Statement of

RUSSELL A. RAU
Assistant Inspector General
for Auditing

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Mr. Chairman and Members of the Committee,

Thank you for the opportunity to be here today to discuss NASA's management of the International Space Station (ISS) Program. The NASA Office of Inspector General (OIG) regularly conducts reviews and audits of the ISS and related Human Space Flight[1] programs and has made numerous recommendations to improve cost, schedule, and technical performance. In today's testimony, we will highlight major challenges to the ISS Program with particular emphasis on contract and program management.

INTRODUCTION

The ISS Program is one of the largest and most complex international scientific projects ever undertaken. The Program's mission is to build and operate the ISS, a world-class orbital research facility. ISS assembly in orbit began with the launch of the U.S.-owned, Russian-built *Zarya* control module on a Russian Proton rocket in November 1998. The launch of the Space Shuttle *Endeavor* carrying the U.S.-built *Unity* connecting module followed in December 1998. Further, Space Shuttle and Russian launches have resulted in the deployment of the *Zvezda* Service Module and *Destiny* Laboratory Module, among other components. The first ISS three-member crew was launched in October 2000 on a Russian *Soyuz* Rocket, and a replacement crew was launched on the Space Shuttle *Discovery* (STS-102) in March 2001.

[1] NASA was appropriated $5.46 billion in FY 2001 for Human Space Flight.

The NASA Inspector General has identified the ISS as one of the Top 10 management challenges at NASA. Specifically, the NASA Inspector General has identified the keys to an effective ISS Program as:

- Managing the political, financial, technical, and safety challenges presented by an international partnership.
- Overcoming technical challenges inherent in manufacturing, assembling, testing and integrating in space, complex hardware and software components provided by different nations.
- Safely maintaining, upgrading, and operating a structure as complicated as the ISS.
- Maximizing the beneficial use of the ISS for scientific research and technology development.

Based on a recent ongoing internal assessment of the ISS Program, NASA determined that significant revisions were required to continue the Program in accordance with the funding profile outlined in the FY 2001 President's Budget. In total, the assessment identified that $11.2 billion was needed for Program requirements of which more than $4 billion[2] (56 percent) was in excess of the FY 2001 President's Budget funding profile for the outyears FY 2002 through 2006.[3] NASA has stated its commitment to execute the ISS Program in accordance with the funding profile in the President's Budget and related

[2] This overrun accounts for planned program content in accordance with the most current ISS assembly sequence. The FY 2001 President's Budget provided a funding profile for FY 2002 through 2006 totaling $7.2 billion, and the ISS assessment concluded $11.2 billion was required, a difference of about $4 billion. Primary areas of cost growth included mission operations and production and integration of hardware and software, the Habitation and Propulsion Modules, and avionics.

[3] On February 28, 2001, the President signed "A Blueprint for New Beginnings." The Blueprint states: "To address this unprecedented cost growth and ensure the program remains within the five-year budget plan, the President's 2002 Budget will include important decisions regarding the funding and management of the (ISS) program while preserving the highest priority goals: permanent human presence in space, world class research in space, and accommodation of international partner elements. Thus, the U.S. core will be complete once the Space Station is ready to accept major international hardware elements."

statutory cost caps[4] and has identified a number of options for consideration in order to meet this commitment. These options include the canceling of the U.S. Propulsion Module,[5] a restructured approach to providing habitation and crew return capabilities, and rephasing research activities.

In summary, the NASA strategy will focus on:

- Deferring capabilities, incorporating management reforms, and refocusing the workforce to build the ISS and maintain commitments to international partners within budget.

- Identifying the path to achieving a six-person crew capability to maximize research activity.

- Seeking additional partner contributions.

- Prioritizing science to increase funding of research.

NASA estimates that statutory cost caps on ISS costs will not be exceeded prior to substantial completion of the ISS,[6] and no contingency funding[7] will be required, although certain contingencies are anticipated. The contingencies will be funded within the existing budget. NASA is continuing its review of options to meet the FY 2002 and beyond funding profile and expects to complete this review in June 2001.

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[4] The National Aeronautics and Space Administration Authorization Act of 2000 establishes a funding limitation on the ISS Program of $25 billion. The statutory cost cap is not associated with a specific set of requirements or configuration of the ISS. The Act provides that, with each annual budget request and as otherwise deemed necessary, the Administrator will provide a written notice and analysis of funding required in excess of the limitation. The notice is required prior to obligating any funding in excess of the limitation, and the NASA Office of Inspector General is required to review the notice and supporting analysis and report to the Congress. The Act limits this contingency funding in excess of the limitation to $5 billion and to certain listed contingencies. The Act also requires that NASA submit an accounting for the funding limitations as part of the annual budget request and arrange with the General Accounting Office (GAO) to perform a verification of the accounting.

[5] In March 2001, NASA canceled the Propulsion Module, which was intended to provide a backup U.S. propulsion capability to the Russian Service Module.

