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United States Government Accountability Office
Washington, D.C. 20548

September 9, 2005

The Honorable Sherwood L. Boehlert
Chairman
Committee on Science
House of Representatives

The Honorable Bart Gordon
Ranking Member
Committee on Science
House of Representatives

Subject: *Business Modernization: Some Progress Made toward Implementing GAO Recommendations Related to NASA's Integrated Financial Management Program*

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 external financial reporting ability and thwart its efforts to effectively manage and oversee its major programs. In April 2000, NASA began addressing many of its financial and management challenges through its effort to implement a new integrated financial management system, known as the Integrated Financial Management Program (IFMP), which NASA expects to complete in fiscal year 2008. However, in April and November 2003—3 years into the IFMP implementation effort and with significant investment already made in the program—we issued a series of four reports[1] that detailed weaknesses in NASA's acquisition and implementation strategy for IFMP. Specifically, we reported that NASA had not followed key best practices for acquiring and implementing IFMP 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

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[1]GAO, *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).

GAO-05-799R Status of GAO Recommendations

support effective day-to-day program management and external financial reporting.

As part of the four reports we issued on IFMP, we made 45 recommendations in the following areas: system component integration, enterprise architecture development and use, risk mitigation, system requirements definition, requirements management and testing, external financial reporting, and program cost and schedule control. Due to your continued interest in ensuring that NASA is taking the necessary actions to successfully implement IFMP, you asked us to assess the extent to which NASA has adopted the recommendations we made in our April and November 2003 reports. To achieve this objective, we interviewed the appropriate NASA officials and obtained and analyzed documentation supporting NASA's progress toward implementing GAO's recommendations. Our work was performed from March 2005 through June 2005 in accordance with U.S. generally accepted government auditing standards. We requested and received written comments on a draft of this report from NASA and have included NASA's comments as enclosure III. Details on our scope and methodology are included in enclosure I.

Results in Brief

Since we last reported on NASA's systems modernization program, NASA's effort has been focused primarily on trying to stabilize the core financial module, the backbone of IFMP. However, more recently, NASA has begun taking steps to implement a number of our recommendations. Overall, progress has been slow—particularly with respect to establishing an enterprise architecture, which is critical for guiding and constraining NASA's investment in IFMP. However, in some other areas—such as NASA's initiative to enhance the core financial module to provide better project management information—NASA is beginning to make some progress. Of the 45 recommendations we made, NASA has closed 3 and partially implemented 13; however, 29 recommendations remain open. Table 1 summarizes our assessment of the extent to which NASA has implemented our recommendations.

Table 1: NASA's Progress toward Implementing GAO's Recommendations

Recommendations	Closed	Partially implemented	Open	Comments
Recommendations to improve NASA's acquisition management practices. GAO-03-507	0	2	0	Key elements of dependency analysis methodology still lacking. Suitability of already-acquired components not evaluated before acquiring additional components.
Recommendations regarding development and use of enterprise architecture. GAO-04-43	1	4	17	Architecture still missing important content and key architecture management processes not yet established. Already-implemented system components not mapped to architecture.
Recommendations to mitigate risk associated with relying on already-deployed components. GAO-03-507	0	0	6	NASA did not develop a formal corrective action plan to mitigate risks.
Recommendations regarding defining program management needs and reengineering business processes. GAO-03-507	1	0	1	Stakeholders engaged to define program management needs. Plans to reengineer contractor cost-reporting processes still several years away.
Recommendations to improve NASA's requirements management and testing processes. GAO-03-507	0	3	0	New requirements management methodology and tools acquired for future modules, but core financial module requirements not yet fully defined.
Recommendations to improve external financial reporting. GAO-04-151	0	0	4	Little progress made in developing a detailed plan for delivering a financial system that substantially complies with federal standards.
Recommendations regarding IFMP life-cycle cost estimates and funding reserves. GAO-04-118	1	4	1	Significant progress made in preparing life-cycle cost estimate, but consistency and support for estimates still lacking.
Total	**3**	**13**	**29**	

Source: GAO analysis of NASA Information.

We considered a recommendation closed when NASA provided us with documentation that demonstrated it had fully addressed the concerns we raised in our prior reports. Recognizing that many of our recommendations may take considerable time and effort to fully implement, we considered the recommendation to be partially implemented if the documentation provided indicated that NASA had made significant progress addressing our concerns. For recommendations we

consider open, NASA's documentation indicated that the agency was either in the very early planning stages or had not yet begun to implement the recommendation. Enclosure II provides our assessment of the status of each recommendation.

We are recommending that NASA develop an integrated enterprise master schedule and milestones that include the improvement activities and plans already in place, dates for completion, how progress will be measured, and clear accountability for each action not completed in a timely and effective manner.

In its written comments, which are reprinted in enclosure III, NASA concurred with our recommendation. However, NASA raised concerns that our characterization of certain recommendations as "open" did not appropriately recognize the full extent of the agency's effort and suggested that we use instead "partially implemented" or, whenever appropriate, "closed." We disagree with NASA's assessment and continue to believe that our characterization of NASA's progress using the criteria above is appropriate.

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, but both of these efforts were eventually abandoned after a total of 12 years and a reported $180 million in spending. In April 2000, NASA began its third attempt at modernizing its financial management processes and systems. This effort, known as IFMP, was expected to produce an integrated, NASA-wide financial management system through the acquisition and incremental implementation of commercial software packages and related hardware and software components.

In April 2003, we issued our first report on IFMP. At that time, we reported that NASA was not following key best practices for acquiring and

implementing the system, which may affect the agency's ability to fully benefit from the new system's capabilities. Specifically, we reported that NASA (1) did not analyze the relationships among selected and proposed IFMP components; (2) had deferred addressing the needs of key system stakeholders, including program managers and cost estimators; and (3) did not properly manage and test its system requirements prior to implementation of the core financial module. As a result, we reported that

- NASA has increased its risks of implementing a system that will not optimize mission performance and will cost more and take longer to implement than necessary,

- the core financial module is not being designed to integrate the cost and schedule data that program managers need to oversee the work of NASA's contractors, and

- costly rework will likely be required to fix requirement defects not identified prior to implementation.

In November 2003, we issued three separate reports on IFMP's (1) enterprise architecture, (2) financial reporting capabilities, and (3) cost and schedule controls. On IFMP's enterprise architecture, we found that NASA had not established an effective architecture to guide and constrain the program. Although NASA had established some important architecture management controls—such as establishing an enterprise architecture program office and designating a chief architect—it had not yet established others, which have made its efforts to develop, implement, and maintain a well-defined architecture more challenging. On IFMP's financial reporting capabilities, we found that NASA deferred configuration and testing of many key capabilities of the core financial module, including the ability to report the full cost of its programs. Further, we reported that many of the financial events or transaction types needed by program managers to carry out day-to-day operations and produce useful financial reports had not been included. As a result, we concluded that IFMP, as implemented in June 2003, did not comply substantially with the requirements of the Federal Financial Management Improvement Act of 1996.[2] Finally, on IFMP's cost and schedule control, we reported that questionable cost estimates, an optimistic schedule, and insufficient processes for ensuring adequate funding reserves put IFMP at further risk of not meeting its cost

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[2]Pub. L. No. 104-208, div. A., § 101(f), title VIII, 110 Stat. 3009, 3009-389 (Sept. 30, 1996).

and schedule commitments. In preparing the current cost estimate for IFMP's 10-year life cycle, NASA did not include the full cost likely to be incurred during the life of the program, including costs to retire the system and other direct and indirect costs.

NASA Is Taking Steps to Assess Integration Risk for IFMP Commercial Components

We reported in April 2003[3] that NASA had not established and implemented a methodology for analyzing and understanding the interdependencies of commercial components prior to acquiring IFMP components. For programs like IFMP, which involve building a system from multiple commercial components, it is important for an agency to understand the behavioral interaction and compatibility of the commercial-off-the-shelf (COTS) components in order to select components that can be integrated in a predictable and standard way. Without an effective methodology to gain and apply such knowledge, building a commercial component-based system can quickly lapse into trial and error, which is fraught with risks. For example, a trial and error approach can lead the agency to pursue expensive modifications and customized solutions or unnecessarily increase the number and complexity of interfaces in an ad hoc and unplanned way—all of which increase system acquisition and maintenance costs, delay the delivery of capabilities and the realization of benefits, and contribute to less-than-optimum agency performance.

To avoid problems with integrating commercial components, we recommended that NASA, in order to mitigate future risks, direct the Program Executive Officer for IFMP to complete the following actions before acquiring any additional components:

- Establish and implement a methodology for commercial system component dependency analysis and decision making.

- Evaluate the suitability of already-acquired, but not yet implemented, IFMP component products within the context of a component dependency analysis methodology.

NASA has made progress toward addressing these recommendations; however, the methodology it has established is incomplete and thus does not support adequate evaluation of IFMP components' suitability.

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[3]GAO-03-507.

Specifically, NASA's methodology does not include a defined design process[4] that includes, among other things, the detailed process for allocating requirements among the various commercial component options and for using iterative prototyping to assess the interactions among these components, which would enable the mitigation of risks associated with integrating products prior to acquiring them. Further, the agency reports that it has to date only applied the methodology to evaluate one component (i.e., the contract management module) that has not yet been acquired. As a result, we focused our assessment of NASA's efforts to implement our recommendations on this component.

According to relevant guidance,[5] an analysis of component dependencies requires a system life-cycle methodology that effectively defines and integrates three system engineering processes—risk management,[6] requirements development and management,[7] and design—and the tools, techniques, methods, and practices for implementing these processes.

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[4]According to relevant guidance, a design process includes examining alternative technical solutions with the intent of selecting the optimum design based on established criteria. These criteria may be significantly different across products, depending on product type, operational environment, performance and support requirements, and cost or delivery schedules. It also includes a decision analysis and resolution process to ensure that alternatives are compared and the best one is selected to accomplish the goals of all the other processes (e.g., requirements development). Effective design processes use design patterns (i.e., recurring solutions to software design problems that are constantly found in application development), and iterative prototyping to establish the preferred design option (system architecture).

[5]Carnegie Mellon, Software Engineering Institute, *Capability Maturity Model® Integration for Systems Engineering and Software Engineering, Version 1.1* (Pittsburgh, Pa.: December 2001); Carnegie Mellon University, Software Engineering Institute, *The Capability Maturity Model: Guidelines for Improving the Software Process* (Addison Wesley Longman, Inc., 1994); Jonathan Adams, Srinivas Koushik, Guru Vasudeva, and George Galambos, *Patterns for e-Business: A Strategy for Reuse* (IBM Press™, 2001); B. Craig Meyers and Patricia Oberndorf, *Managing Software Acquisition: Open Systems and COTS Products* (Addison-Wesley, 2001); Jeffrey A. Hoffer, Joey F. George, and Joseph S. Valacich, *Modern Systems Analysis and Design* (Addison Wesley Longman, Inc., 1999); and Kurt Wallnau, Scott Hissam, and Robert Seacord, *Building Systems from Commercial Components* (Addison-Wesley, 2002).

[6]A risk management process involves identifying potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives.

[7]A requirements development and management process involves generating product and product-component requirements and managing all of the requirements received or generated by the project, including both technical and nontechnical requirements, as well as those requirements levied on the project by the organization.

NASA's methodology describes high-level steps for risk management and requirements development and management, and identifies supporting tools, techniques, methods, and practices for integrating multiple products to fulfill a set of user requirements. However, as stated above, the methodology does not define the activities that are to occur as part of the overall design process to effectively evaluate the suitability of the product for the integrated solution that is to be acquired. For example, it does not define the detailed activities that are to occur and the products to be developed when (1) performing the gap analysis between requirements and component capabilities as part of assessing product feasibility; (2) allocating requirements among the various commercial components that constitute a given system design option; (3) defining the interactions among the various commercial components to enable the processing of transactions, including those interactions that affect data cleanup and conversion activities; (4) documenting commitments and decisions; and (5) using iterative prototyping to assess the interactions among these components.

Nevertheless, in executing the methodology for the one yet-to-be-acquired component (i.e., the contract management module), NASA used prototyping to assess the ability to successfully integrate this new commercial component with already-acquired IFMP commercial components. The application of prototyping to evaluate the interdependencies among the various components is consistent with best practices; however, in this case, the scope was not iterative. Specifically, it was limited to basic integration scenarios (e.g., creating purchase requisitions), and did not incorporate complex scenarios for interactions among the commercial components (e.g., reconciling the obligations of funds to the actual disbursement of cash to determine if previously obligated funds should be deobligated). The IFMP Integration Program Manager stated that the agency intends to use iterative prototyping, although this process was not reflected in the documented methodology.

In addition, the IFMP Integration Program Manager stated that the agency was able to mitigate these prototyping weaknesses by applying other risk reduction methods. These methods included (1) interviewing another agency that had already implemented the commercial components to ensure that integration was feasible and (2) establishing agreements with the users that the products will not be modified to fulfill user requirements, but rather that the requirements will be modified, deleted, or addressed through other means.

Beyond the steps taken to assess component integration risk, it is important that NASA establish more mature and transparent design decision analysis processes. Until it does, the agency remains at risk of implementing a solution that does not optimize mission performance and that costs more than anticipated and takes longer to implement than necessary.

Limited Progress Made in Establishing an Enterprise Architecture to Guide Modernization Efforts

We reported in November 2003[8] that NASA had acquired and implemented significant components of IFMP without having and using enterprise architecture[9] to guide and constrain the program. Attempting major modernization programs, such as NASA's IFMP, without having and using a well-defined enterprise architecture often results in systems implementations that are duplicative, are not well integrated, require costly rework to interface, and do not effectively optimize mission performance. During the course of our fiscal year 2003 review of IFMP, NASA recognized the need for an enterprise architecture and began efforts to develop one, including implementing key architecture program management structures and process controls (e.g., establishing an enterprise architecture program office and designating a chief architect). Over the last 18 months, NASA has made limited progress in adopting other key architecture management best practices that we recommended. In summary, the agency has implemented 1 of our recommendations and has partially implemented 4 others; however, 17 of our recommendations remain open.

In implementing 1 of our 22 recommendations in this area, NASA has had each version of its enterprise architecture approved by the Chief Information Officer (CIO). In partially implementing 4 others, NASA has

- established an architecture board made up of senior agency executives that is responsible and accountable for developing and maintaining the architecture,

- had the architecture board approve version 3.0 of the architecture,

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[8]GAO-04-43.

[9]An enterprise architecture is an organizational blueprint that defines—in both business and technology terms—how an organization operates today and how it intends to operate in the future; it also provides a plan for transitioning to this future state.

- had the NASA Administrator approve version 3.0 of the architecture, and

- established a verification and validation function to review the architecture and related management processes.

These recommendations are categorized as partially implemented because although NASA has established an architecture board, it has yet to develop a policy, as we recommended, demonstrating institutional commitment to developing and using an architecture. In addition, we do not consider that the processes for approving the architecture and performing verification and validation activities are established until they have been repeated. Further, the current verification and validation function is not independent, in that it reports to the program office rather than to the architecture board. NASA's Deputy CIO/Chief Technology Officer (CTO) stated that the board and administrator would continue to review and approve subsequent versions of the architecture, and that verification and validation reviews would be performed on a recurring basis.

NASA has yet to address our other recommendations. With regard to architectural content, the Deputy CIO/CTO stated that the agency has not determined the extent to which NASA's architecture includes the content that we identified as missing in our previous report. However, this official stated that the agency is currently developing a plan to address this recommendation.

NASA has also not addressed our three recommendations aimed at ensuring that IFMP plans are aligned with the architecture and that acquisition and implementation activities are appropriately limited until this alignment is achieved. The Deputy CIO/CTO stated that the Office of the CIO, in conjunction with the agency's Chief Financial Officer (CFO), has conducted reviews of already-implemented IFMP modules (e.g., budget formulation) to determine whether they are aligned with the architecture. This official stated that the reviews conducted to date have not shown any instances of misalignment; however, the agency has yet to provide us with any evidence, such as documentation on the approach and results of these reviews. The Deputy CIO/CTO stated that the offices of the CIO and the CFO are currently reviewing soon-to-be-implemented modules (e.g., contract management) to assess the extent of alignment.

Moreover, NASA has not implemented other architecture management capabilities that our November 2003 report[10] cited as essential to having an effective enterprise architecture program and that we provided recommendations on. In particular, see the following:

- NASA has not established a written/approved policy guiding the development of the enterprise architecture. The Deputy CIO/CTO stated that the agency is currently drafting this policy and that it should be approved by July 2005.

- NASA has not placed enterprise architecture products under configuration management to maintain integrity and traceability and to control modifications or changes to the architecture products throughout their life cycles. However, the Deputy CIO/CTO stated that the agency is currently developing its configuration management plan and associated procedures. Further, the Deputy CIO/CTO told us that the agency has assigned a configuration manager for the architecture program and that all architecture products are under configuration management. However, NASA has yet to provide documentation showing that changes to the architecture products are identified, tracked, monitored, documented, reported, and audited.[11]

- NASA has not ensured that progress against architecture plans is measured and reported, as evidenced by the Deputy CIO/CTO's statement that the agency is not measuring and reporting progress against approved architecture project management plans.

