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BUSINESS MODERNIZATION

NASA Must Consider Agencywide Needs to Reap the Full Benefits of Its Enterprise Management System Modernization Effort





Highlights of [GAO-07-691](#), a report to congressional requesters

Why GAO Did This Study

Since 1990, GAO has designated the National Aeronautics and Space Administration's (NASA) contract management as an area of high risk in part because it lacked modern systems to provide accurate and reliable information on contract spending. In April 2000, NASA began a system modernization effort, known as the Integrated Enterprise Management Program (IEMP). When GAO last reported on the status of IEMP in September 2005, NASA had begun to implement disciplined processes needed to manage IEMP, but had yet to implement other best practices such as adopting business processes that improve information on contract spending. This GAO report addresses (1) actions taken by NASA to effectively implement the disciplined processes needed to manage IEMP and (2) the extent to which NASA has considered the strategic issues associated with developing a concept of operations and defining standard business processes. GAO interviewed NASA officials and obtained and analyzed documentation relevant to the issues.

What GAO Recommends

GAO recommends five new actions directed at improving the processes used to manage IEMP, developing a concept of operations, and defining standard business processes. NASA concurred with all five recommendations and described steps it is taking to improve its enterprise management system modernization efforts.

www.gao.gov/cgi-bin/getrpt?GAO-07-691.

To view the full product, including the scope and methodology, click on the link above. For more information, contact McCoy Williams at (202) 512-9095 or Keith Rhodes at (202) 512-6412.

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What GAO Found

Since GAO last reported on NASA's IEMP efforts, NASA implemented its IEMP contract management module and upgraded the software used for its core financial module. NASA has also taken steps to improve its processes for managing IEMP—including implementing improved requirements management and testing processes, enhancing its performance metrics related to tracking system defects, and developing an IEMP risk mitigation strategy. Further, NASA has developed quantitative entry and exit criteria for moving from one phase of an IEMP project to another—a recognized industry best practice. However, NASA has not yet addressed weaknesses in the areas of requirements development and project scheduling, which ultimately caused the agency to assume a greater risk that it would not identify significant system defects prior to implementation of the core financial upgrade. Despite these difficulties, NASA financial managers have stated that the core financial upgrade is now functioning as expected for most transactions. As of the end of GAO's audit work in May 2007, NASA was working to correct a number of system errors, including posting errors for certain types of transactions. Because NASA was still working to stabilize the system, GAO was unable to determine the significance of these weaknesses.

Further, NASA has not yet fully considered higher-level strategic issues associated with developing an agencywide concept of operations and defining standard business processes. With a planned investment of over \$800 million for IEMP, NASA must immediately and effectively address these strategic building blocks if IEMP is to successfully address long-standing management challenges—including overseeing contractor performance and properly accounting for NASA's property, plant, and equipment.

- NASA officials stated that they have begun developing a concept of operations to describe how all of its business processes should be carried out. According to NASA officials, they expect to complete the concept of operations by the summer of 2008. Ideally, a concept of operations should be completed before system development begins so that it can serve as a foundation for system planning and requirements development. Nonetheless, while NASA's IEMP efforts are already well under way, the completion of such a document remains essential for guiding the development of the remaining IEMP modules as well as any future upgrades.
- As part of developing a concept of operations, NASA should also define standard business processes that are supported by its IEMP software. NASA needs to ensure that its business processes and the information that flows from those processes support the enterprise's needs. Efforts that primarily focus on the parochial needs of a specific organizational unit, such as accounting, do not provide reasonable assurance that NASA's agencywide management information needs are addressed.

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United States Government Accountability Office
Washington, DC 20548

July 20, 2007

The Honorable Bart Gordon
Chairman
Committee on Science and Technology
House of Representatives

The Honorable Todd R. Platts
House of Representatives

As we and others have reported in the past, the National Aeronautics and Space Administration (NASA) has fundamental problems with its financial management operations that undermine its ability to effectively manage its major programs and to report externally on its financial operations. Since 1990, we have designated NASA's contract management as an area of high risk, in large part because NASA has lacked a modern financial management system to provide accurate and reliable information on contract spending.¹ In April 2000, NASA began a program expected to address many of its financial and management challenges. This program, now known as the Integrated Enterprise Management Program (IEMP),² has been focused on implementing a new integrated financial management system. Specifically, NASA has invested in an enterprise resource planning (ERP) solution³—a business system that is intended to meet the information needs of both internal and external customers and to promote standardization and integration of business processes and systems across the agency. NASA plans to complete IEMP by 2009 for a total cost of over \$800 million.

In April and November 2003—3 years into the IEMP implementation effort and with significant investment already made in the program—we issued a

¹GAO, *High-Risk Series: An Update*, [GAO-07-310](#) (Washington, D.C.: January 2007).

²The effort was formerly known as the Integrated Financial Management Program (IFMP). According to NASA, IFMP was renamed to reflect the addition of program management and labor distribution.

³An ERP solution is an automated system using commercial off-the-shelf software consisting of multiple, integrated functional modules that perform a variety of business-related tasks such as payroll, general ledger accounting, contract management, and supply chain management.

series of four reports⁴ that detailed weaknesses in NASA's acquisition and implementation strategy for IEMP. Specifically, we reported that NASA had not followed key best practices for acquiring and implementing IEMP and, therefore, was at risk of making a substantial investment in a financial management system that would fall far short of its stated goal of providing meaningful, reliable, and timely information to support effective day-to-day program management and external financial reporting.

NASA is not alone in its struggle to successfully implement an integrated financial management system. Billions of dollars have been spent governmentwide to modernize financial management systems that have often exceeded budgeted cost, resulted in delays in delivery dates, and did not provide the anticipated functionality when implemented. In our previous report⁵ on government financial management systems failures, we provided our views on actions that can be taken to help improve the management and control of agency financial management system modernization efforts. Based on industry best practices, we identified three key practices, or building blocks, that are needed to ensure a solid foundation for agencies' successful system implementation efforts: (1) developing a concept of operations that would define how an agency will carry out its day-to-day operations in order to meet mission needs; (2) defining standard business processes that result in streamlined operations, rather than simply automating old ways of doing business; and (3) effectively implementing the disciplined processes necessary to manage the project.

When we last reported on NASA's IEMP effort, in September 2005,⁶ NASA had begun to implement a number of recommendations from our earlier

⁴GAO, *Business Modernization: Improvements Needed in Management of NASA's Integrated Financial Management Program*, [GAO-03-507](#) (Washington, D.C.: Apr. 30, 2003); *Business Modernization: NASA's Integrated Financial Management Program Does Not Fully Address Agency's External Reporting Issues*, [GAO-04-151](#) (Washington, D.C.: Nov. 21, 2003); *Information Technology: Architecture Needed to Guide NASA's Financial Management Modernization*, [GAO-04-43](#) (Washington, D.C.: Nov. 21, 2003); and *Business Modernization: Disciplined Processes Needed to Better Manage NASA's Integrated Financial Management Program*, [GAO-04-118](#) (Washington, D.C.: Nov. 21, 2003).

⁵GAO, *Financial Management Systems: Additional Efforts Needed to Address Key Causes of Modernization Failures*, [GAO-06-184](#) (Washington, D.C.: Mar. 15, 2006).

