dismissing a design alternative, such as the propensity model, will have on the ultimate cost of the 2020 Census. Also, by not including all the design features in the cost estimation calculations, the Bureau is unable to identify the potential effect of eliminating design features on the overall cost estimation.

Further, Bureau officials have raised concerns that policy changes or limitations could negate the benefits of cost-saving design features such as using administrative records from outside sources and allowing enumerators to use their own devices during NRFU. The Bureau expects that both of these features, if implemented, would significantly reduce the cost of the 2020 Census. However, considering its current cost estimation method, the Bureau does not have the ability to accurately assess the immediate impact on its cost estimates if significant limitations are placed on either of these two activities. The Bureau does not plan to revise its cost estimate until September 2015.

### *C. 2014 Census Test Did Not Generate Cost Data That Validates Cost Savings Estimates*

Although the Bureau has a strategic objective to contain or reduce the cost of the 2020 Census—and the 2014 Census Test plan indicated that cost comparison was a component of the test—the 2014 Census Test did not provide cost data that can be used to validate cost savings estimates or compare the cost of various design strategies.

During the 2014 Census Test, the Bureau investigated two key factors that drive the cost of decennial censuses:

- I. Self-Response Enumeration:** comparing various methods (including the Internet) to initiate contact and enumerate households. Utilizing multiple contact and enumeration methods could significantly increase self-response rates, reduce the use of paper questionnaires, and reduce the NRFU workload.

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<sup>8</sup> A propensity model considers relevant data to determine the level of expected effort required to enumerate a NRFU case.

**2. Various NRFU Contact Strategies:** comparing various methods, including adaptive design, to enumerate nonresponding households that affect the cost and quality of NRFU enumeration.

The self-response component of the 2014 Census Test was supposed to assess the cost and benefits—as well as the impact on data quality—of the various self-response modes by demographic group and geography. However, according to the project team, the research question underlying this test assumed a national test, and the 2014 Census Test was only conducted in a small geographic area. Therefore, a cost-benefit analysis across various demographic groups and geographic areas to support estimated cost savings, which was the Bureau's goal, was not possible using the results of the 2014 Census Test. If the Bureau had conducted a national test of the various self-response modes—across a representative sample of geographic areas and demographic groups—as originally planned, then it could have conducted a cost-benefit analysis, which would have facilitated the Bureau's ability to make informed design decisions about the 2020 Census.

Additionally, the NRFU operation of the 2014 Census Test was supposed to compare cost, productivity rates, and data quality across the various contact strategies—such as telephone or personal visit—used at nonresponding households. However, according to the NRFU team, cost data collected during the test could not be analyzed because the method used to assign enumerators resulted in inefficiencies, which negatively impacted cost but were not associated with contact strategies. For example, the test area was divided, so that crew leaders were not consistently hired from their own districts.<sup>9</sup> The Bureau also had trouble hiring crew leaders in certain districts. Therefore, in certain districts, some crew leaders were responsible for supervising activities in unfamiliar neighborhoods, and were often required to travel across other crew-leader districts, thereby increasing cost and decreasing efficiency. In addition, we noted that enumerators may not have followed contact protocol, which further reduces the reliability of any cost data associated with specific contact strategies. For example, enumerators were supposed to contact households in a specific order and were not supposed to attempt a visit after the maximum number of attempts had been made. Enumerators who did not follow the contact protocol may have incurred additional salary and/or mileage reimbursements, thereby making it difficult to assess the effects of the various contact strategies on cost. Moreover, during an actual decennial operation, unanticipated situations can arise. For example, cancelling the use of handheld computers for the 2010 Census NRFU operation led to the implementation of a paper-based operational control system, which in turn resulted in significant clerical staff overtime costs. Therefore, we suggest that conducting a cost analysis—with these inefficiencies included—would have produced an approximate estimate of actual costs, since unforeseen challenges will most likely occur during the 2020 Census. Without reliable cost data, the Bureau is unable to validate cost-savings estimates for stakeholders, compare costs of various design strategies, and make informed design decisions.

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<sup>9</sup> Crew leaders train and supervise enumerators and crew leader assistants who work in their own neighborhoods and communities. If crew leaders within a neighborhood cannot be hired, then Census must hire outside the neighborhood. This means crew leaders are travelling longer distances to supervise enumerators and working in an unfamiliar neighborhood, which decreases efficiency.