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[10]GAO-04-43.

[11]According to relevant guidance, an effective configuration management process consists of four primary elements: (1) configuration identification, which includes procedures for identifying, documenting, and assigning unique identifiers (e.g., serial number and name) to product types generated for the architecture program, generally referred to as configuration items; (2) configuration control, which includes procedures for evaluating and deciding whether to approve changes to a product's baseline configuration, generally accomplished through configuration control boards, which evaluate proposed changes on the basis of costs, benefits, and risks and decide whether to permit a change; (3) configuration status accounting, which includes procedures for documenting and reporting on the status of configuration items as a product evolves; and (4) configuration auditing, which includes procedures for determining alignment between the actual product and the documentation describing it, thereby ensuring that the documentation used to support the configuration control board's decision making is complete and correct. Each of these elements should be described in a configuration management plan and implemented according to the plan.

- NASA has not established a written/approved policy for architecture maintenance. The Deputy CIO/CTO stated that the policy was submitted for approval in July 2005.

- NASA has not ensured that (1) the architecture products describe the enterprise in terms of business, performance, data, application, and technology; (2) the products describe the "As Is" environment, the "To Be" environment, and a sequencing plan; or (3) the business, performance, data, application, and technology descriptions address security. The Deputy CIO/CTO stated that the agency is currently developing a plan to address these three recommendations.

- NASA has not measured and reported on the quality of enterprise architecture products, as evidenced by the Deputy CIO/CTO's statement that the agency has yet to develop metrics for evaluating the quality of its architecture products.

- NASA has not established a written/approved policy for architecture implementation. The Deputy CIO/CTO stated that the policy was submitted for approval in July 2005.

- NASA has not completed efforts intended to ensure that the enterprise architecture is an integral component of information technology (IT) investment management processes and that IT investments comply with the architecture. The Deputy CIO/CTO stated that the agency recognizes that such a process needs to be institutionalized and stated that the architecture policy being developed is intended to accomplish this. However, at this time, the policy and associated procedures are being drafted, and the process for conducting investment alignment reviews is being revised. This official also told us that the agency has started reviewing proposed system investments for compliance with the architecture and that the results of these reviews are being used to draft the policy and procedures, as well as revise the review process.

- NASA has not measured and reported enterprise architecture return on investment. The Deputy CIO/CTO stated that the agency is establishing metrics and collecting data, and that it intends to issue a report on its enterprise architecture return on investment by the end of the fiscal year.

- NASA has not measured and reported on enterprise architecture compliance, as evidenced by the Deputy CIO/CTO's statement that

NASA has yet to establish metrics to measure and report on enterprise architecture compliance.

According to the Deputy CIO/CTO, NASA has yet to develop the program management plans that it needs to effectively manage the development, maintenance, and implementation of the architecture. This official told us that the agency is currently drafting such plans and that the plans will specify measurable goals and outcomes to be achieved, the tasks to be performed to achieve these goals and outcomes, the resources (funding, staffing, and training) needed to perform the tasks, and the time frames within which the tasks will be performed. The Deputy CIO/CTO also stated that these plans will include the actions that the agency will take to address both our recommendations and those identified during the verification and validation effort. Until NASA has addressed our prior recommendations, the agency's modernization efforts, including IFMP, will be at risk of being implemented in a way that does not adequately ensure system integration, interoperability, and optimized mission support.

NASA Did Not Develop a Corrective Action Plan to Mitigate the Risk of Relying on Already-Deployed Components

NASA has not yet developed a corrective action plan to identify known and potential risks and, therefore, has not implemented any of the six recommendations related to developing a risk mitigation strategy. According to IFMP officials, they have an overall risk mitigation strategy related to IFMP that they use for this purpose and did not think it necessary to revise their strategy based on our recommendations. As discussed later, NASA has begun to implement our recommendations to improve its requirements management and cost-estimating processes; if implemented properly, these improvements could help to mitigate the risk associated with relying on already-deployed IFMP components. However, we continue to believe that a comprehensive corrective action plan would aid NASA in its effort to stabilize the system and improve the functionality of IFMP.

Progress Made toward Identifying Program Management Needs, but Process Reengineering Still Needed

In April 2003, we reported that NASA had not adequately engaged key stakeholders in designing and implementing its core financial module or fundamentally changed the way it operates by reengineering its core business processes. As a result, the new system had not, as originally envisioned, addressed many of the agency's most significant management challenges—including improving contract management, producing credible cost estimates, and providing the Congress with appropriate visibility over its large, complex programs.

In response to two recommendations we made in that report to (1) engage program managers in identifying program management needs and (2) reengineer core business processes, NASA has recently begun to transform how it manages its programs and projects and oversees its contractors. Through an initiative known as Project Management Information Improvement (PMI[2]), NASA plans to enhance the core financial module to provide better project management information for decision-making purposes. While much remains to be done before IFMP will satisfy the information needs of program managers and cost estimators, NASA has taken an important first step toward achieving its goal. Specifically, NASA has, as we recommended, engaged stakeholders to identify program management needs. However, to ensure that NASA reaps the benefit of implementing this recommendation, it is critical that the agency follows through with its stated plans to reengineer its acquisition management processes such that contractors provide, and the system can accommodate, the information needed by NASA managers to oversee contracts and prepare credible cost estimates. Moreover, as discussed later, to ensure that the system is designed and implemented to satisfy user requirements, NASA will need to implement an effective requirements management process—which includes defining and testing detailed design and coding requirements that are traceable to higher level requirements.

NASA Has Made Significant Progress toward Identifying Program Management Needs

As we reported in April 2003, NASA did not engage program managers and other key stakeholders when defining information requirements for the IFMP core financial module and, as a result, did not design the system to accommodate the information needed to adequately oversee its contracts and programs—including preparing credible cost estimates. To adequately oversee NASA's largest and most complex programs and projects, managers need reliable contract cost data—both budget and actual—and the ability to integrate these data with contract schedule information to

monitor progress on the contract. A well-recognized technique used to monitor progress on contracts, as well as a NASA program management requirement, is earned value management (EVM).[12] However, because NASA did not adequately define its program management needs, NASA did not design the core financial module to accommodate the EVM data needed to perform EVM analysis.

In response to our April 2003 report, NASA has, as we recommended, engaged stakeholders to identify program management needs. Specifically, NASA has inventoried its ongoing programs and projects—categorized by product line and priority and risk—and defined management and information requirements for each category. Through a series of data calls and budget analyses, over the course of a year the Office of the Chief Engineer (OCE) compiled a comprehensive listing of NASA programs and projects. From the listing of NASA programs and projects, OCE identified four product line divisions or investment areas, as follows: (1) Basic and Applied Research, (2) Advanced Technology Development, (3) Flight Development and Operations, and (4) Institutional Infrastructure. Programs and projects in each product line were then placed in a priority/risk category—category I, II, or III—based on priority and risk factors, such as the magnitude of the agency's financial investment, uncertainty surrounding the application of new or untested technology, and strategic importance of the program to the agency. OCE then defined project management requirements based on the product line and the program's priority and risk classification. For example, a category I—high-risk, high-priority—Applied Technology Development program would be required to prepare a life-cycle cost estimate linked to the program's work breakdown structure (WBS) as well as obtain an independent cost estimate. In contrast, an Applied Technology Development program in category III—low-risk, low-priority—is required only to obtain a sufficiency review of its life-cycle cost estimate.

As part of PMI[2], and based on the program management needs identified by OCE, NASA has established high-level functional requirements related to data structures, funds distribution, cost collection, and reporting structures, which, if implemented as intended, should provide the system

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[12]EVM goes beyond the two-dimensional approach of comparing budgeted costs to actuals. Instead, it attempts to compare the value of work accomplished during a given period with the work scheduled for that period. NASA requires EVM reporting and analysis for research and development contracts with a total anticipated final value of $70 million or more, and for production contracts with a total anticipated final value of $300 million or more.

with the functionality currently lacking and needed by program managers and cost estimators. Examples of the functional requirements added are (1) the system shall have the ability to collect the actual cost of work performed and budgeted cost of work performed, (2) the system shall have the ability to collect estimate-to-complete costs at any level of the WBS hierarchy, and (3) the system shall have the ability to interface the actual cost of work performed with the budgeted cost of work performed to an EVM tool. While defining high-level functional requirements is an important first step toward providing NASA managers with the information they need, as discussed later, to ensure that the system is designed and implemented properly, NASA will also need to implement an effective requirements management process—which includes defining and testing detailed design and coding requirements needed to implement these to higher level requirements.

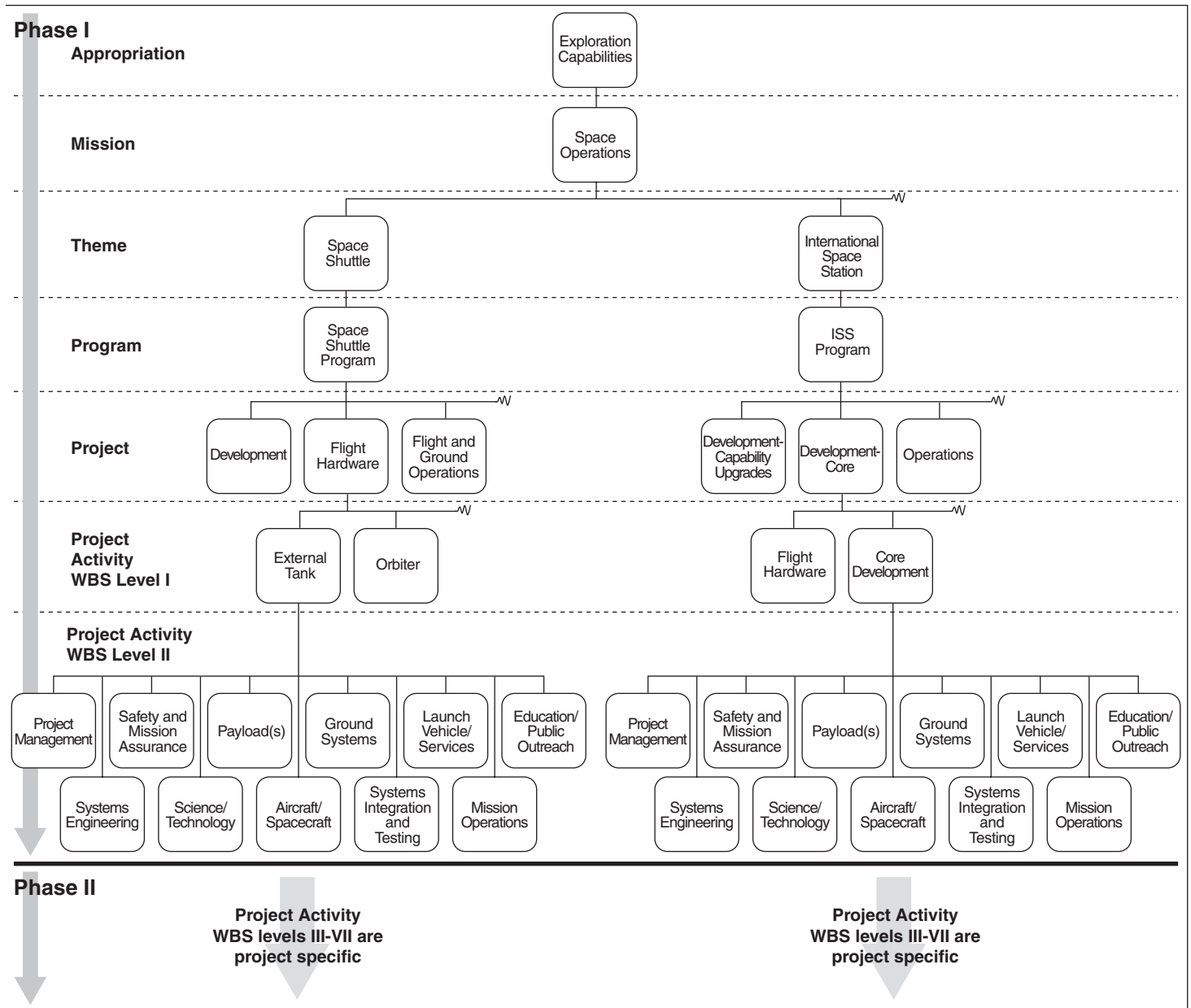## Future Plans to Reengineer Acquisition Management Processes Are Key

As part of PMI[2], NASA plans to, as we recommended, reengineer its acquisition management process, which includes plans for (1) replacing its existing legacy system financial coding structure with a coding structure that will better accommodate the information requirements of program managers and cost estimators, (2) reevaluating its policies and processes for collecting contractor cost data to improve the quality of contractor-provided cost and performance data, and (3) integrating data contained in the core financial module with the tools needed for performing EVM analysis. However, NASA is in the very early planning stage of implementing our recommendation, and the details for how NASA will accomplish its objectives are still vague. Therefore, it was not possible to assess whether NASA's implementation of PMI[2] will accomplish its stated goal of enhancing the core financial module to provide better project management information for decision-making purposes. Further, given the complexity of what NASA is attempting to accomplish, many of its PMI[2] completion milestones appear to be unrealistic. Nonetheless, we are encouraged that NASA has acknowledged that its existing legacy coding structure and acquisition management processes do not always provide sufficiently detailed data to prepare credible cost estimates or effectively monitor contractor performance.

As we reported in April 2003, because NASA did not fundamentally change the way it operates by involving key users in business process reengineering efforts, the core financial module as currently implemented does not capture cost information at the same level of detail that it is received from NASA's contractors. Instead of implementing a financial

coding structure that met the information needs of program managers, NASA embedded the same financial coding structure that it used in its legacy reporting systems in the core financial module. As a result, the availability of detailed cost data depends on the adequacy of NASA's legacy coding structure. Therefore, in some cases, contractor-provided cost data must be aggregated to a higher, less detailed level before they are posted against the legacy financial coding structure.

Using a two-phased approach, NASA now plans to design and implement a new financial and program coding structure, which is intended to better accommodate the information requirements of program managers and cost estimators. As shown in figure 1, NASA plans to organize its work by appropriation, mission, theme, program, and project.

Figure 1: New Financial and Technical Work Breakdown Structure Excerpts

Phase I

Level	
Appropriation	Exploration Capabilities
Mission	Space Operations
Theme	Space Shuttle · International Space Station
Program	Space Shuttle Program · ISS Program
Project	Development · Flight Hardware · Flight and Ground Operations · Development-Capability Upgrades · Development-Core · Operations
Project Activity WBS Level I	External Tank · Orbiter · Flight Hardware · Core Development
Project Activity WBS Level II	Project Management · Safety and Mission Assurance · Payload(s) · Ground Systems · Launch Vehicle/Services · Education/Public Outreach · Systems Engineering · Science/Technology · Aircraft/Spacecraft · Systems Integration and Testing · Mission Operations

Phase II

Project Activity WBS levels III-VII are project specific

Project Activity WBS levels III-VII are project specific

Source: GAO analysis of NASA data.

In phase one, which NASA expects to be complete by October 1, 2005, the agency plans to define and standardize the first two levels of the project management elements of NASA's work—referred to as the project technical work breakdown structure. In phase two, which is planned for completion by October 1, 2006, NASA plans to expand the project's technical work breakdown structure through level 7—as shown in figure 1. NASA does not intend to standardize these lower level elements but instead will allow NASA project managers, within certain parameters, to define project-unique elements. However, these lower level elements may only include work that rolls up to the standard WBS elements. According to NASA PMI[2] officials, it is imperative that phase one is completed and the new project WBS is defined and incorporated into the core financial module by October 1, 2005, to coincide with the beginning of the fiscal year. However, as of the end of our fieldwork in mid-June 2005, NASA had defined level two WBS requirements for only one of its four product lines and had not yet validated these new requirements with the appropriate user groups.

As part of PMI[2], NASA plans to reevaluate its policies and processes for collecting contractor cost data. NASA obtains contractor cost data from two primary sources—monthly contractor financial management reports, NASA Form 533, and monthly contractor cost performance reports. Both reports contain budget and actual cost data, but only contractor cost performance reports contain the data needed to perform EVM analysis. However, as discussed in our April 2003 report, NASA did not evaluate the adequacy of its existing contractor cost reporting vehicles to determine whether the reports met the information needs of program managers and cost estimators. Instead, NASA chose to use NASA Form 533 data to populate the core financial module without considering the merits of the data contained in the contractor cost performance reports. Consequently, the cost data maintained in the core financial module are not adequate for monitoring contractor performance for NASA's largest, most complex contracts—those requiring EVM reporting and analysis.

