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Office of Inspector General

BUREAU OF THE CENSUS

MAF/TIGER Redesign Project Needs Management Improvements to Meet Its Decennial Goals and Cost Objective

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EXECUTIVE SUMMARY

The U.S. Census Bureau—the largest statistical agency of the federal government—conducts the decennial census of population and housing as well as other surveys and censuses that measure changing individual and household demographics and the economic condition of the nation.

To carry out this work, the bureau developed and maintains the Master Address File (MAF) and the Topologically Integrated Geographic Encoding and Referencing (TIGER)[1] databases. MAF is an inventory of address information covering an estimated 115 million residences and 60 million business and other structures in the United States, Puerto Rico, and Island Areas. TIGER is a digital map containing the locations and names of streets, rivers, railroads, boundaries, and other geographic features and their geospatial relationship to each other and to MAF addresses.

The complex, voluminous MAF and TIGER databases are essential to the success of the bureau's census and survey activities. However, the current data contains an unacceptable level of inaccuracy, and the systems, which were internally developed by Census to manage the data, are cumbersome, outdated, and difficult to integrate with newer technology. The bureau has thus launched a major effort to improve the accuracy of the data and redesign these systems. Known as the MAF/TIGER Enhancement Program, this 8-year, roughly $500 million undertaking is part of Census' overall 2010 decennial census strategy to reduce operational complexity and risks, contain costs, and improve census results.

The computer and software upgrade portion of the enhancement program—the MAF/TIGER Processing Environment Redesign—is crucial to the bureau's attainment of these 2010 goals. The redesign will replace the bureau's in-house developed MAF and TIGER systems with a single integrated system consisting of a standard, commercial off-the-shelf database management system and Geographic Information System computer products, supplemented where necessary with in-house developed computer programs. The goals are to develop a system that

- supports hand-held Global Positioning System devices for field operations,
- permits Internet access to geographic information for local governments,
- facilitates faster response to operational requests,
- simplifies error-prone operations such as database updates, and
- reduces training time for new MAF/TIGER programmers.

The Geography Division is developing this complex, technically challenging system itself, with contractor assistance, rather than having a contractor design and implement it based on bureau-provided specifications. Its use of a disciplined project management process that conforms to federal guidelines and accepted business practices,[2] and a methodical software process[3] is

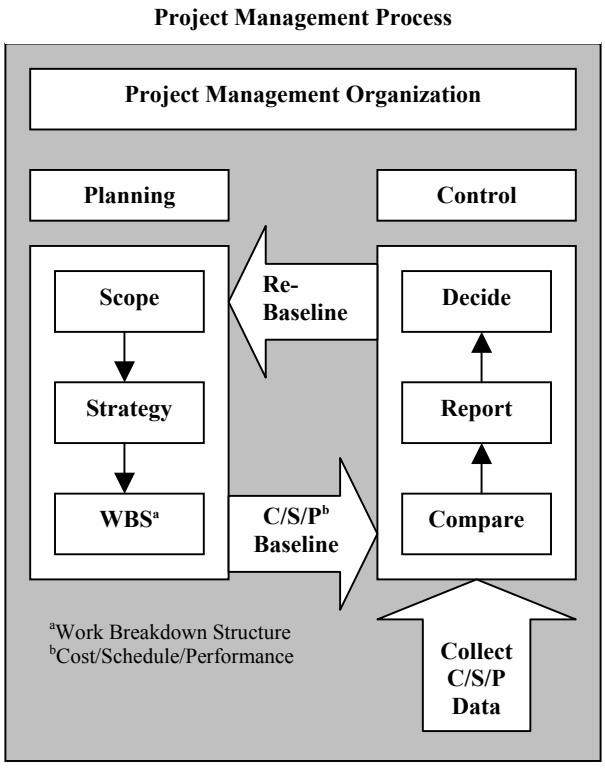
[1] TIGER is a registered trademark of the U. S. Census Bureau.
[2] See the Clinger-Cohen Act of 1996; OMB Circular A-11 Part 7, "Planning, Budgeting, Acquisition, and Management of Capital Assets"; and, for example, Program Management's Institute's *Program Management Body of Knowledge.*
[3] See Carnegie Mellon University's Software Engineering Institute (SEI) Capability Maturity Model (CMM) for Software.

essential for there to be enough time for the system to be thoroughly tested before the 2008 dress rehearsal and completed within its estimated $50 million budget.

Past Census experience has shown the importance of effective project management and software development, and the costs—both in dollars and diminished outcomes—associated with the lack thereof. In our reviews of Census 2000, we found that the bureau did not have enough experienced staff to manage expensive, complex system projects and that the bureau's approach to software development was often *ad hoc* and lacking proper controls, product testing, and documentation.[4,5] As a result of its Census 2000 experience, the bureau initiated a management training program and a bureau-wide program for improving its software process. In addition, it stated that it intends to use a more formal software process for development of the new MAF/TIGER system.

We conducted this evaluation to determine whether Census has established and is following accepted processes for managing and developing the redesigned MAF/TIGER system in light of the bureau's past decennial experience with information technology projects, our related recommendations for improvements, federal requirements, and industry-endorsed project management and software processes. Our findings and recommendations are as follows:

Late start implementing project management process has increased risks. Although the project had been underway for 1½ years at the start of our evaluation, Census had yet to implement a comprehensive project management process (see figure)—it had not established a management organization (the sponsor, review board, a full-time project manager, and key project team members); or developed a comprehensive project plan identifying the scope of work (i.e., the system's requirements and architecture), the strategy for building the system and all major intermediate products, and the activities needed for project completion (the work breakdown structure). It had not assigned baseline activity-level cost, schedule, or performance (C/S/P) parameters. Nor had it implemented required controls such as "earned value management," which is an objective, quantitative technique for measuring project progress by obtaining reliable, timely project data and evaluating it against the baseline to support decision-making throughout the project's life cycle. In the absence of an effective management process to guide the redesign's progress, several initial project activities



[4] *Improving Our Measure of America: What Census 2000 Can Teach Us in Planning for 2010*, OIG-14431, Spring 2002.
[5] *A Better Strategy Is Needed for Managing the Nation's Master Address File*, OSE-12065, September 2000.

did not produce the results needed to proceed to the next stage of development and had to be reworked. These setbacks increase the risk that there will not be enough time for the system to be thoroughly tested before the 2008 dress rehearsal.

Census officials have recently begun implementing more disciplined project management. They attribute their slow start to understaffing and the diversion of key personnel to other high-priority projects in progress when the redesign was initiated. We recommend that Census identify and fill staffing needs for the redesign as quickly as possible and implement a project management process, to include the project management organization, a comprehensive plan, appropriate project controls, and a commitment of adequate resources for their proper implementation. (See page 7.)