[6] The Act states substantial completion of the ISS occurs when the development costs comprise 5 percent or less of the total ISS costs for the fiscal year. Based on this provision, NASA estimates that substantial completion will occur in FY 2005 and that the cumulative ISS budget will exceed $25 billion in FY 2006, when the funding limitation is no longer applicable.

[7] Contingencies identified in the Act include (a) the lack of performance or the termination of participation of any of the international countries that are party to the Intergovernmental Agreement, (b) the loss or failure of a U.S.-provided element during launch or on-orbit, (c) on-orbit assembly problems, (d) new technologies or training to improve safety on the ISS, and (e) the need to launch a Space Shuttle to ensure the safety of the crew or to maintain the integrity of the station.

BACKGROUND

On January 13, 1995, NASA awarded the ISS prime contract (NAS 15-10000) to The Boeing Company (Boeing) Space and Communications Group for a total cost-plus-award fee/fixed fee/incentive fee amount of $5.638 billion.[8] The contract requires Boeing to design, develop, manufacture, integrate, test, verify, and deliver to NASA the U.S. on-orbit segment of the ISS including ground support equipment and to provide ground and orbital support operations. Boeing is also required to provide technical support and data for NASA's operation and utilization of the ISS. Since January 1995, costs have increased significantly. The total award value is now $9.598 billion -- a 70-percent increase over the original contract value. This cost growth includes new work added to the ISS prime contract, reflecting maturity in the program, such as integration and operation of on-orbit segments and cost overruns.

NASA has made significant revisions to the requirements for ISS components. For example, in August 1999, the ISS prime contract was modified to eliminate the Habitation Module,[9] which Boeing forecasted would overrun budget even before substantive work started. In some cases, these revisions occurred due to uncertainty concerning the performance of international partners. In October 2000, NASA halted further development on the Interim Control Module (ICM)[10] after deployment of the Service Module[11] reduced the risk associated with the total loss of Russian propulsion capability. Subsequently, in March 2001, NASA canceled the U.S. Propulsion Module due to budget concerns and the reduced risk of a near-term Russian propulsion shortfall.

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[8] Boeing initially proposed a contract price of $6.6 billion but reached agreement with NASA on August 31, 1994, at a "not-to-exceed" price of $6.2 billion. On January 13, 1995, NASA and Boeing agreed to the $5.638 billion award. At the time of the contract award, NASA and Boeing entered into a Memorandum of Understanding that Boeing officials stated reflected an understanding that the $600 million difference between the prior agreement and negotiated price would be added to the contract target cost, if needed. We found that Boeing expected the $600 million reduction in contract price negotiated in January 1995 to be added to the contract target cost, if needed. NASA disagreed with this interpretation. In February 2000, we recommended the agreement be rescinded, and NASA agreed.

[9] The Habitation Module was intended to provide crew quarters including a galley, wardroom and eating area, exercise equipment, and crew cleansing compartment.

[10] The ICM was intended to provide a low-cost capability to ensure ISS guidance and navigation control, attitude control, and reboost for at least a year to bridge a potential gap between the end of the useful service life of the Russian-built Control Module and the deployment of the Russian Service Module. After the Service Module became operational, the ICM would have been a short-term solution to delays or shortages in Russian Progress resupply vehicles. The Naval Research Laboratory was performing the work on the ICM.

[11] The Service Module, which Russia successfully delivered to the ISS in July 2000, provides attitude and reboost control, communications, electrical power generation, life support supplies and storage, crew systems, and mechanism control.

In December 1999, NASA modified the fee structure of the ISS contract[12] and resolved numerous outstanding and potential contractor claims as part of a global settlement[13] that included an increase in contract cost of $404 million. A significant change involved the Government's ability to recoup award fee if on-orbit performance is unsatisfactory.[14] The restructure enables Boeing to earn up to 11 percent technical and cost award fees on new work added to the contract [15] (other than spares which have a separate fee arrangement). The technical award fee on new work is not subject to Government recoupment based on on-orbit performance problems. NASA accepted all of the contractor claims in the settlement at the amounts estimated by the contractor. Additionally, the entire $404 million amount was applied to increase the contract target cost, which is subject to award fee.

At the time of the global settlement, the cost overrun reported by Boeing was $986 million, the amount first formally reported by Boeing in March 1999. Currently, Boeing is continuing to report the same overrun ($986 million[16]) while at the same time indicating that it will submit claims for at least an additional $200 million.