⁶GAO, *Business Modernization: Some Progress Made toward Implementing GAO Recommendations Related to NASA's Integrated Financial Management Program*, [GAO-05-799R](#) (Washington, D.C.: Sept. 9, 2005).

reports, including taking steps toward implementing the disciplined processes necessary to manage IEMP—one of the key building blocks discussed above that is needed to ensure a solid foundation for agencies' system implementation efforts. For example, we reported that NASA had implemented new requirements management and testing processes and had developed metrics to evaluate the effectiveness of its system implementation processes. However, at that time, the agency had not implemented our recommendation to properly define and document system requirements for already-deployed IEMP modules, including the core financial module. This was important not only because it would affect the way the core financial module functions but also because it would affect NASA's ability to implement future upgrades and other modules expected to interface with the core financial module. In addition, we reported that additional enhancements could be made in the area of regression testing and performance metrics. Finally, NASA had yet to reengineer its business processes so that the commercial off-the-shelf (COTS) software products it had selected for IEMP could support these processes.

Since we last reported, in September 2005, on NASA's efforts to implement IEMP, NASA implemented its IEMP contract management module and upgraded the version of the COTS software that is used for the core financial module of IEMP—which was expected to enhance the functionality of the core financial module. Because of your continued interest in NASA financial management, you asked us to provide periodic updates on the status of NASA's financial management improvement efforts—including its effort to implement IEMP. Specifically, this report addresses (1) actions taken by NASA to effectively implement the disciplined processes necessary to manage IEMP and (2) the extent to which NASA has considered the higher-level strategic issues associated with developing an agencywide concept of operations and defining standard business processes—two key building blocks critical to NASA's ability to successfully implementing its planned financial management system.

To achieve these objectives, we interviewed the appropriate NASA officials and obtained and analyzed documentation supporting the process improvements that were cited by NASA. We performed our work from January 2006 through June 2007 in accordance with U.S. generally accepted government auditing standards. Details on our scope and methodology are included in appendix I.

Results in Brief

Since September 2005, when we last reported on NASA IEMP implementation efforts, NASA has implemented some of the disciplined processes needed to manage IEMP. Specifically, since 2005, NASA has improved its requirements management and testing processes, enhanced its performance metrics program related to tracking system defects, and developed an IEMP risk management strategy—as we previously recommended. In addition, NASA has developed quantitative entry and exit criteria for moving from one phase of an IEMP project to another—a recognized industry best practice. However, weaknesses in the areas of requirements development and project scheduling offset some of the benefits associated with NASA’s improved requirements management and testing processes, causing NASA to compress the testing phase of its core financial upgrade implementation and assume a greater risk that it would not identify significant system defects prior to implementation.

According to NASA officials, NASA’s ability to complete testing for the core financial upgrade within the planned implementation time frames was not so much due to the use of disciplined processes as it was the result of the extraordinary effort put forth by NASA’s project implementation team. Despite the implementation difficulties, NASA financial managers have indicated that the core financial upgrade is now functioning as expected for most transactions. As of the end of March 2007, the upgrade was in a “stabilization” phase as NASA continued to work on correcting a number of system errors, including posting errors for certain types of transactions. Because the upgrade was still quite new and NASA was continuing to stabilize the system, we were unable to determine whether these weaknesses were significant.

Although NASA has taken action to improve its processes for managing the implementation of individual IEMP projects, NASA has not yet fully considered the higher-level strategic issues associated with developing an agencywide concept of operations and defining standard business processes that are supported by its software—two key building blocks critical to the successful implementation of an integrated system such as IEMP. With a planned investment of over \$800 million, completion of these strategic building blocks will be critical if IEMP is expected to address long-standing management challenges, including overseeing contractor performance and properly accounting for its property, plant, and equipment (PP&E).

NASA officials indicated that they have undertaken a critical first step—they have begun developing a concept of operations to describe how all of its business processes should be carried out. According to NASA officials,

they expect to complete the agency's concept of operations by the summer of 2008. Ideally, a concept of operations should be completed before system development begins so that it can serve as a foundation for system planning and requirements development. Although NASA's IEMP development effort began in April 2000, the completion of such a document, even at this late stage in NASA's IEMP effort, would be beneficial for the development of the remaining IEMP modules as well as any future upgrades to the core financial module. For NASA, an effective concept of operations would describe, at a high level, (1) how all of the various elements of NASA's business systems relate to each other and (2) how information flows among these systems. A concept of operations would also provide a useful tool to explain how business systems at the agency can operate cohesively. It would be geared to a NASA-wide solution rather than individual stovepiped efforts. Further, it would provide a road map that can be used to (1) measure progress and (2) focus future efforts.

As part of an agencywide concept of operations, to best leverage its investment in IEMP, NASA should also analyze its current business processes and determine how these processes can be made more efficient and effective. Specifically, it will be important to define standard business processes supported by its IEMP software that result in streamlined operations rather than simply automating the old ways of doing business. To best leverage its investment in IEMP, NASA needs to ensure that the business processes supported by this system are developed and implemented to support the enterprise's needs rather than primarily focusing on the parochial needs of a specific organizational entity. For example, system efforts targeted at addressing accounting or external financial reporting needs do not provide reasonable assurance that the needs of the program or mission managers are addressed. With an ERP solution, one source of data is used for multiple purposes and processes should be designed to ensure that the data obtained and recorded meet the needs of the enterprise. NASA can take advantage of the efficiencies inherent in its ERP solution by allowing the data needed for external financial reporting to be produced as a by-product of the processes it uses to manage its mission.

We are making five recommendations aimed at improving NASA's processes for managing IEMP as well as addressing the higher-level strategic issues associated with developing a concept of operations and defining standard business processes supported by NASA's IEMP software. In written comments on a draft of this report, NASA agreed with all five of our recommendations and described the steps that it is taking to

improve its enterprise management system modernization efforts. NASA's comments are discussed further in the Agency Comments and Our Evaluation section and are reprinted in appendix II.

Background

For more than a decade, we have identified weak contract management and the lack of reliable financial and performance information as posing significant challenges to NASA's ability to effectively run its largest and most costly programs. While NASA has made some progress in addressing its contract management weaknesses through improved management controls and evaluation of its procurement activities, NASA has struggled to implement a modern, integrated financial management system. NASA made two efforts in the past to improve its financial management processes and develop a supporting system intended to produce the kind of accurate and reliable information needed to manage its projects and programs and produce timely, reliable financial information for external reporting purposes. However, both of these efforts were eventually abandoned after a total of 12 years and a reported \$180 million in spending.

IEMP Implementation Status

In April 2000, NASA began its third attempt at modernizing its financial management processes and systems. With its current financial management system effort, known as IEMP, NASA has invested in an ERP solution that is intended to meet the information needs of both internal and external customers and to promote standardization and integration of business processes and systems across the agency. NASA plans to complete IEMP by 2009 for a total cost of over \$800 million.

As of March 2007, NASA had deployed the following nine IEMP functional components: core financial, Travel Manager, ERASMUS,⁷ resume management, position description management, budget formulation, Agency Labor Distribution System, Project Management Information Improvement, and contract management.⁸ Early in fiscal year 2007, NASA also implemented an updated version of the core financial software, which

⁷ERASMUS is an executive management information system that provides information on costs, schedule, and risks for all significant NASA programs and projects. According to the IEMP Program Director, ERASMUS was discontinued in April 2007.

⁸The contract management module of IEMP is intended to support contract and grant writing and administration, and procurement workload management.

includes several critical enhancements to the previous core financial software.⁹ According to NASA, the core financial upgrade provided the opportunity for it to leverage the best practices inherent in the new version and allowed it to redesign or enhance business processes. NASA updated its core financial system in order to improve compliance with Federal Financial Management System Requirements, Federal Accounting Standards, and the Federal Financial Management Improvement Act, and to respond to GAO recommendations. According to NASA, the software upgrade has enabled it to implement critical process changes related to financial tracking and reporting, support the goal of achieving financial management integrity, and provide better project management information. NASA claims that the updated software has also provided other enhancements, which should contribute to NASA's goals of achieving a clean audit opinion and achieving a "Green" rating on the President's Management Agenda scorecard for "improved financial performance." Other IEMP modules that NASA plans to implement in the future include aircraft management and asset management.