To respond to our recommendation to reengineer its acquisition management process, NASA plans to evaluate and potentially combine the two existing contractor cost reports in order to create contractor cost reporting requirements that satisfy its external financial reporting and program management needs. Although NASA plans to complete this process by October 1, 2006, many questions remain unanswered as to how NASA will implement new contractor cost reporting requirements. For example, it is unclear whether NASA will renegotiate existing contracts to include new contractor reporting requirements or implement these

changes prospectively as new contracts are awarded. If NASA plans to implement new contractor reporting requirements prospectively, it is unclear how the core financial module would incorporate a new reporting format for new contracts while maintaining the old reporting format for existing contracts. On the other hand, renegotiating existing contracts to include new reporting requirements could prove to be extremely costly. Because NASA's plans for implementing new contractor reporting requirements are still in their infancy, with most elements of the plans still undefined, the planned October 1, 2006, completion date will be difficult, if not impossible, to meet.

Finally, according to NASA, PMI[2] will also address the integration of financial information with tools for planning, scheduling, and EVM analysis. However, NASA has not yet established a completion date for this phase of the project or any specific implementation details.

Improvements Made to Requirements Management and Testing Processes

In April 2003 we reported that NASA had not effectively implemented the requirements management[13] or disciplined testing processes necessary to support the implementation of the core financial module and, therefore, had increased the risk that it would not be able to effectively identify and manage the detailed system requirements that system developers and program managers need to acquire, implement, and test a system. Due in part to weaknesses in NASA's requirements management process, the core financial module NASA fielded in June 2003 was not properly configured or designed to meet NASA's financial reporting and management needs. Although NASA has recently implemented new requirements management and testing processes, the agency has not implemented our recommendation to properly define and document system requirements for already-deployed IFMP modules, including the core financial module, and has only partially implemented our recommendation related to establishing an effective regression testing and metrics program. As a result, many of the system configuration problems caused by the agency's ineffective

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[13]According 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.

requirements management and testing processes continue to plague the core financial module.

NASA Has Not Yet Fully Developed and Properly Documented Core Financial Module Requirements

Subsequent to our April 2003 report, NASA IFMP officials acknowledged that the requirements management and testing methodology and tools used by the contractor responsible for implementing the core financial module did not result in requirements that were consistent, verifiable, and traceable or that contained the necessary specificity to minimize requirement-related defects. While NASA has taken the critical first steps of implementing the necessary requirements management and testing processes to help manage IFMP, it has not yet fully implemented our recommendation to properly define and document system requirements for the already-deployed IFMP modules, including the core financial module. This is important not only because it affects the way the core financial module currently functions but also because it affects NASA's ability to implement future upgrades and other modules expected to interface with the core financial module.

Requirements represent the blueprint that system developers and program managers use to design, develop, and acquire a system. Improperly defined or incomplete requirements have been commonly identified as a cause of system failure, resulting in systems not meeting their costs, schedules, or performance goals. Further, because requirements provide the foundation for system testing, requirement defects, such as those noted during our review relating to specificity and the ability to determine the relationship between requirements (commonly referred to as traceability), preclude an entity from implementing a disciplined testing process. That is, requirements must be complete, clear, and well documented to design and implement an effective testing program. Absent this, an organization is taking a significant risk that its testing efforts will not detect significant defects until after the system is placed into production.

NASA officials stated that they understand the importance of implementing disciplined requirements management and testing processes and believe that they have developed the necessary procedures to govern its efforts. They also stated that, due to resources and priorities, they decided to use these improved procedures on new projects such as the e-payroll module and defer full implementation of NASA's improved requirements management processes until October 2006—when NASA plans to redefine the core financial module system requirements as part of the core financial module system upgrade. Our limited review of several payroll

requirements, selected by NASA to illustrate the effectiveness of its new requirements management process, showed that NASA has made progress since our April 2003 report. For example, we were able to determine the relationship between a given test and a specific requirement, which was not always possible with the requirements management and testing methodology and tools used previously. Further, it was clear that the new tools and procedures would allow for and facilitate the type of specificity needed to reduce requirements-related defects to acceptable levels. However, some of the problems we identified previously relating to specificity were still present. For example, in reviewing the requirements documentation on employee deductions for such items as taxes, the documentation did not contain all the necessary business rules related to tax withholdings. This is important because, as discussed previously, inadequate or incomplete requirements preclude an entity from implementing a disciplined testing process. Consequently, when we then traced the tax withholding requirement to the testing documentation, we found that the tests NASA constructed did not adequately test key elements of the requirement—including whether withholdings for Social Security taxes are suspended at the appropriate income threshold.

In discussions with NASA officials, they agreed that our observations were correct and that they were not yet where they needed to be with respect to the specificity of NASA's requirements. They also stated that they will continue to monitor their process and look for opportunities for improvement, and as they learn more about performing this vital function, they expect the processes to improve. It will take time to effectively implement the disciplined processes needed to reduce the risks to acceptable levels. Therefore, it will be critical that NASA provide the management support and sustained leadership needed to ensure that this important initiative is successful.

Based on our discussions with NASA officials, it is clear that they now have recognized that the best indicator of whether the project has reduced its risks to acceptable levels is the strength of the processes used to manage the project. For example, NASA officials stated that they are now utilizing an independent validation and verification contractor to help monitor NASA's project management processes and provide suggestions for improvement. It will be critical for NASA to continue its efforts to effectively monitor and evaluate its processes and make the necessary adjustments if it is to continue making progress.

NASA Has Implemented a Regression Testing Program

As changes are made to IFMP, either because additional functionality is added or defects are corrected, it is important to test the revised application before it is released to ensure that modifications have not caused unintended effects and that the system still complies with its specified requirements. This practice is referred to as regression testing. At the time NASA fielded the core financial module in June 2003, it did not have a regression testing program in place. According to NASA officials, as we recommended, the agency is now performing regression testing prior to all new system releases, which is clearly a step in the right direction. However, as discussed previously, complete, clear, and well-documented requirements are the foundation on which an effective testing program is established. Therefore, the weaknesses we identified previously in NASA's core financial module requirements impair the quality of NASA's regression testing program.

In order to reduce the amount of effort involved in documenting the requirements that will support its upgrade efforts, improve regression testing efforts, and increase NASA's confidence in the regression testing program, we were told that in May 2003 NASA began documenting in its regression testing tool the specific business rules and requirements that are associated with its core financial module. While NASA recognizes that this does not fully accomplish all of the objectives called for in its improved processes discussed above, the agency believes that it does help mitigate the risks associated with the regression testing efforts. However, this approach does not provide reasonable assurance that (1) requirements have been properly validated and (2) the tests are designed with a complete set of requirements.

NASA Now Tracks Metrics Related to System Defects

As we recommended in our April 2003 report, NASA has taken steps to develop metrics and implement a metrics measurement process that can be used to evaluate the effectiveness of its processes by identifying the causes of system 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 the requirements management process is not effective, which helps the organization identify the corrective actions needed. While NASA has made progress in this important area by collecting information on the causes of system defects it

identifies in its regression testing efforts, as discussed below, additional information and analysis could enhance the agency's efforts.

According to IFMP officials, NASA is currently collecting data on the cause of core financial module system defects identified through its regression testing program. For example, NASA is tracking the number of system defects related to things such as configuration problems, inadequate requirements definition, inadequate testing, and programmer errors. However, NASA is not collecting the same data for system defects that are identified by users and, as a result, has limited visibility over the cause of these defects. In addition, while NASA is collecting data on defects identified through regression testing, the agency has not instituted a formal process for fully analyzing the data by identifying the trends associated with them. For example, by analyzing the trends, NASA could determine whether the requirements management approach it has adopted sufficiently reduces its risk of the system not meeting cost, schedule, and functionality goals to acceptable levels. This analysis would also help to quantify the risks inherent in the testing process that NASA has selected for the core financial module.

NASA IFMP officials have acknowledged that this type of analysis would be beneficial and stated that they will determine what actions are necessary to implement the necessary improvements. Some of these changes will be easy to implement while others will require more effort. For example, since NASA has already decided to capture the cause associated with the defects identified during regression testing, developing the necessary trending information should be fairly easy. On the other hand, developing similar data for other initiatives, such as data conversion and user-reported problems, will require more effort since a process has not yet been put in place to develop and capture such information.

Detailed Plan for Compliance with the Federal Financial Management Improvement Act Is Still Needed

The Office of the CFO recently updated its *Financial Management Improvement Strategy* and developed a *Financial Leadership Plan,* which are intended to lay the groundwork for improving NASA's financial management operations. However, neither of these documents nor actions taken by NASA to date are evidence of the kind of corrective action plan needed to produce a financial management system that complies substantially with the requirements of the Federal Financial Management

Improvement Act of 1996 (FFMIA).[14] FFMIA requires that agencies implement and maintain financial management systems that comply substantially with federal financial management system requirements, applicable federal accounting standards, and the *U.S. Government Standard General Ledger* at the transaction level. FFMIA also requires the auditors of agencies' financial statements to report on such compliance. Further, FFMIA stresses the need for agencies to have systems that can generate timely, accurate, and useful financial information with which to make informed decisions, manage daily operations, and ensure accountability on an ongoing basis.

As we reported in November 2003 and NASA's independent auditor reported again in November 2004 as part of its report disclaiming an opinion on NASA's fiscal year 2004 financial statements, NASA's new financial system does not comply substantially with the requirements of FFMIA. Key areas of concern include the core financial module's inability to (1) produce transaction-level detail in support of financial statement account balances, (2) identify adjustments or correcting entries, and (3) correctly and consistently post transactions to the right accounts. In addition, material weaknesses in NASA's internal controls over property, financial statement preparation, fund balance with Treasury, policies and procedures, and NASA's financial organization's structure also affect compliance with the requirements of FFMIA. Finally, as discussed previously, the core financial module currently lacks the capability to provide timely and reliable financial information to program managers and cost estimators.

Although NASA has, as discussed previously, begun to implement a corrective action plan to engage key stakeholders in developing a complete and accurate set of user requirements and in reengineering its acquisition management processes, the agency has not prepared a detailed plan for its systems to meet the requirements of FFMIA. While NASA's *Financial Management Improvement Strategy* clearly expresses the need to properly record upward and downward adjustments, improve documentation and audit trails, and address noncompliant cost practices, little explanation of how the agency intends to accomplish these goals is provided. Similarly, while the *Financial Leadership Plan* provides the Office of the CFO's vision for the financial management organization and its roles and

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[14]Pub. L. No. 104-208, div. A., § 101(f), title VIII, 110 Stat. 3009, 3009-389 (Sept. 30, 1996).

responsibilities, it provides little detail on what tasks are required to fulfill that vision.

Improvements Made to NASA's IFMP Life-Cycle Cost Estimate and Processes for Calculating Funding Reserves

In November 2003, we reported that the reliability of NASA's cost estimate for IFMP was uncertain because disciplined cost-estimating processes required by NASA and recognized as best practices—preparing a full-cost life-cycle cost estimate, using breakdowns of work to be performed, and providing a clear audit trail—were not used in preparing the estimate. We also reported that reserve funding for IFMP contingencies may be insufficient because the program did not consistently perform in-depth analyses of the potential cost impact of risks and unknowns specific to IFMP, as required by NASA guidance, nor did the program quantify the cost impact of identified risks or link its risks to funding reserves. We recommended that the program use processes dictated by best practices and NASA guidance for preparing and updating the life-cycle cost estimate as well as establish additional disciplined processes to better ensure that the agency more accurately estimates program cost and predicts the impact of possible undesired events, such as schedule slippage.

Since we issued our report, NASA has taken steps to prepare a full life-cycle cost estimate for IFMP and improve the quality and credibility of the program's cost estimates for the remaining IFMP modules by (1) establishing a new WBS for IFMP, which better describes the work performed under the program, and (2) improving the audit trail supporting the program's life-cycle cost estimate, as we recommended. Similarly, NASA has made progress toward implementing our recommendations for ensuring that adequate funding is available for IFMP contingencies by (1) establishing a comprehensive risk evaluation methodology, which is used to facilitate the estimation and allocation of financial reserves; (2) requiring that the cost impact of high severity risks be analyzed and quantified using probabilistic software tools; and (3) establishing a clear relationship between the program's risk database and its financial reserves. While NASA has made good progress toward implementing our recommendations, additional work remains in order to fully implement most of the recommendations.

Full Life-Cycle Cost Estimate for IFMP Not Yet Complete

In November 2003, we reported that the reliability of NASA's life-cycle cost estimate for IFMP was uncertain because disciplined processes required by NASA and recognized as best practices were not used in preparing the

estimate. One of these processes was the preparation of a life-cycle cost estimate on a full-cost basis—including all direct and indirect costs for planning, procurement, operations and maintenance, and disposal. Such an estimate is important for helping decision makers better assess all the costs associated with operating and implementing a program and for controlling program costs. However, NASA's life-cycle cost estimate for IFMP was incomplete and did not include the full cost likely to be incurred during the life of the program. For example, the life-cycle cost estimate did not include the cost to operate and maintain the system beyond 2010;[15] the cost of retiring the system; enterprise travel costs, which would be provided monthly by the NASA centers; and the cost of nonleased NASA facilities for housing IFMP.

Since our review, NASA has made significant progress in preparing a full life-cycle cost estimate. Based on industry best practices, NASA determined that IFMP's life cycle spans from program inception in 1999 through 2026 and is preparing the estimate according to this life cycle. The estimate also includes the full-cost categories required by NASA full-cost guidance, as well as disposal costs. However, agency officials agree that the estimate is still a work in process. During about a 2-week time frame, NASA provided us with four versions of the draft estimate. Our review of the last version indicated that there were still numerous errors in transferring data from the sources provided and cases where sources were not provided to support portions of the estimate. At the time of our review, NASA was still working to resolve discrepancies before finalizing the estimate.

Current WBS Structure Not Used to Estimate Costs for All Remaining Modules

We also reported in 2003 that NASA did not consistently use breakdowns of the work to be performed—or WBS[16]—in preparing the cost estimates for the IFMP modules, as recommended by NASA guidance. Without using the WBS as a structured approach to prepare the cost estimate, NASA cannot ensure that all costs are accounted for.

Although NASA recently updated its schedule management framework for IFMP and included a new WBS that better reflects the work to be

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[15]NASA assumed a 10-year life cycle beginning in fiscal year 2001, but the actual retirementdate for the system was unknown, according to the Deputy Program Director.

[16]A WBS is a method of organizing a program into logical subdivisions at lower and lower levels of detail.

performed, the agency has not prepared cost estimates for all remaining modules using the new WBS. Instead, only one of the three remaining modules—Integrated Asset Management—has been prepared using the new WBS. Further, this WBS estimate is incomplete, as it does not address the central implementation element. In addition, it only reflects procurement costs and does not include integration project costs, civil service salaries and travel, general and administrative costs, or service pool costs. Likewise, the WBS estimates for the Contract Management and Labor Distribution System modules prepared using the old WBS structure were either incomplete or incorrect. According to a program official, the WBS estimates for the three remaining modules will be updated and prepared in accordance with the new WBS as a part of the fiscal year 2007 budget cycle.

NASA Is on the Right Track to Provide an Audit Trail to Support the Life-Cycle Cost Estimate

In 2003, we also reported that in cases where the WBS was used to prepare the cost estimates for IFMP modules, NASA did not always provide a clear audit trail between the WBS estimate and the life-cycle cost estimate. Having a clear audit trail is among the Software Engineering Institute's (SEI)[17] requisites for producing reliable cost estimates. Without a clear audit trail, it is difficult to determine whether differences between the detailed WBS estimates and the official program cost estimate are appropriate.

NASA has made progress in providing an audit trial to support the life-cycle cost estimate it is preparing. For example, NASA drafted a document to accompany its life-cycle cost estimate that explains the methodology, assumptions, and data sources for the estimate. Also, in preparing the detailed spreadsheets to accumulate costs, the program added a column listing the data sources used. However, the detailed WBS estimates provided do not yet track clearly to the program's life-cycle cost estimate. Although additional work remains, we believe NASA is on the right track to fully implement this recommendation.

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[17]SEI is a government-funded research organization that is widely considered an authority on software implementations.

Progress Made in Establishing a Comprehensive Risk Evaluation Methodology

In addition to our concerns about the reliability of NASA's life-cycle cost estimate, we reported in 2003 that NASA did not consistently perform in-depth analyses of the potential cost impact of risks and unknowns specific to IFMP, as required by NASA guidance. Instead, the agency established funding reserves on the basis of reserve levels set by other high-risk NASA programs. NASA guidance requires cost contingencies to be tailored to the specific risks associated with a particular program or project and suggests that tools such as probabilistic risk assessment can help in analyzing risks. As we reported in 2003, without in-depth analyses of the potential cost impact of risks and unknowns specific to IFMP, NASA cannot ensure that the funding set aside for IFMP contingencies is sufficient.

