IG-00-007

REVIEW REPORT

PERFORMANCE MANAGEMENT OF THE INTERNATIONAL SPACE STATION CONTRACT

February 16, 2000

National Aeronautics and
Space Administration

OFFICE OF INSPECTOR GENERAL

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Acronyms

CFY	Contractor Fiscal Year
CY	Calendar Year
DCAA	Defense Contract Audit Agency
DCMC	Defense Contract Management Command
DFARS	Defense Federal Acquisition Regulation Supplement
DoD	Department of Defense
FAR	Federal Acquisition Regulation
GAO	General Accounting Office
ISS	International Space Station
S&C	Space and Communications

W February 16, 2000

TO: A/Administrator

FROM: W/Inspector General

SUBJECT: INFORMATION: Performance Management of the International Space Station (ISS) Contract
Report Number IG-00-007

The NASA Office of Inspector General has completed a review of the Performance Management of the International Space Station Contract. My office performed this review at your request because The Boeing Company (Boeing), the prime contractor for the ISS, announced in late March 1999 that the total of actual and projected cost overruns on the ISS prime contract[1] had grown by $203 million, from $783 million to $986 million. This was the third major increase in reported cost overruns for a total increase of $708 million in actual and projected cost overruns during the preceding 2-year period. Boeing attributed part of the cost overrun to unexpected increases in indirect cost rates due to recent reorganization activities, including the merger with McDonnell Douglas Corporation and the acquisition of Rockwell International Corporation. The Boeing announcement of additional cost overruns came shortly after the congressional hearings in March 1999 on the NASA fiscal year 2000 budget where the ISS Program including the magnitude of cost overruns were presented.[2]

Results

Performance management of the ISS prime contract needed improvement. Specifically, from at least October 1998 to February 1999, Boeing reported to NASA management unrealistically low estimates of projected cost overruns. Although ample evidence of continued degradation of cost performance, including information provided by Boeing, was available to NASA management at the

[1]NAS15-10000 is the contract number for the ISS prime contract with Boeing.

[2]On March 18, 1999, the NASA Administrator and the Senate Subcommittee on VA, HUD, and Independent Agencies, Senate Committee on Appropriations discussed the FY 2000 NASA budget. On March 23, 1999, the NASA Administrator discussed the FY 2000 NASA budget with the House Subcommittee on VA, HUD, and Independent Agencies, House Committee on Appropriations.

and paid unearned incentive fee totaling $16 million that the Agency recouped in April 1999. This incentive fee payment was based on the contractor's reported cost performance rather than on a Government assessment of available information that clearly indicated the improbability of achieving Boeing's understated estimates. Also, actions by the ISS Program Office were needed to reset the performance measurement baseline and to eliminate ambiguity concerning responsibility for cost overruns.

Furthermore, Boeing did not promptly notify NASA about the potential cost increases due to Boeing's reorganization. Of the estimated increased costs of about $153 million for calendar year 1999, the Boeing's Space and Communications Group proposed that NASA be charged an estimated $82 million, including $21 million for the ISS Program. Also, the ISS Program would be charged an additional $14 million through contract completion. These amounts were net of any savings that might accrue to NASA or specifically, to the ISS Program. In comparison, the Boeing military and commercial groups proposed overall net savings to their respective customers as a result of the reorganization. The contractor's proposals were submitted too late to be negotiated prior to the provisional billing rates being adjusted upward and paid by NASA at the higher levels, and the proposed increases were submitted with little or no forewarning to NASA. During our review, Boeing agreed to work with NASA to identify savings that could offset most, it not all, of the increased costs. However, NASA may be paying higher costs than necessary before the Government completes its review and negotiation of the proposed pricing and billing rates.

Recommendations

We made 14 recommendations aimed at strengthening ISS performance management and minimizing or eliminating the cost impact to NASA of contractor restructuring activities. For example, the performance management of the contract can be improved by routine contractor reporting of known risks included in and outside its estimate at completion and assuring risk mitigation plans are in place for all known risks. Boeing's cost overrun proposals should be expeditiously definitized so that a performance measurement baseline can be set, an ambiguous memorandum of agreement related to control of program reserve funds can be eliminated, contractor negative management reserve[3] reporting can be reassessed, and higher weighting[4] for cost performance can be applied in future award fee evaluations on ISS-related contracts.

NASA needs to monitor Boeing's reorganization cost and savings performance and ensure that Boeing applies the savings requirements to the ISS Program. To protect NASA from paying higher

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[3]Negative management reserve occurs when a contractor's estimate at completion is higher than its budget for management reserve. This condition results in a negative projected cost overrun at contract completion.

[4] An applied numerical value that would increase the significance of Cost Management relative to other factors in the award fee process.

costs than necessary, Boeing should submit estimated net cost increases of reorganization activity. NASA should monitor Boeing's cost and savings performance on the external restructuring activities and direct Boeing to ensure that the cost and savings

requirements of the Defense Federal Acquisition Regulation Supplement are equally applied to the external restructuring costs and savings attributable to the ISS Program. As an additional precaution to protecting NASA, significant issues should be coordinated with the Defense Contract Management Command (DCMC) to ensure that NASA is advised of contract increases and that ISS Program interests are adequately protected.

Management Response and OIG Evaluation

Management concurred or partially concurred with the findings and recommendations. Management agreed to discuss Boeing's cost performance at regularly scheduled meetings. In addition, the ISS Business Manager now prepares a monthly written report to senior NASA management that includes an overrun status and a range of variance at completion estimates. Management has requested Boeing to identify risks that are included in and outside Boeing's estimate at completion. The ISS Program considers several independent estimates including DCMC's in arriving at its budget estimate for cost growth. Management definitized the cost overrun proposals through a contract modification and has met the intent of an integrated baseline review with a functional equivalent, quarterly estimate at completion reviews. Management has agreed to protect its interests by terminating the Memorandum of Agreement on program reserves in February 2000, identifying options associated with Boeing not reporting a negative management reserve, and improving the award fee structure to put more emphasis on cost performance. Management also agreed to work more closely with the DCMC Defense Corporate Executive to monitor Boeing's performance on reorganization activities, external restructuring activities, and other significant issues that could affect the Program on an ongoing basis.

Management comments were responsive to all 14 recommendations. We are monitoring six of the recommendations for reporting purposes pending implementation of agreed-to corrective actions.

[original signed by]
Roberta L. Gross

Enclosure
Final Report on Review of Performance Management of the
International Space Station Contract

FINAL REPORT
REVIEW OF PERFORMANCE MANAGEMENT OF THE INTERNATIONAL SPACE STATION CONTRACT

W February 16, 2000

TO: AA/Director, Lyndon B. Johnson Space Center

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Review of Performance Management of the International Space Station Contract
Assignment Number A9904200
Report Number IG-00-007

The subject final report is provided for your information and use. Please refer to the Executive Summary for the overall review results. Our evaluation of your response is incorporated into the body of the report. The corrective actions taken or planned for the recommendations were responsive. Management's actions are sufficient to close recommendations 1, 3, 4, 5, 7, 9, 10, and 14 for reporting purposes. Recommendations 2, 6, 8, 11, 12, and 13 will remain open for reporting purposes until agreed-to corrective actions are completed.

If you have questions concerning the report, please contact me at (202) 358-1232; Mr. Dennis E. Coldren, Program Director, Human Exploration and Development of Space Audits, at (281) 483-0730; or Ms. Loretta M. Garza, Assignment Manager, at (281) 483-0483. We appreciate the courtesies extended to our staff. The final report distribution is in Appendix N.

[original signed by]
Russell Rau

Enclosure

cc:
B/Chief Financial Officer
B/Comptroller
BF/Director, Financial Management Division
G/General Counsel
M/Associate Administrator for Space Flight
JM/Management Assessment Division
JSC/OA/Space Station Program Manager
Director, Defense Logistics Agency
Director, Defense Contract Audit Agency
Commander, Defense Contract Management Command

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Contents

NASA Office of Inspector General

IG-00-007 **February 16, 2000**
A9904200

Review of Performance Management of the International Space Station Contract

Executive Summary

Background. In late March 1999, The Boeing Company (Boeing) announced to senior NASA management that the total of actual and projected cost overruns on the International Space Station (ISS) prime contract[5] had grown by $203 million, from $783 million to $986 million. This was the third major increase in 2 years in reported cost overruns for a total increase of $708 million in actual and projected cost overruns. Boeing attributed part of the cost overrun to unexpected increases in indirect cost rates[6] due to recent reorganization activities, including the merger with McDonnell Douglas Corporation (McDonnell Douglas) and the acquisition of Rockwell International Corporation (Rockwell). The Boeing announcement came shortly after the March 1999 congressional hearings on the NASA fiscal year (FY) 2000 budget where the NASA Administrator addressed the ISS Program, specifically the magnitude of cost overruns.[7] In response to Boeing's announcement, senior NASA management requested that the NASA Office of Inspector General review performance management of the ISS prime contract and assess the indirect cost rate increases Boeing had proposed for the ISS and related NASA contracts.

Objectives. The overall objective of the review was to evaluate performance management of the ISS prime contract with Boeing. Appendix A contains a detailed description of our objectives, scope, and methodology.