Prior Reporting on IEMP

As discussed previously, we issued a series of four reports in April and November 2003 that detailed weaknesses in NASA's acquisition and implementation strategy for IEMP in general and the core financial module in particular. The core financial module, which utilizes SAP software and is considered the backbone of IEMP, was implemented in June 2003. Because NASA did not follow key best practices or disciplined processes for acquiring and implementing IEMP, we reported that NASA had made a substantial investment in a financial management system that fell far short of its stated goal of providing meaningful, reliable, and timely information to support effective day-to-day program management and external financial reporting. We noted problems in the areas of requirements development, requirements management, testing, performance metrics, risk management, and business process reengineering.

- Neither program managers nor cost estimators were involved in the process of defining requirements for the core financial module. As a result, the module was not designed to maintain the level of detailed cost information needed by program managers to perform contract oversight and by cost estimators to develop reliable cost estimates.

⁹Both the previous and updated versions of the core financial software are from SAP, a company whose integrated software is used by many of the world's largest corporations.

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- The requirements management methodology and tools used to implement the core financial module did not result in requirements that were consistent, verifiable, and traceable or that contained enough specificity to minimize requirement-related defects. Because NASA had not effectively implemented disciplined requirements management processes,¹⁰ we reported that it had increased the risk that it would not be able to effectively identify and manage the detailed system requirements necessary to properly acquire, implement, and test the core financial module.
 - NASA's ability to effectively test the core financial module was limited because of the lack of complete and specific requirements. Industry best practices, as well as NASA's own system planning documents, indicated that detailed system requirements should be documented to serve as the basis for effective system testing.¹¹ Because the link between these two key processes was not maintained, NASA had little assurance that all requirements were properly tested.
 - NASA also did not effectively capture the type of metrics that could have helped the agency understand the effectiveness of its IEMP management processes. For example, NASA did not employ metrics to help it identify and quantify weaknesses in its requirements management processes. Because of its lack of performance metrics, NASA was unable to understand (1) its capabilities to manage IEMP projects; (2) how its process problems affected cost, schedule, and performance objectives; and (3) the corrective actions needed to reduce the risks associated with the problems identified.
 - NASA did not consistently identify known and potential risks for the core financial module. Risk management processes are needed to ensure that a project's risk is kept at an acceptable level by taking actions to mitigate risk before it endangers the project's success.
 - NASA did not use the implementation of IEMP to fundamentally change the way it did business. Instead of reengineering its business

¹⁰According to the Software Engineering Institute, requirements management is a process that establishes a common understanding between the customer and the software project manager regarding the customer's business needs that will be addressed by a project. A critical part of this process is to ensure that the requirements development portion of the effort documents, at a sufficient level of detail, the problems that need to be solved and the objectives that need to be achieved.

¹¹Testing is the process of executing a program with the intent of finding errors.

processes, NASA automated many of its existing ineffective business processes. First, NASA did not design the system to accommodate the information needed to adequately oversee its contracts and programs and to prepare credible cost estimates. Second, NASA did not reengineer its contractor cost reporting processes and therefore, did not always obtain sufficient contract cost information needed by program managers to oversee contracts and needed by financial managers for external financial reporting.

When we last reported on NASA's IEMP effort, in September 2005,¹² NASA had begun to implement a number of recommendations from our earlier reports—including steps toward implementing the disciplined processes necessary to manage IEMP. For example, we reported that NASA had engaged program managers to identify program management needs, implemented new requirements management and testing processes, and developed metrics to evaluate the effectiveness of its system implementation processes. However, at that time, the agency had not implemented several of our other recommendations, including the following:

- Properly define and document system requirements for already-deployed IFMP modules, including the core financial module. This is important not only because it would affect the way the core financial module functions but also because it would affect NASA's ability to implement future upgrades and other modules expected to interface with the core financial module.
- Enhance regression testing processes and performance metrics.
- Develop a risk mitigation plan.
- Reengineer its business processes so that the commercial off-the-shelf software products selected for IEMP could support these processes.

At the time of our last report, NASA was making plans to reengineer some of its business processes. However, because the agency was in the very early planning stage of implementing this recommendation, the details for how NASA would accomplish its objectives were still vague. Overall, our September 2005 report concluded that it was not possible to assess whether NASA's plans would accomplish its stated goal of enhancing the

¹²[GAO-05-799R](#).

core financial module to provide better project management information for decision-making purposes.

Progress Made in Developing Disciplined Project Management Processes, but Some Problems Remain

Since September 2005, when we last reported on NASA IEMP implementation efforts, NASA has implemented some of the disciplined processes needed to manage IEMP. Specifically, NASA has, as we previously recommended, implemented more effective requirements management and testing processes, improved its performance metrics program related to tracking system defects, and developed an IEMP risk management strategy. In addition, NASA has developed quantitative entry and exit criteria for moving from one phase of an IEMP project to another—a recognized industry best practice. However, weaknesses in the areas of requirements development and project scheduling have undermined some of the progress made in other key areas. As a result, NASA struggled to complete required systems testing and deliver the agency’s core financial upgrade. Ultimately, through the heroic efforts of the core financial upgrade team, NASA delivered the upgrade within about 2 weeks of the October 30, 2006, planned completion date. According to NASA officials, the system is functioning as expected for most transactions. However, until the end of March 2007, the upgrade was in a “stabilization” phase as NASA worked on correcting a number of system errors, including posting errors for certain types of transactions. Because the upgrade was still quite new and NASA was continuing to stabilize the system, we were unable to determine the significance of these weaknesses.

Improvements Made to NASA Requirements Management and Testing Processes

Since our September 2005 report, NASA has used its new requirements management process—which documents sufficiently detailed requirements that are traceable from the highest (most general) level to the lowest (most detailed) level in NASA’s requirements management system—for both the core financial upgrade and the contract management module. For example, we selected several requirements for both the core financial module and the contract management module and validated that the requirements management process (1) clearly linked related requirements consistent with industry standards and (2) contained the information necessary to understand how each requirement should be implemented and tested in a quantitative manner.

Because NASA developed and is now using a disciplined requirements management process, it has the quantitative information necessary to support disciplined testing processes. NASA’s disciplined testing

processes include (1) documentation of the scenarios that need to be tested to obtain adequate test coverage, (2) requirements that are traced to the test cases to ensure that all requirements are tested, (3) instructions and other guidance for the testers, and (4) an effective regression testing program.¹³ Although NASA had disciplined requirements management and testing processes in place for the implementation of both the contract management module and the core financial upgrade, difficulties related to requirements development and project scheduling, discussed later, forced NASA to compress the testing phase of its core financial upgrade implementation. As a result, according to NASA officials, completion of testing for the core financial upgrade required an extraordinary effort on the part of NASA's implementation team.

NASA Has Implemented an Effective Metrics Program and Risk Management Strategy

Since we last reported, in September 2005, NASA has also enhanced its metrics measurement program, which is used to evaluate the effectiveness of its project management processes by identifying the causes of process defects. Understanding the cause of a defect is critical to evaluating the effectiveness of an organization's project management processes, such as requirements management and testing. For example, if a significant number of defects are caused by inadequate requirements definition, then the organization knows that corrective actions are needed to improve the requirements definition process. When we last reported, NASA had made progress in this important area by collecting information on the causes of system defects it identified in its regression testing efforts but was not collecting similar information on defects identified by users and lacked a formal process for fully analyzing the data related to system defects by identifying the trends associated with them. Since that time, NASA has developed additional metrics to track and analyze such things as the number of changes made to requirements while a system is under development. In addition, NASA has developed processes for tracking and analyzing defects identified by IEMP users. For example, since implementation of the core financial upgrade, NASA has maintained spreadsheets showing specific information on each service request submitted by users, including the type of defect involved and the status of the request.