Since issuance of our 2003 report, NASA has made progress toward implementing our recommendation to utilize a systematic, logical, and comprehensive tool in establishing the level of financial reserves for the remaining module projects and tailoring the analysis to risks specific to IFMP. NASA has established a comprehensive risk evaluation methodology, which is used to facilitate the estimation and allocation of financial reserves. NASA incorporated the methodology in its Program Risk Management Framework, which it has also updated. A key part of the methodology employs a probabilistic risk tool—CrystalBall—for setting IFMP specific risk-based reserves. However, NASA has not yet used this probabilistic risk tool to estimate financial reserves for all remaining module projects. CrystalBall is a COTS forecasting and simulation tool that allows the prediction of a range of possibilities based on assumptions. NASA relies on the tool's Monte Carlo simulation capabilities to add a level of rigor to the reserves calculation process. NASA has developed and approved a risk reserves template that the program and projects are required to follow and complete in calculating program- and project-level reserves funding. While the new methodology and probabilistic risk tool were used to set reserve levels for IFMP for the fiscal year 2006 budget cycle submission, the risk tool was not used in setting the reserves for the remaining module projects. IFMP program officials stated that this was because the projects submitted their fiscal year 2006 budgets before IFMP began using the risk tool. IFMP program officials said that NASA plans to use it in setting reserves for all of the projects for the fiscal year 2007 budget cycle and use those reserves in the fiscal year 2007 budget submission.

Progress Made, but Cost Impact of Risk Not Quantified Consistently

We further reported in 2003 that NASA typically did not quantify the cost impact of identified risks. According to SEI guidance, estimating the potential cost impact for all identified risks is an element of good estimating practice. Quantifying the cost impact of identified risks helps programs develop realistic budget estimates. As we reported in 2003, without estimating the potential cost impact of its IFMP risks, NASA cannot determine whether it has sufficient reserves to cover such risks.

NASA has taken positive steps to implement our recommendation to quantify the cost impact of risks with a high likelihood of occurrence. Specifically, NASA now requires that the cost impact of high severity risks be analyzed more consistently through the use of standardized risk reserves templates and be quantified through the use of a more rigorous methodology and probabilistic risk tool. However, as we noted previously, NASA used a risk tool in calculating risk-based reserves for IFMP for the fiscal year 2006 budget cycle but not for the individual projects. While NASA did quantify the cost impact of high severity risks for individual projects, it did not do so using the tool, nor did it provide us other documentation that evidenced the projects' use of the tool. IFMP officials stated that NASA plans to use the risk tool along with the new methodology to quantify the cost impact of high severity risks for the projects during the fiscal year 2007 budget cycle and reflect the established reserve levels in the fiscal year 2007 IFMP budget submission.

NASA Has Established a Clear Link between IFMP's Risk Database and Financial Reserves

In addition to not typically quantifying the cost impact of identified risks, we reported in 2003 that NASA did not consistently link identified risks to funding reserves. Linking risks to funding reserves helps to ensure that funds are available should the risk occur. Moreover, quantifying the cost impact of identified risks and clearly and consistently linking the risk database to funding reserves helps programs develop realistic budget estimates.

As we recommended in our November 2003 report, NASA has successfully established the link between the program's risk database and financial reserves. Specifically, NASA's new risk/reserves methodology ensures that traceability is maintained through the use of the risk reserve templates that assist the program and projects in determining the high severity risks and the direct relationship of risk and reserve setting. We also observed this relationship in the IFMP office's reserve template, which included the estimated cost of high severity risk and NASA's reflection of the estimated

cost in the program office's budget submission for the fiscal year 2006 budget cycle.

Conclusion

NASA has begun to implement some of our recommendations related to its acquisition and implementation of IFMP. However, progress in implementing our recommendations has been limited and slow in coming. The longer NASA takes to implement our recommendations, the greater the risk that IFMP will require costly and time-consuming rework to perform as intended. Because NASA did not adopt disciplined acquisition and implementation practices from the onset and has yet to fully implement our recommendations, it has been forced to take actions that should have been accomplished prior to implementation—causing the agency to unnecessarily invest time and resources to rework already-deployed system components in order to produce a system that meets user needs. By expeditiously implementing each of our recommendations, NASA has the opportunity to minimize the impact of past mistakes and begin to reap the benefits of operating with an integrated financial management system sooner. The longer NASA waits to fully implement our recommendations, the greater the risk is that the agency will continue to operate a system that does less than promised and costs more than expected.

Recommendation for Executive Action

Given the significance of the remaining problems with IFMP, we recommend that the NASA Administrator direct the IFMP Program Executive Officer to develop an integrated enterprise master schedule and milestones in coordination with the Office of the CFO, OCE, and the Program Analysis and Evaluation Office. The schedule, developed in the context of modernized business processes and improved operations, should include the improvement activities and plans already in place, dates for completion, how progress will be measured, and clear accountability for each action not completed in a timely and effective manner.

Agency Comments and Our Evaluation

In commenting on a draft of this report, NASA agreed with the intent of our recommendation but expressed concern that the recommendation might be misunderstood. NASA suggested that instead of recommending that NASA develop an overall corrective action plan to address the weaknesses identified, we recommend that NASA develop an integrated enterprise master schedule and milestones. We agree with NASA that the reworded

recommendation captures the intent of our original recommendation and have incorporated this change into our final report.

In its written comments, which are reprinted in enclosure III, NASA also expressed its concern that the nomenclature we used to describe NASA's progress toward implementing our recommendations was potentially ambiguous. Specifically, NASA raised concerns that our characterization of certain recommendations as "open" did not appropriately recognize the full extent of the agency's effort and suggested that we use instead "partially implemented" or, whenever appropriate, "closed." We disagree with NASA's assessment and continue to believe that our characterization of NASA's progress is appropriate. As discussed previously, our criteria for assessing the extent of implementation of our recommendation are as follows. We considered a recommendation closed when NASA provided us with documentation that demonstrated that it had fully addressed the concerns we raised in our prior reports. Recognizing that many of our recommendations may take considerable time and effort to fully implement, we considered a recommendation to be partially implemented if the documentation provided indicated that NASA had made significant progress addressing our concerns. For recommendations we consider open, NASA's documentation indicated that the agency was either in the very early planning stages or had not yet begun to implement the recommendation.

In its comments, NASA stated that it has defined and implemented a methodology for software component dependency analysis that largely mirrors the elements of SEI's approach for performing such analysis.[18] These elements include a design process that allocates requirements among the various commercial components that constitute a given system design option and using iterative prototyping to assess the interactions among these components. NASA also stated that the prototyping that it performed on an IFMP module (i.e., contract management module) was not limited to basic integration scenarios as we reported, but rather included end-to-end processes and detailed key accounting validations. The agency concluded that—based on its methodology and proven track record in implementing it on one module—our two recommendations relating to component dependency analysis should be considered "closed."

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[18]Wallnau, Hissam, and Seacord.

We disagree. Our review of the methodology and supporting documentation provided, observation of the prototyping demonstration, and interviews with IFMP officials showed that while the agency had performed integration activities and produced artifacts and system development products, the methodology is incomplete in that it does not include a defined design process relevant to component dependency analysis. As a result, the methodology limits visibility into the information flows, documentation requirements, product standards, activities, commitment status, events, assessment methods, and roles and responsibilities needed to systematically define the progressive discovery, analysis, tracking, and resolution of component dependencies and their life-cycle relationships to good engineering and management decisions. With respect to the complexity of the integration scenarios that were prototyped, we found that the scenarios were becoming more complex; however, we found that critical and complex scenarios had yet to be prototyped. Specifically, we found that the prototyping scenarios being evaluated were primarily oriented to proving basic feasibility. Further, NASA's own documentation stated that complex but required integration scenarios (e.g., modifications) were not evaluated, but rather basic integration that appeared achievable. Moreover, with regard to its proven track record in implementing these procedures, NASA officials stated that the methodology was being applied for the first time to evaluate the contract management module, and NASA's documentation characterizes the methodology as an overview. We agree that the level of specificity contained in the methodology description provides only an overview, and believe that one application of such a methodology does not constitute a proven track record.

With respect to our assessment of NASA's enterprise architecture, NASA made two primary points. First, NASA stated that it respectfully challenges our 2003 position that the agency acquired and implemented significant components of IFMP without having and using an enterprise architecture to guide and constrain the program. Second, NASA stated that since 2003 it has made extensive progress in adopting key architecture management best practices recommended by GAO and OMB, and it has continued to refine and expand the content of its enterprise architecture. As such, it stated that—based on Version 3.1 of the NASA enterprise architecture—20 of our 22 prior architecture recommendations are "closed." According to NASA, its actions since 2003 provide a solid foundation for the agency's modernization efforts, including IFMP, mitigating the risk of investments being implemented in a way that does ensure system integration, interoperability, and optimized mission support.

We disagree with both of NASA's points. First, in response to NASA's position challenging our finding that the agency had acquired and implemented significant components of IFMP without having and using an enterprise architecture, we note that NASA concurred with all of the recommendations in our 2003 report.[19] In that report, we stated that NASA had either implemented or was in the process of implementing six of nine IFMP modules, and that the enterprise architecture, which NASA, at that time, had just recently begun to develop, lacked sufficient detail to guide and constrain investment decisions. Accordingly, we reported that significant IFMP components had been acquired and implemented outside the context of an enterprise architecture. At that time, NASA's CTO, who is currently the Deputy CIO/CTO, concurred with our position that the architecture products used to acquire and implement the six IFMP modules did not contain sufficient scope and content. Second, our assessment of NASA's efforts to address our prior recommendations is based on the totality of the evidentiary support that NASA has provided. The evidence provided to us during the course of our review and used as a basis for our analysis showed that NASA has implemented 1 and partially implemented 4 of our 22 enterprise architecture recommendations. The evidence that NASA provided us related to Version 3.0 of its architecture and was in response to our request for the most current information. NASA neither cited the existence of Version 3.1 nor provided documentation associated with it. In addition, NASA has yet to respond to our request for the documents referenced in enclosure 3 of its comments (e.g., Master Work Plan and investment reviews) or Version 3.1 of the architecture.

Finally, as part of NASA's written comments, NASA included four enclosures, as follows: (1) the agency's response to each section of our report, (2) NASA's position on each of our prior recommendations, (3) a synopsis of significant enterprise architecture accomplishments, and (4) a briefing slide synopsis of significant enterprise architecture accomplishments. NASA's briefing slide synopsis of significant enterprise architecture accomplishments restates the information contained in the third enclosure; therefore, we did not reprint this document.

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[19]GAO-04-43.

As agreed with your office, unless you publicly 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 Administrator of NASA, 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 Gregory D. Kutz at (202) 512-9095 or kutzg@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs can be found on the last page of this report. Key contributors to this report are acknowledged in enclosure IV.
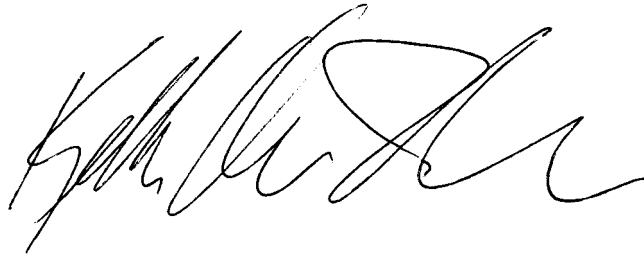
Gregory D. Kutz
Managing Director
Forensic Audit and Special Investigations

Allen Li
Director
Acquisition and Sourcing Management

Randolph C. Hite
Director
Information Technology Architecture and Systems Issues

Keith A. Rhodes
Chief Technologist
Applied Research and Methods

Enclosure I: Objectives, Scope, and Methodology

In fiscal years 2003 and 2004, we issued four reports on the National Aeronautics and Space Administration's (NASA) Integrated Financial Management Program (IFMP) and made a number of recommendations for improving the acquisition and implementation strategy for IFMP. The focus of this report was to determine the extent to which NASA adopted the recommendations made in each of the related reports. This engagement was carried out and managed jointly by GAO's Financial Management and Assurance, Information Technology Architecture and Systems Issues, Acquisition and Sourcing Management, and Applied Research and Methods teams. Each team interviewed the appropriate NASA officials and obtained documentation on NASA's progress toward implementing our recommendations. Based on our assessment of the documentation provided, we determined the extent to which NASA had implemented our recommendations.

To determine whether NASA had established and implemented a commercial component dependency methodology and evaluated the suitability of already acquired but not yet implemented IFMP component products, we (1) obtained IFMP documentation for the requirements, design, and risk management processes with respect to managing commercial-off-the-shelf dependencies; (2) interviewed NASA IFMP officials to obtain an understanding of the methodology being employed by NASA to perform these analyses and the prototype being used; (3) observed NASA's demonstration of the prototype being used; and (4) reviewed documentation showing the preliminary results of NASA's evaluation of the contract management module and ongoing dependency analysis of the interactions between this module and already-implemented IFMP component products.

To determine whether NASA had implemented our recommendations related to the development and use of an enterprise architecture, we (1) interviewed NASA's Deputy Chief Information Officer (CIO)/Chief Technology Officer (CTO) and (2) analyzed documents obtained from this official, including a verification and validation report and draft configuration management plan, to assess whether the agency had established effective architecture management processes and incorporated missing architecture content requirements. We used our Enterprise

Architecture Management Maturity Framework[1] to assess the agency's efforts.

Because NASA officials acknowledged that they had not developed a corrective action plan to mitigate the risks associated with relying on already-deployed IFMP commercial components, we interviewed IFMP program officials to understand their rationale for not developing such a plan.

To determine whether NASA had engaged program managers and cost estimators to identify and document program management needs and reengineered its acquisition management processes, we interviewed officials from the Office of the Chief Engineer, the Office of the Chief Financial Officer (CFO), and the IFMP program office. We also obtained and analyzed NASA's recently updated procedural requirements for program and project management (NPR: 7120.5C) and Project Management Information Improvement (PMI[2)] planning documents—including proposed system requirements, coding structures, and timelines. Because NASA management acknowledged that they have not yet reengineered the agency's acquisition management process, we documented the agency's plans to implement this recommendation through PMI[2].

Because NASA management acknowledged that our recommendations related to the Federal Financial Management Improvement Act of 1996 (FFMIA) compliance remain open, we documented the agency's current plans to produce systems that meet the requirements of FFMIA by obtaining and analyzing the Office of the CFO's *Financial Leadership Plan* and the *Financial Management Improvement Strategy.*

To determine whether NASA had improved its requirements management and testing processes as we recommended, we interviewed IFMP program officials and obtained and analyzed (1) documentation from NASA's requirement tracking system for selected requirements to determine that requirements are consistent, verifiable, and traceable, and contain the necessary specificity; (2) examples of NASA's regression testing results; and (3) the metrics used by NASA to monitor IFMP's stability.

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[1]GAO, *Information Technology: A Framework for Assessing and Improving Enterprise Architecture Management, Version 1.1*, GAO-03-584G (Washington, D.C.: April 2003).

To determine whether NASA had implemented our recommendations
regarding IFMP program life-cycle cost estimates, we obtained and
analyzed NASA's current life-cycle cost estimate to (1) determine whether
estimates for the remaining modules are prepared in accordance with the
current Work Breakdown Structure (WBS); (2) verify the integrity of the
life-cycle cost estimate by footing, cross-footing, and analyzing
components; (3) evaluate the audit trail by tracing amounts in the life-cycle
cost estimate to the module WBS estimates and other supporting sources;
and (4) ensure that the estimate was prepared in accordance with NASA's
life-cycle cost and full-cost guidance. In addition, we interviewed IFMP
officials to determine whether NASA is using a systematic, logical, and
comprehensive tool, such as probabilistic risk assessment, in establishing
financial reserves for IFMP-specific risks for the remaining modules—
which include the Integrated Asset Management, Contract Management,
and Labor Distribution System.

To determine whether NASA had implemented our recommendations
related to funding reserves, we (1) analyzed NASA's program/projects
reserve templates, related budget documentation, and status reports to
verify the extent to which reserve levels are being established using any
new or enhanced risk evaluation methodology and probabilistic risk tool
and (2) observed a demonstration of the probabilistic risk tool that NASA is
now using. In addition, we determined the extent to which NASA reflected
reserves established under its new or enhanced methodology and risk tool
in its fiscal year 2006 budget submissions planned for doing so in the fiscal
year 2007 IFMP budget submissions, or both. Using the reserve templates
and related budget documentation, we determined the extent to which
NASA has quantified the cost impact of high severity risks for IFMP and
whether a direct relationship of risk and reserve setting was established in
the templates or other databases.

The audit work was conducted from March 2005 through June 2005 in
accordance with U.S. generally accepted government auditing standards.

Enclosure II: Status of Recommendations

Table 2 summarizes the status of NASA's efforts to implement recommendations we made in a series of reports issued during fiscal years 2003 and 2004 on IFMP. We considered a recommendation closed when NASA provided us with documentation that demonstrated that it had fully addressed the concerns we raised in our prior reports. Recognizing that many of our recommendations may take considerable time and effort to fully implement, we considered a recommendation to be partially implemented if the documentation provided indicated that NASA had made significant progress addressing our concerns. For recommendations we consider open, NASA's documentation indicated that the agency was either in the very early planning stages or had not yet begun to implement the recommendation.