The ISS Program Office estimates that prime contract activities are about $2.1 billion (26 percent) of the total new obligation authority of $8.0 billion provided in the FY 2001 President's Budget (FY 2001 through 2005). These amounts reflect the completion of design, development, test and evaluation (DDT&E) activities and an increase in research, launch, payload ground operations and other

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[12]The Price Negotiation Memorandum for this modification stated: "In January 1999, Boeing notified the Government that the estimated Variance at Completion (VAC) for contract NAS 15-10000 was $986 million. This additional VAC means that the contractor will now earn the minimum incentive fee (2 percent) specified in the contract. Therefore, there is no longer either a positive or negative incentive to control costs on existing work. Additionally, the earnings potential of any new work is penalized by past performance issues. It is important to re-incentivize Boeing's cost performance." The prior award fee provisions did not emphasize cost management because the incentive fee provisions were focused exclusively on cost. Therefore, the previous incentive fee provisions were converted to a fixed fee at the minimum 2 percent, and award fee pools were established for cost and technical management on new work added to the contract. The objective was to incentivize cost management by enabling the contractor to earn a reasonable return on the new work and not be further penalized by previous poor cost performance.

[13] The Price Negotiation Memorandum referred to the global settlement in the following manner: "The global settlement was negotiated as an integral part of the overall contract restructure which included moving to a new fee structure and reorganizing the Statement of Work to allow a new management approach for the Integration and Operations effort. No attempt was made to establish negotiation positions for, or to reach cost or fee agreement on individual issues. . . . The required result of the global settlement was to reach bottom line agreement on the estimated cost and fixed fee amount to be added to contract value to settle RFEA (Request for Equitable Adjustment) issues."

[14] Unearned award fee is also subject to reconsideration that could result in the fee being paid.

[15] In its Master Buy Plan for the ISS as of March 2001, NASA estimates that about $1 billion in additional contract value will be added to the ISS contract through completion in December 2003 for sustaining engineering, post-production support, and integration and operation activities.

[16] NASA estimates the cost overrun to be $1.14 billion, $154 million more than Boeing's estimate.

"non-prime" activities. These "non-prime" activities total $5.9 billion over the same 5-year period. As of December 2000, Boeing reported that the DDT&E portion of the ISS prime contract[17] was more than 90 percent complete.

CONTRACT MANAGEMENT

The prime contract for the ISS Program requires an Earned-Value Management (EVM)[18] System for cost and schedule reporting. EVM systems track variances from budgeted costs and schedules. These variances can be used to estimate future performance. Our work going back to 1996 (see Appendix A) shows continuing, significant understatement by Boeing of the cost estimates to complete work on the ISS prime contract. We found Boeing has not adequately used EVM data to identify negative variances nor designed and implemented timely corrective action plans to mitigate the problems causing adverse cost and schedule impacts. Additionally, we found that NASA management did not use cost and schedule data from the contractor's EVM system to effectively challenge Boeing on its understated estimates.

In February 2000, we issued a report on performance management of the ISS contract.[19] We conducted the review resulting in this report at the request of the NASA Administrator following the disclosure of a large overrun in the ISS prime contract. Boeing announced in late March 1999 that the total of actual and projected cost overruns on the ISS prime contract had increased by $203 million, from $783 million to $986 million.[20] This was the third major increase in cost overrun that Boeing reported in 2 years. Boeing attributed part of the cost overrun to unexpected increases in indirect cost rates due to reorganizations, including the merger with McDonnell Douglas Corporation and the acquisition of Rockwell International Corporation.

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[17] The ISS prime contract with Boeing has performance-based and level-of-effort portions. The performance-based portion includes: DDT&E, the development, verification, and delivery of hardware and software for the U.S. on-orbit segment of the ISS; the integration and operation of U.S. and other ISS elements; acquisition and deployment of spare hardware components for ISS maintenance and repair; and development and delivery of hardware and software including ground support equipment. The level-of-effort portion includes: sustaining engineering, multi-element integrated testing, technical definition, and post-production support.

[18] Earned-value management is a tool that assists in the effective execution, management, and control of contract performance through integrated evaluation of cost, schedule, and technical performance against a performance measurement baseline. The baseline is an allocation of the contract target cost to specific contract tasks.

[19] The OIG issued Report IG-00-007, "Performance Management of the International Space Station Contract," on February 16, 2000.

[20] Boeing submitted an "Over –Target Baseline" proposal for a $600 million overrun on February 19, 1999, and a "Delta" proposal for an additional $183 million on April 15, 1999. Boeing stated in the "Delta" proposal that another proposal would be submitted by June 28, 1999, for additional cost growth. Boeing submitted this proposal for the remaining $203 million in cost overrun on September 22, 1999, resulting in the $986 million projected overrun.

We concluded that management of the ISS prime contract needed improvement. Specifically, we found:

- Boeing reported to NASA unrealistically low estimates of projected cost overruns on the ISS prime contract.

- NASA did not act to effectively challenge understated contractor estimates. NASA paid (and later recouped) $16 million in unearned incentive fee based on understated estimates.[21]

- NASA and Boeing did not sufficiently emphasize cost management at monthly meetings held to discuss the status of the ISS.

- Boeing extensively delayed negotiating major cost overrun modifications by submitting late proposals.

- NASA did not act to promptly definitize (that is, incorporate into the contract by a modification) cost overrun proposals submitted by Boeing. The delays in definitizing the overruns negatively impacted performance measurement by limiting variance analysis to top-level estimates rather than to the detailed distribution to the work breakdown structure.[22]

- Boeing used "negative" management reserves[23] to accumulate cost overruns that should have been distributed to the specific work performed.