Technical challenges warrant accelerating software process[6] improvement. Because the bureau had no structured process for determining requirements, implementing software, conducting testing, and providing quality assurance for Census 2000, last minute system requirements and software changes were a way of life. This experience prompted the bureau in 2002 to implement a multi-year software process improvement program using the 5-level Capability Maturity Model (CMM) for software developed by the Carnegie Mellon Software Engineering Institute (SEI). The redesign and the software improvement program both started around the same time. Thus, the redesign project did not apply improved processes from the improvement program or elsewhere to its initial activities.

The complex redesign project must be guided by a more mature software process to increase the likelihood that it will meet system requirements, as well as cost and schedule projections, and for there to be enough time for the system to be thoroughly tested before the 2008 dress rehearsal. The redesign is therefore attempting to accelerate development and implementation of CMM level 2 capabilities (see table):

CMM Level 2

Maturity Level 2	Description	Key Process Areas
Repeatable *Project management processes*	Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.	➢ Requirements management ➢ Software project planning ➢ Project tracking and oversight ➢ Subcontract management ➢ Software quality assurance ➢ Configuration management

Source: Software Engineering Institute, *The Capability Maturity Model, Guidelines for Improving the Software Process.*

Upgrading the current process to CMM level 2 is essential to providing the elements most critical to controlling a complex software project—requirements management; project planning, tracking, and oversight; configuration management; and quality assurance. However, according to SEI, the median time for advancing from level 1, the bureau's current status, to level 2 is 2 years. Thus, the bureau needs to develop a plan and strategy that will significantly shorten this duration for the redesign. We recommend that the bureau provide the management commitment,

[6] A software process is a set of activities, methods, practices, and transformations that are employed to develop and maintain software and the associated products (e.g., project plans, design documents, code, test cases, and user manuals).

resources, and oversight needed to attain CMM level 2 capabilities as soon as possible on the redesign, and ensure that the activities to implement those practices are reflected in the project's management plan. (See page 13.)

In its response to our draft report, the Census Bureau generally concurs with our findings and recommendations. Moreover, Census states that it has already started implementing our recommendations. Specifically, Census has started making substantive improvements to its project management and software development processes. These actions include: (1) reorganizing the decennial directorate to provide additional resources, management support, and oversight, (2) filling key project positions, (3) documenting roles and responsibilities of the project management organization, (4) developing the project management plan, and (5) working with internal and contractor experts to establish a repeatable software engineering process. Also, Census has committed to starting to use earned value management in FY 2004 to control the project. We believe these actions will increase the likelihood that the MAF/TIGER redesign will achieve its goals for the 2010 Census and be completed within its budget estimate.

Census' response has raised a new concern about MAF/TIGER redesign testing, however. In decennial documentation we reviewed during our fieldwork, the 2006 census test is identified as the last operational test of the decennial system infrastructure before the 2008 dress rehearsal. The documentation did not indicate that the redesigned MAF/TIGER system would not be part of the test, nor did the recently developed MAF/TIGER project plan address any additional testing that would have to be performed as a result of the system not being part of the 2006 test. In its response, however, Census states that the redesigned MAF/TIGER system is not scheduled to be part of this 2006 test because (1) the system will not be ready to produce preparatory test products needed in the fall of 2004, and (2) the system will not be fully deployed until 6 months after the test's census day (April 1, 2006). Census, in its response, recognizes that additional testing will have to be carried out because the system will not be part of the 2006 test. Moreover, Census states that in 2004 it will develop a system test plan for all testing required, including confirming that the redesign meets the 2006 operational and system interface test objectives.

Based on this new information, we are concerned that the redesigned MAF/TIGER system will not be adequately tested in an operational environment with other decennial systems before the dress rehearsal. In light of this concern, we have expanded the third recommendation in our first finding to state that the Census Bureau should re-examine the MAF/TIGER project management plan to determine the feasibility of testing completed system components in the 2006 census test, and should document the test strategy for confirming that the redesign meets the 2006 operational and system interface test objectives in the system test plan. Also, because of the bureau's response regarding the 2006 test, we have modified our discussion of the system's role in the test and have changed the report title accordingly.

A synopsis of Census' response and our comments are presented after each finding. Census' response is included in its entirety as Appendix C.

INTRODUCTION

As the largest statistical agency of the federal government, the U.S. Census Bureau is charged with gathering and disseminating statistics and information about the people and economy of the United States. In fulfilling this mission, the Census Bureau conducts the decennial census of population and housing as well as other surveys and censuses that measure changing individual and household demographics and the economic condition of the nation.

Census strives to make its information products as accurate as possible because they help shape our federal and state governments and policy decisions. The decennial census, for example, is used to apportion seats in the United States House of Representatives, draw federal and state legislative districts, and distribute hundreds of billions of dollars in federal and state funds.

The Census Bureau has begun implementing a new approach to the 2010 census that seeks to reduce operational risk, improve the accuracy of census coverage, and contain costs. The components of this approach are (1) enhancing the accuracy of its address and digital map data, and redesigning the systems on which they reside, (2) collecting detailed demographic data throughout the decade through the American Community Survey (ACS) in order to eliminate the census long form, and (3) early planning, development, and testing of the short-form only 2010 census.

MAF and TIGER Databases

To carry out its censuses and surveys, the Census Bureau developed and maintains address and geographic location data on the nation's residences and businesses. The Master Address File (MAF) is an inventory of address information covering an estimated 115 million residences and 60 million business and other structures in the United States, Puerto Rico, and Island Areas. MAF is used for delivering questionnaires, carrying out personal interviews, and tracking responses. The Census Bureau decided to develop a permanent address list after the 1990 decennial, and collected and updated address information throughout the 1990s using the U.S. Postal Service's Delivery Sequence Files, information from local governments, and labor-intensive canvassing. Because Title 13 of the United States Code prohibits disclosure of address information, use of MAF data is mostly restricted to the Census Bureau.

The Topologically Integrated Geographic Encoding and Referencing (TIGER)[1] database is a digital map containing the locations and names of streets, rivers, railroads, jurisdictional boundaries, and other geographic features and their geospatial relationship to each other and to MAF addresses. TIGER is used for orienting Census field staff and tabulating census and household survey data. With geographic data supplied by the U.S. Geological Survey, the Census Bureau developed TIGER and the computer program that manages the database in the early 1980s. The public version of TIGER, the TIGER Line Files, has provided base mapping information for the Geographic Information System (GIS) industry in the United States.

[1] TIGER is a registered trademark of the U. S. Census Bureau.

MAF/TIGER Enhancement Program

The bureau has launched a major effort to improve the accuracy of MAF and TIGER data and redesign the computer systems on which they reside. The effort—called the MAF/TIGER Enhancement Program (MTEP)—is part of Census' overall 2010 decennial census strategy to reduce operational complexity and risks, contain costs, and improve census results. The improvements envisioned by MTEP have the potential of yielding significant savings for other bureau statistical activities as well, including demographic survey programs and economic censuses. The MAF/TIGER Processing Environment Redesign project, which is the subject of this report, is part of MTEP.