Table 2: Status of Recommendations from GAO Reports on IFMP

	Closed	Partially implemented	Open
Recommendations to improve NASA's acquisition management practices. GAO-03-507			
(1) Establish and implement a methodology for commercial system component dependency analysis and decision making.		X	
(2) Evaluate the suitability of already-acquired, but not yet implemented, IFMP component products within the context of a component dependency analysis methodology.		X	
Recommendations regarding NASA's enterprise architecture. GAO-04-43			
(1) Establish a NASA enterprise architecture policy and designating a NASA architecture board, or comparable body, that is made up of agency executives who are responsible and accountable for developing and maintaining the architecture.		X	
(2) Ensure that the architecture content requirements identified in this report are satisfied by first determining the extent to which NASA's initial release of an enterprise architecture satisfies these content requirements and then developing and approving a plan for incorporating any content that is missing.			X
(3) Ensure that the program's plans are aligned with the initial and subsequent versions of the enterprise architecture.			X
(4) Immediately map already-implemented IFMP components to the agency's enterprise architecture and report to the Program Executive Officer any instances of misalignment, the associated risks, and proposed corrective actions.			X
(5) Develop corrective action plans that include specific milestones, cost estimates, and detailed actions to be taken to align the program with the enterprise architecture.			X
(6) In developing the architecture, the board and the CIO should			
(a) Establish a written and approved policy for architecture development.			X

(Continued From Previous Page)

	Closed	Partially implemented	Open
(b) Place enterprise architecture products under configuration management.			X
(c) Ensure that progress against architecture plans is measured and reported.			X
(7) In completing the architecture, the board and the CIO should			
(a) Establish a written and approved policy for architecture maintenance.			X
(b) Ensure that enterprise architecture products and management processes undergo independent verification and validation.		X	
(c) Ensure that architecture products describe the enterprise's business and the data, application, and technology that support it.			X
(d) Ensure that enterprise architecture products describe the "As Is" environment, the "To Be" environment, and a sequencing plan.			X
(e) Ensure that business, performance, data, application, and technology descriptions address security.			X
(f) Ensure that the CIO approves the enterprise architecture.	X		
(g) Ensure that the steering committee and/or the investment review board has approved the current version of the enterprise architecture.		X	
(h) Measure and report on the quality of enterprise architecture products.			X
(8) In implementing the architecture, the board and the CIO should			
(a) Establish a written and approved policy for IT investment compliance with the enterprise architecture.			X
(b) Ensure that the enterprise architecture is an integral component of IT investment management processes.			X
(c) Ensure that IT investments comply with the enterprise architecture.			X
(d) Obtain Administrator approval of each enterprise architecture version.		X	
(e) Measure and report enterprise architecture return on investment.			X
(f) Measure and report on enterprise architecture compliance.			X
Recommendations to mitigate risk associated with relying on already-deployed components. *GAO-03-507*			
(1) Identifying known and potential risks.			X
(2) Assessing the severity of the risks on the basis of probability and impact.			X
(3) Developing risk mitigation strategies.			X
(4) Assigning responsibility for implementing the strategies.			X
(5) Tracking progress in implementing these strategies.			X
(6) Reporting progress to relevant congressional committees.			X
Recommendations regarding identifying program management needs and reengineering business processes. *GAO-03-507*			
(1) Engage stakeholders—including program managers, cost estimators and the Congress—in developing a complete and correct set of user requirements.	X		

(Continued From Previous Page)

	Closed	Partially implemented	Open
(2) Reengineer acquisition management processes, particularly with respect to the consistency and detail of budget and actual cost and schedule data provided by contractors.			X
Recommendations to improve NASA requirements management and testing processes. *GAO-03-507*			
(1) Develop and properly document requirements.		X	
(2) Conduct thorough regression testing before placing modified components into production.		X	
(3) Implement a metrics program that will identify and address the root causes of system defects.		X	
Recommendations to improve external financial reporting. *GAO-04-151*			
Implement a corrective action plan that will produce a financial management system that complies substantially with the requirements of FFMIA. This includes capabilities to produce timely, reliable, and useful financial information related to (1) property, plant, equipment, and materials;			X
(2) budgetary information, including adjustments to prior year obligations;			X
(3) accounts payable and accrued costs; and			X
(4) the full cost of programs for financial reporting purposes.			X
Recommendations regarding IFMP program life-cycle cost estimates and funding reserves. *GAO-04-118*			
(1) Prepare a full life-cycle cost estimate for the entire IFMP that meets NASA's life-cycle cost and full cost guidance.		X	
(2) Prepare cost estimates by the current Work Breakdown Structure for the remaining modules.			X
(3) Provide a clear audit trail between detailed WBS estimates and the program's cost estimate for the remaining modules.		X	
(4) Utilize a systematic, logical, and comprehensive tool, such as Probabilistic Risk Assessment, in establishing the level of financial reserves for the remaining module projects and tailor the analysis to risks specific to IFMP.		X	
(5) Quantify the cost impact of at least all risks with a high likelihood of occurrence and a high magnitude of impact to facilitate the continuing analysis necessary to maintain adequate reserve levels.		X	
(6) Establish a clear link between the program's risk database and financial reserves.	**X**		

Source: GAO.

[a]Although NASA did not develop a corrective action plan to identify known and potential risks, NASA has begun to take steps to implement our recommendations to improve its requirements management and cost-estimating processes, which if implemented properly, could help to mitigate the risk associated with relying on already-deployed IFMP components.

Enclosure III: Comments from the National Aeronautics and Space Administration

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

July 27, 2005

Mr. Gregory Kutz
Managing Director
Forensic Audits and Special Investigations
United States Government Accountability Office
Washington, DC 20548

Dear Mr. Kutz:

Thank you for the opportunity to review and comment on the draft report entitled, *Some Progress Made Toward Implementing GAO Recommendations Related to NASA's Integrated Financial Management Program (IFMP)* (GAO-05-799R), dated June 22, 2005. I appreciate the Congressional and General Accountability Office's (GAO) interest in this vital program as it continues to improve NASA's 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.

We also truly appreciate the GAO recognition that progress has been made against its previous recommendations. Moreover, we also believe that significant progress has now been made in several of the areas identified by GAO in the past few years. As seen in Enclosures 1, 3, and 4 of this letter, a high number of actions and efforts have been successfully performed since the GAO issued its earlier reports in 2003 and 2004. We are concerned with the potentially ambiguous "Open" nomenclature used as classification on most of the recommendations and respectfully suggest that the GAO, in producing its final report, use the possibly more accurate nomenclature of "Partially Implemented" or, whenever appropriate, "Closed." NASA's response to each section of the draft GAO report is provided within Enclosure 1, and our position on each of the recommendations is summarized in Enclosure 2.

Finally, while NASA understands the intent of the draft report's new recommendation to "develop an overall corrective action plan," as noted above, we are quite concerned that the intent of this recommendation might be misunderstood and would respectfully propose that NASA "develop an integrated enterprise master schedule and milestones, encompassing and tightly coordinating with the improvement activities and plans already in place from the Office of the Chief Financial Officer, the Office of the Chief Engineer and the Program Analysis and Evaluation Office," which NASA believes meets the letter and intent of this new recommendation.

2

       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,

Frederick D. Gregory
Deputy Administrator

4 Enclosures

cc:
Program Executive Officer/Mr. Ciganer
Chief Information Officer/Ms. Dunnington
Associate Administrator (Acting)/Mr. Geveden
Chief Financial Officer/Ms. Sykes
Office of Chief Financial Officer/Mr. Blair
Program Director/Mr. German
Office of the Chief Information Officer/Mr. McManus

Enclosure 1 - Detailed Responses to Draft GAO Report (GAO-05-799R)

Response to GAO report section titled *"NASA is Taking Steps to Assess Integration Risk for IFMP Commercial Components"*

The Integrated Financial Management Program (IFMP) has defined and implemented a methodology for software component dependency analysis. The elements of this approach largely mirror those of the Software Engineering Institute (SEI). The table below identifies the major areas that are covered by our methodology. We believe that our methodology provides a framework that reduces the risks introduced by organizational complexity and the variance in project priorities and agendas.

See comment 1.

IFMP Software Component Dependency Methodology

Recommended Methodology Activities	Equivalent IFMP Integration Project Office Methodology Activity	Activity Deliverables	Organization with Primary Responsibility
Gap analysis between requirements and component capabilities	Systematic Gap Analysis	▪ Detailed Gap Analysis Assessment ▪ Communication concerning gaps in the Preliminary Project Review	Agency System Implementation Project Office (ASIPO) Project Team
Risk Management	Risk Management Plan On-going Risk Reviews	▪ Prioritized list of risks ▪ Mitigation strategies and action plans ▪ Updated Risk Management database	ASIPO Project Team
Allocating requirements among the various commercial components that comprise a given system design option.	Requirements Management Plan	▪ Project Scope Document ▪ Requirements in RequisitePro (Level I – Level IV, as well as Use Case requirements)	ASIPO Project Team
Defining the interactions among the various commercial components to enable the processing of transactions.	Initial Integration Workshop Detailed Design Workshops	▪ High-level 'To Be' Business Workflows ▪ List of proposed interfaces ▪ Detailed use cases and software requirement specifications ▪ Detailed list of requirements ▪ Maturity Level Designation ▪ Enterprise Application Integration Pattern Survey	Integration Project Office
Interactions that affect data clean-up and conversion activities.	Data Conversion Workshops	▪ Data Clean-up Plan ▪ List of proposed data conversions	ASIPO Project Team

Enclosure 1-1

Enclosure 1 - Detailed Responses to Draft GAO Report (GAO-05-799R)

Recommended Methodology Activities	Equivalent IFMP Integration Project Office Methodology Activity	Activity Deliverables	Organization with Primary Responsibility
		▪ Functional designs ▪ Technical designs	
Documenting commitments and Decisions	Proof of Concept Review Critical Design Review	▪ Documented approval to proceed	ASIPO Project Team
Using iterative prototyping to assess the interactions among these components.	Proof of Concept Phase	▪ Use cases and software requirement specifications ▪ Working integrations for selected interfaces	Integration Project Office

In addition, it should be noted that the prototyping executed for the Contract Management Module was not limited to basic integration scenarios as suggested in the GAO report. It included the following end-to-end business processes and detailed key accounting validations:

1. PR sent to PRISM (Commitment recorded in SAP)
2. PR validated in PRISM
3. Award Created in CMM
4. PO Sent to SAP (Obligation recorded in SAP, Commitment Liquidated in SAP)
5. PO Content Validated in SAP
6. Accounting Validated as Correct (Funds Management and Special General Ledger updated correctly in SAP)
7. Goods Receipt Completed (Cost recorded in SAP)
8. Accounting Validated as Correct (Funds Management and Special General Ledger updated correctly in SAP)
9. Invoice Completed (Disbursement recorded in SAP)

These steps were all executed against the following scenarios:

▪ Simple fixed-price PO from a one-line, one-account PR, Project Funds
▪ Simple ten-line PO from a ten- line supply PR, Project Funds
▪ Fixed Price PO from a one-line, one-account service PR, Cost Center Funds
▪ Multi-Line Fixed Price Contract from a PR with two service lines. Each service line has one accounting line, Project Funds
▪ Cost-Plus Fixed Fee Contract from a one-line, two-account service PR, Material Group "A", Project Funds
▪ Hybrid Contract from a three-line service PR. Each line has at least two account lines, Project Funds
▪ PO from a two-line PR. One line is for supplies and one line is for services. Each line has only one accounting line, Project Funds
▪ FPDS-NG, fixed-price contract from a one-line PR with one accounting line
▪ FedBizOpps, fixed price contract from a one line PR with one accounting line

Based upon the scope of our methodology, and the fact that we have a proven track record in implementing these procedures, NASA's position is that the two recommendations related to

Enclosure 1-2

See comment 1.

Enclosure 1 - Detailed Responses to Draft GAO Report (GAO-05-799R)

component dependency analysis are well beyond being "partially implemented," and should be considered "closed."

Response to GAO report section titled *"Limited Progress Made in Establishing an Enterprise Architecture to Guide Modernization Efforts"*

See comment 2.

See comment 3.

See comment 4.

NASA respectfully challenges the GAO's assessment that NASA acquired and implemented significant components of IFMP without having and using an enterprise architecture to guide and constrain the IFMP program. In response to the GAO fiscal year 2003 review of IFMP, NASA acknowledged the value of a more mature and robust enterprise architecture. NASA has continued efforts to refine the NASA Enterprise Architecture (EA), including implementing key architecture program management structures and process controls (e.g., establishing an enterprise architecture program office and designating a chief architect). NASA has now established the required Capital Planning and Enterprise Architecture processes to ensure that the NASA EA is current and NASA program and projects are measured in a proactive manner against current documents. All responses contained in this letter and supporting documentation are based on Version 3.1 of the NASA EA.

See comment 5.

See comment 6.

Over the last 18 months, NASA has made extensive progress in adopting key architecture management best practices recommended by GAO and the Office of Management and Budget (OMB). Enclosures 2, 3 and 4 contain summaries of the actions taken over the past ten months. NASA's EA program continues to mature and provide measurable value to the Agency. Enclosure 2 contains an element-by-element response to the GAO-04-43 audit recommendations.

NASA has taken key steps in direct response to GAO's recommendations including:

- Establishing an architecture board made up of senior agency executives that is responsible and accountable for developing and maintaining the architecture.
- Having the architecture board approve Version 3.0 of the architecture.
- Having the NASA Administrator approve Version 3.0 of the architecture.
- Establishing an independent verification and validation function to review the architecture and related management processes.

NASA continues to expand the content of the EA, developing elements in a priority order based on the strategic goals of the Agency.

See comment 7.

For the past two years, NASA has matured the IFMP related portion of the NASA EA, ensuring that IFMP plans are aligned with the architecture and that acquisition and implementation activities are appropriate. The reviews conducted to date have not shown any instances of misalignment, and the NASA OCIO and CFO are currently reviewing soon-to-be-implemented modules (e.g., contract management) to assess the extent of alignment. In addition,

See comment 8.

- NASA has established a draft written/approved policy guiding the development of the enterprise architecture. The policy was submitted for final approval in July 2005.

Enclosure 1-3

Enclosure 1 - Detailed Responses to Draft GAO Report (GAO-05-799R)

See comment 9.

See comment 10.

See comment 8.

See comment 11.

See comment 12.

See comment 13.

See comment 13.

See comment 14.

See comments 3 and 5.

See comment 15.

- NASA has placed all enterprise architecture products under configuration management to maintain integrity and traceability and to control modifications or changes to the architecture products throughout their life cycles.
- NASA has developed metrics to ensure that progress against architecture plans is measured and reported. NASA is measuring and reporting progress against approved architecture project management plans.
- NASA has established a draft written/approved policy for architecture maintenance. The policy was submitted for approval in July 2005.
- NASA has ensured that the architecture products describe the enterprise in terms of business, performance, data, application, and technology. The NASA EA products describe the "As Is" environment, the "To Be" environment, and a sequencing plan to transition from the "As Is" to the "To Be." The EA business, performance, data, application, and technology descriptions all address security.
- NASA has measured and reported on the quality of enterprise architecture products. ROI for NASA's EA program is reported as a part of the Office of Management & Budget (OMB) business case submission and reporting process.
- NASA has completed efforts intended to ensure that the enterprise architecture is an integral component of IT investment management processes and that IT investments comply with the architecture. NASA has a clearly documented Capital Planning and Investment Control Process and a set of Enterprise Architecture (EA) review processes for conducting investment alignment reviews. NASA reviews proposed system investments for compliance with the architecture and that the results of these reviews are used to revise the policy and procedures, as well as revise the review process.
- NASA has established and documented a detailed review process for enterprise architecture compliance and has completed ten EA reviews of projects and steady state services.

NASA has developed the EA program management plans required to effectively manage the development, maintenance, and implementation of the Enterprise Architecture. As documented in Enclosures 3 and 4, the plans specify measurable goals and outcomes, the tasks to be performed to achieve these goals and outcomes, the resources (funding, staffing, and training) needed to perform the tasks, and the time frames within which the tasks will be performed.

NASA has taken considerable action and made significant progress in addressing prior GAO recommendations. These actions provide a solid foundation for the Agency's modernization efforts, including IFMP, mitigating risk of investments being implemented in a way that adequately ensures system integration, interoperability, and optimized mission support.

Response to GAO report section titled *"NASA Did Not Develop a Corrective Action Plan To Mitigate the Risk of Relying on Already Deployed Components"*

The GAO's comment in this area is partially ambiguous. In its original report, GAO-03-507, dated April 2003, the GAO recommended that NASA develop and implement (1) a short-term plan to identify and mitigate the risks currently associated with relying on already deployed IFMP commercial components and (2) a longer term strategy for acquiring additional IFMP components that includes implementing a methodology for commercial system component

Enclosure 1-4

Enclosure 1 - Detailed Responses to Draft GAO Report (GAO-05-799R)

dependency analysis. At the time that GAO recommended that a "short-term plan" be developed, NASA was still in the process of implementing the Core Financial system, and the GAO was concerned about requirements and testing processes.

See comment 15.