## II. Project Teams Are Not Following Project Plan Management and Change Control Protocol

We could not determine whether scope changes occurred for six of the seven projects included in the 2014 Census Test, because the project teams could not provide the original project plan, or a project plan was not developed prior to the test. Project documents establish the tactical vision and include technical and operational details. Baselined, or original, project plans are needed so that a project's initial scope is established and any subsequent changes to it are documented and approved. Project plans are required by the Decennial Program's document management plan, which defines document management as "the process that receives, reviews, approves, and archives documents at strategic, program, and project levels."<sup>10</sup> The document management plan further states that "these elements combine to provide consistency, quality and control, and accessibility over the strategic, program and project documents." Research team project plans are covered by this guidance. Each research project's plan serves as a vehicle for both communication and coordination to team members and stakeholders during early project organization stages by providing a broad outline of project objectives, tasking, and timelines. Once approved, the project plan includes the project control baseline; and any changes to the approved baseline need to go through the program-level approved change management processes.

In order to address our second audit objective—whether the 2014 Census Test responded to its original research questions—and to identify changes in scope to the various research projects included in the test (as well as any subsequent deleterious effects on the Decennial Program's goal of a cost-effective and quality decennial census), we attempted to compare the original scope of each project—as defined in the baselined project plan—to the current scope of each project as defined in the 2014 Census Test plan. We found that, of the seven projects included in the 2014 Census Test (see table I), only one—Non-ID Processing—had a project plan that we could confirm was the original plan prepared at the beginning of the project's life cycle. For the remaining six plans, we found the following:

- **Automating Field Activities and Administrative Records Modeling:** Original plans for two projects: "Automating Field Activities" and "Supplementing and Supporting NRFU with Administrative Records" (which later became the "Administrative Records Modeling" project) could not be found by the current team leads. The current Automating Field Activities team lead was not assigned to the project when the original plan should have been developed. The project plan for the original Supplementing and Supporting NRFU with Administrative Records team lead did not complete the project plan until July 2014, after the start of the 2014 Census Test. Project teams conducting research without approved project plans, which have been processed through the document management and change control process, may alter project scope, which in turn could negatively impact cost savings, research project goals, or other projects.

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<sup>10</sup> U.S. Census Bureau, August 9, 2012. *2020 Census Document Management Plan WBS 1.102*, Suitland, MD: U.S. Census Bureau, 1.

- **Optimizing Self Response:** We requested version 1.0 but were never provided with the document. The team lead did provide version 2.0, but it was dated June 2014, after the start of the 2014 Census Test. Based on the version history, this project plan did not appear to be the original, approved plan.
- **Contact Frame and Language Research:** These two projects were originally combined with other projects and then separated; however, the version history in the subsequent project plans did not clearly reflect their separation as distinct projects. For the Contact Frame project, we requested its original, combined project plan but only received an incomplete plan.
- **NRFU Design and Operations:** This project included three sub-projects (“Tailoring Contact Strategies,” “Adaptive Design,” and “Field Staff Efficiencies”), but the project plan for the combined project was not prepared until July 2014, after the start of the 2014 Census Test. We were able to locate project plans (with a different project number) for Tailoring Contact Strategies and Field Staff Efficiencies, but the project history of the plan developed in July 2014 neither reflects the change to the new project, nor project scope changes. A project plan for Adaptive Design was not developed until July 2014, after the start of the 2014 Census Test.

In addition to an incomplete history of projects included in the 2014 Census Test, discussion with team leads indicates there was significant turnover on teams and—perhaps because of this—some team leads were not aware that they needed to prepare a project plan. Two of the four research areas have had three project managers during the current life cycle; and three of the seven projects have had at least two team leads throughout those projects’ life cycle.

Team continuity is important because tests overlap—as one test is wrapping up, another is starting—and often one test depends on the results of previous tests. Coupling turnover with the fact that many project teams did not follow document-management and change-control policies could result in undetected or unreviewed and unapproved scope changes.