A primary reason the bureau has undertaken MTEP is because the current MAF and TIGER data has an unacceptable level of inaccuracy. One of the major goals of MTEP is to put TIGER features and MAF addresses at their true geographic location, which will allow the Census Bureau to use modern locational technology such as the Global Positioning System (GPS) that could, for example, help field staff locate rural addresses using GPS-enabled mobile computers.

Funding for MTEP started in FY 2002, and the program is estimated to cost in excess of $500 million when it is completed by FY 2010.[2] Its most expensive component is an 8-year, $200 million contract to improve the accuracy of Census' address list and digital map. The redesigned MAF/TIGER processing environment will facilitate managing this more accurate data.

MAF/TIGER Processing Environment Redesign

The current MAF and TIGER systems are cumbersome to use and maintain and difficult to integrate with newer technology. They consist of internally developed computer programs that manage and update the data, and create data products. TIGER is a large, complex system that has been two decades in the making. Combined, MAF and TIGER have grown to 33 million lines of computer program code. MAF and TIGER products are used throughout the Census Bureau for operational planning and data collection. TIGER products are also used by other federal agencies; state, local, and tribal governments; industry; and educational institutions.

The purpose of the redesign project is to replace these in-house developed systems with a single, integrated system residing in a modern processing environment consisting of a standard, commercial off-the-shelf (COTS) database management system and GIS computer products, supplemented where necessary with in-house developed computer programs. The goals are to develop a system that

- supports hand-held GPS devices for field operations,
- permits Internet access to geographic information for local governments,
- facilitates faster response to operational requests,

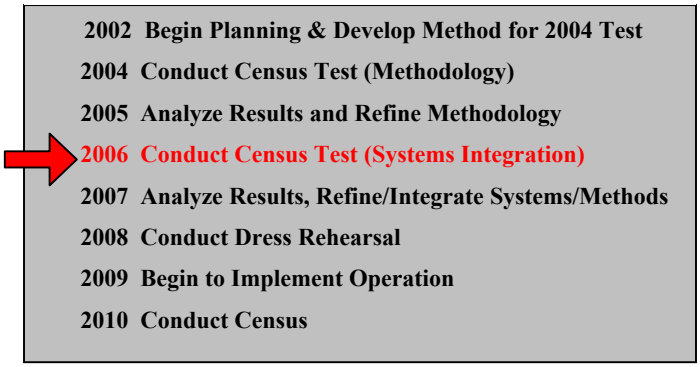
[2] The MTEP consists of 5 objectives: (1) improve address/street location accuracy and implement automated change detection; (2) implement a modern processing environment; (3) expand and encourage geographic partnership options; (4) support the American Community Survey which gathers detailed population and housing data throughout the decade; and (5) implement periodic evaluation activities and expand quality metrics.

- simplifies error-prone operations such as database updates, and
- reduces training time for new MAF/TIGER programmers.

The Census Bureau's Geography Division[3]—the developer of the current MAF and TIGER systems—is responsible for the redesign project. The Geography Division is developing the new system itself, with contractor assistance, rather than having a contractor design and implement it based on bureau-provided specifications. Funding for the redesign started in FY 2002 with an $8 million allocation. Another $11.5 million was allocated in FY 2003. The bureau estimates the total cost for the redesign at about $50 million, and project completion in FY 2006.

Census wants to fully test major elements of its systems and new approach before the 2008 dress rehearsal so it can avoid problems it encountered in the past. The purpose of the 2006 decennial integration test is to bring together software and hardware components that will support the new approach envisioned for Census 2010. The timing of the 2006 test (see figure 1) was selected to allow the bureau enough time to fix system and integration problems before testing under the dress rehearsal's real-time conditions, in the hopes that only minor refinements will then be necessary to be ready for 2010. However, according to the bureau, the MAF/TIGER redesign will not be ready in time to be part of the 2006 test. Insufficient system testing was identified as a problem in the bureau's preparation for the 2000 decennial census by the U.S. General Accounting Office[4]—a deficiency that increased risk and added unnecessary expense, and that the bureau does not want to repeat.

Figure 1. Decennial Major Milestones



Source: Census Briefing to the National Academy of Sciences, Sept. 2002.

At the end of FY 2006, Census plans to have all existing MAF/TIGER data transferred to the redesigned COTS-based system. At that point, the Geography Division will shut down the old systems, enter all new data into the redesigned database, and maintain it as part of the ongoing Geography Division system maintenance program. Failure to meet this deadline could compromise preparations for the dress rehearsal as well as complicate ongoing operations because the Geography Division would have to manage both the old and new systems.

Software development for the redesign presents considerable technical challenges. It will involve (1) identifying the many capabilities of the existing large and complex system, including, for example, the detailed rules for manipulating TIGER map features; (2) implementing complex requirements such as providing electronic maps and address lists for mobile computing devices in the field and synchronizing updates to MAF/TIGER from regional offices, the postal service, and potentially 39,000 local governments, and maintaining data currency for the ACS; (3) integrating COTS products, not all of which have been tested in the marketplace; (4) using modern software analysis, design, and coding techniques with which the Census development

[3] The Geography Division is a component of the Office of the Associate Director for Decennial Census.
[4] *2000 Census: Headquarters Processing System Status and Risks*, GAO-01-1, October 2000.

team is unfamiliar; (5) preserving the integrity of complex and voluminous data when transferring it from the old databases to the new one; and (6) ensuring Title 13 data security.

The success of the redesign is a crucial component in the ultimate success and cost-effectiveness of Census 2010. Commerce has designated the redesign as a major information technology (IT) project because of its cost, complexity, and importance to the bureau's mission. As such, it is essential that the redesign be carefully managed according to federal guidelines and accepted business practices[5] and that Census use a methodical process for software development.[6]

Past Census experience has shown the importance of both disciplined project management and mature software processes, and the costs—both in dollars and diminished outcomes—associated with the lack thereof. In our reviews of Census 2000, we found that the bureau did not have enough experienced staff to manage expensive, complex system projects and that the bureau's approach to software development was often *ad hoc* and lacking proper controls, product testing, and documentation, leaving the bureau to correct system errors as the census was being conducted.[7,8] As a result of its Census 2000 experience, the bureau initiated a management training program and a bureau-wide program for improving its software process. In addition, it stated that it intends to use a more formal software process for development of the new MAF/TIGER system.

Because the bureau is developing this complex, technically challenging system itself, it must employ the same disciplined management processes as would be used by a competent system development contractor. We assessed the project management and software processes of the redesign thus far in light of the bureau's past history, our recommendations for improvements, federal requirements, and established industry principles for managing major IT projects and improving software processes.

Synopsis of Census' Response

Census states that the redesigned MAF/TIGER system is not scheduled to be part of the 2006 census test because (1) the system will not be ready to produce preparatory test products in the fall of 2004, 1½ years in advance of test census day (April 1, 2006) and (2) the system will not be fully deployed until 6 months after census day. In its response, Census recognizes that additional testing will have to be carried out because the system will not be part of the 2006 test and states that it will confirm that the redesigned system will meet 2006 census test objectives. Census further states that it will describe MAF/TIGER redesign testing in a system test plan to be developed in 2004.