Results of Review. Performance management of the ISS prime contract needs improvement. Specifically, Boeing reported to NASA management unrealistically low estimates of projected cost overruns on the ISS prime contract from October 1998 through February 1999 and presented the cost data to indicate that no additional cost overrun would occur. Boeing did not revise its reported $783 million variance at completion (cost overrun)[8] until late March 1999. The ISS Program Office (Program Office) had a fundamentally sound process for assessing contractor performance, identifying

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[5]NAS15-10000 is the contract number for the ISS prime contract with Boeing.

[6]An example of an indirect rate cost would be the rent on a building where work is performed on more than one contract. A Glossary at the end of the report defines this and other terms used in the report.

[7]On March 18, 1999, the NASA Administrator and the Senate Subcommittee on VA, HUD, and Independent Agencies, Senate Committee on Appropriations discussed the FY 2000 NASA budget. On March 23, 1999, the NASA Administrator discussed the FY 2000 NASA budget with the House Subcommittee on VA, HUD, and Independent Agencies, House Committee on Appropriations.

[8]A variance at completion could mean a cost overrun or underrun. It is the mathematical difference between the budget at completion and the estimate at completion. In this report, a variance at completion implies a cost overrun.

risk, and reporting its assessment to senior NASA management. Further, both the Program Office and Boeing had informed senior NASA management that further cost overruns were likely. However, although the Program Office was aware and had evidence of cost overruns and schedule slippages, it did not effectively challenge the contractor's estimate or sufficiently emphasize estimates of the cost overrun at monthly Station Development and Operations Meetings. As a result, corrective action was not taken and Boeing received incentive fees totaling $16 million that it had not earned and benefited financially from those fees (Finding A).

Neither Boeing nor its Space and Communications Group (S&C Group) promptly notified NASA about the potential cost increases due to Boeing's reorganization. Of the S&C Group's estimated increased costs of about $153 million for calendar year (CY) 1999, NASA will be charged an estimated $82 million, including $21 million for the ISS Program. Also, the ISS Program will be additionally charged an estimated $14 million through contract completion. As a result, NASA may be paying higher costs than necessary before the Government completes its review and negotiation of the proposed pricing and billing rates (Finding B).

Recommendations. The Program Office should strengthen policies and procedures to ensure that Program cost estimates are realistic. The performance management of the contract can be improved through discussion of Boeing's cost performance and, in particular, cost overruns, at regularly scheduled meetings with senior NASA management. For more realistic estimates, Boeing should identify known risks included in its estimate at completion and known risks outside its estimate at completion and ensure that risk mitigation plans are in place. NASA's budget requirements should be reassessed based on new estimates provided by the Defense Contract Management Command (DCMC) and the Monte Carlo analysis. Boeing's cost overrun proposals should be expeditiously definitized and an integrated baseline review should be conducted after definitization of the ISS contract modification. NASA's interests can further be protected by terminating the Memorandum of Agreement for Program reserve funds; identifying alternatives to Boeing reporting a negative management reserve[9] status; and considering a higher weighting for Cost Management in future award fee evaluations on ISS-related contracts (Finding A).

NASA needs to monitor Boeing's reorganization cost and savings performance and ensure that Boeing applies the savings requirements to the ISS Program. To protect NASA from paying higher costs than necessary, Boeing should submit estimated net cost increases of reorganization activity. NASA should monitor Boeing's cost and savings performance on the external restructuring activities and direct Boeing to ensure that the cost and savings requirements of the Defense Federal Acquisition Regulation Supplement (DFARS) are equally applied to the

[9]Negative management reserve occurs when a contractor's estimate at completion is higher than its budget for management reserve. This condition results in a negative projected cost overrun at contract completion.

external restructuring costs and savings attributable to the ISS Program. As an additional precaution to protecting NASA, significant issues should be coordinated with DCMC to ensure that NASA is advised of contract increases and that ISS Program interests are adequately protected (Finding B).

Based on a meeting with management after issuance of the draft report, we revised two recommendations. A detailed listing of recommendations for corrective action can be found in Appendix B.

Management's Response. Management concurred or partially concurred with all the recommendations. Management agreed to discuss Boeing's cost performance at regularly scheduled meetings. In addition, the ISS Business Manager now prepares a monthly written report to senior NASA management that includes overrun status and a range of variance at completion estimates. Management has requested Boeing to identify risks that are both included and outside its estimate at completion. The ISS Program considers several independent estimates including DCMC's in arriving at its budget estimate for cost growth. Management definitized the cost overrun proposals through a contract modification and has met the intent of an integrated baseline review with a functional equivalent, quarterly estimate at completion reviews. Management has agreed to protect its interests by terminating the Memorandum of Agreement in February 2000, identifying options associated with Boeing not reporting a negative management reserve, and improving the award fee structure to put more emphasis on cost performance (Finding A).

Management also agreed to work more closely with the DCMC Defense Corporate Executive to monitor Boeing's performance on reorganization activities, external restructuring activities, and other significant issues that could affect the Program on an ongoing basis (Finding B).

A copy of management's response is in Appendix M.

Evaluation of Management's Response. The actions taken or planned by management are responsive to the recommendations. However six recommendations will remain undispositioned and open until agreed-to corrective actions are completed.

Introduction

International Space Station Program

The ISS Program vision is to provide a permanent human presence in space for the expansion of knowledge benefiting the international community. The Program's mission is to build and operate the ISS, a world-class orbital research facility that is safe, productive, affordable, and on schedule.

There have been several notable successes in the ISS Program including the launch and assembly of several key components. For example, the Russian Zarya module was launched in November 1998, and the U.S. Unity module was launched in December 1998. Both modules are reported to be working well. In May 1999, Space Shuttle Mission STS-96 docked with the ISS and performed a number of activities, including the transfer of critical supplies. The next Space Shuttle assembly flight, STS-101, will be followed by the next major piece of hardware to be launched, the Russian-provided Zvezda Service Module.

The ISS Program is divided into two categories of effort, prime and nonprime. The prime effort is all activities by the prime contractor, Boeing, to deliver, operate, and support the U.S. On-Orbit Segment of the ISS and related ground support equipment.[10] The nonprime effort is all other activities that are an integral part of the overall ISS Program, including non-U.S. participation, acquisition of crew recovery capabilities, and the ISS research program. NASA personnel and nonprime contractors perform a significant portion of the effort in order to build and operate the ISS. The nonprime effort will continue to increase until the majority of the ISS budget is for nonprime activities. In addition, civil service labor, which is outside the Program budget, could increase, depending on the cost-effectiveness of using contractors instead of civil servants.

Contractor Reorganization

Boeing's acquisition of Rockwell was completed in December 1996. Because the merger with McDonnell Douglas was on the horizon, Boeing performed only minimal reorganization to incorporate Rockwell organizations into its existing structure. After the McDonnell Douglas merger was completed in August 1997, Boeing began its efforts to create "one global company." Its goal was to have an organization that would enable the company to "design anywhere and build anywhere." To accomplish this, Boeing significantly reorganized its operations, consolidated and closed facilities, harmonized policies, modified certain accounting practices, and consolidated systems. Appendix D contains additional information on Boeing's reorganization.

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[10] Appendix C contains information on Boeing's contract cost and fee structure for NAS15-10000. Ground support equipment is deliverable items that do not go into orbit but stay on the ground in support of mission-essential launch activities and launch site operations.

Findings and Recommendations

Finding A. Adequacy of Cost and Schedule Reporting

Boeing reported to NASA management unrealistically low estimates of projected cost overruns on the ISS prime contract from October 1998 through February 1999 and presented the cost data to indicate that no additional cost overruns would occur. Boeing did not revise its reported $783 million cost overrun until late March 1999. The Program Office had a fundamentally sound process for assessing contractor performance, identifying risk, and reporting its assessment of cost and schedule performance to senior NASA management. Further, both the Program Office and Boeing had informed senior NASA management that further cost overruns were likely. Although the Program Office was aware and had evidence of cost overruns and schedule slippages, it did not effectively challenge the contractor's estimate or sufficiently emphasize estimates of the cost overrun at monthly Station Development and Operations Meetings.[11] As a result, corrective action was not taken and Boeing received incentive fees[12] totaling $16 million that it had not earned and benefited financially from those fees.

Cost and Schedule Reporting

Performance Measurement System Report. NASA requires Boeing to report contract cost and schedule performance each month in the Performance Measurement System Report (performance report). The performance report provides the primary data for determining current cost and schedule performance and the forecast of the estimated cost at completion to all levels of management. The monthly performance reports are due 20 business days after the end of each month, are addressed to the ISS Business Manager, and are widely distributed within NASA.

- **June 1998 Performance Report.** In the June 1998 performance report, Boeing incorporated an additional $183 million increment into the ISS cost overrun, increasing the cost overrun from $600 million to $783 million. At the time of the increase, the Boeing Program Manager was forecasting that additional cost growth of more than $85 million would occur. Boeing included the $85 million in the $783 million estimate. In the July and August 1998 performance reports, Boeing reduced the "risk" amount to about $69 million and $58 million, respectively, despite the fact that cost overruns continued on the ISS Program.