### III. 2014 Census Test Projects Did Not Develop Measurable Success Criteria

Six of the seven project teams included in the 2014 Census Test did not develop measurable success criteria with which to validate potential cost savings or establish benchmarks for a cost-benefit analysis of test results. GAO identified the following guidelines for establishing and reviewing performance measures and indicators:

Activities need to be established to monitor performance measures and indicators. These controls could call for comparisons and assessments relating different sets of data to one another so that analyses of the relationships can be made and appropriate

actions taken. Controls should also be aimed at validating the propriety and integrity of both organizational and individual performance measures and indicators.<sup>11</sup>

In addition, the Bureau provides stringent guidelines of its own for measuring the performance of its research projects and collective R&T effort. According to the Bureau, to succeed, the Decennial Program must meet two key expectations:

1. Projects must provide research results that address specific research questions in a timely manner.
2. Projects must back up their recommendations with appropriate evidence.

According to the Bureau, all of its projects must produce outputs—such as data, products, or objects—during the life cycle of the project. Performance measures must be developed to evaluate progress towards achieving the outputs and to evaluate project and program performance against pre-established targets.

The 20RPO is responsible for defining success criteria, maintaining performance metrics, managing key milestones, and ensuring that those milestones are achieved. All metrics are approved by the 20RPO chief. According to the Bureau's guidance, each performance metric should

- align with the goals and mission of the R&T effort and be clearly communicated;
- be clearly stated with a unique name and definition, and have a specific methodology used to calculate it;
- have a quantifiable goal that is achieved during a defined time period;
- be free from significant bias and produce the same result under similar conditions;
- cover activities that support program goals and objectives; and
- provide new and unique information.

The 2014 Census Test Plan, finalized in May 2014, included success criteria for each project. However, only one project—Non-ID Processing—developed success criteria that established predetermined and quantifiable benchmarks against which to measure actual result (see table 2, next page). In reviewing each project, we discovered unclear success criteria for six of the seven projects, including such vague terms as “ability to analyze” and “preliminary evidence.” These criteria provide no benchmark for establishing whether the individual projects, or the 2014 Census Test as a whole, can achieve specific objectives and the ultimate goal of reducing the cost and maintaining the quality of the 2020 Census.

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<sup>11</sup> GAO, November 1999. *Standards for Internal Control in the Federal Government*, GAO/AIMD-00-21.3.1. Washington, DC: GAO, 14.

**Table 2. 2014 Census Test Project Success Criteria**

Project	Success Criteria
Automating Field Activities	<ul style="list-style-type: none"> <li>Effectively assign, locate, enumerate, and collect and transfer data for individual addresses in an automated environment</li> </ul>
Contact Frame	<ul style="list-style-type: none"> <li>Analyze the survey results and add to our body of knowledge about (1) the use of phone number data from vendor sources; (2) the validity of phone numbers and email address data from vendor sources; and (3) the characteristics of phone numbers and emails addresses that are correctly linked to an address</li> </ul>
Language Research	<ul style="list-style-type: none"> <li>Optimized questionnaire designs for each mode in a consistent and culturally appropriate manner by language</li> <li>Successful completion of data collection instrument development and data processing in languages other than English</li> </ul>
Non-ID Processing	<ul style="list-style-type: none"> <li>Administrative records provide enhancements to respondent addresses at comparable or improved rates when compared to the results from National Census Contact Test</li> <li>All address records delivered by UCRM<sup>a</sup> to Non-ID Processing (1) obtain a resolution from automated matching and geocoding; and (2) resolved within 24 hours of receipt and delivered back to UCRM</li> </ul>
NRFU Design and Operations	<ul style="list-style-type: none"> <li>Assess how much of the total cost of the operation is from time spent interviewing respondents and navigating the questionnaire</li> <li>Recommend a strategy for testing the use of proxy respondents, in order to reduce costs while striving to maintain data quality</li> <li>Distinguish inbound phone calls from outbound phone calls in the paradata results and recommend a strategy for relying on inbound phone calls in the future</li> <li>Determine contact patterns or problems in enumerator fieldwork and reduce cost</li> <li>Recommend a strategy for more structured testing aimed at determining optimum NRFU methodology by demographic group and geographic area</li> <li>Associate cost to contact strategies</li> <li>Recommend improved instructions for fieldwork and contact attempts, in order to reduce costs while striving to maintain data quality</li> <li>Implement an adaptive design strategy and gather data to allow researchers to assess cost and data quality</li> <li>Track enumerator activity with the T&amp;M<sup>b</sup> software and devices and deliver data for modeling and analysis</li> </ul>
Optimizing Self Response	<ul style="list-style-type: none"> <li>Implement an Internet Push contact strategy that optimizes self-response before mail out of a paper questionnaire</li> <li>Measure response rates for Internet at each point in the contact strategy</li> <li>Obtain paradata and demographic data for respondents across response modes</li> <li>Adopt the strategy to engage respondents early and deploy a pre-registration web site</li> </ul>
Administrative Records Modeling	<ul style="list-style-type: none"> <li>Use administrative records to remove NRFU workload</li> <li>Determine cost implications of NRFU workload removal in a site test</li> <li>Determine when administrative records may be useful</li> </ul>