Since the time that GAO issued its report (GAO-03-507), NASA has fully implemented and stabilized the financial system, and is continuing to seek ways to improve its use of the system (e.g., re-engineered financial structures). Also, as noted in the current GAO draft report, NASA has made significant progress with respect to (1) component dependency analysis, (2) requirements management processes, (3) testing processes, and (4) risk management and evaluation processes. In short, we believe that we have the right processes in place related to this area of concern, and respectfully disagree with the GAO's assessment that the recommendations in this area are "open."

Response to GAO report section titled *"Progress Made Toward Identifying Program Management Needs But Process Reengineering Still Needed"*

NASA Has Made Significant Progress Toward Identifying Program Management Needs
As noted in the GAO report, NASA has engaged stakeholders to identify program management needs. We agree with the GAO's findings and assessment.

Future Plans to Reengineer Acquisition Management Processes Are Key
The GAO adequately captured the multitude of plans and activities currently underway which address weaknesses in acquisition management processes. As noted, NASA has embarked on an ambitious endeavor to re-engineer and implement a new financial structure aligned with the Agency's technical work breakdown structure. This will be completed by October 1, 2005. NASA has also formed a "Business Integration Team," consisting of both internal and external experts, to review NASA's contractor cost reporting and associated cost accrual processes, and to implement the re-engineered changes by October 1, 2006. These and other process improvement efforts will establish the critical framework needed for more effective acquisition management practices.

Response to GAO report section titled *"Improvements Made To Requirements Management and Testing Process"*

See comment 16.

As stated in the GAO's report, beginning in May 2003, the IFMP Competency Center deployed a Test Management application that has since provided the basis for improved requirements management and regression testing of the Core Financial and subsequently implemented modules. In February 2004, the IFMP Quality Assurance team deployed an advanced computerized tool, "RequisitePro," used to create an additional level of control over the several thousands of detailed requirements associated with the development and performance of our IFMP software applications. In addition to the deployment of these new tools, a separate Quality Assurance team was established as part of the Competency Center to focus on sound requirements collection and documentation for all IFMP software components.

Now that the framework is established, our aim is to continually improve our requirements management procedures. As stated in the GAO's report, we are looking at addressing the

Enclosure 1-5

Enclosure 1 - Detailed Responses to Draft GAO Report (GAO-05-799R)

remaining outstanding requirements documentation issues from the Core Financial in time to leverage this new framework for the design, development, and testing associated with the SAP Version Upgrade activities scheduled for FY 2006. As this will be a complex and challenging task, we plan to work with the GAO on these activities and leverage their recommendations.

See comment 16.

We disagree with the statement in the report that "many of the system configuration problems caused by the Agency's ineffective requirements management and testing processes continue to plague the Core Financial module." To suggest that the Core Financial system has significant configuration problems is inaccurate. At the present time, very few configuration issues remain in the Core Financial system. The most recent analysis of data shows that fiscal year 2005 is relatively clean. The continued challenges faced by NASA in receiving a clean audit opinion stem from problems not directly related to the Core Financial SAP system. For the GAO to continue to point to the Core Financial SAP system as the source of the NASA's financial accounting problems misrepresents the nature of the issues, and could result in further weakening of support for IFMP's efforts, both internal and external to the Agency.

Response to GAO report section titled *"Detailed Plan for Compliance with the Federal Financial Management Improvement Act is Still Needed"*

See comment 17.

The Office the CFO's Financial Leadership Plan provides the goals of the organization and the framework for achieving those goals. The OCFO Strategic Initiatives (formerly known as the Financial Management Improvement Plan) established the near term priorities and objectives for improving financial management. Through these initiatives, progress has been made in addressing material weaknesses in the areas of fund balance with Treasury, policies and procedures, financial statement preparation, and system issues, including producing transaction level detail in support of financial statement account balances, compensating controls and procedures for identification of correcting entries, and accuracy of transactional postings. The extent of this progress will be assessed during the FY05 Financial Audit, which is currently underway. An FFMIA Remediation Plan is under development and will be completed by the end of calendar year 2005.

Response to GAO report section titled *"Improvements Made To NASA's IFMP Life-Cycle Cost Estimate and Processes for Calculating Funding Reserves"*

Full Life-Cycle Cost Estimate for IFMP Not Yet Complete
As the GAO stated in its report, IFMP has made significant progress in preparing a full Life-Cycle Cost Estimate (LCCE) based on industry best practices. As noted by the GAO, the IFMP LCCE estimate was a "work in progress" at the time the GAO made its assessment, which is why this area is considered "partially implemented." We agree with this assessment.

NASA is on the Right Track to Provide an Audit Trail to Support Life-cycle Cost Estimate
We agree with the GAO's assessment. We are continuing to refine the mapping of IFMP data sources to the Work Breakdown Structure (WBS) structure in the LCCE. When completed, we will have a clear audit trail between detailed WBS estimates and Program costs for remaining modules. The next version of the LCCE will be finalized by late October 2005.

Enclosure 1-6

Enclosure 1 - Detailed Responses to Draft GAO Report (GAO-05-799R)

Current Work Breakdown Structure (WBS) Not Used To Estimate Costs For All Remaining Modules

In this case, NASA respectfully disagrees with the GAO findings in this area. As the GAO noted, the Program is employing a standard WBS, which was updated with its "Schedule Management Framework." That WBS has been used in recent cost estimates within new and updated Business Case Analyses (BCA). Specifically,

See comment 18.

- The new WBS was used in the two BCAs (Labor Distribution System and Contract Management Module) referenced in the draft GAO report.
- The WBS estimate does include Center Implementation Costs, which are Section 2.0 of the WBS. An appendix of each BCA provides a Basis of Estimate (BOE) that identifies the cost build that supports the BCA cost estimate.
- Lastly, within the BOE for each BCA are included following costs: integration project, civil service salaries and travel, G&A, and service pool costs. These cost builds are reflected on a line-item basis in the BOE, though rolled up to the respective cost category in to the Program's WBS.

The IFMP will continue to use this current WBS for all remaining modules for the current and future budget cycles.

Progress Made in Establishing a Comprehensive Risk Evaluation Methodology

See comment 19.

As the GAO noted in their report, "NASA has established a comprehensive risk evaluation methodology, which is used to facilitate the estimation and allocation of financial reserves" and ".... employs a probabilistic risk tool." Since the time of the GAO's assessment, IFMP has fully implemented and applied the risk methodology and probabilistic tool as the basis for reserves for all elements of the Program. This was accomplished as part of this year's budget cycle. Though we agree with the GAO's findings (based on the timing of their assessment), our position, however, is that the two recommendations related to this area should be considered "closed."

Progress Made But Cost Impact of Risk Not Quantified Consistently

See comment 19.

As the GAO noted in their report, "NASA now requires that the cost impact of high severity risks be analyzed more consistently through the use of standardized risk reserves templates and be quantified through the use of a more rigorous methodology and probabilistic risk tool. As we stated above, since the time of the GAO's assessment, IFMP has fully utilized the risk methodology and probabilistic tool as the basis for reserves for all elements of the Program. Though we agree with the GAO's findings (based on the timing of their assessment), our position, however, is that the two recommendations related to risks and reserves should be considered "closed."

NASA Has Established a Clear Link Between IFMP's Risk Database and Financial Reserves

The GAO noted that NASA has successfully established linkage between IFMP's risk database and its financial reserves, and considered this recommendation closed. We agree with this assessment.

Enclosure 1-7

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

The tables below reflect NASA's position on each of the GAO recommendations. Further comments, in addition to those included in Enclosure 1, are also provided below.

See comment 1.

C = Closed, **P** = Partially implemented, **O** = Open

Recommendations to improve NASA's acquisition management practices (GAO-03-507)	GAO Position	NASA Position	Comments / Reference
(1) Establish and implement a methodology for commercial system component dependency analysis and decision making.	**P**	**C**	
(2) Evaluate the suitability of already acquired, but not yet implemented IFMP component products within the context of a component dependency analysis methodology.	**P**	**C**	

C = Closed, **P** = Partially implemented, **O** = Open

Recommendations to mitigate risk associated with relying on already-deployed components (GAO-03-507)	GAO Position	NASA Position	Comments / Reference
(1) Identifying known and potential risks.	**O**	**C**	
(2) Assessing the severity of the risks on the basis of probability	**O**	**C**	
(3) Developing risk mitigation strategies	**O**	**C**	
(4) Assigning responsibility for implementing the strategies	**O**	**C**	
(5) Tracking progress in implementing these strategies	**O**	**C**	
(6) Reporting Progress to relevant Congressional committees	**O**	**C**	The IFM Program has been reporting progress bi-annually to the House Science Committee.

See comment 15.

See comment 20.

C = Closed, **P** = Partially implemented, **O** = Open

Recommendations regarding identifying program management needs and reengineering business processes (GAO-03-507)	GAO Position	NASA Position	Comments / Reference
(1) Engage stakeholders—including program managers	**C**	**C**	
(2) Reengineer acquisition management processes	**O**	**P**	

See comment 21.

Enclosure 2-1

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

C = Closed, **P** = Partially implemented, **O** = Open

See comment 22.

Recommendations to improve NASA requirement's management and testing processes. (GAO-03-507)	GAO Position	NASA Position	Comments / Reference
(1) Developing and properly documenting requirements.	P	P	
(2) Conduct thorough regression testing before placing modified components into production.	P	C	
(3) Implement a metrics program that will identify and address the root causes of system defects.	P	P	

C = Closed, **P** = Partially implemented, **O** = Open

Recommendations to improve external financial reporting (GAO-04-151)	GAO Position	NASA Position	Comments / Reference
Implement a corrective action plan that will produce a financial management system that complies substantially with the requirements of FFMIA. This includes capabilities to produce timely, reliable, and useful financial information related to: (1) property, plant, equipment, and materials;	O	O	
(2) budgetary information including adjustments to prior year obligations;	O	O	
(3) accounts payable and accrued costs; and the full cost of programs for financial reporting purposes.	O	O	

C = Closed, **P** = Partially implemented, **O** = Open

See comments 18 and 23.

Recommendations regarding IFMP program life-cycle cost estimates and funding reserves (GAO-04-118)	GAO Position	NASA Position	Comments / Reference
(1) prepare a full life-cycle cost estimate for the entire IFMP that meets NASA's life-cycle cost and full cost guidance.	P	P	
(2) Prepare cost estimates by the current Work Breakdown Structure for the remaining modules	P	C	
(3) Provide a clear audit trail between detailed WBS estimates and the program's cost estimate for the remaining modules.	P	C	

Enclosure 2-2

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

Recommendations regarding IFMP program life-cycle cost estimates and funding reserves (GAO-04-118)	GAO Position	NASA Position	Comments / Reference
(4) Utilize a systematic, logical, and comprehensive tool, such as Probabilistic Risk Assessment, in establishing the level of financial reserves for the remaining module projects and tailor the analysis to risks specific to IFMP.	P	C	
(5) Quantify the cost impact of at least all risks with a high likelihood of occurrence and a high magnitude of impact to facilitate the continuing analysis necessary to maintain adequate reserve levels.	P	C	
(6) Establish a clear link between the program's risk database and financial reserves.	C	C	

See comments 19 and 24.

The table below summarizes NASA's position on each of the recommendations in GAO report GAO-04-043. In addition, to the comments provided in the table summarize comments included in Enclosures 1, 3, and 4 of this response.

See comment 25.

It should be noted that several of the GAO's recommendations (e.g., GAO 8.c, "ensure that IT investments comply with the enterprise architecture") can be categorized as "open ended." Given that both the NASA IT investment portfolio and the NASA EA are living documents, these can only be "closed" at a specific point in time and instance of the IT investment portfolio and version of the NEAS EA. NASA's responses are based on Version 3.1 of the NASA Enterprise Architecture and the March 2005 version of the IT Investment portfolio. NASA has established Capital Planning and EA processes to ensure that the NASA EA is current and NASA program and projects are measured in a proactive manner against the current documents. GAO Recommendation (3) has been split into two distinct tasks as follows:

See comments 3, 4, and 13.

- (3a) Ensures that the program's plans are aligned with the initial version of the EA.
- (3b) Ensures that the program's plans are aligned with subsequent versions of the EA.

The original wording included two steps: alignment with the initial version of the EA and alignment with subsequent versions of the EA. Based on the original wording of the GAO recommendation, it was not possible to close any portion of GAO recommendation (3). The whole recommendation including completed elements (i.e., alignment with the initial enterprise architecture) would remain open for the life of the IFMP.

See comments 7 and 25.

C = Closed, **P** = Partially implemented, **O** = Open

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
(1) Establish a NASA enterprise	P	C	This action was

Enclosure 2-3

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comments 6 and 8.

See comments 4 and 11.

See comment 7.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
architecture policy and designating a NASA architecture board, or comparable body, that is made up of agency executives who are responsible and accountable for developing and maintaining the architecture.			closed during the development of version 3.0 of the NASA EA. Version 3.0 was approved by the NASA Executive Committed and signed by the NASA Administrator. Version 3.0 of the NASA EA and the signed review documents were provided to the GAO IT Issues Team
(2) Ensures that the architecture content requirements identified in this report are satisfied by first determining the extent to which NASA's initial release of an enterprise architecture satisfies these content requirements and then developing and approving a plan for incorporating any content that is missing.	O	C	This action was closed during the development of version 3.1 of the NASA EA. Version 3.1 of the NASA EA was provided to the GAO IT Issues Team. NASA has not received specific written feedback from GAO detailed any specific elements of this action that are not closed.
(3a) Ensures that the program's plans are aligned with the initial versions of the enterprise architecture.	O	C	This action was closed during the development of version 2.0 of the NASA EA. All IFMP elements were reviewed and alignment

Enclosure 2-4

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comment 7.

See comments 4, 7, and 25.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43)*	GAO Position	NASA Position	Comments / Reference
			addressed. The IFMP Office provided detailed program formulation and project planning documentation to the GAO audit team in April/May of 2003 to close this action. NASA has not received specific written feedback from GAO outlining any specific elements of this recommendation that are considered not closed or completed.
(3b) Ensures that the program's plans are aligned with subsequent versions of the enterprise architecture.	O	O	This is an ongoing action that will last the life of the IFMP. All IFMP elements are reviewed and alignment addressed as a part of ongoing EA efforts. The IFMP is included in all versions of the NASA EA, including Version 1.0 and all subsequent versions. Specific evidence is located in Enclosure 3, Section II, Paragraph 3, subparagraphs 3 and 4.
(4) Immediately map already	O	C	This action was

Enclosure 2-5

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
implemented IFMP components to the agency's enterprise architecture and reports to the Program Executive Officer any instances of misalignment, the associated risks, and proposed corrective actions.			closed during the development of version 2.0 of the NASA EA. All IFMP elements were reviewed and alignment addressed. The IFMP is included in all subsequent versions of the NASA EA. NASA has not received specific feedback from GAO outlining any specific elements of this recommendation that are considered not closed or completed.
(5) Include specific milestones, cost estimates, and detailed actions to be taken to align the program with the enterprise architecture.	**O**	**C**	This action was closed during the development of version 2.0 of the NASA EA. All IFMP elements were reviewed and alignment addressed. NASA has not received specific feedback from GAO outlining any specific elements of this recommendation that are considered not closed or completed.
(6) In developing the architecture, the board and the CIO should:			

See comments 4, 7, and 25.

See comment 7.

Enclosure 2-6

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comments 3 and 8.

See comment 9.

See comments 10 and 14.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
(a) Establish a written and approved policy for architecture development.	O	P	NASA's Enterprise Architecture policy directive (NPD) and policy guidance (NPG) have been submitted to NASA policy approval process. NASA also has a policy addressing the EA certification of all staff supporting NASA EA efforts. NASA will close this action when the formal NASA review process is complete. Draft versions of all policies have been shared with the GAO IT Issues team. Specific evidence is located in Enclosure 3, Section IV, Policy and Governance.
(b) Place enterprise architecture products under configuration management.	O	C	All EA documents and data are stored under configuration control in the NASA EA repository. Specific evidence is located in: Enclosure 3, Section II, Develop Architecture Products, Paragraph 1.
(c) Ensure that progress against architecture plans is measured and	O	C	NASA has developed metrics to

Enclosure 2-7

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comments 10 and 14.

See comment 8.

See comment 26.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
reported.			ensure that progress against architecture plans is measured and reported. NASA is measuring and reporting progress against approved architecture project management plans. Specific evidence is located in: Enclosure 3, Section II Develop Architecture Products, Paragraph 1.
(7) In completing the architecture, the board and the CIO should:			
(a) Establish a written and approved policy for architecture maintenance.	O	C	NASA's EA policy directive (NPD) and policy guidance (NPG) have been submitted to NASA policy approval process. NASA will close this action when the formal NASA review process is complete. Draft versions of all policies have been shared with the GAO IT Issues team. Specific evidence is located in Enclosure 3, Section IV, Policy and Governance.
(b) Ensure that EA products and management processes undergo independent verification and validation.	P	C	NASA established an independent verification and

Enclosure 2-8

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comment 26.