To avoid increasing the cost overrun, Boeing began estimating offsetting savings and applying management reserve[13] rather than giving cost account managers a more realistic (that is, a higher) budget. A Boeing manager's explanation for not allowing a higher budget for the cost account

[11]Station Development and Operations meetings were monthly meetings to discuss the status of the ISS.

[12]Incentive fees are provided for in the contract for the initially negotiated fee to be adjusted later by a formula based on the relationship of total allowable costs to total target costs.

[13]Management reserve is a portion of the budget that the contractor holds for management control purposes to cover the expense of unanticipated program requirements. It is not part of the contract's performance measurement baseline.

managers, was because Boeing wanted to motivate the cost account managers to meet more constrained budgets as a means of reducing overall contract costs. This tactic results in a top-down rather than a bottoms-up estimate at completion,[14] meaning that Boeing management was determining the estimate at completion rather than allowing it to be developed based on estimates from the cost account managers who were responsible for the work. In such an environment, a realistic estimate at completion can be and was compromised.

- **September Through November 1998 Performance Reports.** In the September 1998 performance report, Boeing reported for the first time a target cost[15] overrun greater than $783 million. Rather than increase the cost overrun estimate, Boeing reported Program Manager "opportunities" or cost savings of more than $37 million, in essence stating that opportunities for cost savings of that amount would be realized to offset the projected cost growth. The October 1998 performance report showed a similar variance and cost saving opportunities. The November 1998 performance report reflected an $8 million reduction in the reported variance and cost saving opportunities. During this time period, Boeing applied management reserve[16] to the cost overrun in addition to proposing cost saving opportunities. By doing so, Boeing masked the overrun. See "Effects of Risks on Management Reserve" in the report for more details.

- **December 1998 Performance Report.** In the December 1998 performance report, Boeing reported an increase of $72 million in the target cost overrun and a corresponding increase in the needed cost saving opportunities to achieve the reported cost overrun of $783 million.[17] In our opinion, Boeing identified the cost saving opportunities estimate based on the amount needed to continue to report the $783 million cost overrun rather than basing the opportunities on actual, well-supported initiatives to reduce ISS Program costs. This is evidenced by the fact that Boeing did not allocate[18] the cost saving opportunities to cost account managers. Rather, in the December report, Boeing included two additional categories ("Risk/Opportunity" and "Program Negotiation Adjustment") which, in effect, decreased the total ISS Program costs. It also resulted

[14]The estimate at completion is a value developed to represent a realistic appraisal of the final cost of the total contract.

[15]Target cost is the negotiated cost for the original, definitized contract and all contractual changes that have been definitized.

[16]Management reserve is defined as a portion of the budget that the contractor holds for management control purposes to cover the expense of unanticipated program requirements. It is not part of the contract's performance measurement baseline.

[17]Boeing calculated a cost overrun of $885 million. However, Boeing identified more than $100 million in cost savings in order to continue reporting a $783 million cost overrun.

[18]Boeing should have allocated to the cost account managers budgeted dollars equal to those cost savings opportunities. Allocate means to assign an item of cost, or group of items of cost, to one or more cost objectives.

in two amounts reflected as totals for the ISS Program, one including and one excluding the cost saving opportunities. From June to December 1998, actual cost variances[19] of more than $107 million had been incurred and cost performance trends were steadily declining.

- **March 1999 Performance Report.** The March 1999 performance report showed that Boeing increased the cost overrun projection an additional $203 million, increasing the cost overrun from $783 million to $986 million. Also, the March 1999 report eliminated the "Risk/Opportunity" category that Boeing had previously used to balance the totals from the Earned Value Management[20] system with the cost overrun reported to the Government.

As late as April 1999, in the Program Operating Plan[21] Review, Boeing reflected no cost growth for the 6-month period, June through December 1998, and that cost growth in the first quarter of FY 1999 resulted in the need to increase its cost overrun estimate from $783 million to $986 million. However, cost performance did degrade over most of that 6-month period. In addition, only when Boeing depleted the management reserve and established future funding requirements did it realize that the management reserve was not adequate to cover future cost growth on the contract. See "Cost Variance Trends" in Appendix C for more details on the continued degradation to Boeing's cost performance.

NASA Oversight

NASA Reporting. The Program Office has a fundamentally sound process for assessing contractor performance, identifying risk, and reporting its assessment of cost and schedule information to senior NASA management. In addition, the Program Office together with Boeing supported various reviews of contractor performance during CY 1998 and the first 3 months of CY 1999. The Program Office cost overrun estimate of $848 million was consistently higher than the contractor estimate of $783 million. However, the Program Office did not effectively challenge the contractor estimate in light of its continued degradation in cost performance and did not ultimately take action to reject the contractor's estimated cost overrun once the Program Office determined it to be unrealistic. An effective challenge of the contractor estimate would be to use a higher estimate to calculate incentive fee. Appropriate action to reject an unrealistic contractor estimate of an overrun would be to withhold award fee. Instead, the Program Office reported the same cost overrun from July 1998 to February 1999 while at the same time recognizing and advising senior NASA management of the actual cost growth and decreasing probability that the $848 million cost overrun would actually be achieved.

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[19] A cost variance is a numerical difference between budgeted cost of work performed and actual cost of work performed.

[20] Earned value management is a tool that allows effective execution, management, and control of the project and the integrated evaluation of cost, schedule, and technical performance against the performance measurement baseline.

[21] The Program Operating Plan is a time-phased projection of resource requirements in terms of planned rates of obligations, which the NASA Centers submit periodically to Officials-in-Charge of Program Offices and which officials submit to the NASA Chief Financial Officer.

Headquarters Oversight. While numerous elements of NASA Headquarters are responsible for the ISS in a variety of ways, the Associate Administrator for Space Flight and the Chief Financial Officer have lead roles in the management of the ISS Program. The Office of Space Flight provides corporate leadership, top-level requirements development, and programmatic oversight to accomplish the NASA human space flight program, including the ISS. The Associate Administrator for Space Flight is in the chain of command throughout ISS Program formulation, approval, implementation, and evaluation. The Associate Administrator regularly attends the Station Development and Operations Meetings. Last fall, the Associate Administrator initiated a review with the Comptroller to determine whether costs could be avoided or saved on the ISS contract.

The Chief Financial Officer provides for the overview and financial management of Agency resources relating to ISS operations, including all resource aspects of the planning, programming, and budgeting process. Also, the Chief Financial Officer reviews, assesses, and validates ISS resources requirements and makes recommendations to the Administrator for approvals and authorizations for fiscal resources. The Comptroller, within the Office of the Chief Financial Officer, serves as the principal administrative official for Agency funds and resources and directs, monitors, and approves the structure of budget formulation and execution, including Agency requests for apportionments and allotments. The Comptroller frequently attends the Station Development and Operations Meetings. In the past, the Comptroller has performed special reviews of the ISS Program, especially when budget stability is in question. Last fall, the Comptroller initiated a special review as a result of NASA providing additional funding to Russia for the ISS.

Senior NASA Management Were Aware of Higher Overruns. By fall 1998, senior NASA management knew that a cost overrun of as much as $1.2 billion was likely. During the October 1998 meeting with the Office of Management and Budget, the Associate Administrator for Space Flight and the NASA Administrator discussed a probable cost overrun of $1.0 billion to $1.1 billion. During November 1998 talks with the Office of Management and Budget, the NASA Comptroller advised the Office of Management and Budget that the $848 million budgeted by the Program Office was not realistic. The Comptroller stated the Agency needed to inform the Office of Management and Budget of the higher estimates in order to obtain more funding.

Program Office Continued Use of Unrealistic Estimate. By December 1998, NASA officials at all levels, including the Comptroller, considered the Boeing cost overrun to be unreliable. However, the Program Office continued to accept the contractor's estimate for the purpose of providing incentive fees rather than use a higher estimate or a revised estimate based on the information available. The issue of incentive fees is discussed in detail later in the report under the section entitled, "Award Fee Evaluation." The Program Office should have rejected Boeing's reported estimates when the Program Office determined the estimates to be unrealistic and because it had the evidence to support that determination. A realistic estimate should have been used for Program management and contract administration, including the provision of award and incentive fees.

International Space Station Program Evaluations

Station Development and Operations Meetings. The monthly meetings provide one of the primary means for Boeing and the Program Office to report the cost overrun and other cost estimates to senior NASA management. The business portion of the Station Development and Operations Meeting is a joint presentation by NASA and Boeing officials. The attending NASA senior managers usually include, but are not limited to, the Associate Administrator, Office of Space Flight; Deputy Associate Administrator (Space Station); and the Johnson Space Center (Johnson) Director. A separate technical portion of the Station Development and Operations Meetings addresses the engineering issues confronting the Program.

During the Station Development and Operations Meetings, the Program Office and Boeing did not place sufficient emphasis on Earned Value Management information. For example, Program officials did not report their cost overrun estimate because it did not change from month to month. The Program Office practice was to report only changes in the cost overrun. From February 1998 through March 1999, the Program maintained its cost overrun budget constant at $848 million. Also, Boeing reported actual overrun to date but did not change its projection.