Source: OIG analysis of U.S. Census Bureau information

<sup>a</sup> The Universe Control and Response Management (UCRM) maintains a master list of test addresses; stores case data, including responses; stores United States Postal Service mail tracking data; and assigns cases to field.

<sup>b</sup> The Time and Motion Study observed and measured the day-to-day tasks performed by the enumerator in the course of conducting the NRFU operation.

A number of risks are associated with inadequate performance measurement. First, failure to apply appropriate performance measures to projects will hinder the Bureau's ability to assess research results. Second, if managers and staff responsible for performance measures do not follow standard measurement procedures, then results cannot be validated and verified. Finally, if the 20RPO or other governance entities do not use performance measurement and management results for decision-making, then decisions may be based more on intuition and speculation. Failing to establish measurable success criteria for each project may also preclude the Bureau from demonstrating that the 2014 Census Test's expenditures produced quantifiable results that will help the Bureau achieve a cost-effective and quality 2020 Census.

### *Recommendations*

We recommend that the Director of the Census Bureau do the following:

1. Obtain and keep a record of documentation that supports the cost estimation process and results.
2. Implement a sufficiently robust cost modeling system, which includes all vital component variables, and incorporates cost updates as design decisions are reached, or quantifies the effect on the cost of design alternatives as needed.
3. Prior to testing activities, ensure that the cost information that will be collected is reliable and can be used to validate life-cycle estimates.
4. Develop an improved process for research project teams to document and maintain a complete history throughout each project's life cycle, and prepare updated project plans prior to the start of tests.
5. Develop test success criteria that are in compliance with the guidelines recommended by GAO and the Census Bureau.

# Summary of Agency Response and OIG Comments

We reviewed the Census Bureau's response, included in appendix B. The Bureau generally concurs with the findings and recommendations in the report. The response identifies several actions that, if taken, should improve the Bureau's ability to update stakeholders regarding potential cost savings and the status of 2020 decennial design changes. We look forward to reviewing the Bureau's corrective action plan.

# Appendix A: Objectives, Scope, and Methodology

As part of our ongoing oversight of the U.S. Census Bureau's preparations for the 2020 Census, we conducted this audit to assess whether the Bureau incorporated iterative testing strategies and included originally established research questions in the 2014 Census Test in order to fully inform design decisions. Our audit of the 2014 Census Test had two objectives. First, we evaluated whether 2013 test results informed 2014 testing strategies. Then, we examined whether testing strategies of projects included in the 2014 Census Test responded to originally developed research questions.

We conducted audit field work between June and December 2014. Our methodology included interviewing senior managers and 2020 Census research project managers, members, and analysts to gain an understanding of 2013 test results and the projects associated with the 2014 Census Test. We also observed field enumeration in Montgomery County, Maryland, and Washington, DC, during the NRFU portion of the 2014 Census Test. In addition, we reviewed documentation related to the 2013 test and results, project plans for the 2014 Census Test (when available), and plans for the 2015 tests.

The following guidance and research project documentation was reviewed:

- Project plans, study plans, and test results
- Policies, procedures and guidance related to projects
- Knowledge Management Database, to assess whether 2020 project teams incorporated 2013 test results into their research
- U.S. Census, *Mobile Computing Strategy*, and the Enterprise Systems Development Life Cycle for the *2020 Census Commercial Mobile Device*
- U.S. Census, *2020 Rough Order of Magnitude Cost Estimation*
- U.S. Census WBS I.102, *2020 Census Document Management Plan*
- U.S. Census WBS I.102, *2020 Census Program Change Control Management Plan*
- Government Accountability Office GAO-09-3SP, *Cost Estimating and Assessment Guide, Best Practices for Developing and Managing Capital Program Costs*
- Government Accountability Office GAO/AIMD-00-21.3.1, *Standards for Internal Control in the Federal Government*
- Office of Management and Budget, *Standards and Guidelines for Statistical Surveys*