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[5] See the Clinger-Cohen Act of 1996; OMB Circular A-11 Part 7, "Planning, Budgeting, Acquisition, and Management of Capital Assets"; and, for example, Program Management's Institute's *Program Management Body of Knowledge.*

[6] See Carnegie Mellon Software Engineering Institute (SEI) Capability Maturity Model (CMM) for Software.

[7] *Improving Our Measure of America: What Census 2000 Can Teach Us in Planning for 2010*, OIG-14431, Spring 2002.

[8] *A Better Strategy Is Needed for Managing the Nation's Master Address File*, OSE-12065, September 2000.

OIG Comments

In decennial documentation we reviewed during our fieldwork, the 2006 census test is identified as the last operational test of the decennial system infrastructure before the 2008 dress rehearsal. The documentation discussed a systems integration test and did not indicate that the redesigned MAF/TIGER system would not be part of the test, nor did the recently developed MAF/TIGER project plan address any additional testing that would have to be performed as a result of the system not being part of the 2006 test. Based on this new information, we are concerned that the redesigned MAF/TIGER system may not be adequately tested in an operational environment with other decennial systems before the dress rehearsal. Thus, the additional testing the bureau has indicated it will conduct is of utmost importance.

OBJECTIVES, SCOPE, AND METHODOLOGY

The purpose of our review was to assess whether management and software development processes as well as project and system documentation were adequate to support the redesign project. Specific objectives were to: (1) assess the extent to which a project management process has been established and used as well as any plans for improvement; (2) assess the extent to which a software process has been established and used as well as any plans for process improvements; and (3) assess project plans and system documentation.

To accomplish these objectives, we asked the bureau to present a project management review briefing to us, describing the redesign's structure, status, and technology, as well as the policies, procedures, and tools used for project management and software development. We reviewed documentation for the overall MAF/TIGER Enhancement Program and for the redesign effort, including the MTEP business case, cost model, modernization study, management plan, status reports, and capital asset plans; the redesign's requirements specification; and other project documents. We met with the assistant director for decennial census, the Geography Division chief (who has since retired) as well as the acting chief, the MTEP program manager, the redesign project manager, and other key staff.

We chose to review the redesign portion of the overall enhancement project in part at the request of the associate director for decennial census and in part to follow up on management and software development issues we reported with regard to Census 2000.[9] We conducted our fieldwork from January through May 2003, limiting our review to the management and system development processes used in redesigning the new environment.

We performed our work in accordance with the Inspector General Act of 1978, as amended, and the *Quality Standards for Inspections*, March 1993, issued by the President's Council on Integrity and Efficiency.

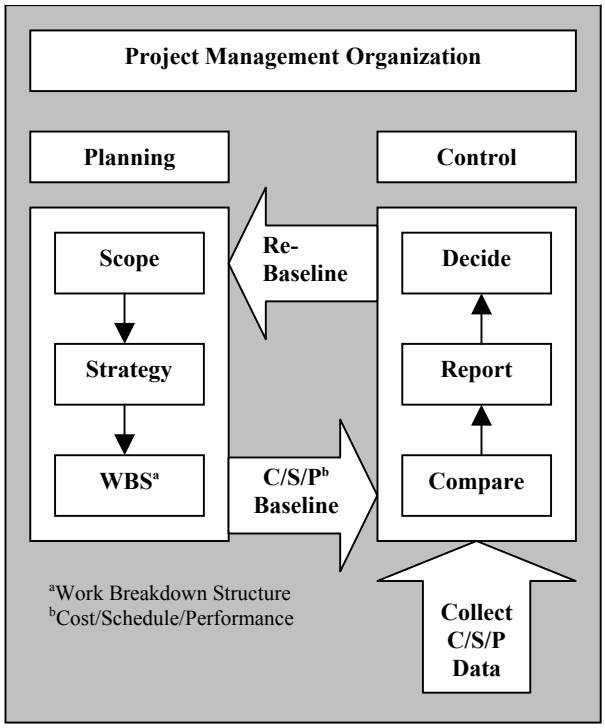
[9] See *Improving Our Measure of America: What Census 2000 Can Teach Us in Planning for 2010*, OIG-14431, Spring 2002.

FINDINGS AND RECOMMENDATIONS

I. Late Start Implementing Project Management Process Has Increased Risks

When we started our review, nearly a third of the 5-year timeframe for completing the MAF/TIGER redesign had passed, but Census had not implemented a comprehensive project management process. A conceptual depiction of the project management process is presented in figure 2 and the process is further described in Appendix B. Specifically, Census had yet to

Figure 2. Project Management Process



- establish a management organization (the sponsor, review board, a full-time project manager, and key project team members);
- develop a comprehensive project plan identifying the scope of work (i.e., the system's requirements and architecture), the strategy for building the system and all major intermediate products, and the activities needed for project completion (the work breakdown structure) that include baseline activity-level cost, schedule, and performance (C/S/P) parameters; or
- implement required controls, such as earned value management[10], for obtaining reliable, timely project data and evaluating it against the baseline to support decision-making throughout the project's life cycle.

In the absence of an effective management process to guide the redesign's progress, several initial project activities had not produced the results needed to proceed to the next stage of development and had to be reworked. These setbacks increase the risk that there will not be enough time for the system to be thoroughly tested before the 2008 dress rehearsal. Bureau officials were responsive to our concerns and have started to take corrective actions.

A. Implementation of a Project Management Process Was Delayed

At the start of our evaluation, Census had not established a project management organization for the MAF/TIGER redesign. There was no review board and no project manager, and while a project leader had been designated to work on the redesign, he was part-time and lacked both staff and authority to direct project activities.

[10] OMB requires that earned value management policies, procedures, and systems comply with ANSI/EIA standard 748-A, "*Earned Value Management,"* and that agencies report earned value measures for major IT projects in their capital asset plans, which are part of their annual budget submissions.

Moreover, the bureau did not develop a comprehensive project plan. It had not gathered and analyzed key planning information regarding the scope of the project (e.g., the size of the legacy system and the new architecture), completed addressing system requirements for end users outside the Geography Division, or identified the activities needed to complete the project. Consequently, it had neither a realistic strategy nor a WBS.

We also found that Census had not established adequate management controls and thus had already lost critical time in preparing for the project's execution. It was not intending to use earned value management for the redesign, believing this methodology was only required for contractors. As a result, it had not defined policies and procedures for earned value management and had not established other controls necessary for tracking and reporting. Census could not reliably report actual performance against overall project goals because it could not develop a C/S/P baseline without a WBS and work packages—which define component activities on a scale small enough to allow for work to be budgeted, scheduled, assigned, and monitored—and could not capture and track cost data at the activity level. Similarly, the Geography Division's software process was immature (as discussed in finding 2), which meant the project team did not have standard procedures for conducting activities or evaluating the quality of intermediate and final products. Finally, the bureau had no reliable information against which to judge how the project was unfolding—the monthly MTEP narrative report did not provide details on its progress, and cost and completion data for redesign activities in the capital asset plan, which is part of the annual budget submission, was not based on objective, quantitative information, which would have been gleaned from earned value management.

