

**The Cost and Schedule Estimation Process
for the Business Systems Modernization
Program Has Been Improved, but Additional
Actions Should Be Taken**

September 2003

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WASHINGTON, D.C. 20220

INSPECTOR GENERAL
for TAX
ADMINISTRATION

September 29, 2003

MEMORANDUM FOR CHIEF INFORMATION OFFICER

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FROM: Gordon C. Milbourn III
Assistant Inspector General for Audit (Small Business and
Corporate Programs)

SUBJECT: Final Audit Report - The Cost and Schedule Estimation Process
for the Business Systems Modernization Program Has Been
Improved, but Additional Actions Should Be Taken
(Audit # 200320024)

This report presents the results of our review of the cost and schedule estimation process for the Business Systems Modernization (BSM) program. The overall objective of this review was to determine if the Business Systems Modernization Office (BSMO) and the PRIME contractor¹ have developed a cost and schedule estimation system that will produce reliable estimates and follow applicable regulations and best practices.

In summary, the BSM program has been plagued with cost and schedule overruns and has been criticized for its ineffective cost and schedule estimation capabilities.² Until recently, the PRIME contractor's cost and schedule estimation process was decentralized at the project level, and the BSMO had not independently reviewed cost and schedule estimates or the PRIME contractor's cost and schedule estimation system. In response to criticism and the need to improve processes, the BSMO has taken the lead by tasking the PRIME contractor to build a program-wide cost and schedule estimation system that is compliant with best practices in the Information Technology industry. In addition, the BSMO is nearing completion of the initial validation of the PRIME contractor's cost and schedule estimation system and has created a process for independently reviewing cost and schedule estimates.

¹ The Internal Revenue Service hired the Computer Sciences Corporation as the PRIME contractor to design and develop modernization programs and projects and created the BSMO to coordinate and oversee the work of the PRIME contractor.

² *IRS Needs to Better Balance Management Capacity with Systems Acquisition Workload* (GAO-02-356, dated February 2002), and *Analysis of Business Systems Modernization Cost, Schedule, and Functionality Performance* (Reference Number 2003-20-007, dated October 2002).

The BSMO and the PRIME contractor have made progress in establishing a program-wide cost and schedule estimation system by developing estimation procedures. In addition, the BSMO and PRIME contractor began other estimation activities, such as establishing a historical database, reviewing and adjusting cost and schedule estimation models, and developing a risk-adjusted model to include an analysis of uncertainty when preparing estimates. These procedures and activities incorporate industry best practices. However, the cost and schedule estimation system had not been validated, and procedures had not been fully implemented during our audit time period. Because significant work remains, we could not determine if the cost and schedule estimation system would produce reliable estimates and follow applicable regulations and best practices.

To provide recommendations for improvement as the cost and schedule estimation capability was being enhanced, we reviewed the current BSMO and PRIME contractor activities and process documentation. We determined that the Chief Information Officer should ensure the BSMO takes additional steps to further enhance the cost and schedule estimation system. Accordingly, we recommended that the Chief Information Officer ensure that all modernization contractors follow cost and schedule estimation guidance, the cost and schedule model calibration³ process is documented, cost and schedule estimation guidance is revised, and an independent assessment of the cost and schedule system is made once improvements are made. We also recommended improving system validation and estimate review processes.

Management's Response: BSMO management requested an extension to respond to our draft report from September 19, 2003, to September 26, 2003. As of September 26, 2003, management had not responded to the draft report.

Copies of this report are also being sent to the Internal Revenue Service managers affected by the report recommendations. Please contact me at (202) 622-6510 if you have questions or Margaret E. Begg, Assistant Inspector General for Audit (Information Systems Programs), at (202) 622-8510.

³ Calibration involves reviewing and adjusting estimation models to ensure that they represent the PRIME contractor's specific cost and product history.

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Background

The Internal Revenue Service (IRS) is currently modernizing its computer systems and business processes and practices. This effort is known as the Business Systems Modernization (BSM). Since the inception of the BSM, the General Accounting Office (GAO) has designated the program as high risk, in part because of its size, complexity, and immense importance to improving IRS performance and accountability.

In December 1998, the IRS hired the Computer Sciences Corporation as the PRIME contractor to design and develop the BSM program and projects. The expectation was that the PRIME contractor would strengthen the IRS' ability to manage and control modernization initiatives. In addition, the IRS created the Business Systems Modernization Office (BSMO) to coordinate and oversee the work of the PRIME contractor.