We gained an understanding of research project internal controls by reviewing Bureau guidance, interviewing project managers, and reviewing supporting documentation (when available). Based on this understanding, we identified internal control weaknesses that are discussed in the findings above. Because of the internal control weaknesses, we were unable to assess whether testing strategies responded to originally developed research questions. Therefore, we limited our review to evaluating whether iterative testing strategies were used, and evaluating quantifiable success criteria that can be used to evaluate the cost-benefit of projects.

We received data from the Bureau to evaluate the cost estimation model, and we obtained data to verify 2014 Census Test results by accessing the Bureau's Unified Tracking System (UTS). We were unable to audit the cost estimation model because staff did not collect or maintain supporting documentation for those variables used in the cost estimation process (see finding I.A.).

We conducted this audit from June 2014 through December 2014. The audit was conducted under the authority of the Inspector General Act of 1978, as amended, and Department Organization Order 10-13, dated April 26, 2013, at the Department's offices in the Washington, DC, metropolitan area. We conducted this performance audit 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 objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

# Appendix B: Agency Response



UNITED STATES DEPARTMENT OF COMMERCE  
Economics and Statistics Administration  
U.S. Census Bureau  
Washington, DC 20233-0001  
OFFICE OF THE DIRECTOR

SEP 11 2015

MEMORANDUM FOR: Carol Rice  
Assistant Inspector General for Economic  
And Statistical Program Assessment

From: John H. Thompson   
Director, U.S. Census Bureau

Subject: *2020 Census: The 2014 Census Test Misses an Opportunity to  
Validate Cost Estimates and Establish Benchmarks for Progress*  
Draft Report

The attached comments are in response to your draft report entitled *The 2014 Census Test Misses an Opportunity to Validate Cost Estimates and Establish Benchmarks for Progress*. The Census Bureau appreciates the opportunity to review and provide comments to this draft report.

Attachment

cc: Pam Moulder, ESA  
Burton Reist, ESA

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Census Bureau Comments on OIG Draft Report:  
“2020 Census: The 2014 Census Test Misses an Opportunity to Validate Cost Estimates and  
Establish Benchmarks for Progress” (Draft Issued August 13, 2015)  
September 4, 2015

The Census Bureau appreciates the opportunity to comment on this draft report. We have no fundamental disagreements with any of the recommendations, and will soon prepare a formal action plan to document the steps we will take in response to those recommendations.

The first three recommendations concern our need to:

- better document the sources of information that support our cost estimation process and results;
- implement a more robust cost modeling system that includes all key variables, incorporates updates as design decisions are made, and can be used to quantify the cost of design alternatives;
- take additional steps to ensure that cost information we plan to collect in tests will be reliable and usable to validate our life-cycle cost estimates.

We agree that additional efforts are needed to strengthen our cost estimates, but we appreciate the acknowledgement that we have made progress in following the GAO’s cost estimation guidelines. Due to reductions to our budget requests for each of the last two fiscal years, we have had to prioritize our research activities and how to allocate our staff resources.

In large measure, the comments about our cost estimates in this draft report seem based on the fact that we did not build a bottom-up estimate using documented parameters from previous censuses or our research. While this is true at the moment, our inability to produce such estimates is the result of needing to plan, conduct, and evaluate a number of critical tests and research efforts over the next several years that will provide us with tangible information on the values of key cost parameters (e.g., the likely Internet response rate in 2020). If we already knew the values of these parameters, we would not need to do (nor request funding for) these tests and research efforts. Conversely, if our appropriations are insufficient to conduct these efforts, we will not be able to obtain the data needed to improve our cost estimates.

That being said, we also believe the top-down estimates we produced were sufficient, and sufficiently precise, to identify the major cost drivers for the decennial census, and in turn to identify those testing and research projects most likely to lead to major cost savings in 2020. Our top-down estimates used the best information we had about key cost parameters, coupled with expert judgment on the likely range of values for those parameters, prior to conducting our research and testing efforts. As we complete those efforts, we regularly will revise our estimates of costs and savings to incorporate the results of our research, and eventually will have sufficient information to use GAO best practices in producing bottom-up estimates of lifecycle costs and savings for the 2020 Census.