From August through December 1998, Boeing's cost performance continued to significantly deteriorate. The continued deterioration was evident from the cumulative and monthly cost variances presented at the Station Development and Operations Meetings. At the same time, Boeing officials identified new cost risks at an accelerated rate. Boeing's realization of the risks was high, while realization of cost savings was low. However, the Program Office continued to maintain a cost overrun that was not much higher than Boeing's and, like Boeing, did not sufficiently emphasize to senior NASA management, during the monthly meetings, the increasing risk to achieving the cost overrun.

Although five Station Development and Operations Meetings were held from September 2, 1998, through March 2, 1999, only one (on January 25, 1999) addressed the Boeing and the Program Office cost overrun estimates. At that meeting, ISS Program officials warned senior NASA managers that Boeing could exceed the $848 million cost overrun by more than $100 million. The $100 million was based on the Program's assessment of an estimate at completion that Boeing performed in December 1998. The Program Office earmarked $100 million as a threat against Program reserve[22] for the additional risks of a cost overrun. Also, at the executive meeting in conjunction with the January 1999 Station Development and Operations Meeting, the Program Office showed an independent variance at completion between $930 million and $1.025 billion. See "Reporting at Station Development and Operations Meetings" in Appendix C for more details.

[22]Program reserve is held by NASA. Management reserve is held by the contractor. Both are held to pay for unanticipated work. The ISS Program maintains reserve funds for new work that must be performed to complete the ISS. When necessary, the Program Office budgets some of the reserve funds for identified new work.

Government-Only Portion of Station Development and Operations Meetings. As part of the Business Station Development and Operations Meeting, NASA holds a "Government Only" session. The purpose of the "Government Only" session is to review the Program reserve status of the ISS budget and to discuss NASA-sensitive contract and budget issues. Program liens and threats against the budget[23] are discussed in each meeting. Estimate at completion costs and cost overruns are discussed as part of the overall Program liens and threats. The Associate Administrator for Space Flight, Deputy Associate Administrator (Space Station), and the Johnson Director usually attend this session.

Program Office Assessments. The Program Office performed monthly Program Management Reviews and obtained periodic ISS contract cost and schedule assessments completed by a support services contractor. Specifically, the Program Office contracted with the Blackhawk Management Corporation (Blackhawk) for cost and schedule assessment support of the ISS Program. Blackhawk assisted in determining the current cost overrun of $1.03 billion to $1.05 billion[24] for the Program Office. Blackhawk provided its analysis results after the April 1999 Program Operating Plan review, which is part of the Agency's planning process for the FY 2001 budget.

Independent Variance at Completion Comparisons. Each month since April 1998, an ISS Program Analyst calculated a high and low variance at completion (cost overrun) using data from Boeing's performance reports. The Program Analyst compared his current month's cost overrun to his calculations for the prior 7 or 8 months. The analyst also compared his cost overruns to the Boeing and Program Office cost overruns. From August 1998 through February 1999, Boeing's cost overrun and the Program Office's budget were less than the low estimate of the Program Analyst. See Appendix E for a comparison of the Program Analyst's cost overruns at completion and Boeing's cost overruns. Except in January 1999, Program Office managers did not provide this information to senior NASA management at the Station Development and Operations Meetings.

Recommendation, Management's Response, and Evaluation of Response

1. **The ISS Program Manager should request discussion of Boeing's cost performance and, in particular, the estimated cost overrun, at regularly scheduled meetings with senior NASA management.**

Management's Response. Concur. Management stated that Boeing's performance (including the cost overrun) is reviewed at monthly management meetings. The ISS Business Manager now prepares a widely distributed monthly report that includes overrun status and a range of variance at completion estimates.

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[23] See "Liens and Threats" section of Appendix C for more details.

[24] Blackhawk estimated the cost overrun to be $1.03 billion. The ISS Business Manager added $20 million to this estimate for a range of $1.03 billion to $1.05 billion.

Evaluation of Response. The actions taken by management are responsive to the recommendation. Management's completed actions are sufficient to close the recommendation for reporting purposes.

Independent Annual Review

ISS Program Management Council. The Program Management Council, which is chaired by the NASA Deputy Administrator, provides the Agency's highest level forum for addressing the planning, implementation, and management of Agency programs including the ISS. Two of the functions of the Council are to report on the conformance of a program to its Program Commitment Agreement[25] and to recommend cancellations or continuation of programs and selected projects. The Council presents its assessments to the Administrator in the form of minutes that may include recommended corrective actions.

Independent Program Assessment Office. In early 1999, the NASA Independent Program Assessment Office conducted an Independent Annual Review[26] of the ISS Program for the Program Management Council. NASA policy[27] does not require the Independent Annual Review to address the adequacy of the estimate at completion or a completed independent cost estimate; therefore, the Independent Annual Review did not cover those areas. Rather, the Independent Annual Review of the ISS Program identified risk areas and potential schedule slips and indicated that the Boeing prime contract cost overrun will continue to grow. The Independent Annual Review presented its results to the NASA Program Management Council on May 3, 1999. Some items that pertain to the prime contract with Boeing included:

- Boeing's corporate structure had a positive impact, but cost overruns continued.
- Major adds/changes to the Program should be subject to NASA Procedures and Guidelines 7120.5A.
- Budget liens should be identified.
- Development delays will result in increased cost and increased Program risk.
- If the estimate at completion is understated at the time of the Boeing proposed transition from design, development, test, and engineering to sustaining engineering, then the proposed cost savings may not be achieved.
- Boeing cost overruns continue to increase and will likely continue to grow.

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[25]The agreement is the contract between the Administrator and the cognizant Enterprise Associate Administrator for the implementation of a program.

[26]An independent annual review is an analysis of the status of the commitments (performance, cost, and schedule) in a Program Commitment Agreement as compared to the program/project baseline and established thresholds.

[27]NASA Procedures and Guidelines 7120.5A, "NASA Program and Project Management Processes and Requirements," April 3, 1998.

- Expected similar (poor) performance in post-development activities such as sustaining engineering and spare parts.

Need for Independent Assessments of the Estimate at Completion. The ISS Program has not instituted a process of periodic independent assessments of the prime contract estimate at completion. Periodic independent assessments, whether completed as part of the Independent Annual Review or performed by an entity independent of the Program Office, would help ensure that the Government has a reliable basis for (1) challenging unrealistic estimates at completion, (2) adjusting incentive fee payments based on cost performance, and (3) budgeting sufficient funds to complete the contract. Periodic independent assessments would also provide the Program Office with additional information in an effort to derive the best estimate to complete[28] the contract.

Recommendation, Management's Response, and Evaluation of Response

2. The ISS Program Manager should establish a process for periodic independent estimates of the cost to complete the ISS contract, and consider requesting that the estimate be performed as part of the Independent Annual Review.

Management's Response. Concur. Management stated that the Advisory Committee on the International Space Station has conducted two independent estimates and that the Space Station Business Office performs internal independent assessment of contract overrun. Management also agreed to request that the next Independent Annual Review included an independent assessment of the completion cost on the contract.

Evaluation of Response. The actions planned by management are responsive to the recommendation. The recommendation is resolved but will remain undispositioned and open until agreed-to corrective actions are completed.

Other Program Oversight

Defense Contract Audit Agency. The Defense Contract Audit Agency (DCAA)[29] is responsible for reviewing the financial and accounting aspects of contractors' cost control systems. In addition, DCAA performs other audits and analyses to fulfill the DCMC[30] contract administration functions delegated by NASA. In support of the ISS contract, DCAA has reviewed a variety of systems[31] at Boeing's sites

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[28]Estimate to complete is an estimated value developed to represent a realistic appraisal of the cost of work still to be performed on the contract.

[29]DCAA is the audit organization for the Department of Defense. DCAA provides accounting and financial advisory services to other Government agencies. DCAA provides NASA these services in connection with negotiation, administration, and settlement of NASA contracts and subcontracts.

[30]DCMC is a federal agency that performs delegated contract administration function not retained by the contracting agency.

[31]Those systems include accounting, compensation, estimating, general electronic data processing controls, indirect and other

and has determined that Boeing's systems were adequate. DCAA also participated in joint Earned Value Management system surveillance reviews with NASA, DCMC, and Boeing officials, which resulted in the acceptance of the Earned Value Management System at Boeing's Canoga Park and Huntington Beach sites.

Defense Contract Management Command. The ISS Contracting Officer delegated contract administration of Boeing's contract to DCMC. DCMC prepares and submits to the ISS Contracting Officer a Monthly Status Report for each Boeing development site and the Houston field site.[32] The Monthly Status Reports are due to NASA officials on the 15th of the month following the month in which DCMC receives the Boeing performance report. DCMC uses the performance data to calculate independent estimates at completion each quarter, as directed in the contract administration delegation. Appendix F includes information on NASA's delegation of contract administration functions to DCMC. The independent estimate at completion represents an earned value estimate based on Boeing's actual performance to date.

The DCMC Monthly Status Reports identified cost-growth problems at individual Boeing sites. For example, since February 1997, at Boeing Huntsville, DCMC has reported a possibility of a cost overrun of $500 million,[33] which is double the cost overrun that Boeing Huntsville reported. Appendix G includes information on DCMC Monthly Status Reports and the indications of higher estimates at completion.

The Monthly Status Report identifies cost growth problems at the site level but it does not include a Monthly Status Report at the total ISS contract level. The contract administration delegation did not require DCMC to provide total contract-level data; therefore, the Monthly Status Reports do not address total contract costs and/or schedule performance. Consequently, total contract status is not consolidated into one easy-to-read document that the Program Office can use to manage the contract.