While the partnership between the PRIME contractor and the BSMO was meant to strengthen systems acquisition and development capabilities, the BSM program has been plagued with cost and schedule overruns and criticized for its ineffective cost and schedule estimation capabilities.

In February 2002, the GAO reported that the BSM cost and schedule estimates being provided to the Congress were contractor-provided "rough order of magnitude" estimates that were not subjected to meaningful, reliable validation by the IRS. The GAO recommended that the IRS adopt effective cost and schedule estimation practices.¹

In addition, we have reported that the BSMO and PRIME contractor have experienced difficulties in meeting cost and schedule estimates. For example, we reported in October 2002 that the BSM program experienced a \$75 million, or 24 percent, cost increase for the 20 projects that had been initiated since 1999.² We also testified this year before the Congress that one of the more critical BSM projects, the

¹ *IRS Needs to Better Balance Management Capacity with Systems Acquisition Workload* (GAO-02-356, dated February 2002).

² *Analysis of Business Systems Modernization Cost, Schedule, and Functionality Performance* (Reference Number 2003-20-007, dated October 2002).

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Customer Account Database Engine, would miss its planned delivery date by at least 20 months.

In response to criticism and the need to improve processes, the BSMO has taken the lead by tasking the PRIME contractor to build a program-wide cost and schedule estimation system that is compliant with best practices in the Information Technology industry. The BSMO is currently validating the PRIME contractor's cost and schedule estimation system, as well as establishing a capability for validating estimates received from the PRIME contractor.

We conducted our audit work at the IRS National Headquarters and the BSM offices in New Carrollton, Maryland, between April and July 2003 in accordance with *Government Auditing Standards*. Detailed information on our audit objective, scope, and methodology is presented in Appendix I. Major contributors to the report are listed in Appendix II.

Progress Has Been Made in Establishing a Cost and Schedule Estimation System

The Federal Acquisition Regulation (FAR) provides that using an acceptable estimation system benefits both the Federal Government and a contractor by increasing the accuracy and reliability of individual proposals.³ Until recently, the PRIME contractor's cost and schedule estimation process was decentralized at the project level, and the BSMO had not independently validated cost and schedule estimates or the PRIME contractor's cost and schedule estimation system. For example, program-level guidance on creating and validating cost and schedule estimates was not available, and historical data on cost and schedule performance within the BSM program were not easily accessible.

The BSMO and the PRIME contractor have made progress in establishing a program-wide cost and schedule estimation system by developing estimation procedures and beginning

³ FAR, 48 C.F.R. part 15.407-5 (2002).

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other estimation activities. These procedures and activities incorporate industry best practices.⁴

- The PRIME contractor developed a guidebook to provide assistance with developing cost and schedule estimates. This guidebook is being updated quarterly to provide additional guidance and respond to recommended improvements.
- The BSMO developed a draft procedure to be followed by the BSMO validation team in performing the validation of the PRIME contractor's cost and schedule estimation system capabilities. The procedure includes a checklist based on the Software Engineering Institute (SEI) guidance to be used in conducting the validation. At the end of our audit work, the BSMO was nearing completion of the initial validation of the cost and schedule estimation system.
- The BSMO developed a draft procedure to provide guidance for an independent review of contractor-provided cost and schedule estimates. The procedure includes a checklist based on the SEI guidance to be used in conducting the reviews. In addition, the BSMO conducted a pilot of three project estimates to verify the adequacy of the procedure.
- The PRIME contractor began establishing a database containing historical cost and schedule data from PRIME projects to be used in preparing future estimates.
- The PRIME contractor began calibrating its estimation models. Calibration involves reviewing and adjusting estimation models to ensure that they represent the PRIME contractor's specific cost and product history.
- The BSMO and the PRIME contractor recently began developing a risk-adjusted model to include an analysis of uncertainty when preparing estimates. This model is

⁴ Best practices include guidance produced by the Software Engineering Institute, which defines effective cost and schedule estimation practices in its model for evaluating organizational cost and schedule estimating capabilities.

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being developed to meet a recent Office of Management and Budget requirement for budget justifications.

Significant activities are being completed to lay the groundwork for a reliable cost and schedule estimation system. However, progress has been slower than expected, and continued management focus is needed to ensure that planned activities are completed and that future improvement activities are initiated and completed.

Continued Management Focus Is Needed to Further Improve Cost and Schedule Estimation Capabilities

While the BSMO and PRIME contractor have made progress in establishing a cost and schedule estimation system, the system had not been validated and procedures had not been fully implemented during our audit time period. Because significant work remains, we could not determine if the IRS' and PRIME contractor's cost and schedule estimation system would produce reliable estimates and follow applicable regulations and best practices.