- NASA had not routinely performed independent estimates to complete the ISS contract using EVM data.[24]

- NASA made optimistic award fee evaluations during a period of significantly understated contractor cost overruns.

- Boeing had not developed mitigation plans for known cost risks.

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[21] NASA had previously reduced award fee payments to Boeing due to deficiencies in its cost and schedule performance reporting to the Government.

[22] The work breakdown structure displays and defines the product, or products, to be developed and/or produced. It relates the elements of the work to be accomplished to each other and to the end product.

[23] Management reserve is an amount of the contract target cost set aside for management control purposes that is not budgeted to accomplish specific contract tasks. "Negative" management reserves represent cost overruns that have been identified but not allocated to specific contract work. As a result, the cost overrun for that work is understated.

[24] Periodic independent assessments performed by an entity independent of the Program Office would help ensure that the Government has a reliable basis for (1) challenging unrealistically low contractor cost estimates, (2) adjusting fee payments based on cost performance, and (3) budgeting sufficient funds to complete the contract. See the discussion starting on page 9 concerning independent assessments of costs to complete the contract.

- NASA paid insufficient attention to Boeing's reorganization and restructuring activities due to mergers and acquisitions and related cost impacts on the ISS and other NASA contracts (see Appendix B for a discussion of the related NASA OIG audit of Boeing restructuring costs).

- NASA had not structured award fee provisions[25] of the ISS prime contract to provide sufficient weight (and, therefore, incentive) to the cost management area to ensure reporting of realistic cost estimates. Consequently, even unsatisfactory ratings in this area reduced the award fee by only a minimal amount.

- NASA had not required that monthly status reports on Boeing cost, schedule, and technical performance from the Defense Contract Management Command (DCMC)[26] be summarized at the ISS prime contract level. These reports provide valuable insight into emerging issues, particularly those with cost and schedule impacts, such that corrective action can be taken to mitigate these adverse consequences.

We made numerous recommendations to improve ISS contract and performance management. NASA generally concurred with our recommendations.[27]

PROGRAM MANAGEMENT

Our oversight of the ISS has found that NASA could make many improvements in program management. Some of NASA's ISS management practices were inconsistent with the high-risk, technologically complex environment of the ISS Program. The international aspects of the program also compound the challenges facing NASA management (see Appendix C for a discussion of NASA OIG reviews related to ISS Program management and the risks associated with

[25] Award fee is an element of a contract that provides for a fee consisting of (1) a base amount fixed at inception of the contract and (2) an award amount that the contractor may earn in whole or in part during performance and that is sufficient to provide motivation for excellence in such areas as quality, timeliness, technical ingenuity, and cost-effective management.

[26] The Defense Contract Management Command was the predecessor to the present Defense Contract Management Agency (DCMA). NASA generally delegates numerous contract administration responsibilities to DCMA related to oversight of NASA contracts including surveillance of EVM systems and data.

[27] Although NASA concurred with the recommendation to estimate the cost to complete the ISS contract as part of independent reviews, the Agency has not performed a review since 1999.

international partnerships). We will discuss two particular areas of concern: the need for periodic, independent life-cycle cost estimates and Independent Annual Reviews (IARs)[28] of the ISS Program.

In 1998, the General Accounting Office (GAO)[29] completed a life-cycle cost estimate of the ISS Program that totaled about $96 billion, but NASA had not developed its own estimate against which the GAO amount could be compared. NASA has not done an independent life-cycle cost estimate of the ISS, although the Agency has requested at least one major external review of ISS costs.[30] Periodic independent life-cycle cost estimates are a key program management tool for determining and assessing budgets and identifying and quantifying areas of program risk.

The ISS Program was not subjected to an IAR in 2000 or to-date in 2001.[31] The NASA Independent Program Assessment Office reported the results of the last IAR of the ISS Program in May 1999. That review was comprehensive and provided clear warning of cost, schedule, and technical problems that required management attention. Concerning the ISS prime contract with Boeing, the IAR concluded that cost overruns were likely to continue to grow because Boeing had not improved its cost performance since the prior (1998) IAR. Also, the IAR forecasted that similar poor cost performance could be expected in post-development activities such as sustaining engineering. The 1999 IAR did not independently estimate ISS Program life-cycle costs or the cost to complete the ISS prime contract with Boeing. The 1999 review followed up on recommendations made in the 1998 IAR of the ISS Program.

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[28] NASA has established an Independent Program Assessment Office that is intended to conduct reviews of programs and projects in support of the NASA program and project management process. The Assessment Office conducts IARs of major programs and projects, the results of which are presented to the NASA Program Management Council, which is chaired by the NASA Associate Deputy Administrator. The Council is NASA's highest level forum for addressing planning, implementation, and management of NASA programs. (See Appendix D for a discussion of prior OIG reviews on the NASA independent assessment process.)