¹³Regression testing is the practice of testing changes to a software application before it is released to ensure that modifications have not caused unintended effects and that the system still complies with its specified requirements.

Finally, NASA has also developed a comprehensive risk management strategy. Specifically, NASA now has an IEMP Risk Management Plan that outlines the standard processes and techniques for identifying, analyzing, planning, tracking, and controlling risks as well as defining the roles and responsibilities for each level of project risk management. In applying these techniques to the core financial upgrade, NASA officials documented the risks that they identified for the project, as well as their mitigation strategies, likelihood, consequence, and criticality. According to NASA officials, their risk management process worked well and was one of the key reasons for the success of the core financial upgrade. For example, using the metrics information discussed previously, NASA officials said they were able to assess the risks of changing requirements late in the project and then mitigate those risks by performing additional testing.

NASA Uses a Recognized Industry Best Practice to Move from One Project Phase to the Next

In addition to the disciplined processes discussed above, NASA has also taken action to establish the use of quantitative entry and exit criteria to move from one phase of an IEMP project to another. The use of such criteria is considered an industry best practice. Entry criteria are the minimum essential items considered necessary to enter into a given project phase, while exit criteria are the minimum essential items necessary to consider a given project phase successfully completed. For example, the NASA entry criterion for moving into the regression testing phase requires that all remaining significant defects from the integration testing phase be resolved and successfully retested before regression testing can begin. NASA demonstrated application of this criterion when it implemented the contract management module. About 3 weeks before the scheduled start date of regression testing, the project had not yet successfully completed all test scenarios, and several significant defects had not been fully resolved. In addition, a series of critical corrections from the software vendor had not yet been delivered, and the project team agreed that there would not be adequate time to test the corrections prior to beginning the scheduled regression testing. Consequently, the team decided to push back the scheduled date for the contract management module to begin operating.

For the core financial upgrade, NASA officials said that they used entry and exit criteria as one of the management tools to determine whether the project should move forward. However, rather than adopt a “hard stop” approach when criteria were not met, they used the criteria to make sure that all appropriate factors were considered before moving forward, including the risks of not meeting certain criteria. Any instances in which the project team thought exceptions to the criteria were warranted were

ultimately reviewed and decided on by higher levels of NASA management, which helped ensure that such decisions were adequately considered.

Improved Requirements Development and Project Scheduling Needed

Weaknesses in the areas of requirements development and project scheduling offset some of the benefits associated with NASA's improved requirements management and testing processes—causing NASA to assume a greater risk that it would not identify significant system defects prior to implementation. Weaknesses in requirements development and project scheduling processes resulted in NASA having to compress the testing phase of its core financial upgrade implementation. As a result, according to NASA officials, NASA's ability to complete testing for the core financial upgrade within the planned implementation time frames ultimately depended on the extraordinary effort put forth by NASA's project implementation team.

Because of weaknesses in NASA's requirements development process, it did not have reasonable assurance that it identified all appropriate requirements for the core financial upgrade when the project began. Consequently, NASA continued making changes to the requirements very late in the project's development, resulting in increased risks, delays, and a compressed testing schedule. Improperly defined or incomplete requirements have commonly been identified as a root cause of system failure. Although NASA made a concerted effort, as part of its core financial system upgrade, to involve program managers and other key stakeholders in the requirements development process, it did not follow standard industry practices for identifying and documenting user requirements.

According to the Software Engineering Institute (SEI),¹⁴ to help ensure that critical requirements are identified, an organization should have a well-documented, disciplined requirements development process that, among other things, (1) defines how customer needs will be elicited, developed, and validated; (2) specifies how to identify and ensure involvement of relevant stakeholders; and (3) ensures that people involved in the requirements development process are adequately trained in such topics

¹⁴Mary Beth Chrissis, Mike Konrad, and Sandy Shrum, *CMMI: Guidelines for Process Integration and Product Improvement*, SEI Series in Software Engineering (Boston, Mass.: Pearson Education, May 2004).

as requirements definition and analysis. In addition, it is critical that requirements flow from an organization's business requirements or its concept of operations. However, as discussed later, NASA has not yet completed a concept of operations.

In developing its core financial upgrade requirements, NASA established a task force, consisting of both financial and program managers, whose primary objective was to "review, assess, and document Program/Project Management requirements as they relate to financial management." In addition, other groups of program managers were asked to review the requirements and provide input to the task force. However, according to NASA officials, they have not yet documented and institutionalized requirements development procedures as recommended by SEI. Lacking documentation, NASA cannot ensure that appropriate procedures are followed and that all appropriate stakeholders are included in the process so that all requirements are identified. Moreover, the requirements that were addressed by the task force and user groups were at a very high or general level and therefore, lacked a level of specificity that is needed to ensure that users' needs are met.

Because it did not have a well-documented, disciplined requirements development process in place to provide reasonable assurance that all requirements had been identified, NASA delayed finalizing the system's expected functionality until April 2006—about 6 months before the upgrade was expected to be implemented—and continued to change some requirements for several months after that. Delays in finalizing the requirements contributed to delayed testing and a compressed testing schedule. To meet the planned October 30, 2006, implementation date, the three rounds of system testing for the core financial upgrade were scheduled to occur from mid-June through September 22, with less than a week between each round. A less compressed schedule could have allowed more time between the testing cycles to perform necessary actions, such as additional development work and testing to adequately address the defects that had been identified. This, in turn, could have reduced the risk that significant system defects would not be detected prior to implementation.

One key to developing a realistic project schedule is determining the sequence of activities, which requires identifying and documenting the dependencies among the various project activities. For example, testing activities cannot be completed before the software being tested is developed, and software should not be developed until requirements have been defined. However, NASA did not document the dependencies among

the detailed project tasks for the core financial upgrade and therefore, did not have reasonable assurance that the project schedule established at the start of the project was realistic. According to NASA officials, they recognized this risk and adopted several processes to identify and mitigate the weakness, such as having knowledgeable project officials review the schedule and holding weekly status meetings to determine whether the tasks were on schedule.

While the techniques used by NASA to constantly evaluate and adjust the schedule are considered best practices and allowed NASA to gain confidence in the schedule as the core financial upgrade project progressed, they were not sufficient to ensure that the original schedule was reasonable because they relied on ad hoc processes rather than a formal task dependency analysis. If NASA had also identified the task dependencies for the core financial upgrade, it would likely not have had to rely on extraordinary efforts to complete the project. Rather, project management would have been in a better position to assess the difficulty in meeting the planned schedule and to take further steps to reduce this risk, such as scaling back some aspects of the project or adding more resources to the project.

According to NASA officials, through the heroic efforts of IEMP staff—their knowledge and experience with past projects and a considerable amount of overtime invested—the core financial project team was able to complete testing and other work within about 2 weeks of the planned implementation date. Although NASA has made significant improvements in its project management processes, NASA management recognizes that weaknesses in its requirements development and project scheduling processes have undermined some of the progress made. Despite the implementation difficulties, NASA financial managers have indicated that the core financial upgrade is now functioning as expected for most transactions. Through the end of March 2007, the upgrade was in a “stabilization” phase as NASA continued to work on correcting a number of system errors, including posting errors for certain types of transactions. Because NASA was continuing to stabilize the system during most of our audit period, we were unable to determine the significance of these weaknesses.