To provide recommendations for improvement as the cost and schedule estimation capability is being enhanced, we reviewed the current BSMO and PRIME contractor activities and process documentation. We determined that the BSMO could take the following additional steps to further improve the cost and schedule estimation system:

- Complete a schedule for developing the historical cost and schedule database.
- Require all modernization contractors to follow cost and schedule estimation system policies and procedures.
- Document the process for calibrating estimation models and complete a schedule for the calibration.
- Improve the cost and schedule estimation guidebook.
- Conduct a future independent assessment to ensure that the cost and schedule estimation system has the ability to produce reliable estimates.
- Improve BSMO procedures for validating the PRIME contractor's cost and schedule estimation system and reviewing contractor-provided estimates.

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Complete a schedule for developing the historical cost and schedule database

The PRIME contractor is in the process of developing a database to include historical cost and schedule data from PRIME projects. The database is needed to provide a solid historical measurement basis for more accurate estimates. Project managers will use the database to develop estimates for their projects.

Due to competing priorities, not all project data have been provided to the PRIME contractor's Estimation and Measurement staff for inclusion in the database. To further complicate the completion of this task, the project teams have not been collecting consistent data. Also, the process is time-consuming, and there is no detailed schedule for completing the database.

Without a detailed schedule, the BSMO and PRIME contractor do not know when the database will be completed. Until the database is completed, program-wide historical data will not be available to assist project managers in preparing estimates.

Management Action: During the audit, we communicated to the BSMO that the PRIME contractor should prepare a detailed schedule for completing the historical cost and schedule measurement database. During discussions of a preliminary version of this report, the BSMO and the PRIME contractor provided a schedule detailing when the highest priority projects would become part of the historical cost and schedule database.

Require all modernization contractors to follow cost and schedule estimation system policies and procedures

The PRIME contractor's estimation policies and procedures are applicable to the BSM program. However, there is no requirement for non-PRIME contractors involved in the modernization effort to follow the policies and procedures. In addition, there are currently no plans to include non-PRIME contractor cost and schedule data in the historical database.

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For example, the Custodial Accounting Project is a modernization project that is being managed and developed by a non-PRIME contractor. Non-PRIME contractors are not required to follow the policies and procedures in the PRIME contractor's cost and schedule estimation guidebook and have not been requested to provide any measures on their cost and schedule estimates to the PRIME contractor for inclusion in the historical database for modernization.

Without specific requirements for all modernization contractors to follow established policies and procedures, there will not be consistency in the estimation process. In addition, if measures are not collected from all modernization projects, the database will not include all modernization data. The more historical data available in the database for preparing estimates, the more reliable future estimates will be to improve the overall estimation process.

Document the process for calibrating estimation models and complete a schedule for the calibration

The PRIME contractor is in the process of calibrating the estimation models that are currently being used to prepare cost and schedule estimates. The FAR provides that the Federal Government may use various cost analysis techniques and procedures to ensure a fair and reasonable price, given the circumstances of the acquisition.⁵ These techniques and procedures include the reasonableness of estimates generated by appropriately calibrated and validated models.

The PRIME contractor does not have a documented process for the calibration of the estimation models, as required by IRS draft procedures. In addition, there is no detailed schedule to prioritize and complete the calibration of the estimation models. Since there is no process or schedule for the calibrations, the PRIME contractor has not identified the time required to complete the calibrations. Until all models are calibrated, the estimates are being prepared using estimation models that have not been calibrated and, therefore, do not meet the FAR requirement or IRS draft procedures.

⁵ FAR, 48 C.F.R. part 15.404-1 (c)(2)(C) (2002).

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Management Action: During the audit, we communicated to the BSMO that the PRIME contractor should document the process for cost and schedule estimation model calibrations and prepare a detailed schedule for completing the calibration of the estimation models. During discussions of a preliminary version of this report, the BSMO and PRIME contractor provided a status update. The PRIME contractor has created a draft, high-level process for calibrating estimation models. In addition, the PRIME contractor has also created a schedule for completing the calibration of an established industry estimation model, as well as several other estimation models used by the PRIME contractor.