Recommendation, Management's Response, and Evaluation of Response

3. The ISS Program Manager should request that DCMC provide an independent estimate at completion in its monthly status report for each Boeing site on the same date and consolidate the results for the total ISS contract.

Management's Response. Partially concur. Management stated that DCMC reports estimates at completion by site on a monthly visit. The Space Station Business Office consolidates the DCMC assessments because DCMC is organized by the individual sites and not by the Program.

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direct costs, labor accounting, material management and accounting system, planning and budgeting, and purchasing systems.

[32]The Program Office uses the Monthly Status Reports from DCMC to identify potential problems as illustrated in Appendix G.

[33]Source: Earned Value Management System Surveillance Report, ISS, Boeing Huntsville, February 1997.

Evaluation of Response. Although management did not request DCMC to consolidate the reports, the intent of management's actions is responsive to the recommendation. Management's completed actions are sufficient to close the recommendation for reporting purposes.

Award Fee Evaluation

NASA established the Award Fee Plans in the ISS contract to motivate Boeing to strive for excellence in managerial, technical, schedule, and subcontracting performance. The plans allow Boeing to earn award fees[34] from a minimum of zero dollars to the maximum amounts. See Appendix C, "Award Fee Provisions and Payments," for more details. The plans require evaluations of Boeing's performance every 6 months based on the weights[35] assigned to the evaluation factors established at the beginning of each evaluation period. The award fee curves are based on ratings[36] and a numerical scoring system from 0 to 100. The earned award fee dollars are calculated by applying the total numerical score to available dollars.

The seventh award fee evaluation period on the ISS contract started April 1, 1999, and ended September 30, 1999. The award fee evaluation was based on an assessment of three areas: Program Management; Technical; and Small Disadvantaged Business Utilization, which are weighted 40 percent, 45 percent, and 15 percent, respectively, for the purposes of determining an overall award fee score.[37] See Appendix C, "Award Fee Provisions and Payments" for more details.

Within the Program Management area, Contract Management is one of four subfactors evaluated and is weighted at 10 percent. The Contract Management subfactor includes two criteria – Contract Administration and Cost Management, which are not weighted. In the sixth period evaluation regarding Cost Management, NASA concluded: "Boeing reported a VAC [variance at completion] which was much lower than NASA independent estimates and which did not incorporate known risks which had a high probability of occurrence." The evaluation went on to state that Boeing increased the cost overrun by $203 million in March 1999, which indicated that the prior estimate was not valid. Further, the evaluation stated that the prior contractor estimate did not incorporate known risks with a high probability of occurrence. In the seventh period evaluation regarding Cost Management, NASA concluded:

> Boeing's forecasting, integrated cost management, and risk management products continued to be significant problems during this period. These deficiencies impacted the Program's ability to plan for appropriate funding needs and foresee issues that may affect the Program. Boeing failed to provide rationale for lack of

[34] 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.

[35] Weights are the numerical percentages applied to each evaluation factor denoting the relative importance of each factor for calculating the total amount of award fee each period.

[36] The award fee ratings are excellent, very good, good, satisfactory, or poor/unsatisfactory.

[37] The sixth award fee evaluation period assessment and weightings were identical.

> cost savings while meeting an aggressive de-staffing plan during this period. Also, EVMS [Earned Value Management System] surveillance support was inadequate. Many changes submitted . . . do not reflect a thorough understanding of the requirements or a basis for acceptable cost forecasting of the resources needed to work the change.

Despite this negative information, for both evaluation periods, NASA provided an overall rating of "satisfactory" to the Contract Management subfactor, which was high enough to pay the contractor award fee for its performance in this area. Boeing's cost performance in award fee periods six and seven were similar to its performance in period two for which no award fee was paid.[38]

The award fee provisions did not provide sufficient weight (and, thus, an incentive) to the Cost Management area to ensure reporting of realistic cost estimates. Specifically, only a minimal amount of award fee was at risk given the structure of the award fee weighting for determining the overall award fee score. Therefore, even an unsatisfactory rating in this area would reduce the award fee by only a minimal amount, with the additional provisions that unearned award fee could be earned later. See Appendix C, "Award Fee Provisions and Payments," for further details. As of March 1999, the ISS contract was 83-percent complete and modifications of the award fee provisions would likely not be cost beneficial. Accordingly, future ISS-related contracts should more heavily weight the critical Cost Management area.

Recommendation, Management's Response, and Evaluation of Response

4. The ISS Program Manager should consider revising the award fee provisions to require a higher weighting for Cost Management on future ISS-related contract award fee evaluations.

Management's Response. Concur. Management stated the award fee structure was changed to place more emphasis on cost performance in contract modification No. 836.

Evaluation of Response. The actions taken by management are responsive to the recommendation. Management's completed actions are sufficient to close the recommendation for reporting purposes.

Budgeting Requirements for the Current Cost Overrun

As of June 1999, the Boeing projected cost overrun was $986 million and the Program Office cost overrun was $1.05 billion. Appendix H compares Boeing and NASA cost overrun estimates to the actual cost variance on the ISS contract. To validate the Boeing and NASA cost overruns,

[38]Identified weaknesses from period two that still existed in period six are unreliable cost variance estimates and overly optimistic schedule variances.

we requested that DCMC and Boeing perform separate analyses of all remaining work to be completed on the ISS contract (exclusive of modifications that increase the scope of effort). The results of the analyses are discussed below.

DCMC Estimate. We requested that DCMC provide a cost estimate for the total contract as part of the DCMC analysis. DCMC provided the cost estimate based on Boeing's March 1999 performance report data. DCMC identified an estimate at completion significantly higher than Boeing's estimate. Based on the DCMC estimate, Boeing's reported contract cost overrun of $986 million could be about $1.3 billion. Appendix I contains the DCMC analysis, which indicates that the ISS contract cost overrun is understated by about $312 million.

Boeing's Monte Carlo Analysis. A Monte Carlo[39] analysis is widely accepted and used in estimating contract costs because it provides a quantification of program risks. In mid-1998, Boeing used a Monte Carlo analysis to estimate the costs associated with certain technical risks facing the ISS Program. The 1998 analysis, which was incorporated in the June 1998 performance report, resulted in Boeing increasing its cost overrun from $600 million to $783 million. However, the 1998 analysis did not address all remaining work to be completed on the ISS contract. Using the results from the Monte Carlo analysis that Boeing performed at our request in May 1999, we determined, using a 75 percent probability of occurrence, that the estimate at completion for the Boeing prime contract would be $8.199 billion with an estimated cost overrun of $1.115 billion. This is an increase in the Boeing estimate at completion and cost overrun of $129 million. Appendix J discusses a Monte Carlo analysis in more detail.

Additional Budget May Be Needed. The cost overrun being budgeted by the Program Office is substantially below the cost overrun estimates resulting from both DCMC's estimate and Boeing's Monte Carlo analysis. In April 1999, the Program Office budgeted $1.05 billion for the cost overrun. This amount represents $986 million of the proposed budget and $64 million for additional costs, which is covered by Program reserve. The $1.05 billion also represents the $1.03 billion cost overrun calculated by Blackhawk plus an additional $20 million of costs added by the ISS Business Manager. However, the $1.05 billion is considerably less than the budget needed to cover the cost overruns that resulted from the DCMC estimate ($1.307 billion) and the Monte Carlo analysis ($1.115 billion).

Recommendation, Management's Response, and Evaluation of Response

5. The ISS Program Manager should reassess budget requirements for the ISS prime contract based on the new estimates provided by the DCMC and the Monte Carlo analysis.

[39] A Monte Carlo analysis is a simulation using a statistical software model that draws random samples from a number of lower level work package distributions and totals them to estimate the parameters of the overall system.

Management's Response. Concur. Management stated the ISS Program considers not only the DCMC estimate but also a number of independent estimates when determining its budget estimate for the cost overrun.

Evaluation of Response. The actions taken by management are responsive to the recommendation. Management's completed actions are sufficient to close the recommendation for reporting purposes.

Effects of Risks on Management Reserve

In its April 1999 Program Operating Plan presentation to NASA, Boeing identified $95 million of high risk, $79 million of medium and low risk, $98 million in cost saving opportunities, and $175 million to $245 million in unknown unknowns.[40] Boeing's March 1999 performance report showed the $95 million of high risk as part of the management reserve.[41] Boeing did not include the medium and low risks, cost saving opportunities, and unknown unknowns in its estimate at completion for the March 1999 performance report.

High, Medium, and Low Risks. Boeing's inclusion of the $95 million high risk reflects a new philosophy about recognizing risk. In March 1999, senior Boeing management decided to cover the high-risk items with the management reserve because Boeing management believed it was appropriate for the Program's advanced stage of maturity.[42] Although, Boeing identified $79 million in medium and low risks, it did not include those risks in the March 1999 estimate at completion. For a more accurate estimate at completion, high, medium, and low risks should be included in the estimate at completion.

Unknown Unknowns. Boeing estimated that the unknown unknowns category of risk could cost from $175 million to $245 million. However, Boeing did not include either amount in its estimate at completion.