[29] The GAO issued Report NSIAD-98-147, "International Space Station: U.S. Life-Cycle Funding Requirements," on May 22, 1998. GAO reported that life-cycle cost is the sum total of direct, indirect, recurring, and nonrecurring cost of a system over its entire life through disposal. GAO concluded the life-cycle cost to develop, assemble, and operate the ISS to be $96 billion, a $2 billion increase over a similar estimate GAO made in June 1995. NASA did not agree with several key aspects of the GAO estimates.

[30] In September 1997, the NASA Administrator asked the Chairman of the NASA Advisory Council to establish a Cost Assessment and Validation Task Force, reporting through the Advisory Committee on the International Space Station (ACISS) to the NASA Advisory Council, for an independent review and assessment of cost, schedule, and partnership performance on the ISS Program. In April 1998, the Task Force reported its estimates that the overrun on the ISS prime contract could be $1 billion based on work included in the contract at that time. In addition, the Task Force estimated funding requirements of $24.6 billion through FY 2003 compared to $20.3 billion in the FY 1999 budget request. This report was a one-time review of ISS costs but did not include a full life-cycle cost estimate and was not a part of an established independent cost estimating process within NASA.

[31] NASA has advised us that an IAR is now scheduled for July 2001, but the scope has not been defined. The NASA OIG is presently reviewing NASA's IAR implementation.

In our February 2000 report, we indicated that independent estimates of ISS contract costs were not routinely performed by an activity outside the program management chain of command. The ISS Program Office does not conduct truly independent assessments given its management responsibilities for the Program. We recommended that such independent estimates be performed, and NASA agreed to obtain them as part of the IAR process. Since that time, however, NASA has not performed an IAR.

Independent cost estimates of both the ISS Program and its contracts serve NASA management as well as the Congress and OMB by providing a "nonadvocate" perspective on cost estimating assumptions and methodologies used to develop cost, budget, and other financial information.

CONCLUSION

In summary, NASA can use the framework established by the National Aeronautics and Space Administration Authorization Act of 2000 to accurately report ISS costs. In addition, improvements to existing contract and program management guidance can strengthen oversight of the ISS Program.

The combination of the following actions will help ensure the most current status of the ISS Program is reported to the Congress, OMB, and NASA management:

- annual accounting for, and GAO verification of, statutory funding limitations as required by the National Aeronautics and Space Administration Authorization Act of 2000;

- review by the NASA OIG of NASA notifications, if any, of changes in ISS costs that require contingency funding above the statutory caps as required by the National Aeronautics and Space Administration Authorization Act of 2000;

- improved use of EVM systems and data for monitoring contractor performance;

- periodic independent life-cycle cost estimates;

- regular performance of IARs that include independent estimates of costs to complete ISS contracts; and

- timely implementation of actions agreed upon in response to independent reviews.

In addition, we plan to continue our emphasis on oversight of the ISS Program as one of our Top 10 NASA management challenges.

If you are interested in learning more about the activities or reports referenced in this testimony, you can find the full text of most of our reports on the NASA OIG homepage, at http://www.hq.nasa.gov/office/oig/hq, or contact our office at (202) 358-2061.

Thank you, and I would be pleased to answer any questions.

APPENDIX A: EARLIER NASA OFFICE OF INSPECTOR GENERAL REVIEWS OF INTERNATIONAL SPACE STATION COST AND SCHEDULE MANAGEMENT

In 1996, we reported that Boeing was not revising its monthly performance measurement reports on the ISS prime contract to reflect a reasonable estimate of cost to complete the ISS.[32] Boeing's performance management system required that the company review monthly its estimate at completion and update the estimate at least annually. Boeing was reporting a variance at completion of about $13 million. However, based on our review of Boeing cost performance, we estimated that the variance at completion could be more than $140 million — $127 million more than Boeing was then reporting to NASA.

We concluded that NASA did not have a reliable estimate at completion to manage future funding requirements. We stated that the ISS Program may have to fund overruns in FY 1996 through 2003 in order to build the ISS. As a result, we recommended that NASA require Boeing to better analyze and report estimate-at-completion data. NASA agreed with our recommendation.

In 1997, based on concerns that Boeing was continuing to report unrealistic cost estimates on the ISS prime contract, we performed a follow-up to our prior audit.[33] Our 1997 audit again found that Boeing did not report in its monthly performance measurement reports, reasonable cost estimates for completing work. The estimates were not realistic because Boeing reduced the monthly estimates provided by major subcontractors under the prime contract and thus reported a smaller cost overrun. Boeing stated that it used these reduced estimates as a management tool to encourage managers to reduce costs. In fact, the reduced estimates did not decrease costs. Instead, they limited visibility into expected cost overruns.

In February 1997, Boeing's variance at completion--the expected cost overrun--was $278 million. At this same time, NASA estimated the overrun to be $425 million--$147 million, or about 53 percent, more than the Boeing estimate. In June 1997 (after our follow-up audit began), Boeing increased its estimated variance at completion from $278 million to $600 million.