B. Neither Key Managers Nor Adequate Staff Were Assigned to the Redesign Full-Time

According to decennial and Geography Division management officials, implementation of basic elements of project management was delayed largely because key redesign personnel were diverted to higher priority projects. During FY 2002, the assistant division chief[11] responsible for the redesign was assigned to several projects, including preparation for decennial tests and Geography Division support to other bureau survey operations. Other assistant division chiefs participating in the redesign were diverted to the large MTEP contract for obtaining more accurate MAF/TIGER data. The delay has been exacerbated, according to the bureau, by insufficient staffing levels for the project—a difficulty officials attribute to their decision not to hire new Geography Division employees while the bureau was operating under continuing resolutions in FY 2002 and FY 2003.

Hiring constraints, competing staff priorities, and funding uncertainties have been recurring problems at the Census Bureau and impacted Census 2000 preparations and operations as well. Given this reality, bureau management must anticipate and plan for these challenges in order to ensure the success of the redesign effort.

[11] The Geography Division has seven subdivisions, each one managed by an assistant division chief.

C. Time Was Lost and Work Needed to Be Redone

When $8 million became available in FY 2002 to begin the redesign, Geography Division managers formed groups to work on three project activities: milestone development, requirements analysis, and COTS market research. However, in the absence of a project management process, these activities were uncoordinated and inadequately performed (see table 1).

Table 1. Major FY 2002 Redesign Project Activities

Activity	Funding	Results	Rework
Milestone Development	Unknown	High-level schedule Not supported by detailed work plan	Yes
Requirements Analysis	$2.5 M	Extended data model Little progress on functional requirements	Yes
COTS Market Research	$2.0 M	Selected database management system Limited results for GIS research	Continued past deadline

Source: MTEP Monthly Reports, October and November 2001; MTEP Capital Asset Plan, August 2002, and Interviews.

Specifically, we found that the milestone activity did not produce a detailed work plan that could be used to guide the project. Similarly, the requirements analysis resulted in a specification that did not contain all the information needed to begin systems analysis and design. Both activities are now being reworked. Although the COTS market research did lead to the selection of a database management system, the GIS portion of the research produced only limited results for planning and evaluating commercial products, and work is continuing past the initial deadline. We were unable to determine the impact of the repeated work on the overall funding requirements for the redesign project, because only partial funding information was available for these activities and, as noted earlier, actual expenditures at the activity level were not being tracked.

D. More Disciplined Project Management Has Begun

Decennial and Geography Division officials responded to the concerns we raised during our evaluation and have begun implementing basic elements of project management. In February 2003, they convened a steering committee to discuss the project's organization. It now meets biweekly to monitor project progress. At the end of March, the acting Geography Division chief issued a decision memorandum officially naming the assistant division chief leading the redesign as the project manager, as well as establishing the redesign requirements and development teams. However, project documentation we reviewed did not fully describe the redesign's management organization. Specifically, the roles and responsibilities of the project sponsor and steering committee were not addressed, nor were the process and authority for deciding whether to continue as planned or to modify the plan at key project milestones.

The redesign team is now developing a project plan that includes the components of the project management process described earlier (see figure 2). With assistance from a recently hired contractor, the team is analyzing factors affecting the project's scope such as the size and

architecture of the legacy system and the redesign's high-level requirements, creating a new architecture showing where COTS products could replace the legacy system's internally developed components, and developing a WBS and corresponding schedule.

The bureau is also preparing to implement earned value management to track the project, and has informed us that actual staff costs would be captured at the activity level. However, staff costs represent only one piece of a comprehensive set of data required to effectively support earned value management. Use of this methodology is new to the bureau, and it will have to give considerable effort and commitment to make the transition from its current management practices to those of earned value. For example, it will need to conduct more detailed work planning and resource estimation; tie associated costs to project activities; implement new methods for evaluating activities; and develop new reporting formats to present the project's earned value metrics.

E. Conclusion

Project management for the redesign is improving. However, the failure to implement an effective management process at the project's inception has resulted in the loss of valuable time and increased the risk that the new MAF/TIGER system may not be thoroughly tested before the 2008 dress rehearsal. Because the bureau lacks experience in applying disciplined management processes to complex software projects, designing and implementing these processes for the redesign project involve considerable work and pose significant challenges. The bureau needs to reassess its original project objectives, adjust them as warranted to account for the risks posed by the delayed implementation of a project management process, and develop contingency plans in the event that essential requirements cannot be implemented on time.

F. Recommendations

The Census Bureau Director should ensure that the appropriate management officials take the following actions as soon as possible:

1. Dedicate adequate and stable staffing to the redesign project. Census needs to
    a. identify staffing requirements, to include an appropriate mix of bureau and contractor employees,
    b. establish milestones for meeting needed staffing levels, and
    c. develop a strategy for overcoming anticipated obstacles such as funding uncertainties and for prioritizing work demands.

2. Fully define and document the project management organization, to include identification of project management roles and responsibilities, including the decision-making process and management components.

3. Complete the redesign project plan. The plan should
    a. incorporate a revised project strategy and objectives based on an assessment of current project risks,
    b. include contingency plans for delivering essential system requirements in time to meet the September 30, 2006 project completion date,
    c. consider feasibility of testing completed system components in the 2006 test, and be updated to reflect additional testing required for confirming that the redesigned system meets the 2006 operational test and system interface test objectives, and
    d. be updated if the baseline changes.

4. In accordance with OMB requirements and ANSI/EIA-748-A, establish policies and procedures for controlling the redesign project that call for
    a. collecting actual activity-level costs for government and contractor staff on a regular basis,
    b. reporting earned value measures to senior and project managers who can take corrective actions when project progress significantly deviates from the baseline, and
    c. presenting earned value information in the capital asset plan.

5. Develop a schedule for implementing the above recommendations.

6. Provide adequate resources, management support, and oversight to ensure that responsibilities are carried out as defined in the project's charter and plan, and that project controls are properly implemented.

Synopsis of Census' Response

In its response to our draft report, the Census Bureau generally concurs with the above finding and recommendations and has already taken action to implement some of them. Specifically, Census has completed and approved the baseline project management plan. The plan identifies annual staffing requirements and describes project roles and responsibilities. Census intends to add a description of the decision making process to the plan and update the plan if risk assessments indicate that a change in strategy is necessary. Also, Census states that it has filled 4 key project positions—the system architect and 3 functional area managers. Further, Census has committed to tracking government and contractor staff costs on a monthly basis, improving project oversight, and developing a schedule for implementing recommendations not yet in place. Notably, Census has reorganized the decennial directorate to provide additional management support and oversight to the MAF/TIGER redesign project.