Negative Management Reserve. Management reserve is an amount of the total allocated budget withheld, for management control purposes, rather than designated for the accomplishment of a specific task or set of tasks. As reported in Boeing's March 1999 performance report, Boeing had a management reserve budget of $53 million. However, in the same report, Boeing estimated it would eventually need management reserve funding of $145 million. The $145 million consisted of $95 million of the high-risk items (identified to specific tasks) and $50 million of unencumbered management reserve (not identified to specific tasks). The difference between Boeing's management reserve budget of $53 million and the estimate at completion amount of $145 million resulted in a negative management

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[40]Boeing defines "unknown unknowns" as risks having almost no probability of occurrence, but potentially catastrophic effects.

[41]Boeings Integrated Management System Description defines management reserve as "An amount of the total allocated budget withheld for management control . . . ." Accordingly, only the amount budgeted for management reserve would be available for use.

[42]As of March 1999, the Program was about 83 percent complete, with some of the most difficult work ahead such as qualification testing, functional configuration audits, physical configuration audits, and completion of software.

reserve[43] variance of $92 million. Boeing's Integrated Management System Description states that management reserve will not be in a negative status. By including an estimate for specific tasks in the estimate for management reserve, Boeing exceeded its budget for management reserve and was in noncompliance with its Integrated Management System Description. Also, because management reserve is not suppose to be identified with specific tasks, it is not part of the work breakdown structure[44] or performance baseline. By putting the $95 million in the estimate for management reserve, Boeing does not have to address these risks in its corrective action plans in the monthly performance report because the $95 million is not in the performance baseline.

Recommendation, Management's Response, and Evaluation of Response

6. The ISS Program Manager should identify alternatives to the current practice of having Boeing report a negative management reserve status.

Management's Response. Concur. Management stated it would identify options associated with reporting the risk within the contractor's scope of work.

Evaluation of Response. The actions taken by management are responsive to the recommendation. The recommendation is resolved but will remain undispositioned and open until agreed-to corrective actions are completed.

Risk Mitigation

Risk Mitigation Planning. Boeing has drafted a formal process[45] for the mitigation of risks.[46] As of August 1999, Boeing was still developing mitigation plans for the risks (high, medium, and low) identified in the April 1999 Program Operating Plan. However, Boeing's prior risk mitigation plans have not been effective in controlling cost overruns or schedule slips as evidenced by past cost growth. Also, Boeing has not maintained a database of identified risks and opportunities for use in calculating future risks and opportunities, which will help Boeing determine a more realistic estimate at completion.

Boeing should identify and appropriately include risks in the estimate at completion. As discussed earlier, although Boeing identified high, medium, and low risks, it did not include all those known risks in the estimate at completion. Also, a risk mitigation process and risk mitigation plan should be in place to control cost growth associated with risks.

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[43]Negative management reserve is a result of the estimated amount of unanticipated program requirements being greater than the amount that was withheld for control purposes. Management reserve is in an overrun status.

[44]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.

[45]The Program Instruction describes the risk and opportunity management tracking system and is ready for signature. The draft instruction requires the risk owner to develop a risk mitigation plan and schedule.

[46]Examples of the high-probability risks are qualification test failures, software problems, rate issues, and rework.

Recommendation, Management's Response, and Evaluation of Response

7. The ISS Program Manager should request Boeing to identify which known risks are included in their estimate at completion and which known risks are outside their estimate at completion. Mitigation plans should be implemented for all known risks.

Management's Response. Concur. Management has requested Boeing to identify the risks in accordance with the recommendation and has implemented a process to verify Boeing's execution.

Evaluation of Response. The actions taken by management are responsive to the recommendation. Management's completed actions are sufficient to close the recommendation for reporting purposes.

Contract Modifications

Negotiation of ISS Contract. During the transition from the Space Station Freedom configuration to the ISS configuration, much uncertainty existed concerning the potential technical problems and costs necessary to complete the ISS. NASA signed a letter contract with Boeing on November 15, 1993, primarily for the transition effort necessary to shift from the Space Station Freedom management and technical baseline to the new ISS management and technical approach.[47] On February 1, 1994, the three NASA prime contracts were novated[48] to the existing Boeing letter contract. Boeing then had complete responsibility for the design, manufacture, and integration of the ISS.

On August 31, 1994, NASA and Boeing signed a Memorandum of Understanding known as the "Handshake Agreement." This agreement established technical requirements and a not-to-exceed estimated target price[49] of $6.2 billion.[50] The agreement also established that NASA and Boeing would negotiate and definitize[51] a cost-plus-incentive-fee/award fee-contract. NASA established a technical baseline and considered cost management the most critical issue for successful contract completion.

The "Handshake Agreement," which contained an estimated total contract price of $6.2 billion, was subsequently negotiated and definitized in the ISS contract for about $5.6 billion, a reduction of $600 million. Table 1 summarizes the results of the contract negotiations.

Table 1. Summary of Contract Negotiations

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[47] A technical baseline and approach refers to the functional and physical configurations of a system.

[48] A contract is novated by an agreement where the transferor guarantees performance of the contract, the transferee assumes all obligations under the contract, and the Government recognized the transfer of the contract and related assets.

[49] A target price is the target cost plus profit or fee.

[50] The agreement was made without the benefit of formal cost proposals; therefore, the incentive fee curve contained a "deadband," or flat spot on the cost incentive share line, where no incentive for cost performance was paid. A NASA goal for definitizing the contract was to eliminate the deadband, which was accomplished during the contract negotiations.

[51] Definitize means to settle and sign a contractual action that would include a new contract or modification to an existing contract.

($ in billions)

Element of Contract	Boeing Proposed	NASA Objective	Negotiated
Cost	$ 5.889	$ 4.613	$ 5.147
Fee*	.758 (13.5%)	.649 (15.0%)	.491 (9.5%)
Total	$ 6.600	$ 5.200	$ 5.638

*The fee is a combination award fee and incentive fee. The percentages represent the positions of Boeing and NASA before negotiation of the contract and then the negotiated result. The percentages in the parentheses represent the available award fee.

Memorandum of Agreement for Program Reserve Funds. Following the Handshake Agreement, NASA and Boeing recognized that the funding constraints on the ISS Program made it necessary for Boeing, as the ISS prime contractor, to have insight into Program funds and to participate in the development of Program plans for reserve funds. On January 13, 1995, the same day that the contract was definitized, NASA and Boeing signed a Memorandum of Agreement, which states:

1. All Program reserve funds not residing within the prime contract cost target shall reside under NASA Program control.

2. Boeing, as the Program prime contractor, will be given visibility into the Program reserve as part of the overall management process of the ISS Program.

3. As the ISS Program prime contractor, Boeing will be coordinated with and participate in the Program decision making process for allocation of Program reserves.

4. NASA Program management recognizes the criticality of Program reserve allocation during the 1995 through 1997 time frame and will ensure that the insight and concerns of Boeing as the Program prime contractor will be given recognition in Program allocation decisions.

Based on Boeing's understanding of the terms of the agreement, Boeing management stated that the company believed that the $600 million reduction in the negotiated contract price in January 1995, in effect, amounted to management reserve being held at the Program Office level. Boeing expected to see the $600 million added to the contract as target cost, if needed. However, NASA management maintained that the reduction was attributed to normal contract negotiations and that any cost growth not attributed to change orders or equitable adjustments was considered cost overrun that should be added to the total contract cost but not to the target cost.

Since January 1999, the Program Office, contrary to its Memorandum of Agreement, has restricted discussion of Program reserve, including threats and liens, to the NASA-only Business Station Development and Operations Meetings. ISS procurement officials stated that they do not consider the Memorandum of Agreement as an extra-contractual agreement because the Boeing prime contract

value does not include Program reserve. Program reserve is managed at the ISS Program level. Even though ISS procurement officials do not believe the Memorandum of Agreement has implications on the contract terms and conditions, we believe it is in NASA's best interest to officially terminate the Memorandum of Agreement.

Recommendation, Management's Response, and Evaluation of Response

8. The ISS Program Manager should require that the Memorandum of Agreement for Program reserve funds be formally terminated with Boeing.

Management's Response. Concur. Management stated it would rescind the Memorandum of Agreement in February 2000.

Evaluation of Response. The actions planned by management are responsive to the recommendation. The recommendation is resolved but will remain undispositioned and open until agreed-to corrective actions are completed.

Over-Target Baseline Proposal

On September 30, 1997, Boeing requested that the ISS Program Manager approve an increase of $600 million in the ISS performance measurement baseline.[52] That amount represented a cost overrun of about $398 million of incurred cost overrun and about $202 million of forecasted cost overrun**.** Boeing explained that the adjustment would achieve a more meaningful Program baseline with which to measure performance. The Boeing request included a Memorandum of Agreement, which defined the conditions under which the cost overrun would be approved and the baseline change would be implemented. In October 1997, the Program Manager approved the Boeing request and signed the Memorandum of Agreement. In November 1997, Boeing increased the ISS performance measurement baseline by the $600 million cost overrun. The adjustment eliminated all variances and reset cost and schedule performance efficiency to 100 percent.