Improve the cost and schedule estimation guidebook

The PRIME contractor is responsible for the establishment of estimation processes to more accurately estimate costs and schedules associated with task order proposals, impact assessments, and change requests. The PRIME contractor developed a guidebook to provide assistance with developing estimates. The guidebook is in its early stages of development and does not include guidance on:

- What documentation is required to support estimates. SEI guidance provides that the estimation process should be documented. During one of the pilot estimate reviews, engineering judgment was used extensively for the estimates. Engineering judgment is acceptable; however, insufficient documentation was provided for how the engineers applied past experience to estimate the current job.

In addition, the PRIME contractor did not provide a schedule for a change request. The PRIME contractor stated that a schedule was not required for the change request, but the BSMO insisted that a schedule was needed. The guidebook and the Enterprise Life Cycle (ELC)⁶ Change Management Process procedure do not include the specific information that should be included with change requests. If all documentation is not

⁶ The ELC is a structured business systems development method that requires specific work products to be developed during different phases of the development process.

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provided to the BSMO estimate review team, the team may not be able to determine if future estimates are reasonable.

- When estimators are required to use a second method in developing estimates. The BSMO estimate review team noted on all three pilot project estimates that there was no second method used when developing estimates. The purpose of using a second method is to validate the estimate and increase its reliability. In addition, using a second method is an SEI best practice and is recommended in the PRIME contractor's estimation guidebook.
- How and where estimation lessons learned should be documented. The ELC requires that lessons learned be documented, including recommendations for improvement for future projects. Without proper guidance, significant lessons learned on cost and schedule estimation may not be documented, shared with other project personnel, and used to improve the estimation process.
- How to prepare estimates for the operations and maintenance phase of projects. The estimation guidebook includes guidance for all ELC phases, except the operations and maintenance phase. The IRS plans to task modernization contractors with the operation and maintenance of systems in the future; therefore, sound management practices dictate that guidance needs to include procedures on how to prepare estimates for the operations and maintenance phase.

Detailed procedures are needed so that project teams know how to provide support for cost and schedule estimates. Without detailed guidance, the staff involved in the estimation process will not know what is specifically required by the policies and procedures, and there will be inconsistencies in how the guidance is followed.

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Conduct a future independent assessment to ensure that the cost and schedule estimation system has the ability to produce reliable estimates

Validation is the process of demonstrating a model's ability to function as a credible estimation tool. Validation ensures that estimation system policies and procedures are established and enforced, and that key personnel have proper experience and are adequately trained. In addition, validation ensures that proper information system controls are established to monitor system development and maintenance activities, and that the model is a good predictor of costs.

The BSMO established a validation team to conduct the validation of the PRIME contractor's cost and schedule estimation system. During the validation process, the team assisted the PRIME contractor in areas that needed to be completed so that they could continue with their validation. This involvement has increased the amount of time needed to complete the validation.

Since the BSMO has been closely involved in both assisting the PRIME contractor with establishing the system while simultaneously validating the system, a third-party opinion may be needed to ensure that the cost and schedule estimation system follows best practices and will produce reliable estimates.

In our opinion, the validation of the cost and schedule estimation system should be independently conducted. Without an independent assessment, the BSMO cannot be confident that the cost and schedule estimation system has the ability to produce reliable estimates and follows applicable best practices. Because the BSM program has been estimated to last as long as 15 years and cost up to \$7 billion, any investment in ensuring that cost and schedule estimates are as reliable as possible is prudent.

Improve BSMO procedures for validating the PRIME contractor's cost and schedule estimation system and reviewing contractor-provided estimates

The BSMO developed two draft procedures to provide guidance for its estimation processes. One procedure is for

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the validation of the PRIME contractor's cost and schedule estimation system, and the other provides guidance on how to conduct an independent review of contractor-provided cost and schedule estimates. Although the procedures are comprehensive, they are focused on the process, not on how to use the results to improve the process.

The BSMO focused initially on establishing processes. The next step will be to add detail to the processes and begin tracking results. We identified the following areas that need additional guidance in the draft BSMO cost and schedule estimation system validation procedure and the draft procedure for independent review of contractor-provided cost and schedule estimates:

- Tracking identified issues – The BSM Risk Management Plan provides that all modernization organizations use the Item Tracking Reporting and Control (ITRAC) system to record and update the status of issues. The BSMO system validation and estimate review procedures provide for limited follow-up of issues identified; however, there is no guidance on including identified issues in the ITRAC system or on tracking the issues through to resolution. Any issues identified in the validation of the cost and schedule estimation system and during the estimate reviews should be tracked in the ITRAC system to ensure that they are resolved. If the issues are not tracked in the ITRAC system, all parties may not be aware of the issues, and the issues may not be resolved timely or at all.
- Providing results to the IRS Procurement function – BSMO procedures do not require that system validation and estimate review reports be provided to the IRS Procurement function. The Procurement function conducts reviews of contractor pricing and cost data to ensure rates charged are appropriate. Understanding the cost and schedule estimation system is important because it is the basis for the cost estimates. The results of the BSMO reviews may affect the degree upon which the Procurement function relies on the contractor's cost data. Without the sharing of information, the

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Procurement function's reviews will not take into consideration issues identified by the BSMO.