We also recognize the Census Bureau needs to improve its capabilities and skill sets in the area of cost estimation. We currently are standardizing a product-oriented work breakdown

structure (WBS) which provides a comprehensive structure of each census and survey. Using the WBS as the foundation for the Cost Element Structure (CES) will assist our certified cost estimators in ensuring their cost estimates are also comprehensive. The Census Bureau established the Office of Cost Estimation, Analysis, and Assessment (OCEAA) to provide enterprise guidance and policies for cost reporting. These policies will require all programs to report lifecycle costs annually and to report Earned Value Management (EVM) data monthly; both structured around the standardized WBS. The OCEAA will store and manage these reports centrally. Because the use of actual data is the "gold standard" for cost estimation, the proper use of these cost reports will ensure that the Census Bureau bases decisions on credible data. Additionally, the Census Bureau will continue to hire and train certified cost estimators, as well as work with both internal and external experts, to increase the sophistication of our sensitivity analyses.

Because our research and testing efforts will be a critical source of information for the life-cycle cost estimates that will accompany our 2020 Census Operational Plan at the end of FY 2015, we chose to devote more staff resources to those testing and research activities, and less to efforts to document the sources of our initial estimates. We recognize the OIG may disagree with our choice of priorities, just as we recognize that the additional steps they recommend are needed to improve our estimates, and to reduce the risk of significant unexpected costs during 2020 Census implementation.

As far as the third recommendation about taking additional steps to ensure cost information from tests can be used to validate our life-cycle cost estimates, this gets close attention from our subject-matter experts involved in cost estimation. Census tests (especially those not national in scope) and small-scale research projects can never fully simulate or reflect the conditions of an actual census (especially the effects of all the media attention, and our partnership and outreach efforts). Further, site tests in just one or two locations can't be generalized to the national level, especially when the sites are chosen because they have particular characteristics (e.g., a high vacancy rate) that are useful for studying certain methods. For all these reasons, the results of these tests can't be used unmodified to update the 2020 Census cost model. Instead, some thought must be given to how these results can best be used in the cost model. For example, rather than using the Internet response rate in the test directly, perhaps we instead use it in conjunction with the 2010 Census mail response rate for the same area to estimate the likely increase (including upper and lower bounds) in overall response at the national level from adding Internet as an option. Overall, however, we agree that it would be good to devote more resources to these efforts. As mentioned above regarding the first two recommendations, we chose to give higher priority to the actual research and testing, but we understand the OIG's concerns for the long term.

On page 8 the reports faults the Census Bureau for changing the 2014 Census Test from a national test to a local site test, and thereby missing an opportunity to gather national level estimates of cost parameters. It is true that our FY 2014 budget request to Congress (prepared in 2012) stated we were planning several field tests, including a large national response test, for FY 2014. However, in response to funding reductions, in 2013 we undertook a review and re-plan of the early testing plan that had been developed during FY 2010. We consolidated, rescheduled, and otherwise modified some of that early planning, including making a decision to postpone the

national test until FY 2015. That test (the 2015 National Content Test) got underway in late August, and among other things, it is designed to capture some of the very things the OIG mentions can be gathered from a national test, such as national level estimates of Internet response rates, and variations in response rates by geography.

The fourth recommendation in this OIG draft report focuses on improving our process for documenting project plans and updates over time. Again, we appreciate the acknowledgment that we've made improvements to such efforts compared to last decade, and absolutely agree there is room for improvement. We established plans, requirements, and processes for documenting project plans and for change control to those plans. We have followed that process, and much of the documentation is complete or underway. However, as stated above, in the face of budget reductions for both FY 2014 and FY 2015, we chose to devote more staff resources to operational activities for the 2015 Census Tests, and less to efforts to keeping program documents fully up-to-date.

The fifth and final recommendation in this draft report concerns the need to better define success criteria for each of our testing and research projects. We agree with the OIG's concerns regarding the 2014 Census Test, and that we can and must improve the effectiveness of our projects by following this best practice in the future. The success criteria for the 2015 tests were articulated in all test documents and reports, and we will require this be done for all 2016 Census Test projects as well.

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