As noted previously, Census states in its response that redesigned MAF/TIGER will not be ready to participate in the 2006 census test. In lieu of participating in the 2006 test, Census also states that it will confirm that the redesigned system will meet the 2006 test objectives through additional testing. Moreover, Census states that it will develop a system test plan for all testing required, including confirming that the redesign meets the 2006 operational and system interface test objectives.

OIG Comments

Although Census generally concurs with our recommendations and has started to implement them, it still needs to fully address several concerns. Specifically, Census needs to more fully define the roles and responsibilities of the project sponsor and steering committee in the project management plan. Although Census states that it is currently reporting earned value information in its capital asset plan (Exhibit 300) and will report these measures to the steering committee, budget, schedule, and performance must be estimated and tracked at the detailed activity level to provide more reliable and useful earned value information.

We have expanded the third recommendation (3.c.) to address the new information Census provided in its response about the redesigned MAF/TIGER system not being part of the 2006 census test. We believe the Census Bureau should re-examine the MAF/TIGER project management plan to determine the feasibility of testing completed system components in the 2006 census test. Also, the bureau needs to update the project management plan with the test strategy for confirming that the redesign meets the 2006 operational and system interface test objectives.

II. Technical Challenges Warrant Accelerating Software Process Improvement

Problems developing and maintaining software during Census 2000 prompted the bureau to subsequently implement a software process improvement program. However, the redesign and the software improvement program both started around the same time. Thus, the redesign did not apply improved processes from the improvement program or elsewhere to its initial activities. Given the technical challenges of the critical MAF/TIGER system, the bureau must employ a more mature software process on the redesign, and thereby increase the likelihood of meeting system requirements, as well as cost and schedule projections, and having enough time for the system to be thoroughly tested before the 2008 dress rehearsal. Although the bureau's software process is still too incomplete to provide the needed level of discipline, the bureau is now taking action to accelerate software process improvement for the redesign project.

A. Lack of a Mature Software Process Compounded Census 2000 Risks

For Census 2000, last minute system requirements and software changes were a way of life. Because a formal software process has not been a Census tradition, staff often provided system requirements via e-mails, hallway conversations, and meeting notes. The results of having no consistent approach to developing and managing requirements have been confusion, wasted or duplicated efforts, and inadequate control over software modifications. With no structured process for determining requirements, implementing software, conducting testing, and providing quality assurance, the bureau found itself making many software changes to systems needed to support decennial operations already underway. Under such intense pressure, Census management had to rely on the few very experienced IT professionals familiar with its systems. As Census itself has noted, this work—conducted without standard policies and procedures, and by an overextended core staff—increased the risks of flawed logic in Census 2000 tabulations.[12]

Census needs to systematically document the requirements a system must meet, and develop processes for communicating, implementing, and managing changes to them. Without a corporate-wide software process, communication regarding software/system requests or problems between the system's stakeholders and developers, and among divisions is compromised. As noted in previous OIG reports, the bureau must implement a disciplined system and software development process that is supported by Census leadership, planning, and training.[13] Research shows that software developed in the absence of a mature process has, on average, five times more defects than software developed according to basic process improvement principles such as requirements management and software quality assurance.[14]

[12] Waite, Preston J., Obenski, Sally M., Buckley, Lisa E., *2010 Census Planning: The Strategy, 2001,* U.S. Census Bureau*,* August 2001. Paper prepared for the 2001 Joint Statistical Meetings, Atlanta.
[13] *Improving Our Measure of America: What Census 2000 Can Teach Us in Planning for 2010*, OIG-14431, Spring 2002.
[14] Paulk, Mark C., *Investing in Software Process Improvement: An Executive Perspective.* SEI, April 29, 2003. Presentation at the 2003 Census SEPG Conference.

B. Census Is Improving Its Software Process

Not wanting to repeat the experience of the last decennial, the bureau has committed to improving its software process using the Capability Maturity Model (CMM) developed by the Carnegie Mellon Software Engineering Institute (SEI), a federally funded research and development center. The CMM for software provides a roadmap for software process improvement and has been a major influence on the global software community. It defines a 5-level framework to take an organization from *ad hoc* and chaotic software process capabilities to ones that are mature and disciplined (see table 2). In applying the model, organizations assess their methods for building software to determine their current capability level. CMM offers guidance for planning and accomplishing the steps to close the gap between the current and more mature levels.

Table 2. An Overview of the Software CMM

Maturity Level	Description	Key Process Areas
1. Initial *Competent people and heroics*	The software process is characterized as *ad hoc*, and occasionally even chaotic. Few processes are defined, and success depends on individual effort and heroics.	
2. Repeatable *Project management processes*	Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.	➢ Requirements management ➢ Software project planning ➢ Project tracking and oversight ➢ Subcontract management ➢ Software quality assurance ➢ Configuration management
3. Defined *Engineering processes and organizational support*	The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard software process for developing and maintaining software.	➢ Organization process focus ➢ Process definition ➢ Training ➢ Integrated software management ➢ Software product engineering ➢ Intergroup coordination ➢ Peer reviews
4. Managed *Product and process quality*	Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.	➢ Quantitative process management ➢ Software quality management
5. Optimizing *Continual process improvement*	Continuous process improvement is enabled by quantitative feedback from the process and from piloting innovative ideas and technologies.	➢ Defect prevention ➢ Technology change management ➢ Process change management

Source: Software Engineering Institute, *The Capability Maturity Model, Guidelines for Improving the Software Process.*

Associated with each maturity level are key process areas that a software development organization must master. CMM describes the steps most important to implementing each key process area. The objective is for the organization to establish a structured process that becomes used, accepted, and institutionalized throughout the organization. When this is achieved, project staff and management rely on this process under virtually all circumstances—even in the face of technical setbacks or compressed schedules.

In January 2002, Census' Associate Director of Information Technology chartered a software engineering process group (SEPG), which has embarked on a multi-year improvement plan to instill a more mature software process throughout the entire bureau. Membership consists of midlevel managers and software engineers drawn from offices throughout Census, including the Geography Division. The bureau intends to take the organization-wide software process from the current *Initial* level (level 1) to a more mature level.

Entities throughout Census—including the Geography Division—have volunteered projects to be CMM test cases. Geography Division volunteered two small, low-risk projects that are not part of the redesign. The SEPG has provided technical support to these projects and disseminated lessons learned from the use of the new processes such as development of a WBS and application of configuration management techniques to documents and other non-software products. In order to familiarize bureau employees with the benefits and requirements of process improvement, the Census SEPG conducted its first annual conference in April 2003, which included presentations by leading CMM experts.