To increase the reliability of Boeing's cost estimates, we recommended that NASA require Boeing to prepare detailed support for adjustments to

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[32] The OIG issued Report JS-96-002, "Space Station Prime Contractor Performance Management," on June 11, 1996.

[33] The OIG issued Report IG-98-002, "Space Station Performance Measurement Cost Data," on November 13, 1997.

subcontractor estimates. We also recommended that the ISS Program Office monitor Boeing's adjustments to subcontractor estimates. NASA agreed with our recommendations.

In 1999, we reported additional problems related to oversight of Boeing's Earned Value Management System.[34] We found that NASA had not ensured that the DCMC, its agent at Boeing's Huntington Beach facility,[35] accomplished Government surveillance of Boeing's EVM System, as required by the contract administration delegation and the DCMC surveillance plan. As a result, the ISS Program had not benefited from the intended early identification of Program risks and oversight of corrective actions.

In this same audit, we also found that Boeing had not resolved an earlier identified weakness in the preparation and submission of the Variance Analysis Report.[36] In 1997, the ISS Program Office notified Boeing that the Variance Analysis Report elements, including recovery plans for negative variances, were inadequate and out of date. However, deficiencies still existed in the June 1998 Variance Analysis Report. NASA concurred with our recommendations to ensure effective surveillance of the EVM System and to direct Boeing to improve the quality of its Variance Analysis Reports.

[34] The OIG issued Report IG-99-007, "Space Station Corrective Action Plans," on January 28, 1999.
[35] Boeing Huntington Beach is one of the prime contractor's sites that supports the ISS Program.
[36] Boeing uses the Variance Analysis Reports to identify problems causing negative cost and schedule variances, record corrective action plans, and report progress on implementing corrective action to NASA.

APPENDIX B: DISCUSSION OF BOEING RESTRUCTURING COSTS

In our February 2000 report on performance management of the ISS contract, we found that Boeing proposed to charge NASA significant costs related to the company's reorganization at the same time that Boeing's military and commercial customers would receive net savings as a result of the reorganization. To determine the cost impact on the ISS and other Agency programs, we performed an audit of the effects of the Boeing restructuring on NASA.[37]

On December 17, 1999, Boeing entered into an advance agreement[38] with the DCMA acting on behalf of the Department of Defense (DoD), NASA, and other U.S. Government customers of Boeing. The advance agreement allowed Boeing to claim costs to reorganize and restructure as a result of its previous acquisitions and mergers, with the expectation that future savings to the Government would be at least twice the amount of the restructuring costs incurred and charged to Government contracts. NASA did not benefit from Boeing's restructuring and its advance agreement with DCMA. Boeing estimated that its DoD customers could realize potential net savings of $276 million and that NASA could incur as much as $115 million[39] in additional costs resulting from Boeing's acquisition of the Rockwell International Corporation Aerospace and Defense Units (Rockwell) and its merger with the McDonnell Douglas Corporation (McDonnell Douglas). NASA did not have legislation and regulations[40] comparable to those of the DoD regarding external business restructuring costs. Also, NASA was not closely involved in reviewing and negotiating Boeing's restructuring proposal and related accounting changes. We concluded that NASA has an opportunity to recover about $64.7 million[41] on the ISS and other Boeing contracts through a more equitable distribution of future contract cost reductions.

We recommended that NASA seek legislation for NASA similar to that provided to DoD regarding business restructuring costs and participate in negotiations between DCMA and Boeing to protect NASA interests. NASA has proposed

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[37] The OIG issued Report IG-01-006, "Impact of the Boeing Company's Restructuring on NASA," on November 27, 2000.

[38] The Federal Acquisition Regulation (FAR) and the Department of Defense Federal Acquisition Regulation Supplement permit contractors to enter into advance agreements with the Government for the treatment of special or unusual costs.

[39] The amount related to the ISS prime contract could be $30.6 million.

[40] The Defense Federal Acquisition Regulation Supplement (DFARS) is the implementing guidance for DoD concerning contractor restructuring as a result of legislation provided under Section 8115 of the DoD Appropriations Act of 1997 (Public Law 104-208). This Act is implemented through the DFARS, which states: ". . . (DoD) must certify that projections of future restructuring savings resulting to DoD from the business combination are based on audited cost data and the audited projected savings for the DoD will either exceed the costs allowed by a factor of at least 2-to-1 or that the business combination results in the preservation of a critical capability that might otherwise be lost to DoD."

[41] NASA agreed to pursue this amount, but the actual settlement has not yet occurred.

alternative corrective actions that are potentially responsive to our recommendations, including the modification of acquisition regulations to ensure NASA receives a fair share of future restructuring savings. We are awaiting implementation of the corrective actions.

APPENDIX C: RELATED NASA OFFICE OF INSPECTOR GENERAL REVIEWS OF ISS PROGRAM MANAGEMENT

The following are summaries of NASA OIG reviews that illustrate the need for increased management attention on various aspects of the ISS Program.