See comment 27.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43)*	GAO Position	NASA Position	Comments / Reference
			validation function to review the architecture and related management processes. NASA contracted with SRA for a complete IV&V of the NASA EA Program, including the EA products, processes and the EA program management processes. SR is under contract to repeat the IV& V process in September of 2005. SRA Completed the IV&V in January of 2005 and their Remediation Plan in July of 2005. The IV&V and Remediation Plan have been provided to the GAO IT Issues team. Detailed evidence is provided in Enclosure 3, Section III, Inter-agency Interfaces and Reporting, Paragraph 1.
(c) Ensure that architecture products describe the enterprise's business and the data, application, and technology that support it.	O	C	The Agency has ensured that the architecture products describe the enterprise in terms of business, performance, data, application, and

Enclosure 2-9

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comment 27.

See comment 27.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
			technology. The EA business, performance, data, application, and technology descriptions address security. Specific evidence is located in Enclosure 3, Section II, Develop Architecture Products, Paragraph3, subparagraphs C and D.
(d) Ensure that EA products describe the "As Is" environment, the "To Be" environment, and a sequencing plan.	O	C	The NASA EA products describe the "As Is" environment, the "To Be" environment, and a sequencing plan to transition from the "As-Is" to the "To-Be." The EA business, performance, data, application, and technology descriptions address security. NASA is documenting reference architectures for key architectural elements and sequencing plans for the transition between the "as-is" and the "to-be" states.

Enclosure 2-10

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
			Specific evidence is located in Enclosure 3, Section II, Develop Architecture Products, Paragraph3, subparagraphs C and D.
(e) Ensure that business, performance, data, application, and technology descriptions address security	O	P	The Agency has ensured that the architecture products describe the enterprise in terms of business, performance, data, application, and technology. All elements of the NASA EA address security as a required cross cutting element.
(f) Ensure that the CIO approves the enterprise architecture.	C	C	NASA concurs that this action is closed.
(g) Ensure that the steering committee and/or the investment review board has approved the current version of the enterprise architecture.	P	C	This action was closed during the development of version 3.0 of the NASA Enterprise Architecture. Version 3.0 was approved by the NASA Executive Committee and signed by the NASA Administrator. Version 3.0 of the NASA EA and the signed review documents were provided to the

See comments 4 and 11.

See comment 6.

Enclosure 2-11

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comments 10 and 14.

See comments 3, 8, and 13.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
			GAO IT Issues Team.
(h) Measure and report on the quality of EA products.	**O**	**C**	NASA has developed metrics to ensure that progress against architecture plans is measured and reported. NASA is measuring and reporting progress against approved architecture project management plans. Detailed evidence is provided in Enclosure 3, Section I, Customer Outreach and Communications, Paragraph 3 and 4.
(8) In implementing the architecture, the board and the CIO should			
(a) Establish a written and approved policy for IT investment compliance with the enterprise architecture.	**O**	**C**	The Agency has completed efforts to ensure that the EA is an integral component of IT investment management processes and that IT investments comply with the architecture. NASA has a clearly documented Capital Planning and Investment Control Process. NASA has established and documented a detailed review

Enclosure 2-12

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comments 3, 8, and 13.

See comments 3, 8, and 13.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
			process for EA compliance and has completed ten EA reviews of projects and steady state services.
			Detailed evidence is provided in Enclosure 3, Section II, Develop Architecture Products, Paragraph 3 and Enclosure 3, Section IV, Policy and Governance, Paragraph 2.
(b) Ensure that the EA is an integral component of IT investment management processes.	**O**	**C**	The Agency has completed efforts intended to ensure that the enterprise architecture is an integral component of IT investment management processes and that IT investments comply with the architecture. NASA has a clearly documented the Capital Planning and Investment Control Process and a set of EA review processes for conducting investment alignment reviews. NASA reviews proposed system investments for compliance with the architecture

Enclosure 2-13

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comments 3, 8, and 13.

See comments 3, 8, and 13.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
			and that the results of these reviews are reported to the EA review sponsors and the NASA CIO. Detailed evidence is provided in Enclosure 3, Section II, Develop Architecture Products, Paragraph 3 and Enclosure 3, Section IV, Policy and Governance, Paragraph 2.
(c) Ensure that IT investments comply with the enterprise architecture.	**O**	**C**	NASA has a clearly documented set of EA review processes for conducting investment alignment reviews. NASA reviews proposed system investments for compliance with the architecture and that the results of these reviews are reported to the EA review sponsor and the NASA CIO. NASA has completed ten EA reviews of projects and steady state services. Detailed evidence is provided in Enclosure 3, Section

Enclosure 2-14

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

See comment 6.

See comment 12.

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
			II, Develop Architecture Products, Paragraph 3.
(d) Obtain Administrator approval of each enterprise architecture version.	**P**	**C**	This action was closed during the development of version 3.0 of the NASA Enterprise Architecture. Version 3.0 was approved by the NASA Executive Committee and signed by the NASA Administrator. Version 3.0 of the NASA EA and the signed review documents were provided to the GAO IT Issues Team.
(e) Measure and report EA return on investment.	**O**	**C**	The Agency measures and reports on the quality of EA products. ROI for the Enterprise Architecture program is reported as a part of the Office of Management & Budget business case submission and reporting process. Detailed evidence is provided in Enclosure 3, Section II, Develop Architecture Products, Paragraph

Enclosure 2-15

See comment 13.

Enclosure 2 – Summary of NASA's Position on each GAO Recommendation

Recommendations regarding NASA's enterprise architecture (*GAO-04-43*)	GAO Position	NASA Position	Comments / Reference
			3.
(f) Measure and report on EA compliance.	**O**	**C**	NASA has a clearly documented set of EA review processes for conducting investment alignment reviews. NASA reviews proposed system investments for compliance with the architecture. Review results are documented and available. NASA has completed ten EA reviews of projects and steady state services. Detailed evidence is provided in Enclosure 3, Section II, Develop Architecture Products, Paragraph 3.

Enclosure 2-16

Enclosure 3 - Synopsis of Significant Enterprise Architecture Accomplishments
(August 2004 to Present)

I) Customer Outreach & Communications
1) New EA Communications Structure
   A Based on GAO recommendation, selected and implemented Sharepoint software, an
      Agencywide document management system, used by the Core EA team and anyone who
      wishes to engage. Documents and artifacts are under version and configuration control, and
      users must have authenticated accounts to add or modify content. Content is organized into
      broad categories, including documentation, news and articles, action items, team lists, and
      forums. The documentation group is organized as follows:
      (1) EA NPD and NPR
      (2) NASA Federal and Legal Documentation
      (3) NASA EA Volumes
      (4) EA Reviews
      (5) EA Project Management
      (6) Reference Materials and Links of Interest

   B Developed an EA Web Site to better facilitate strategic outreach and communication.
      Completed pilot EA web site. Production site rollout planned for July 30. Content is
      prepared for NASA audiences who seek basic understanding and guidance about EA, and
      includes contact information for local and Agency EA Team members. Includes links to EA
      Reviews, policy and guidance, and more. Site conforms to all applicable NASA web site
      standards. (EA Website Initial Content Draft-2-1-1, 7/7/2005)

   C Now using email list server lists to broadcast information to pre-defined EA communities,
      including the core team (52 members), leader team (26 members), and the overall agency EA
      contact team with more than 152 members. Push information includes citations and links to
      recent EA articles, notification of recent additions to Sharepoint and the EA repository, and
      EA teleconference announcements.

2) Reorganized the EA core team for better efficiency. There are 52 core team members (24 Civil
   Service Employee and 28 Contractors) assigned to EA activities. Most are performing EA as an
   additional duty. There are 26 executives on the strategic communications team for the Agency.
   The strategic communications team acts as the management interface to quickly disseminate key
   EA actions through the Agency. Assigned tactical level EA leadership to improve product
   quality of EA work products, help define deliverables and completion schedules, and consolidate
   activities among all EA contractor teams to improve planning and workforce utilization.

3) Updated and loaded in Sharepoint a detailed and approved EA work plan. Prepared an executive
   overview briefing of all major work activities and deliverables using information derived from
   our integrated project plan (EA NASA Master Workplan V1.3, 6-3-2005; NASA EA Project
   Plan, 5-23-2005). The briefing, presented to the NASA CIO Board, presents work activities in
   120-day cycles, derived from the integrated MS Project Plan for EA.

4) Continued revisions and additions to the NASA EA repository. The repository is available to
   any NASA Civil Service Employees and contains NASA information related to the BRM, SRM,
   TRM, and DRM. The ITPM server is located at GRC at https://itpm.grc.nasa.gov/a3/index.htm.

Enclosure 3-1

See comment 28.

See comment 14.

See comment. 28.

Enclosure 3 - Synopsis of Significant Enterprise Architecture Accomplishments
(August 2004 to Present)

Materials prepared for training NASA staff on the use of the EA Repository are located at:
https://portal.nasa.gov/sites/niie/ea/Documentation/NASA_Agency_EA_Project/Training.

See comment 28.

5) Completed the second nationwide tour of each NASA Center. The first was completed in
   FY2004 and the second was completed in FY2005. The tour included on-site visits to
   Headquarters, Glenn Research Center, Langley Research Center, Ames Research Center, Dryden
   Flight Research Center, Johnson Space Center, Kennedy Space Center, Marshall Space Flight
   Center, Stennis Space Center, Goddard Space Flight Center, and Jet Propulsion Laboratory.
   Visits were designed to brief each Center's executive and line staff on Agency EA direction and
   strategy, provide ongoing training for the EA Repository, and show tangible artifacts of how EA
   is being used around the Agency. Visits are also used as a forum to derive customer feedback to
   guide our future EA activities. Visits notes for each Center are posted to Sharepoint at:
   :(https://portal.nasa.gov/sites/niie/ea/Documentation/NASA_Agency_EA_Project/Center_Visits/
   FY_2004;
   https://portal.nasa.gov/sites/niie/ea/Documentation/NASA_Agency_EA_Project/Center_Visits/F
   Y_2005

6) Conduct bi-weekly teleconferences with Agencywide EA team members. Discussion items
   include work in progress, planned work, issues tracking and resolution, and progress toward
   milestone completion. Open to all Agency Civil Service and contractor staff. Meeting notes of
   every Agency telecon are available at
   https://portal.nasa.gov/sites/niie/ea/Documentation/Forms/AllItems.aspx

7) August 2004 Workshop. NASA (Office of Chief Engineer) provided funding to pay for 75 Civil
   Service Employee from across the Agency to attend a one-week EA training class. The Core EA
   team prepared and presented the entire curriculum to this audience. The workshop established a
   baseline understanding of EA for the participants, and provide guidance on the application of EA
   products. Workshop curriculum content, presenter briefings, and case studies are located at:
   https://portal.nasa.gov/sites/niie/ea/Documentation/Forms/AllItems.aspx/sites/niiefea/Documenta
   tion/NASA_Agency_EA_Project/EA_Workshop_July_2004

8) August 2005 Workshop [PLANNED]. Anticipate 75-125 participants. The NASA EA Core
   Team will present results of major work activities from past year, propose projects for the next
   year, and receive input from participants to define and agree upon next year's work plan. Draft
   curriculum content is located at:
   https://portal.nasa.gov/sites/niie/ea/Documentation/Forms/AllItems.aspx/sites/niiefea/Documenta
   tion/NASA_Agency_EA_Project/EA_Workshop_August_2005.

II) Develop Architecture Products

See comment 9.

1) Documents and data stored in the EA repository are under configuration control.   A robust user
   authentication schema is used to assign, add, modify, and delete privileges based on user
   profiles. A security profile (proposed) is available to assure appropriate protection and access to
   sensitive NASA information, at:
   https://portal.nasa.gov/sites/niie/ea/Documentation/Forms/sites/niiefea/Documentation/NASA_A
   gency_EA_Project/ITPM_Security_Levels.doc

See comment 28.

Enclosure 3-2

Enclosure 3 - Synopsis of Significant Enterprise Architecture Accomplishments
(August 2004 to Present)

See comments 28 and 29.

2) <u>March 2005 Workshop</u>. The Core EA Team prepared training materials and facilitated a 3-day workshop to define and rationalize NASA's BRM and SRM. Created Business sub team for FEA BRM mapping analysis, a Services sub team for FEA SRM mapping analysis, and a Value team for EA Performance Metrics. The Value team defined the EA guiding principles, EA benefits for multiple user communities, and success criteria. Civil Service Employees volunteered to lead the respective BRM and SRM sub teams and defined deliverables and delivery schedules. Work products are captured in the EA repository and will undergo additional refinement in subsequent work cycles. Workshop curriculum, presenter briefings, and work products are located at:
https://portal.nasa.gov/sites/niie/ea/Documentation/Forms/AllItems.aspx/sites/niiefea/Documentation/NASA_Agency_EA_Project/EA_Workshop_March_2005;

3) Instituted EA reviews based on the SRA IV&V remediation plan. Since starting the EA Review process we have finished 8 reviews and 10 more are in progress for a total of more than $259 million in investments under review. The reviews are split between Project Reviews and Service Reviews. NASA has found that Service Reviews for the on-going, sustained IT operations provides positive focus and change management for the bulk of annual IT investment

A   EA Project Reviews (EAPR) information is found at
https://portal.nasa.gov/sites/niie/ea/Documentation/EA_Reviews/EA_Reviews_Tracking_List_7/7/2005.
.

See comments 7, 13, and 28.

(1) To date, 12 EA Project Reviews have been initiated by the Chief Enterprise Architect. Six Project Reviews have been completed, and six are in progress.   More than $93 million in project investments under EA review. Completed and approved EAPRs include NAMIS, PBMA, WBS-LPM, N2 NBS, CMM, ETPM)

(2) All completed reviews are posted to Sharepoint and the EA repository. The review documents are auditable, stand alone briefings. A comprehensive list of EAPR's is maintained on Sharepoint at:
https://portal.nasa.gov/sites/niie/ea/Documentation/EA_Reviews

(3) Notable example: The EA Project Review of IFMP's Contract Management Module (CMM) resulted in the ROI analysis and approval of a $60 Million investment, and the review prompted updates to IFMP business plans.

(4) Notable example: The EA Project Review of NASA Aircraft Maintenance Information System (NAMIS) resulted in the ROI analysis and approval of a $12.5 million investment. This investment was recently selected as the Agency Integrated Asset Management (IAM) solution for NASA aircraft. NAMIS was a Center-specific asset management application, and the EA Review analysis helped determine that it could be leveraged and scaled for Agencywide use.

See comments 3 and 7.

(5) NASA Customer feedback for EA Project Reviews.

Enclosure 3-3

Enclosure 3 - Synopsis of Significant Enterprise Architecture Accomplishments
(August 2004 to Present)

    (a) Notable example: The Process Based Mission Assurance (PBMA) executive sponsor
declared the EA Review process very valuable in preparing a business case for this IT
investment that truly supports NASA's Safety and Quality goals.

    (b) Notable example: The NASA Budget System executive sponsor declared the EA
Review process helped to demonstrate a tangible ROI after only 8 months by
standardizing how budgeting is done across the Agency, and how an improved
forecasting capability would minimize cycle preparation time for POP submission.

B   EA Service Reviews (EASR)

   (1) To date, six EA Service Reviews have been initiated by the Chief Enterprise Architect.
Two EA Service Reviews are completed and four are in progress. More than $166
million in Service (on-going) investments under review. The completed reviews include
the NDC and NISN Agencywide Services)

See comment 28.

   (2) All completed and draft EARS's posted to Sharepoint. The review documents are
auditable, stand alone briefings. A comprehensive list of EASR's is maintained on
Sharepoint at: https://portal.nasa.gov/sites/niie/ea/Documentation/EA_Reviews

    (a) Notable example: The NASA Data Center (NDC) completely rationalized all
services and investments in this services portfolio, totaling a $32 million annual
spend. Feedback from the NDC Manager indicated the EASR helped to renew focus
and contact with customers, define customer densities, and refine pay-for-serve cost
recovery models.

    (b) Notable example: The NASA Integrated Services Network (NISN) used EA work to
reorganize and rationalize its services portfolio, and create reference architectures that
graphically represent operating environments to illustrate system components,
relationships between components, and definitions of relationships between system
components and elements external to the system. This activity allowed NASA to gain
insight into this annual $100 million steady state investment.

    (c) Reference architectures for major NASA IT systems:
      (i) NASA Data Center (NDC) completed 9 Jun 2005
      (ii) NASA integrated Services Network (NISN) completed 17 Jun 2005
      (iii)Marshall Space Flight Center Infrastructure in progress
      (iv)Marshall Space Flight Center IT Security Infrastructure in progress

C   NASA BRM and SRM mapping. Marshall Space Flight Center (MSFC) has mapped their
Center infrastructure services to the participating Center businesses in order to rationalize
and understand the relationship of appropriate service for business support. This exercise is
the pilot model for all NASA Centers. MSFC has also gone on to map the specific Center IT
services back to Center businesses supported. As we make gains in these types of EA
mapping we are experiencing a better understanding of

Enclosure 3-4

Enclosure 3 - Synopsis of Significant Enterprise Architecture Accomplishments
(August 2004 to Present)

(1) Current services as they support the current Lines of Business (LoB)
(2) Gaps in services that identify the potential for new services
(3) Businesses that may not fully leverage available infrastructure support
(4) Gaps in future service plans as compared to LoB strategic plans

D   Current Agencywide effort to map NASA LoB Agencywide to IT services throughout the
Agency. We have created three EA sub-teams (working groups) to pioneer this work and
provide a basis for discussion in NASA LoB investments.