NASA Has Not Yet Fully Considered an Enterprise View of Its Operations and Processes

Although NASA has significantly improved its processes for implementing IEMP projects, these improvements are directed at implementing the desired functionality for an individual project. NASA has not yet fully considered the higher-level strategic issues that affect how useful IEMP will be in addressing long-standing management challenges—including problems associated with stovepiped systems and parochial interests of individual NASA components as well as problems in overseeing contractor performance and properly accounting for its property, plant, and equipment. NASA envisions IEMP to be a leading-edge business system¹⁵ that will provide management information needed for mission success, meet the needs of internal and external customers, and promote standardization and integration of business processes and systems across NASA. To achieve this vision, it is critical that NASA develop an agencywide concept of operations and adopt standard business processes that are supported by its software.

Concept of Operations Would Provide an Important Foundation for IEMP

NASA officials stated that they have undertaken a critical first step to achieving their vision for IEMP—they have begun developing a concept of operations to describe how all of its business processes should be carried out. NASA created a framework for developing a concept of operations in fiscal year 2006 and plans to complete it by the summer of 2008, according to NASA officials. Ideally, a concept of operations should be completed before system development begins so that it can serve as a foundation for system planning and requirements development. Nonetheless, the completion of such a document even at this late stage in NASA's IEMP effort would be beneficial for the development of the remaining IEMP modules as well as any future upgrades to the core financial module. In addition, once a concept of operations is complete, NASA could reassess the modules that are already implemented and determine whether and how they might need to be modified to best meet its agencywide needs.

A concept of operations defines how an organization's day-to-day operations are (or will be) carried out to meet mission needs. The concept of operations includes high-level descriptions of information systems, their interrelationships, and information flows. It also describes the operations that must be performed, who must perform them, and where and how the

¹⁵A business system is an information system that is used to support business activities such as acquisition, financial management, logistics, strategic planning and budgeting, installations and environment, and human resources management.

operations will be carried out. Further, it provides the foundation on which requirements definitions and the rest of the systems planning process are built. Normally, a concept of operations document is one of the first documents to be produced during a disciplined development effort and flows from both the vision statement and the enterprise architecture.¹⁶ According to Institute of Electrical and Electronics Engineers (IEEE) standards,¹⁷ a concept of operations is a user-oriented document that describes the characteristics of a proposed system from the users' viewpoint. The key elements that should be included in a concept of operations are major system components, interfaces to external systems, and performance characteristics such as speed and volume.

For NASA, an effective concept of operations would describe, at a high level, (1) how all of the various elements of NASA's business systems relate to each other and (2) how information flows among these systems. Further, a concept of operations would provide a useful tool to explain how business systems at the agency can operate cohesively. It would be geared to a NASA-wide solution rather than individual stovepiped efforts.¹⁸ Further, it would provide a road map that can be used to (1) measure progress and (2) focus future efforts. While NASA's enterprise architecture efforts, when fully completed, can be used to help understand the relationships between the various systems, a concept of operations document presents these items from the users' viewpoint in nontechnical terms. Such a document would be invaluable in getting various stakeholders, including those in the programs and administrative activities, to understand how the business systems are expected to operate cohesively and how they fit into "the big picture."

¹⁶An enterprise architecture is a blueprint that defines, both in logical terms (including integrated functions, applications, systems, users, work locations, and information needs and flows) and technical terms (including hardware, software, data, communications, and security), how an organization's information technology systems operate today and how they are to operate in the future and provides a road map for the transition.

¹⁷IEEE Std. 1362-1998.

¹⁸For example, as we discuss later, NASA receives two different types of cost reports from its major contractors. Even though both types of reports pertain to the same costs for a given contract, one report is used for financial management while the other is used for program management. A concept of operations might describe how NASA could use the information from only one report for both purposes.

Adopting Enterprise Business Processes Would Help NASA Transform the Way It Does Business

As part of an agencywide concept of operations, to best leverage its investment in IEMP, NASA should also analyze the agency's current business processes and determine how these processes can be made more efficient and effective. Specifically, NASA needs to ensure that the business processes supported by this system are developed and implemented to support the enterprise's needs rather than primarily focusing on the needs of a specific organizational entity. For example, system efforts targeted only at addressing accounting or external financial reporting needs—as was done during the initial implementation of the core financial module—do not provide reasonable assurance that the needs of the mission managers or other support organizations are addressed as well. Our review identified an important opportunity for NASA to leverage its investment in IEMP by using the system's inherent business processes to meet the enterprise's needs.

Agencies such as NASA that invest in ERP solutions to meet their enterprise needs often face difficulty in shifting from the stovepiped processes of the past to the enterprise processes that underlie the ERP concept. According to technical experts,¹⁹ a key benefit of an effective ERP system is that the system provides the entire entity consistent data regardless of which entity component generates a request or for what purpose; the system maintains data based on the concept of “one truth.” In other words, in non-ERP environments, one system may have one amount for an agency's obligations while another system has another amount for the same obligations. While either of these systems may be the “official system,” actions and plans may be based on information in the other system. In order for all of an organization's actions and plans to be consistent, the same information needs to be available and used by all segments of that organization. Under the ERP concept, it does not matter whether an individual is in budget, accounting, procurement, or any other organizational component; the answer to the question of “how much money has been obligated and how much is still available” is consistent.

One example of an opportunity for NASA to use enterprise processes to accomplish multiple needs is in the area of program oversight and accounting for PP&E. NASA typically spends about 85 percent of its budget procuring goods and services from its contractors each year.

¹⁹Thomas F. Wallace and Michael H. Kremzar, *ERP: Making It Happen; The Implementers' Guide to Success with Enterprise Resource Planning* (New York: John Wiley & Sons, Inc., 2001).

Therefore, much of the cost information NASA needs to oversee its programs and compile its external financial reports resides with its contractors. For its larger contracts,²⁰ NASA generally obtains cost data from monthly contractor financial management reports, commonly referred to as NASA Form 533s. NASA Form 533 captures planned and actual contract costs and, according to NASA officials, is used for budgeting, monitoring contract costs, and controlling program resources. The Office of the Chief Financial Officer (OCFO) also uses NASA Form 533 to capture the costs reported on the agency's financial statements. However, NASA Form 533 does not contain information related to the status of work performed on a contract. Therefore, for all major acquisitions²¹ and for development or production contracts and subcontracts valued at \$20 million or more, in addition to NASA Form 533s, NASA's contractors are also required to provide monthly contract cost performance reports. Each of these reports is treated as a stovepiped activity; that is, they provide cost information for a given contract in two different formats and are used by different organizations and for different purposes within NASA.

For those contracts for which NASA receives contract cost performance reports in addition to Form 533s, program managers use the cost performance reports to monitor contract performance, while the OCFO uses NASA Form 533 to accrue costs that, among other things, are reported on the agency's financial statements. Although NASA Form 533 and the cost performance report reflect cost data pertaining to the same contract, the level of detail provided in each report may vary considerably depending on the contractor cost reporting requirements negotiated as part of the contract. For example, the cost data required by program managers to manage major acquisitions are often more detailed than those required by the OCFO. In addition, because neither the cost performance report nor NASA Form 533 contains the information needed by the OCFO

²⁰NASA requires its contractors to report monthly accrued costs on NASA Form 533 for cost type, price redetermination, and fixed-price incentive contracts with a performance period of 1 year or more and a contract value of \$500,000 to \$999,000 or a performance period of less than a year but with a contract value of \$1 million or more.