RISK MANAGEMENT

In a recent inspection, we found several problems with the ISS Portable Computer System (PCS) and the displays developed for the PCS.[42] The on-board PCS is the crew's primary interface for command and control of the ISS and provides the crew with caution and warning information.[43] We determined that the ISS Program was not using an integrated product team in the PCS display development process. An integrated product team would enhance coordination between the various organizations responsible for display development. The lack of an integrated approach resulted in a communication breakdown between organizations responsible for PCS display development and the design of procedures for its use.

We also found that the ISS Program had no independent verification (evaluation and validation) of PCS displays or of the display development process, primarily due to schedule and personnel constraints. An independent verification process would help detect and correct errors and enhance utility at an earlier stage in the display development process. In addition, we found several usability issues that may impact safety, cost, and schedule. The issues include the display of inaccurate information, inconsistent application of commands, and cumbersome navigation. Finally, our assessment determined that the ISS Program does not have a coordinated, well-defined process for software engineering and software management. In some cases, ISS crew members did not have an opportunity to see the software until they were trained in its use, which was so late in the process that changes were difficult to make. We made several recommendations to improve development of the PCS. NASA either concurred or partially concurred with our recommendations.

For the X-38/Crew Return Vehicle (CRV) Project, NASA was using a "rapid prototyping"[44] strategy. Rapid prototyping is one of the methodologies used to respond to the NASA Administrator's challenge of performing projects "faster, better, and cheaper." Under rapid prototyping, the X-38/CRV project was relying

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[42] We issued Report G-99-01A, "Assessment of the Portable Computer System and the Data Display Process," on August 11, 2000.

[43] The caution and warning system is designed to warn the crew of conditions that may adversely affect ISS operations. The system consists of hardware and electronics that provide the crew with both visual and aural cues when a system exceeds predefined operating limits.

[44] Rapid prototyping allows project maturation through fault detection, analysis, and correction during system development rather than after system development.

on a high degree of concurrency among design, development, test, and engineering/evaluation activities, assuming an optimistic schedule to accomplish development and production of the CRV. While this approach offers potential high payoff, we found that under the more likely ISS scenarios, the approach negatively affects NASA's ability to accurately adhere to project schedule and cost, thus increasing risk.[45] We recommended the Project focus attention on risk and performance management, including the use of documented performance metrics and criteria needed to enter and exit from each Project phase. NASA agreed with our recommendations to develop and document major characteristics, criteria, and strategies for progressing though the major Project phases.

INTERNATIONAL PARTICIPATION

We reviewed the planned acquisition of the Propulsion Module and have issued a draft report to NASA on our findings and recommendations. The purpose of the Propulsion Module Project was to develop a U.S. propulsion capability to mitigate the risk of a Russian failure to deliver critical elements or provide support to the ISS. NASA began the Project in October 1998 and selected a design called the U.S. Propulsion Module (USPM) in February 1999. In May 2000, NASA canceled one of two major elements of the USPM because of unacceptable safety, technical, and cost risks.[46] In September 2000, NASA selected a new design called the U.S. Propulsion System (USPS) that was intended to be simpler and safer than the USPM. The Project Office estimated that the cost to complete the USPS would be $675 million. However, NASA canceled the USPS in March 2001 because of budgetary concerns and the reduced risk of a near-term shortfall in Russian propulsion capability due to the deployment of the Service Module in July 2000.

In relation to managing the risks of international participation, we also reported that the ISS Program Office had not effectively transferred lessons learned to subsequent phases of the program for experiences gained in other long-duration space flights and in working with international partners.[47] In another review, we found that the ISS Program Office had not developed an integrated and comprehensive contingency plan to address risks to the successful assembly of the ISS by the possible delay or default of the international partners.[48] The contingency plan did not contain or clearly identify several critical elements for effective risk management, as required by Agency guidance. Specifically, the

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[45] The OIG issued Report IG-00-005, "X-38/Crew Return Vehicle Project Management," on February 9, 2000.

[46] The unacceptable risks related to the use of a volatile bipropellant fuel; a complex system of lines, valves, and tanks for transferring the fuel; a permanent weight increase of about 1,500 pounds to the Space Shuttle Orbiters; and significant cost growth.

[47] The OIG issued Report G-98-012, "Review of International Space Station Phase I Lessons Learned Activity," on December 23, 1998.

[48] The OIG issued Report IG-99-009, "Space Station Contingency Planning for International Partners," on March 9, 1999.

Program contingency plan did not contain cost and schedule impacts and did not clearly identify risk mitigation measures and primary consequences of the contingencies. In addition, certain Agency actions being planned and implemented to prevent additional schedule delays caused by problems in Russian participation had not been incorporated into the contingency plan because the plan was not kept current. NASA cannot assess the feasibility of the proposed contingency responses or determine the budgetary impacts without current and complete contingency plans. NASA basically agreed to establish procedures to ensure the ISS Program contingency plan complies with Agency guidance for effective risk management and to establish a process to ensure the plan is kept current.