On February 1, 1999, the Contracting Officer requested that Boeing submit a proposal for the $600 million cost overrun. This written request also stated that the contract would soon be funded (obligated)[53] to the contract value and that NASA did not intend to provisionally increase the contract value without a cost overrun proposal from Boeing. On February 19, 1999, Boeing submitted a cost overrun proposal to Johnson for $600 million. The proposal provided a basis for the Contracting Officer to provisionally increase the contract value. The Contracting Officer modified the contract to increase the value by $295 million, which represented available funding at the time. This modification

[52] A performance measurement baseline is a timed-phase budget plan against which project performance is measured. It equals the total allocated budget less management reserve.

[53] NASA cannot fund or obligate more for contract disbursements than the contract value.

raised the ISS contract value to $7.6 billion and provided funding through June 28, 1999.[54] On March 1, 1999, the Contracting Officer requested a new proposal to include the current cost overrun so that the $783 million cost overrun could be definitized. On April 15, 1999, Boeing submitted a cost variance ("delta") proposal for $183 million, which when added to the February 1999, $600 million cost overrun proposal, equaled the $783 million cost overrun Boeing had reported through February 1999. However, by April 15, 1999, Boeing had increased its cost overrun by an additional $203 million for a total cost overrun of $986 million. Therefore, Boeing stated in the April 1999 delta proposal that it would submit another delta proposal for the additional cost growth by June 28, 1999. On August 6, 1999, the Program Office negotiated $730 million of the first two cost overrun proposals of $783 million. The $53 million difference is being separately negotiated. On September 22, 1999, Boeing submitted a proposal for the remaining $203 million cost overrun. NASA intends to definitize this amount as part of a global settlement modification that also settles a number of Requests for Equitable Adjustments by November 30, 1999. The delays in definitizing the over-target baseline negatively impact performance measurement by limiting variance analysis to top-level estimates rather than the detailed distribution of the baseline to work breakdown structure. Therefore, Government insight into contractor performances and the ability to take corrective action are impaired.

Coordination with Earned Value Management Focal Point. NASA Federal Acquisition Regulation (FAR) Supplement 1852.242-75, "Earned Value Management Systems," March 1999, provides for the Government to require integrated baseline reviews.[55] The reviews shall be scheduled as early as practicable and should be conducted within 180 days after contract award, exercise of significant contract options, or incorporation of major contract modifications. The objective of the review is to jointly assess areas, such as Boeing's planning, to ensure complete coverage of the statement of work, logical scheduling of the work activities, adequate resources, and identification of inherent risk.

Draft NASA Procedures and Guidelines 9501.4, "NASA Earned Value Management," requires each field installation (for example, a NASA Center) to designate one person to serve as the NASA Earned Value Management focal point. The Assistant Chief Financial Officer is that focal point at Johnson. Draft NASA Procedures and Guidelines 9501.4 also requires the NASA program or project manager to request the support of the focal point in resolving significant problems with the contractors' Earned Value Management system. Further, NASA Policy Directive 9501.3, "Earned Value Performance Management," February 18, 1997, requires NASA program and project managers to coordinate with the focal point during any contract reprogramming or rebaselining[56] activities. However, the focal point

[54]The contract target cost had been provisionally increased for a total of $384 million, $351 million of which was due to the overrun which has now been definitized. The contract value is now $8.067 billion (Modification No. 822), and funding is expected to last through December 1, 1999 (Modification No. 830).

[55]An integrated baseline review is a joint review of the contractor's planning to ensure complete coverage of the statement of work, logical scheduling of the work activities, adequate resources, and identification of inherent risks.

[56]Reprogramming or rebaselining is a comprehensive replanning of the effort remaining in the contract that results in a revised total allocated budget, which may exceed the current contract budget.

stated that the Program Manager did not consult with him about the performance measurement baseline increase. The focal point continued that if he had been consulted, he may have advised the Program Manager about the need to modify the contract. The Program Manager explained that the Associate Administrator for Space Flight and the Johnson Director made the decision to rebaseline and that the decision had been briefed to the NASA Administrator.

In our opinion, the $600 million increase to the performance measurement baseline of the ISS contract should have been accompanied by a timely modification to the contract. From October 1997 through February 1999, Johnson had not modified the contract value to account for the $600 million cost overrun. Because funds obligated for contract costs were projected to reach the contract value as of March 24, 1999,[57] Johnson would have been precluded from legally paying further costs incurred by Boeing unless the ISS procurement officials modified the contract.

Recommendations, Management's Response, and Evaluation of Response

The ISS Program Manager should:

9. **Require ISS procurement officials to expeditiously complete actions to definitize the cost overrun proposals and claims and to modify the contract.**

10. **Conduct an integrated baseline review after definitization of the contract modification that implements the over-target baseline.**

Management's Response. Partially concur. Management stated the cost overrun proposals were definitized by contract modification No.836. However, management did not agree to conduct an integrated baseline review. Instead, management proposed an alternative solution. Because of the Program's stage of development, the Program's quarterly review of Boeing's estimate at completion provides substantially the same benefit as an integrated baseline review. All remaining work, schedules, and resources are reviewed on a quarterly basis, but not to the extent an extensive exercise such as the integrated baseline review would require.

Evaluation of Response. The actions taken and planned by management are responsive to the recommendation. Management's completed actions are sufficient to close the recommendation for reporting purposes.

[57] Since this date, modifications to provisionally increase the contract value have occurred and cost overrun proposals have been received and negotiated.

Finding B. Cost Increases for NASA Programs

Neither Boeing nor its S&C Group[58] promptly notified NASA about the potential cost increases resulting from Boeing's reorganization. Of Boeing's estimated $153 million in increased costs to the S&C Group's customers for Contractor Fiscal Year (CFY)[59] 1999, NASA will be charged an estimated $82 million, including $21 million for the ISS Program. Also, the ISS Program will be additionally charged an estimated $14 million in cost increases resulting from the reorganization for years subsequent to CFY 1999. While most of Boeing's reorganization activities were planned or completed in late CFY 1998, Boeing was unable to estimate the increased costs at that time since the structure of its proposed indirect rates[60] had changed so significantly. A new S&C Group General and Administrative rate was established, replacing eight individual rate categories, each containing multiple rates. The result of this change is that costs are now collected at different levels, and are allocated[61] using different methodologies to a business base dramatically changed by the reorganization. The Government must review the proposed indirect rates and negotiate a forward pricing rate agreement[62] with Boeing. However, until the Government completes its review and negotiation, it has allowed Boeing to use the proposed indirect rates for pricing contracts and modifications. As a result, NASA may be paying higher costs than necessary on its program contracts.

Boeing's Reorganization Activities

Many major NASA programs, including the ISS Program, experienced increased costs as the result of Boeing's reorganization. Boeing's S&C Group, which has the largest share of NASA's business, ultimately experienced the largest increase in costs from the company's reorganization activities. That Group's overall estimated cost increases ($153 million) for CFY 1999 were

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[58]This group is one of three Boeing business units (a segment of an organization). The S&C Group performs the majority of NASA business with Boeing. More details on the S&C Group are in Appendix D. A segment is one of two or more divisions, product departments, plants, or other subdivisions of an organization reporting directly to a home office, usually identified with responsibility for profit and/or producing a product or service.

[59]Boeing's Contractor Fiscal Year begins January 1st and ends December 31st.

[60]An indirect cost rate is the calculated rate used to distribute indirect costs to final cost objectives on the basis of the relative benefits received. An indirect cost is any cost not directly identified with a single, final cost objective, but identified with two or more final cost objectives. An example of an indirect cost would be the rent on a building where work is performed on more than one contract.

[61]To allocate means to assign an item of cost, or group of items of cost, to one or more cost objectives. This term includes both direct assignment of cost and the reassignment of a share from an indirect cost pool.

[62]A Forward Pricing Rate Agreement is a written agreement negotiated between a contractor and the Government to make certain rates available during a specified period for use in pricing contracts or modifications. The agreement may include rates for items such as labor, indirect costs, material obsolescence and usage, spare parts provisioning, and material handling.

caused by three types of reorganization activities: (1) external restructuring activities,[63] (2) accounting practice changes,[64] and (3) other consolidation and realignment activities. Table 2 shows a breakout of the estimated cost increases among the three categories.

Table 2. CFY 1999 Estimated Cost Increase to S&C Group
($ in millions)

Category of Reorganization Activity	CFY 1999
External restructuring activities	($ 8.7)*
Accounting practice changes	79.6
Other consolidation and realignment activities	81.9
Total 1999 Cost	$ 152.8

*External restructuring activities result in greater savings than costs and, therefore, reduce the estimated cost increase to the S&C Group.

Source: S&C Group Rough Order Magnitude Impact Assessment

Table 3 shows an estimate of how the S&C Group will charge the CFY 1999 increased costs to NASA.

Table 3. CFY 1999 Cost Increases to NASA
($ in millions)

Category of Reorganization Activity	S&C Group	NASA*
Accounting practice changes	$ 79.6	$ 46.0
Other consolidation and realignment and external restructuring activities	73.2	35.6
Total	$ 152.8	$ 81.6

*The estimated NASA cost increase may actually be less, due to the contractor's sharing with NASA in the cost increases on cost-plus-incentive-fee type contracts.

Source: S&C Group Rough Order Magnitude Impact Assessment

[63]These activities are extraordinary, nonrecurring, and nonroutine, combining facilities, operations, and the workforce of two or more companies not previously under common ownership or control.