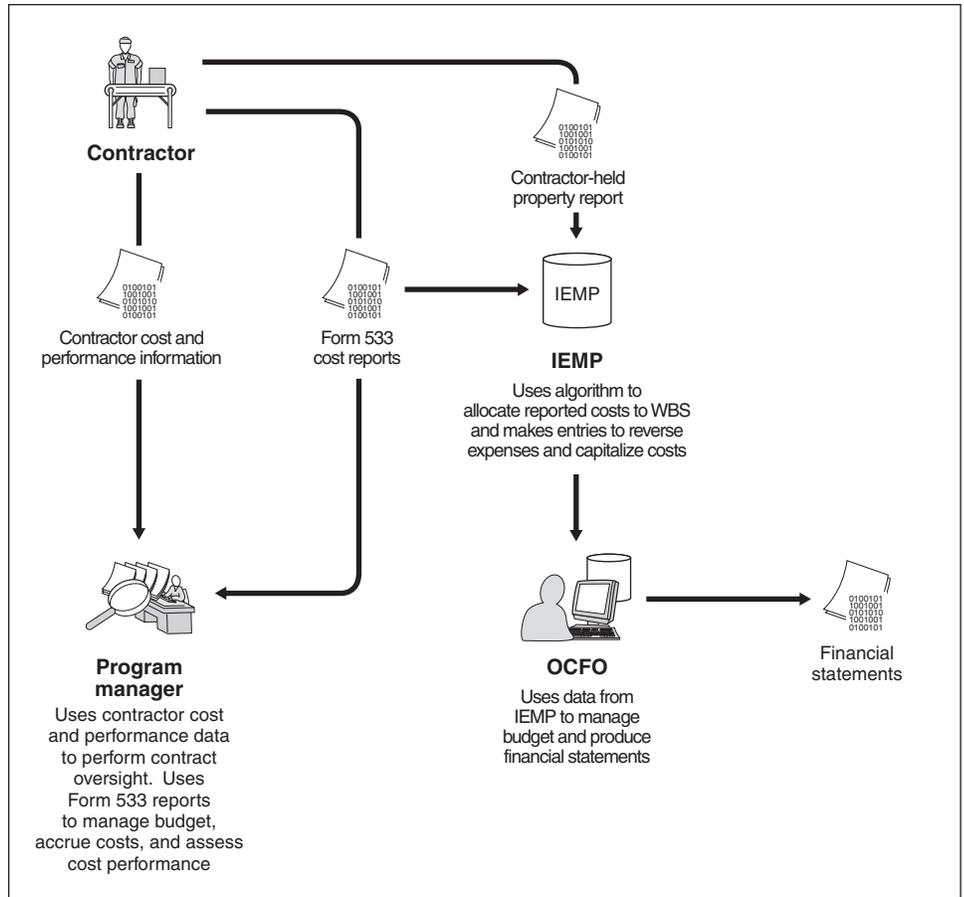
²¹A major acquisition, as defined by OMB Circular A-11, means a system or project requiring special management attention because of its importance to the mission or function of the agency, a component of the agency, or another organization; is for financial management and obligates more than \$500,000 annually; has significant program or policy implications; has high executive visibility; has high development, operating, or maintenance costs; or is defined as major by the agency's capital planning and investment control process.

to properly account for equipment and other property acquired from contractors, NASA also relies on periodic, summary-level information provided by its contractors to report property amounts on its financial statements.

When NASA initially implemented its IEMP core financial module in June 2003, it did not adequately consider program managers' needs and did not design the system to accommodate the more detailed cost data contained in contractor cost performance reports. Since that time, NASA has redesigned the coding structure embedded in the core financial module to be more consistent with the work breakdown structure (WBS) coding used by program managers. However, NASA continues to use cost data from NASA Form 533—generally reported by contract line items²²—to populate the core financial module. As a result, as shown in figure 1, NASA uses a complex, NASA-specific process to allocate the costs reported on NASA Form 533 to the WBS codes in IEMP based on available funding.

²²Contract line items are usually consistent with higher levels of the WBS, but do not contain the details that are found in the lower levels of the WBS.

Figure 1: Current NASA Processes for Oversight of Large, Complex Contracts and for Asset Accounting



Source: GAO.

In a very simplified example,²³ if NASA received a Form 533 showing \$1,000 of cost incurred for a particular contract line item and two WBS codes pertained to that line item, NASA would allocate the costs to those two WBS codes. Assuming WBS 1 had more funding available than WBS 2, NASA might allocate \$600 to WBS 1 and \$400 to WBS 2. However, the contract cost performance report might show that the actual costs were

²³This example is for illustrative purposes only; the dollar amounts in the example are not based on actual NASA data.

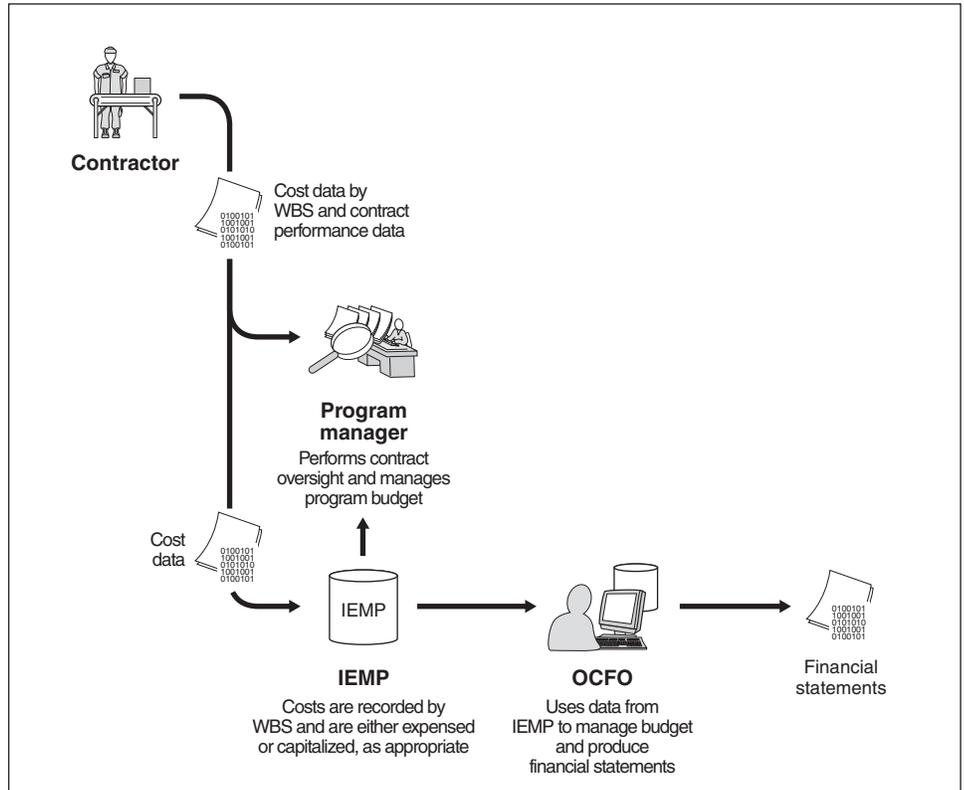
\$500 for WBS 1 and \$500 for WBS 2. Although this allocation process reorganizes cost data reported on NASA Form 533 into the same reporting structure that is used by program managers, it still results in different costs, maintained in different systems, used for different purposes. Accordingly, these separate processes do not result in the “one truth” that is provided when an ERP view is taken.

Further, this dual reporting approach has not addressed one of NASA’s long-standing financial reporting weaknesses: reporting on its PP&E. For example, NASA’s processes do not allow the agency to identify capital costs—that is, those that should be recorded as assets—as they are incurred. Instead, as we recently reported,²⁴ the agency performs a retrospective review of transactions entered into its property system to determine which costs should be capitalized. This subsequent review is labor-intensive and error-prone, and therefore increases the risk that not all related costs will be properly captured and capitalized.

Figure 2 provides an example of how NASA could use IEMP to implement an enterprise process that (1) provides the necessary data for the enterprise operations and (2) reduces the burden on NASA and contractor officials.

²⁴GAO, *Property Management: Lack of Accountability and Weak Internal Controls Leave NASA Equipment Vulnerable to Loss, Theft, and Misuse*, GAO-07-432 (Washington, D.C.: June 25, 2007).