C. Accelerating Software Process Improvement on the Redesign Will Be A Significant Challenge

Absent the guidance provided by a defined process, the initial redesign activities did not produce the results needed to proceed to the next stage of development. Moreover, considerable work and technical challenges remain for the redesign to be completed and thoroughly tested before the 2008 dress rehearsal, and an improved software process is essential to doing so. Upgrading the redesign's current process to CMM level 2 would provide the elements most critical to controlling a complex software project—requirements management; project planning, tracking, and oversight; configuration management; and quality assurance. According to SEI, however, the median time for advancing from level 1 to level 2 is approximately 2 years—more time than the redesign can afford. The redesign project manager recognizes the need for process improvement on the redesign and is committed to reaching CMM level 2 on an accelerated schedule. For the project to reap the benefits of level 2, Census must now determine the strategy and resources needed to significantly accelerate process improvement and provide the management support needed for this effort.

Toward this end, the redesign project manager recently directed the project's technical support contractor to identify key areas in which additional efforts are needed to reach level 2. Using the areas identified, the contractor and the Geography Division's SEPG representative have begun collaborating to devise a strategy for advancement. However, this collaboration is in the early stages and is occurring simultaneously with redesign development activities. Preliminary versions of the project management plan include some process improvement elements, but a comprehensive process improvement strategy and structure do not yet exist. The bureau should develop an approach for the redesign project that draws on both the achievements thus far of the Census-wide software process improvement effort and the strategies offered by the contractor. Designing and implementing—on an accelerated basis—a software process that enhances redesign project work and will not be abandoned under the inevitable pressures to meet scheduled deadlines will be extremely challenging. But without such a process and a senior-

level commitment to making it work, the bureau will repeat its high risk software development approach and jeopardize cost, schedule, and performance goals along the way.

D. Conclusion

The bureau has not used the more mature software processes that the redesign effort demands, and hence lacks the institutional experience, tools, and procedures for doing so. Sufficiently improving the redesign's software process, in conjunction with implementing the needed project management improvements and performing ongoing project work, requires considerable resources and management commitment. However, these improvements are essential to the successful completion of the reengineered MAF/TIGER processing environment and for the system to have the time to be thoroughly tested before the 2008 dress rehearsal.

E. Recommendations

The Census Bureau Director should ensure that the appropriate management officials take the following actions as soon as possible:

1. Design and implement CMM level 2 practices for the redesign project. In so doing, it should consider methods and practices that have already been developed by the Census SEPG and successfully used in pilot tests, as well as those incorporated into the software process of the contractor currently working on the redesign project.

2. Ensure that the redesign project's management plan contains the necessary activities to accelerate its advancement to CMM level 2.

3. Provide the continuing management commitment, resources, and oversight to ensure that all necessary improved software processes are developed and properly used.

Synopsis of Census' Response

In its response to our draft report, the Census Bureau generally concurs with the above finding and recommendations and is taking action to the attain CMM level 2 maturity. Specifically, the redesign project has been working closely with Census' SEPG, its CMM level 3 contractor, and a Geography Division process improvement working group to assess the project's current software process capabilities to identify areas needing improvement. Also, the response states the bureau will revise the redesign's project management plan and schedule to reflect any additional activities that may be needed to accelerate advancement to CMM level 2, if necessary. Moreover, Census has reorganized the decennial directorate to provide additional management support and oversight to the MAF/TIGER redesign project software improvement process.

OIG Comments

The Redesign project's commitment to attain CMM level 2 maturity is a positive step and will require significant effort. Because additional activities will be needed to achieve this maturity level, the baseline project management plan, including the work breakdown structure, *must* be updated to reflect the new activities, along with their resource and schedule requirements.

Appendix A. Acronyms

ACS	American Community Survey
C/S/P	Cost, schedule, and performance
CMM	Capability Maturity Model
COTS	Commercial off-the-shelf
GIS	Geographic Information System
GPS	Global Positioning System
IT	Information technology
MAF	Master Address File
MTEP	MAF/TIGER Enhancement Program
SEI	Software Engineering Institute
SEPG	Software engineering process group
TIGER	Topologically Integrated Geographic Encoding and Referencing
WBS	Work breakdown structure

Appendix B. Principles of Project Management Organization, Planning, and Control

At the start of a major project, senior management establishes the *project management organization*, typically by issuing a charter that describes the roles and responsibilities of the project's management components, including the sponsor (the organization that funds the project), review board (the officials who oversee it), manager, and other key staff. The charter gives the project manager the authority to apply organizational resources to project activities.

With the authority granted by the charter, the project manager and key staff (the project team) begin *planning*—that is, identifying the work needed to meet project objectives within constraints such as staff and funding availability, and considering potential risks. The team defines the project's scope, refining its high-level requirements and specifying the architecture of the proposed system. It then devises a strategy for building the new system and all associated major intermediate products. The team then translates the strategy into a hierarchical work breakdown structure (WBS) that encompasses all activities needed for project completion. For the WBS to be useful in controlling the project, component activities must be specified on a scale small enough to allow for the work to be budgeted, scheduled, assigned, monitored, and evaluated against completion criteria or performance.[1] Activities described on this scale of the WBS are known as work packages, and these are assembled into an integrated cost, schedule, and performance (C/S/P) baseline for managing the project. The results of these various steps are documented in a project plan, which must be regularly updated to reflect any changes to the project that occur along the way.

With the plan in place, the team then manages the project using *controls*: the policies and procedures for obtaining, reporting, and using reliable, timely, and objective project execution data and comparing it against the baseline for decision-making purposes. OMB Circular A-11 requires agencies to use an automated earned value management system to control major information technology projects. Earned value is a measure of the value of work performed so far. Earned value uses original estimates and progress-to-date to show whether the actual costs incurred are within budget and whether the activities are ahead or behind the baseline plan. Earned value management allows for an integrated and objective assessment of cost, schedule, and performance progress by providing measures that show whether the work is being accomplished within the plan's cost estimates and schedule goals, and helps identify activities that are problematic.

As work is conducted, actual cost, schedule, and performance data is collected at regular intervals and put into the earned value management system that allows it to be compared with the C/S/P baseline. A project status report is generated that identifies any deviations from the baseline and that forecasts the final costs and completion dates. With earned value management, managers can have objective measures beginning early in the project's life cycle, and if actual C/S/P exceeds the baseline by a given threshold, may decide to revise the original project plan and baseline.

[1] Performance refers to activity outputs such as physical products produced, milestones or technical performance goals achieved, and other indicators that will be used to measure progress.

Appendix C. Bureau's Response

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

SEP 30 2003

MEMORANDUM FOR Judith J. Gordon
Assistant Inspector General for Systems Evaluation
Office of the Inspector General

Through: Kathleen B. Cooper KBC
Under Secretary for Economic Affairs

From: Charles Louis Kincannon
Director

Subject: *MAF/TIGER Redesign Project Needs Management Improvements to Reduce Decennial System Test Schedule Risk* - Draft Inspection Report No. OSE-15725/August 2003

This memorandum responds to your request of August 29, 2003, for comments on the above-referenced report. The U.S. Census Bureau generally concurs with the overall findings and recommendations contained in the draft report. However, we indicated to your staff that the MAF/TIGER Redesign is not scheduled for completion in time to support a full system test as part of the 2006 Census Test and therefore poses no risk to the 2006 Census Test schedule. Under normal census operational schedules, the production of geographic products begins one and a half years prior to "Census Day" (April 1). This means that the production of geographic products for the 2006 Census Test must begin in the fall of 2004. Because this is a full two years before the scheduled completion of the redesign effort, we have always planned to provide the geographic products needed for the 2006 Census Test from the existing MAF/TIGER system. Although the 2006 Census Test will provide an important opportunity for the Census Bureau to conduct testing of critical decennial systems, our customary test of full, end-to-end system integration is the Dress Rehearsal, scheduled for 2008. We agree that the redesigned MAF/TIGER will require full system integration testing, as well as complete testing of the interfaces with the decennial and other Census Bureau systems. A System Test Plan, providing the details of MAF/TIGER Redesign testing, is scheduled for development in 2004.