Another area of risk involving international partners is common operations offsets or "bartering" agreements intended for NASA and its international partners to make exchanges in furtherance of their individual and collective interests. For example, in response to a request by the Chairman, House Committee on Science, we conducted an assessment of a barter arrangement between NASA and Japan and its National Space Development Agency.[49] We found that NASA already had operational contingency plans and partnership agreements in place to meet current emergency crew medical transport requirements and that the Agency's decision to proceed to acquire an aircraft through a barter arrangement was based on an incomplete analysis, did not consider all reasonable alternatives, and cannot be clearly linked to overall crew medical requirements.

Because barter agreements lack the structure and visibility that would otherwise be provided by contractual actions requiring appropriated funds, we recently announced a review of these arrangements to determine whether NASA is receiving reasonable consideration for launch services and other "bartered" items identified in the related agreements with international partners.

[49] The OIG issued a letter (G-00-015) to Hon. James F. Sensenbrenner regarding the Crew Medical Transport on October 6, 2000.

APPENDIX D: PRIOR NASA OFFICE OF INSPECTOR GENERAL REVIEWS OF NASA'S INDEPENDENT ASSESSMENT PROCESS

NASA's ability to provide accurate and credible cost assessments for its projects has been a concern for many years. The 1990 Report of the Advisory Committee on the future of the U.S. Space Program recommended NASA for an independent cost analysis group made up of about 20 "top-notch specialized personnel" to advise the Administrator on significant cost estimates provided to the OMB and Congress. In 1992, the GAO emphasized that "estimates and analysis provided to the Administrator by the cost analysis group need to be independent in fact and appearance."

In 1996, we reported on the organizational location of NASA's independent program evaluation and assessment function.[50] At the time of our review, the Office of the Chief Financial Officer at NASA Headquarters performed the function. NASA planned to transfer the function from Headquarters to the Langley Research Center (Langley).

We concluded that locating the independent assessment and cost estimation function in a subordinate organization (that is, Langley) placed the function's independence and impartiality at risk. True independence and impartiality require that the function reside with officials without any stake in the competition for limited resources. Moreover, accessibility of the function's analysts to both top management officials and key program and project staff at Headquarters and in the field was a significant issue and was fundamental to the function's success. A staff at Headquarters would have ready access to key counterparts at GAO, DoD, and other Federal agencies. Staff at the Langley Research Center would not have this same access.

We recommended that NASA locate a core staff at Headquarters capable of managing and overseeing the independent assessment and cost estimation function. Assistance could be provided by personnel located at Langley but functionally assigned to Headquarters. Management established the Independent Program Assessment Office at Langley but did not locate a core staff at Headquarters.

In 2000, we conducted a review to assess NASA's current and planned ability to develop independent cost estimates[51] in support of the Agency's program and project management processes. We found that NASA was taking positive steps to improve its cost estimating capability by establishing a System Management

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[50] The OIG issued a report on "Assessment of the Relocation of NASA's Independent Program Evaluation & Assessment Activities to LaRC [Langley Research Center]," on July 8, 1996.

[51] An independent cost estimate is a cost projection by analysts who are not part of the program/project under review.

Office (SMO)[52] at each Center and by adding cost estimators in the Independent Program Assessment Office at Langley. However, we found that the organizational structures for the independent cost estimating function at the Independent Program Assessment Office and SMO did not provide for independent reporting of findings directly to the approving official who is designated depending on the nature of the individual program or project. Also, the Independent Program Assessment Office and SMO are funded through the Centers — a process that may hinder their independence. Consequently, NASA has less assurance that the opinions, conclusions, and recommendations made to the Administrator or other approval authority on acquisitions for Agency programs and projects are independent in fact and appearance.

We made recommendations to improve the independence of the cost estimating function and revise Agency policy to require an independent cost estimate at major milestone reviews. NASA agreed to make the policy changes. Management stated that the Agency conducts cost assessments annually as part of the IAR process. NASA policy also requires that an independent cost estimate be performed during a Non-Advocate Review.[53] In response to our recommendation, management agreed to require another independent cost estimate after the Critical Design Review.[54] However, NASA has not implemented our recommendations to enhance the independence of the cost estimating function.

[52] The SMOs, which are located at some NASA Centers, provide (1) support and independent evaluation of projects and programs for compliance with and implementation of NASA guidelines; (2) leadership, consultation services, and technical expertise on system engineering process; and (3) support in forecasting costs for advanced program/project planning initiatives.

[53] A Non-Advocate Review is an analysis of a proposed program or project by a nonadvocate team comprised of management and technical and budget personnel who will not participate in the implementation of the proposed program or project. The review provides Agency management with independent assessments of new program and project starts.

[54] NASA performs a Critical Design Review to determine that the detailed design of a program or project satisfies the performance and engineering requirements of the development specification.