Figure 2: Example of How NASA Could Follow an Enterprise Process Using IEMP for Program Management and External Reporting



Source: GAO.

As shown in figure 2, if NASA received only one monthly report containing contract cost data reported in sufficient detail for both program management and financial reporting purposes, then it could record these costs directly in IEMP without first going through an allocation process as it does now. All individuals and components throughout NASA could then use the same cost data that reside within IEMP for a given contract; IEMP could provide different arrays of cost information based on each user's needs, but all cost information for a given contract would come from one source. For example, as shown in figure 2, the program manager could use the cost data from IEMP along with other supplemental contractor performance information, such as labor hours used, to see if the project is meeting expectations. In addition, if discrete WBS codes were established to identify the costs associated with the acquisition of property, then IEMP

could automatically capitalize those costs and financial managers could readily determine how much cost has been recorded for property.²⁵ The key is that under the enterprise process concept, single data entry is used for multiple purposes. Since the enterprise view provides “one truth,” an adequate audit trail over the data used to report property can be maintained simply by reviewing the cost reports that were provided by the contractors. Thus, NASA can take advantage of the efficiencies inherent in an ERP solution by allowing the data needed for external financial reporting to be produced as a by-product of the processes it uses to manage its mission.

Conclusions

NASA has made significant strides in developing and implementing more disciplined processes for supporting its IEMP efforts since our last report in 2005. NASA has recognized the need for the disciplined processes necessary to reduce risks to acceptable levels, as evidenced by its implementation of several of our recommendations. More importantly, NASA officials recognize that improving system implementation processes is a continuous effort and that certain processes—particularly requirements development and project scheduling—may need more attention. However, the real key to realizing NASA’s IEMP vision is for NASA’s management to develop an overarching strategy for managing its agencywide management system development effort. We are encouraged that NASA has begun to develop a concept of operations. As part of the development of this document, it will be critical for NASA to define (1) the agency’s business processes and information needs and (2) the types of systems that will be used to carry out these processes and produce the necessary information. Another critical factor in developing a concept of operations will be analyzing the agency’s current business processes and determining how these processes can be made more efficient and effective. For example, NASA can take advantage of the efficiencies inherent in the solution it has selected by utilizing an enterprise view to produce the data needed for external financial reporting as a by-product of the processes it uses to manage its mission. Unless NASA devotes immediate, focused attention to taking these critical strategic planning steps, it will continue to face the risk that its planned \$800 million investment in IEMP will not achieve the transformational changes

²⁵In its technical comments on a draft of this report, NASA stated that it plans to establish unique WBS codes for contractors to use to report asset costs on the Form 533. It is too early to determine the extent to which these plans might address agencywide information needs.

necessary to provide NASA with the information needed to make well-informed business decisions and to effectively manage its operations.

Recommendations for Executive Action

To help ensure that disciplined processes are effectively implemented for future IEMP modules, upgrades, or other business systems, we recommend that the NASA Administrator direct the IEMP Program Director to take the following two actions.

- Establish requirements development policies and procedures regarding (1) how customer needs will be elicited, developed, and validated; (2) how to identify and ensure the involvement of relevant stakeholders; and (3) required training in such topics as requirements definition and analysis to be provided to people involved in the requirements process.
- Develop policies and procedures that require project schedules to include the identification and documentation of dependencies among various project tasks.

To help ensure that future IEMP projects are designed to carry out NASA's mission in an efficient manner that meets the needs of all users, we recommend that the NASA Administrator establish as a high priority the completion of a concept of operations that addresses NASA's business operations for both its mission offices and administrative offices (such as financial management and human capital) before any new implementation efforts begin.

Once the concept of operations is complete, we recommend that the NASA Administrator review the functionality of previously implemented IEMP modules for the purpose of determining whether enhancements or modifications are needed to bring them into compliance with the concept of operations.

To help ensure that NASA receives the maximum benefit from its reported \$800 million investment in IEMP, we recommend that the NASA Administrator establish policies and procedures requiring approval to establish or maintain business processes that are inconsistent with the processes inherent in the COTS solutions selected for IEMP. The reasons for any decisions made to not implement the inherent COTS processes should be well-documented and approved by the Administrator or his designee. At a minimum, approved documentation should address any decisions to maintain current contractor cost reporting processes rather

than revise these processes to facilitate the use of one consistent source of cost data.

Agency Comments and Our Evaluation

We received written comments on a draft of this report from NASA, which are reprinted in appendix II. NASA agreed with our recommendations and described the approach and steps it is taking or plans to take to improve its enterprise management system modernization efforts. We are encouraged that a number of these steps are already under way, including the establishment of an IEMP advisory body representing NASA's missions and centers. As NASA progresses in addressing our recommendations, it is important that it focuses on the concepts and underlying key issues we discussed, such as considering the need to reengineer key business processes to support agencywide needs and to take full advantage of its ERP solution. We continue to believe that careful consideration of all of the building blocks and key issues we identified will be integral to the success of NASA's efforts. NASA also provided technical comments, which we incorporated as appropriate.

As agreed with your offices, unless you announce its contents earlier, we will not distribute this report further until 30 days from its date. At that time, we will send copies to interested congressional committees, the NASA Administrator, and the Director of the Office of Management and Budget. We will make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions concerning this report, please contact McCoy Williams at (202) 512-9095 or williamsm1@gao.gov or Keith Rhodes at (202) 512-6412 or rhodesk@gao.gov. Key contributors to this

report are acknowledged in appendix III. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report.



McCoy Williams
Director
Financial Management and Assurance



Keith A. Rhodes
Chief Technologist
Applied Research and Methods
Center for Technology and Engineering

Appendix I: Scope and Methodology

To determine whether the National Aeronautics and Space Administration (NASA) has improved its management processes for implementing the Integrated Enterprise Management Program (IEMP), we reviewed project management documentation for several IEMP projects, including the core financial upgrade and the contract management module. The documentation we reviewed for these projects included requirements management documents, detailed testing plans, project schedules, risk management plans, and metrics documentation. We also interviewed numerous IEMP officials, including the IEMP Director, the Director and Assistant Director at the IEMP Competency Center, and the Manager of IEMP Application Development and Software Assurance. In addition, we interviewed the leader of a NASA team that provided an independent assessment of the core financial upgrade project to obtain his views of IEMP management processes.

To assess NASA's implementation of disciplined processes, we reviewed industry standards and best practices from the Institute of Electrical and Electronics Engineers, the Software Engineering Institute, and the Project Management Institute. To assess the effectiveness of NASA's requirements management processes, we performed a traceability analysis of several requirements for both the contract management module and the core financial upgrade, which demonstrated that there was traceability among the different levels of requirements and with testing documentation. To determine whether NASA had adequately and systematically determined the information needs of key users of IEMP data when developing system requirements, we reviewed documentation of NASA's requirements identification effort for the core financial upgrade and interviewed a number of program managers and staff who worked on various space and science programs at three NASA centers—Marshall Space Flight Center, Johnson Space Center, and Goddard Space Flight Center. We also met with officials from the Office of the Chief Financial Officer (OCFO), including the Deputy Chief Financial Officer, and with officials from the Office of the Chief Engineer to obtain their opinions regarding the requirements of the core financial upgrade. In addition, we discussed the requirements development methodology with IEMP management.

To determine the results of the implementation of the core financial upgrade, we met with both IEMP and OCFO officials. We reviewed data on the amount and types of system defects that were identified by users during the project's stabilization phase. We also obtained written responses to specific questions about the results of the implementation from three NASA centers.