We want to thank you and your staff for responding to the concerns we raised and conducting a review that has already led to needed improvements. Our responses to the individual recommendations in the draft report follow.

Responses to Recommendations in Section I

Recommendation 1: *The Census Bureau should dedicate adequate and stable staffing to the redesign project. Census needs to:*

a. *identify staffing requirements, to include an appropriate mix of bureau and contractor employees,*
b. *establish milestones for meeting staffing levels, and*
c. *develop a strategy for overcoming anticipated obstacles, such as funding uncertainties and for prioritizing work demands.*

Census Bureau Response: The Census Bureau concurs with the recommendation. The MAF/TIGER Redesign Project Management Plan identifies the staffing requirements for the project, both federal and contract employees, by fiscal year. The baseline plan was provided to the Office of the Inspector General (OIG) staff on July 22, 2003. We will develop strategies for dealing with anticipated obstacles, such as funding uncertainties, through our formal risk management process. Since the OIG staff completed their data collection early this year, the Geography Division has filled the following key positions for this project:

- Manager for Requirements and Standards
- Manager for Design and Implementation
- Manager for Software Quality Assurance
- System Architect

Recommendation 2: *The Census Bureau should fully define and document the project management organization, to include identification of project management roles and responsibilities, including the decision-making process and management components.*

Census Bureau Response: The Census Bureau concurs with the recommendation. The project management organization and roles and responsibilities are defined and documented in the MAF/TIGER Redesign Project Management Plan. The plan will be modified to more explicitly describe the decision-making process for the project. The Change Control Board will make decisions that impact changes in requirements (scope), cost, or schedule. The project manager is responsible for most other decisions with input from the Division Chief and the MAF/TIGER Redesign Steering Committee.

Recommendation 3: *The Census Bureau should complete the redesign project plan. The plan should*:

a. *incorporate a revised project strategy and objectives based on an assessment of current project risks,*

b. *include contingency plans for delivering essential system requirements in time for the 2006 decennial systems integration test, and*
c. *be updated if the baseline changes.*

Census Bureau Response: The Census Bureau concurs with the recommendation. The MAF/TIGER Redesign Project Management Plan (baseline) was completed following review by the Steering Committee on July 14, 2003. Project risks have been identified and are being assessed. We will change the project plan if risk assessments indicate that a change in strategy is necessary. We will develop contingency plans in the event that the schedule for completion (September 30, 2006) is at risk. Because the MAF/TIGER Redesign is scheduled for completion by September 30, 2006, the 2006 Census Test will be supported using the existing MAF and TIGER databases and legacy systems. Once the 2006 Census Test objectives are defined, we will confirm that the redesigned system would meet the 2006 Census Test requirements once the redesign is deployed.

Recommendation 4: *In accordance with OMB requirements and ANSI/EIA-748-A, establish policies and procedures for controlling the redesign project that call for:*

a. *collecting actual activity-level costs for government and contractor staffs on a regular basis,*
b. *reporting earned value measures to senior and project managers who can take corrective actions when program progress significantly deviates from the baseline, and*
c. *presenting earned value information in the capital asset plan.*

Census Bureau Response: The Census Bureau concurs with the recommendation. In FY 2004, we will report actual activity-level costs for government and contractor staffs on a monthly basis for the MAF/TIGER Redesign Project. We are presenting earned value information about the MAF/TIGER Redesign in the capital asset plan (Exhibit 300) and will report these measures to the Steering Committee. As part of our efforts to achieve CMM level 2, we are introducing procedures that will strengthen our project tracking and oversight.

Recommendation 5: *The Census Bureau should develop a schedule for implementing the above recommendations.*

Census Bureau Response: The Census Bureau concurs with the recommendation. Many of the recommendations have already been implemented. For those not yet implemented, the Census Bureau will develop a schedule for implementation and will provide it to the OIG following issuance of its final inspection report.

Recommendation 6: *The Census Bureau should provide adequate resources, management support, and oversight to ensure that responsibilities are carried out as defined in the project's charter and plan, and that project controls are properly implemented.*

Census Bureau Response: The Census Bureau concurs with the recommendation. The Census Bureau plans to provide adequate resources, management support, and oversight to the project to ensure that responsibilities are carried out and that project controls are properly implemented. We have recently reorganized our Decennial Directorate so that the Geography Division reports directly to Mr. Arnold Jackson, Assistant Director for Decennial Census. Mr. Jackson chairs the MAF/TIGER Redesign Steering Committee and provides additional oversight and support for the project.

Responses to Recommendations in Section II

Recommendation 1: *The Census Bureau should design and implement CMM level 2 practices for the redesign project. In so doing, it should consider methods and practices that have already been developed by the Census SEPG and successfully used in pilot tests, as well as those incorporated into the software process of the contractor currently working on the redesign project.*

Census Bureau Response: The Census Bureau concurs with the recommendation. The Census Bureau has recognized the attainment of CMM level 2 processes as a project objective and remains committed to that objective. We are working closely with the Software Engineering Processing Group, our CMM level 3 contractor, and an internal the Geography Division process improvement working group to establish repeatable software engineering methods.

Recommendation 2: *The Census Bureau should ensure that the redesign project's management plan contains the necessary activities to accelerate its advancement to CMM level 2.*

Census Bureau Response: The Census Bureau concurs with the recommendation. We have conducted an informal assessment of the project for CMM level 2 key process areas, and the assessment results are directing our efforts to areas of needed improvement. If necessary, we will revise the Project Management Plan and schedule to reflect any additional activities that may be needed to accelerate advancement to CMM level 2.

Recommendation 3: *The Census Bureau should provide the continuing management commitment, resources, and oversight to ensure that all necessary improved software processes are developed and properly used.*

Census Bureau Response: The Census Bureau concurs with the recommendation. The Census Bureau plans to provide adequate resources, management support, and oversight to the project to ensure that improved software processes are developed and properly used. As mentioned earlier, we have recently reorganized our Decennial Directorate so that the Geography Division reports directly to Mr. Jackson, Assistant Director for Decennial Census. Mr. Jackson chairs the MAF/TIGER Redesign Steering Committee and provides additional oversight and support for the project.

cc: US/EA