(1) Create NASA IT services reference model - August 2005
(2) Use NASA IT Service model for analysis - October 2005
(3) Create common IT definitions across the agency - August 2005
(4) Work to agreed common definitions throughout agency - October 2005

III)   Inter-Agency Interfaces & Reporting

See comments 6, 14, and 26.

1)   Based on GAO's recommendations in FY2003, the NASA Office of the CIO contracted with an
outside vendor (SRA) to conduct an Independent Validation and Verification (IV&V)
assessment of NASA's EA program. The IV&V Recommendations and Remediation plan was
completed and results are incorporated into EA work plan.
https://portal.nasa.gov/sites/niie/ea/Documentation/Forms/niie/fea/fDocumentation/EA_Referenc
e_Materials_and_Links_of_Interest/NASA_IVV_Report_Final.pdf

See comment 28.

2)   To demonstrate depth of EA understanding, NASA's Chief Enterprise Architect (John
McManus) is involved in the following Federal EA working groups:
A   Chairs the FEA Emerging Technologies working group
B   Member of FEA Component Based Architecture Working group
C   Member of FEA Governance Sub-Committee
D   Past chair of the 2005 Architecture.Gov forum
E   Member of Chief Architects Forum (CAF)
F   Recognized guest speaker at numerous forums and inter-agency meetings

3)   To demonstrate quality of leadership, the NASA Chief Enterprise Architect:
A   Is the recipient of a Federal 100 award cited for EA efforts.
B   Actively participates in OMB Enterprise Architecture activities.
C   Frequently acts as OMB reference to other agencies for:
(1) Instituting and guiding Capital Planning Investment Council (CPIC) processes
(2) Making EA real to the Agency
(3) Instituting and guiding Earned Value Management (EVM)
(4) Instituting and guiding IT Investment Portfolio management

D   NASA's Deputy Enterprise Architect is involved in:
(1) Member of Chief Architects Forum (CAF)
(2) Requested Speaker for NARA EA efforts
(3) Cited as EA contact in industry magazines

Enclosure 3-5

Enclosure 3 - Synopsis of Significant Enterprise Architecture Accomplishments
(August 2004 to Present)

4) NASA is consistently scored a high score for use of EA in the OMB Capability Maturity Model.

IV) Policy & Governance

See comments 8 and 28.

1) NASA has a completed EA NPD and NPR draft that was submitted to NODIS on July 6th for final review. Documents are located on Sharepoint (EA NPD rev-2, 7/7/2005; EA NPR Draft 7/7/2005).

2) NASA has a published CPIC policy that is has been proactively used since FY2003 to plan and manage IT investments.

See comments 3, 7, and 13.

3) Version 3.0 of the NASA EA was approved by the NASA Executive Council on August 24, 2004 and signed by the NASA Administrator.

4) EA Volumes 1-5 have been reviewed by OMB and GAO, and are currently being updated with new content to reflect changes in NASA's current and future IT environments. (Volume 6 is replaced by the NPR). Volumes are located on Sharepoin at:
https://portal.nasa.gov/sites/niie/ea/Documentation/Forms/niie/fea/fDocumentation/NASA_Enterprise_Architecture_Volumes_EA_V3.0. This includes the following:

    A   Volume 1 Version 3.0, 4/8/2005, Overall Architecture and Governance
    B   Volume 2 Version 3.0, 4/8/2005, OAIT Investment Category
    C   Volume 3 Version 3.0, 4/8/2005, Program Unique and Multi Program/Project Investment Category
    D   Volume 4 Version 3.0, 4/8/2005, Structures and Strategies
    E   Volume 5 Version 3.0, 4/8/2005, EA "To-Be" Guidance

5) NASA has an EA Certification Policy with accompanying goals:
    A   Civil Servants goals and standards
        (1) All Agency level EA Civil Servants to be certified by FY 2007
        (2) At least 1 Civil Servant for each center certified by FY 2009
        (3) Civil servants trained to lead all EA reviews by FY 2009
    B   EA contractor goals and standards
        (1) 30%-50% of all EA contractors certified by end of FY 2006
        (2) 60% - 80% of all EA contractors certified by end of FY 2007
        (3) All contractors certified by end of FY 2008

6) NASA's EA policy and guidance documents are prepared in parallel and in conjunction with other Agency policy and governance to assure uniformity of policy and consistency of application. Specifically, the EA:

See comment 3.

    A   Is interlocked with Agency IT Security policy, NPG 2810. Scott Santiago is NASA's Deputy CIO for IT Security and is the interface to the Agency EA team.
    B   Is collaborating with NASA Technical standards team. Walter Kit is a senior member of the NASA CIO staff at Headquarters and is the primary interface for this effort with the Agency EA team.

Enclosure 3-6

Enclosure 3 - Synopsis of Significant Enterprise Architecture Accomplishments
(August 2004 to Present)

C Is collaborating with the Knowledge/Records Management team led by Dr. Nitin Naik. Dr. Naik is the NASA deputy Chief Technology Officer and the primary interface to the EA Agency team for this work.

D Is collaborating with the Standards & Technical Information team at Langley Research Center. This effort is being sponsored by the Langley CIO, Duane Melson.

E Is leveraging Jet Propulsion Lab (JPL) NASA taxonomy efforts. Using the NASA Taxonomy prepared for use in the NASA portal to assure that web content adheres to a pre-defined data schema and that content is highly searchable. This body of work was sponsored by the NASA CTO and implemented at JPL. The NASA taxonomy work is located at:
   http://nasataxonomy.jpl.nasa.gov

F Was developed concurrently with CPIC and Investment portfolio documents. Documents are available at NASA Headquarters. These efforts were led by the NASA headquarters financial lead Mr. Bill Tufte.

G Is interlocked with NASA IT Project management team. This effort, lead by Scott Bair, is building a rigorous IT Project Management process that will mirror the NASA Provide Aerospace Products And Capabilities (PAPAC) process used in all major NASA flight hardware investments.

V) Future Plans
1) Workplan for FY 2006 & 2007
2) EA Reviews throughout OAIT, Multi-Purpose/Program and Program Unique IT
3) Better granularity in BRM/SRM mapping
4) First full agency draft on DRM/Taxonomy
5) Greater use of Center Architects to infuse and affect Agency EA policy into local investments and operations.

See comment 28.

Enclosure 3-7

The following are GAO's comments on NASA's letter dated July 27, 2005.

GAO Comments

1. See the Agency Comments and Our Evaluation section of this report.

2. We stand by our position in our November 2003 report[1] and would add that in its comments on this report, NASA concurred with all of our recommendations. In the 2003 report, we stated that NASA had either implemented or was in the process of implementing six of nine IFMP modules, and that the enterprise architecture, which NASA had just recently begun to develop, lacked sufficient detail to guide and constrain investment decisions. Accordingly, we reported that significant IFMP components had been acquired and implemented outside the context of an enterprise architecture. At that time, NASA's CTO, who is currently the Deputy CIO/CTO, concurred with our position that the architecture products that had been used to acquire and implement the six IFMP modules did not contain sufficient scope and content.

3. NASA has yet to provide us documentation to support this statement.

4. In response to our request for the latest version of the architecture, NASA provided us Version 3.0. NASA has yet to provide us Version 3.1 of its architecture.

5. We disagree. Based on our review of the evidence provided by NASA, the agency has made limited progress over the last 18 months in implementing our architecture recommendations. Of the 22 recommendations, NASA has implemented 1 and partially implemented 4. Seventeen remain open. Further, NASA has not provided us the documents referred to in its comments or provided us access to the Web sites cited so that we could view these documents.

6. NASA has taken these steps in each of the areas, which we acknowledge in our report. However, as we state in the report, the approval of the architecture by the architecture board and NASA Administrator and the review of the architecture and management processes by an independent verification and validation function need

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[1]GAO, *Information Technology: Architecture Needed to Guide NASA's Financial Management Modernization*, GAO-04-43 (Washington, D.C.: Nov. 21, 2003).

to be a recurring process before we will consider the associated recommendation closed. Also, as we state in the report, the current verification and validation function is not independent because it reports to the program office and not the architecture board.

7. NASA has yet to provide documentation of these reviews and proof of alignment.

8. NASA has drafted written policies governing the development, maintenance, and implementation of the architecture, as we state in our report. In May 2005, we shared our view on these drafts with the Deputy CIO/CTO. According to the Deputy CIO/CTO, the policies were to be finalized in July 2005. NASA has yet to provide us with either revised draft policies or approved policies.

9. We disagree. The configuration management plan that NASA provided us was a draft version and it did not specifically address architecture products. Further, NASA has yet to provide us with configuration procedures or processes, and the agency's Deputy CIO/CTO stated that the configuration management plan was being developed and that not all architecture products were being managed using the automated configuration management tool, SharePoint. Similarly, the verification and validation report[2] on the agency's architecture program states that NASA used both a paper-based and repository format for its architecture products, and that NASA was only beginning to plan for agency-wide use and maintenance of an architecture repository. Moreover, NASA has yet to provide us with documentation demonstrating that actual changes to architecture products were identified, tracked, monitored, documented, reported, and audited.

10. NASA has yet to provide us with documentation of the metrics it developed and used to ensure that progress against architecture plans and quality of the products are measured and reported. In addition, NASA has yet to provide us with its approved architecture project management plans.

11. See comment 4. Also, at the time of our review, the agency had not ensured that architecture products described the enterprise's business

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[2]SRA International, Inc., *National Aeronautics and Space Administration, NASA EA IV&V Report* (Jan. 10, 2005).

and data, applications, and technology that support it; ensured that the products described the "As Is" environment, the "To Be" environment, and a sequencing plan; or ensured that the business, performance, data, application, and technology descriptions address security. The Deputy CIO/CTO stated that the agency was currently developing a plan to address this recommendation.

12. See comment 10. Also, NASA has yet to provide us with the Office of Management and Budget business case submission. In addition, NASA's Deputy CIO/CTO stated that return on investment would not be reported until the end of fiscal year 2005.

13. See comment 3. Also, at the time of our review, the Deputy CIO/CTO stated that—while the agency recognizes that the architecture should be an integral part of the investment management process—the policy requiring that all investments be aligned with the architecture was still being developed and the associated procedures were in draft format. This official also stated that the process for conducting these reviews was being revised.

14. See comment 10. According to the Deputy CIO/CTO, these plans were being developed and were to be finalized in May 2005.

15. Although NASA has begun to implement our recommendations to improve its requirements management and cost-estimating processes, we continue to believe that a comprehensive corrective action plan would aid NASA in its effort to stabilize the system and improve the functionality of IFMP. Such a plan should include milestones and provide clear accountability for each action not completed in a timely and effective manner and, as such, would facilitate the expeditious implementation of each of our recommendations.

16. Our conclusion that many of the system configuration problems caused by the agency's ineffective requirements management and testing processes continue to plague the core financial module is supported in large part by assertions made by NASA's Office of the CFO. In the notes to NASA's financial statement for the first and second quarter of fiscal year 2005 (October 1, 2004 through March 31, 2005), NASA's Office of the CFO disclosed, among other things, the following:

- The financial management system is not currently designed to distinguish between current transactions and corrections to prior year transactions posted in the current year.

- Functionality and configuration problems in SAP created inappropriate transactional postings, which resulted in abnormal balances and misstatement of unobligated and other balances.

- The financial system as currently configured is unable to properly record Recovery of Prior Year Obligations (upward and downward obligation adjustments).

- The configuration and data integrity issues from fiscal years 2003 and 2004 continue to cause misstatements in accounts that contain trading partner data. This has limited NASA's ability to reconcile and resolve differences with trading partners (other federal agencies) and to eliminate intra-entity transactions (activity between NASA centers).

- Data anomalies and abnormalities also caused misstatements in many budgetary and proprietary accounts.

- We agree that NASA faces significant challenges in receiving an unqualified opinion on its financial statements that do not relate to its financial system, but clearly many of these challenges stem directly from the core financial system.

17. Two years after we recommended that NASA prepare a detailed plan to provide systems that comply with the requirements of FFMIA, according to NASA, the agency has begun this effort. However, NASA's FFMIA remediation plan is not projected to be completed until December 2005, and therefore, we could not review the plan and have no basis to assess the quality of the plan.

18. The two business case analyses (BCA) referred to in NASA's response—Labor Distribution System and Contract Management Module—were updated earlier this year, but did not use the new WBS. Further, the BCA cost estimates were based on a different life cycle than the estimates in the program's life-cycle cost estimate, and the amounts of the estimates in the BCAs and the life-cycle cost estimate differ substantially. During our fieldwork, IFMP officials told us that the BCAs did not support the program's life-cycle cost estimate but rather were intended to ensure that each project was well thought out from an

investment standpoint. As we stated in the report, each of the WBS cost estimates provided for the remaining modules in support of the life-cycle cost estimate was either incomplete or incorrect, and only one of them was prepared using the new WBS structure. Therefore, we continue to believe that IFMP needs to prepare cost estimates for the remaining modules using the current WBS.

19. At the time of our assessment, NASA agreed with our position that the recommendations pertaining to utilizing a comprehensive risk assessment tool and quantifying the cost impact of risks were partially implemented. Since completion of our assessment, according to NASA, it has implemented and applied the risk methodology and probabilistic tool as the basis for reserves for all elements of IFMP as part of the fiscal year 2007 budget cycle, which is referred to in NASA's response as this year's budget cycle. As such, NASA considers the recommendation closed. We have not reviewed the actions taken by NASA since completion of our work, and therefore, have no basis to assess the merits of NASA's assertion. We reaffirm that based on the most current information available at the time of our assessment, the recommendation was partially implemented.

20. When asked to provide an update on the status of our six recommendations intended to mitigate risk associated with relying on already-deployed components, NASA officials stated that they had an overall risk mitigation strategy related to IFMP that they use for this purpose and did not think it necessary to revise their strategy based on our recommendations. However, we continue to believe that a comprehensive corrective action plan would aid NASA in its effort to stabilize the system and improve the functionality of IFMP. Further, during the course of our work—including entrance and exit meetings in which we discussed each recommendation separately—NASA officials did not tell us that the agency reports its progress biannually to the House Science Committee. Therefore, we did not request and NASA did not provide documentation of its biannual progress briefings.

21. We considered a recommendation to be partially implemented if the documentation provided indicated that NASA had made significant progress addressing our concerns. Because NASA was in the very early planning stage of implementing our recommendation to reengineer its acquisition management process and the details for how NASA would accomplish this objective were still vague, we consider this recommendation open.

22. We reaffirm that in order to have an effective regression testing
    program NASA must also develop and properly document
    requirements. Complete, clear, and well-documented requirements are
    the foundation on which an effective testing program is established.
    Therefore, the weaknesses we identified in NASA's core financial
    module requirements impair the quality of NASA's regression testing
    program. As a result, we consider this recommendation partially
    implemented.

23. In NASA's detailed response to the recommendation pertaining to the
    audit trail between the WBS estimate and the program's cost estimate,
    NASA agreed with our assessment that the recommendation was
    partially implemented.

24. At the time of our assessment, NASA agreed with our position that the
    recommendations pertaining to utilizing a comprehensive risk
    assessment tool and quantifying the cost impact of risks were partially
    implemented, but NASA's status table shows them closed because the
    agency has taken additional action to close the recommendations since
    we completed our audit work. We reaffirm that based on the most
    current information available at the time of our assessment, the
    recommendations were partially implemented.

25. We disagree that several of GAO's recommendations can be categorized
    as "open ended." For the particular example that NASA cited, "ensure
    that IT investments comply with the enterprise architecture," closure of
    this recommendation would require documentation showing that a
    process has been established and that it is being followed on a
    recurring basis.

26. See comment 6. Also, we state in our report that according to the
    Deputy CIO/CTO, the verification and validation reviews would be
    performed on a recurring basis. However, NASA has yet to provide us
    with either the remediation plan or the evidence referred to in
    enclosure 3 of its comments.

27. See comments 4 and 11. Also, NASA has yet to provide us with the
    evidence referred to in enclosure 3 of its comments.

28. NASA has yet to provide us access to its Web site.

29. See comments 7 and 13. Also, NASA has yet to provide us with the remediation plan.

Enclosure IV: GAO Contacts and Staff Acknowledgments

GAO Contacts

Randolph C. Hite, (202) 512-7686 or hiter@gao.gov
Gregory D. Kutz, (202) 512-9505 or kutzg@gao.gov
Allen Li, (202) 512-3600 or lia@gao.gov
Keith A. Rhodes, (202) 512-6412 or rhodesk@gao.gov

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