To determine the extent to which NASA has considered the higher-level strategic issues associated with developing an enterprisewide concept of operations and defining standard business processes, we met with senior management from IEMP and the OCFO. In addition, we also discussed these issues with senior officials in the Office of the NASA Administrator. We also interviewed IEMP officials about NASA's current processes for recording contract costs. We also discussed this issue with officials from the OCFO, the Office of the Chief Engineer, and the Office of Program and Institutional Integration. In addition, we obtained documentation of NASA's plans for reengineering processes related to the costs of capital assets. We briefed NASA officials on the results of our audit, including our findings and their implications. On May 25, 2007, we requested comments from NASA and we received them on June 21, 2007. NASA also separately provided technical comments. Our work was performed from January 2006 through June 2007 in accordance with U.S. generally accepted government auditing standards.

Appendix II: Comments from the National Aeronautics and Space Administration

National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001



June 21, 2007

Mr. McCoy Williams
Director
Financial Management and Assurance
United States Government Accountability Office
Washington, DC 20548

Dear Mr. Williams:

Thank you for the opportunity to review and comment on the draft report entitled "NASA Must Consider Agencywide Needs to Reap the Full Benefits of Its Enterprise Management System Modernization Effort" (GAO-07-691), dated June 2007. I appreciate the Government Accountability Office's (GAO) interest in NASA's business modernization as the Agency continues to improve its business environment, which is also fully consistent with my own personal priorities for enhancing the Agency's ability to better manage and report on its mission and goals.

NASA appreciates the GAO noting that "NASA has made significant strides in developing and implementing more disciplined processes" since it last reported in this area in 2005. Clearly, NASA's Integrated Enterprise Management Program (IEMP) has matured in its processes since its inception in 2000, which has contributed to its successes in planning, developing, implementing, and operating Agency-wide business applications – a daunting task for any Federal organization. Nevertheless, we also recognize more work needs to be done if NASA is to achieve the full benefit of its investments in this area.

In its draft report, the GAO makes five recommendations aimed at improving the processes used to manage IEMP, ensuring that NASA's business systems support NASA's missions and maximize the Agency's benefit of its investment in its business systems modernization. NASA's response to each of these five recommendations is provided below.

Recommendation 1: Establish requirements development policies and procedures regarding (1) how customer needs will be elicited, developed, and validated, (2) how to identify and ensure the involvement of relevant stakeholders, and (3) required training in such topics as requirements definition and analysis to be provided to people involved in the requirements process.

Response: NASA concurs with this recommendation. As noted in the GAO report, IEMP has made significant improvements to its requirements processes for projects in formulation and implementation. In addition to those improvements, the IEMP is now using an iterative software development implementation approach that provides for formal product reviews at the end of each development iteration, soliciting feedback from a wide range of stakeholders.

This feedback is used to validate requirements, as well as to elicit additional or changed requirements early in the project life cycle. The new approach provides more opportunity to validate stakeholder and user requirements than the previous development methodology. Further, NASA's Operations Management Council (OMC) chartered the Management/Business Systems Integration Group (M/BSIG) as an advisory body to recommend and prioritize future IEMP requirements. Membership is comprised of representatives from Mission Support Organizations, Mission Directorates, and Centers. The focus of the M/BSIG is to assess and prioritize future IEMP requirements from a strategic and cross functional perspective, taking into account the end-to-end business processes. Recommendations from the M/BSIG are reviewed and approved by the OMC. In conjunction with the establishment of the M/BSIG, IEMP has established the role of Integration Manager, which is responsible for applying systems engineering techniques to the identification, prioritization, development, and collation of requirements for future business systems implementation. The IEMP Integration Manager and the IEMP Competency Center will assess the systems' capabilities to efficiently meet the proposed requirements, and recommendations and assessments will be vetted by the M/BSIG.

Notwithstanding the above improvements, IEMP recognizes that policies and guidance in this area are not cohesively documented. The IEMP Integration Manager will document a singular policy framework regarding the identification and prioritization of requirements associated both with new efforts and with modifications to operational systems. This framework will also describe a process to elicit customer needs, develop requirements, prioritize those requirements, and obtain cross function Agency approval. The target date for completion of this document is December 2007.

Recommendation 2: Develop policies and procedures that require project schedules to include the identification and documentation of dependencies among various project tasks.

Response: NASA concurs with this recommendation. As noted in the above response, IEMP has adopted a revised software development implementation approach that is geared toward providing short-term deliverables. The new methodology, which IEMP began using in early fiscal year 2007, requires the identification of feature and object dependencies at the start of each iteration to ensure that completed components can be delivered by the end of the iteration. The use of the time-boxed, iterative approach addresses the weakness in the previous methodology that attempted to manage the project schedule with long-term, activity-based items that were not well-suited to the identification of object dependencies. In summary, the new development approach adopted by IEMP enables more detailed identification and documentation of project tasks and dependencies, which meets the GAO's recommendation.

Recommendation 3: Establish as a high priority the completion of a concept of operations (ConOps) that addresses NASA's business operations for both its mission offices and

administrative offices (such as financial management and human capital) before any new implementation efforts begin.

Response: NASA concurs with this recommendation. The IEMP Integration Manager is currently establishing a plan to develop a ConOps, which will (1) provide a description of NASA's business systems characteristics from an operational perspective; (2) facilitate understanding of the overall system goals with users, managers, and others; (3) form an overall basis for long-range operations planning and provide guidance for development and/or update of subsequent system definition documents, such as the system specification and the interface specification, and (4) describe the user organization and mission from an integrated user/system point of view (per ANSI/AIAA G-043-1992, Guide for the Preparation of Operational Concept Documents). Target completion for the ConOps is the summer of 2009 due to the need to engage all functional organizations owning business systems (and their customers) in the development of this important document.

Recommendation 4: Review the functionality of previously implemented IEMP modules for the purpose of determining whether enhancements or modifications are needed to bring them into compliance with the concept of operations.

Response: NASA concurs with this recommendation. IEMP is currently working with mission projects to identify business system gaps from the perspective of the project management community. Data from this activity, to be completed in the July 2007 timeframe, will be incorporated into the ConOps. Any enhancements or modifications to existing IEMP modules will be assessed by the M/BSIG following the completion of the ConOps.

Recommendation 5: Establish policies and procedures requiring approval to establish or maintain business processes that are inconsistent with the processes inherent in the COTS solutions selected for IEMP.

Response: NASA concurs with this recommendation. NASA recognizes that it has, over time, created several complex business processes which have resulted in complicated and convoluted software configurations and extensions which create operational inefficiencies. As noted in the response to Recommendation 1 above, the role of the IEMP Integration Manager and the IEMP Competency Center will be to assess the systems' capabilities to efficiently meet the proposed requirements. Assessment results will be vetted through the M/BSIG to ensure cross functional agency-wide impacts have been addressed. This assessment process will be included within the forthcoming requirements policy framework identified in the response to Recommendation 1. Meanwhile, NASA is already taking steps to assess its cost collection processes with a target to streamline the business processes while continuing to meet the information needs of project management, financial management, and asset management.

Technical comments to the draft report have been provided to GAO separately.

My point of contact for this matter is Mr. Bobby German, Program Director for NASA's Integrated Financial Management Program. He may be contacted by e-mail at bobby.german@nasa.gov or by telephone at (202) 358-2498.

Sincerely,

A handwritten signature in black ink, appearing to read 'Shana Dale', with a long horizontal flourish extending to the right.

Shana Dale
Deputy Administrator

Appendix III: GAO Contacts and Staff Acknowledgments

GAO Contacts

McCoy Williams, (202) 512-9095 or williamsm1@gao.gov

Keith A. Rhodes, (202) 512-6412 or rhodesk@gao.gov

Acknowledgments

In addition to the contacts named above, staff members who made key contributions to this report were Diane Handley, Assistant Director; J. Christopher Martin, Senior Level Technologist; Francine DeVecchio; Kristi Karls; and Lauren Catchpole.

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