- Trending of review results – According to SEI guidance, the estimating capability of an organization should be quantified, tracked, and evaluated. Evidence of maturity in this area includes management tracking and reviewing the effectiveness of its estimation processes. To track and review effectiveness, the BSMO needs to include guidance on trending review results so that areas needing improvement can be identified.
- Providing issues to the system validation team – The cost and schedule estimation system validation team needs to be aware of all issues identified during the estimate reviews so that it can take the issues into account during its periodic validation of the cost and schedule estimation system. Therefore, sound management practices dictate that the estimate review procedure needs to include a requirement that the reports be provided to the cost and schedule estimation system validation team.

If procedures do not include guidance on how to use results to improve the process, the same issues may continue to occur, and the BSM program will not have evidence that cost and schedule estimation capabilities are improving.

Recommendations

To further improve cost and schedule estimation processes, the Chief Information Officer (CIO) should ensure that:

1. All contractors working on BSM projects follow the PRIME contractor's policies and procedures for preparing cost and schedule estimates and provide data for inclusion in the historical database.

Management's Response: BSMO management requested an extension to respond to our draft report from September 19, 2003, to September 26, 2003. As of September 26, 2003, management had not responded to the draft report.

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2. The PRIME contractor documents the process for cost and schedule estimation model calibrations.
3. The PRIME contractor revises the cost and schedule estimation guidebook and applicable ELC references to provide details of what specific documentation is required to support estimates. The CIO should also require the BSMO to ensure that guidance is clarified regarding when a second method is required for preparing estimates.
4. The SEI is requested to conduct an independent review of the cost and schedule estimation system once the initial validation is complete and policies and procedures are fully implemented.
5. The BSMO updates draft procedures to include guidance on:
 - a. Including all issues identified during the cost and schedule estimation system validation and estimate reviews in the ITRAC system.
 - b. Providing cost and schedule estimation system validation and estimate review reports to the IRS Procurement function.
 - c. Trending estimate review results.
 - d. Providing all estimate review findings to the cost and schedule estimation system validation team.

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Appendix I

Detailed Objective, Scope, and Methodology

The overall objective of this review was to determine if the Business Systems Modernization Office (BSMO) and the PRIME contractor¹ have developed a cost and schedule estimation system that will produce reliable estimates and follow applicable regulations and best practices. To accomplish our objective, we:

- I. Determined if the BSMO validation of the PRIME contractor's cost and schedule estimation system would be sufficient to ensure the reliability of cost and schedule estimates.
 - A. Determined the status of the BSMO validation of the PRIME contractor's cost and schedule estimation system and planned corrective action(s).
 - B. Interviewed Internal Revenue Service (IRS) Procurement function personnel to determine the function's involvement in the validation of the PRIME contractor's cost and schedule estimation system.
- II. Determined if the BSMO estimate review process was adequate to provide an independent review of contractor-provided cost and schedule estimates.
 - A. Obtained and reviewed the IRS Cost and Schedule Basis of Estimate Review Checklist for the piloted estimate reviews to determine any identified issues.
 - B. Obtained and reviewed the Cost and Schedule Estimate Report for one of the piloted reviews to determine the completeness of the review.
 - C. Interviewed staff responsible for the estimate review to determine the process used for conducting the reviews.
- III. Determined the process and status of the PRIME contractor's activities for the cost and schedule estimation system.
 - A. Determined if the PRIME contractor had an adequate process in place to establish the centralized, historical database.

¹ The Internal Revenue Service hired the Computer Sciences Corporation as the PRIME contractor to design and develop modernization programs and projects and created the BSMO to coordinate and oversee the work of the PRIME contractor.

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- B. Determined the process being used for calibrating² the cost and schedule estimation system models.
- IV. Determined if the cost and schedule estimation system policies and procedures follow best practice guidance and if improvements could be made.

² Calibration involves reviewing and adjusting estimation models to ensure that they represent the PRIME contractor's specific cost and product history.

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Appendix II

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Appendix III

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