[64]An Accounting Practice is any disclosed or established accounting method or technique that is used for allocation of cost to cost objectives, assignment of cost to cost accounting periods, or measurement of cost. An Accounting Practice Change is any alteration in a disclosed or established accounting method or technique used for allocation, assignment, or measurement of cost.

Communication of Rate Information to NASA

In late December 1998, the S&C Group submitted to DCMC[65] its proposed, new forward pricing rate[66] and billing rate,[67] which incorporated the changes, including cost increases, caused by the reorganization. At that time, DCMC did not have information on the potential cost increases to certain customers and could not determine potential cost increases based on rate changes, including NASA, because the rate structure had changed significantly and a comparison between old and new rates could not be made. As a result, DCMC did not negotiate a lower rate for Boeing's interim use for pricing and billing purposes. Instead, DCMC allowed the S&C Group to use the proposed rates pending completion of a DCAA review and DCMC final negotiation of the proposed rates.[68] DCAA's review is still ongoing.

During January 1999, many S&C Group customers saw increased costs in their programs. Because of concern that the increases were the result of the new rates, the DCMC Corporate Administrative Contracting Officer asked the Group to identify its cost impact resulting from the reorganization. NASA contacted DCMC's Defense Corporate Executive in Seattle, Washington, about the increased costs in Agency programs.

In March 1999, the S&C Group Controller estimated $128.5 million in increased costs to the Group during CFY 1999. The S&C Group presented the estimate to the cognizant DCMC and DCAA officials on March 12, 1999, and to NASA's Associate Administrator for Space Flight on March 28, 1999. Shortly thereafter, the S&C Group program offices developed cost estimates for NASA programs. Table 4 shows that the aggregate of those estimates was based on the Group's first quarter 1999 estimates at completion.[69]

[65]DCMC is the cognizant Federal agency for Boeing and is responsible for establishing final indirect cost rates, forward pricing rates, and administering cost accounting standards for all contracts, on behalf of all Federal agencies.

[66]Forward pricing rates are rates projected by a contractor for the contractor's use to price contracts and contract modifications.

[67]FAR 42.701 defines a billing rate as an indirect cost rate (a) established temporarily for interim reimbursement of incurred indirect costs and (b) adjusted as necessary pending establishment of final indirect cost rates.

[68]Requirements and procedures for a DCAA review and DCMC negotiation are prescribed in FAR Subpart 42.7.

[69]An estimate at completion is a value developed to represent a realistic appraisal of the final cost of the total contract.

Table 4. Estimated Cost Increases to NASA Programs*
($ in millions)

Program	1999	After 1999	Total Program
International Space Station	$ 20.5	$ 14.1	$ 34.6
Space Flight Operations Contract	8.6	9.3	17.9
Space Shuttle Main Engine	23.4	35.3	58.7
Payload Ground Operations Contract	5.5	9.3	14.8
Spacehab	2.9	10.7	13.6
Space Lab	0.9	0.5	1.4
Aggregate increase to NASA	$ 61.8	$ 79.2	$ 141.0

*The estimated NASA cost increases may actually be less, due to the contractor's sharing with NASA in the cost increases on cost-plus-incentive-fee type contracts.

Source: S&C Group's first quarter 1999 estimates at completion

At the request of the DCMC Corporate Administrative Contracting Officer, the S&C Group Controller's office initiated a Rough Order Magnitude Impact Assessment of the Group's increased costs. On April 2, 1999, the S&C Group Controller's office requested data[70] from the rate manager at each S&C Group site in order to determine a more precise cost impact to the Group and its major programs as a result of the new rate. In late May 1999, the S&C Group Controller's office finalized its assessment and revised S&C Group's CFY 1999 cost increase from $128.5 million to $152.8 million. However, the S&C Group Controller did not revise the estimates of increased costs to NASA's programs. As a result, the Group could not identify the impact to NASA's major programs by cost category. Although the S&C Group Controller's office initially requested data specific to program impacts, the S&C Group Controller informed us that the assessment was not intended to revise the Group's program office estimates, which had been based on the first quarter 1999 estimate at completion for NASA programs.

We attempted to validate S&C Group program impact estimates to determine whether the calculations encompassed all the effects of the reorganization. The S&C Group Controller gave us parameters[71] of the program office estimates and identified the extent of contractual effort on which the estimates were based. Because the S&C Group Controller did not give us the estimate calculations, we cannot attest as to the completeness of the estimates.[72]

[70]The data request required the identification of significant changes to the site, by cost category, and total estimated cost increases/decreases to program estimates for FY 1999 and later.

[71]See Appendix K for more details on the parameters used to estimate program cost increases.

[72]The S&C Group Controller did not provide us the calculations of the program offices' estimates because he did not want to

Disparity in Estimates

We identified a significant disparity between the results of the S&C Group Controller's assessment and the S&C Group program office estimates for the six major programs at an aggregate-NASA level. Specifically, the assessment shows that NASA's increased costs total about $81.6 million for CFY 1999 (see Table 3). However, the aggregate cost increases total $61.8 million for CFY 1999 (see Table 4). The difference between the S&C Group Controller's office estimate and the Group's program office estimates is $19.8 million (24 percent of the assessment estimate). The S&C Group Controller attributed this difference to several factors, including the fact that the assessment included nonmajor NASA contracts. However, we determined NASA's nonmajor programs comprised about 5 percent of NASA's contracts with the S&C Group and, therefore, believe that the nonmajor contracts are not a significant factor. The S&C Group Controller also expressed his belief that the independent sources[73] of the two estimates used different assumptions, which caused some of the disparity.

Recommendation, Management's Response, and Evaluation of Response

11. The ISS Program Manager should obtain from Boeing its estimated net cost increases to the ISS Program, by specific category of reorganization activity, and identify estimated net cost increases on the ISS Program that were not included in S&C Group's May 1999 data.

Management's Response. Partially concur. Management stated it would obtain the required data through the DCMC Defense Corporate Executive rather than directly from Boeing. Management will ensure NASA's interests are represented by DCMC.

Evaluation of Response. The actions planned by management are responsive to the recommendation. The recommendation is resolved but will remain undispositioned and open until agreed-to corrective actions are completed.

External Restructuring

External restructuring activities are extraordinary, nonrecurring, and nonroutine and involve the combination of facilities and/or resources of more than one of Boeing's three companies (see Appendix C, "Contractor Reorganization"). Under the DFARS, external restructuring costs are not allowable costs to the Department of Defense (DoD) unless savings outweigh costs by a factor of two-to-one. While the regulation does not specifically apply to NASA, Boeing is planning on exceeding the ratio for DoD and NASA. Table 5 shows that Being's proposed estimate indicates that the Boeing-wide cost and savings ratio is greater than three-to-one, with about $237.6 million of costs

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compromise the company's negotiation position on unnegotiated work content.

[73]The two independent sources are (1) the S&C Group site rate managers for the assessment and (2) the S&C Group program offices for the first quarter 1999 estimates at completion.

being offset by $839.3 million of savings over the next 5 years. Boeing estimated that NASA will also benefit by more than a three-to-one ratio, with about $22 million of costs being offset by $72 million of savings over the next 5 years.

Table 5. Boeing–Wide Proposed External Restructuring Estimate
($ in millions)

Entity	1999	2000	2001	2002	2003	Totals
Boeing						
Savings	$ 80.1	$ 166.0	$ 190.6	$ 197.8	$ 204.8	$ 839.3
Less Costs	54.3	47.6	45.7	45.2	44.8	237.6
Net Savings	$ 25.8	$ 118.4	$ 144.9	$ 152.6	$ 160.0	$ 601.7
NASA						
Savings	$ 7.8	$ 15.1	$ 17.8	$ 15.5	$ 16.1	$ 72.4
Less Costs	5.7	4.4	4.4	3.6	3.6	21.8
Net Savings	$ 2.1	$ 10.7	$ 13.4	$ 11.9	$ 12.5	$ 50.6

Sources: Boeing External Restructuring Proposal, August 2, 1999
DCMC-Seattle, Washington, August 12, 1999, (Annual breakout of NASA savings and cost)

While costs will be realized at relatively the same level over the next 5 years, the majority of savings resulting from external restructuring will be realized at an increasing level over the next 5 years. Except for CFY 1999, when restructuring implementation costs are slightly higher, Boeing is amortizing external restructuring costs in accordance with Cost Accounting Standard 406, "Cost Accounting Period," and 48 Code of Federal Regulations 9904.406-61, which provides a specific interpretation of external restructuring costs. The accounting standard's provision allows deferral of external restructuring costs on a straight-line basis over a period not to exceed 5 years. However, savings will offset costs in the years they are realized, which Boeing estimated would occur in the latter part of the 5-year period.

Of the Boeing-wide external restructuring estimate for CFY 1999, S&C Group's portion is an estimated $47.5 million in savings and $38.9 million in costs for CFY 1999, a net savings of $8.7 million. The S&C Group estimated that NASA's share of the $8.7 million net savings would be $0.6 million for CFY 1999. The S&C Group did not have estimates for CFY's 2000 through 2003.

Recommendations, Management's Response, and Evaluation of Response

The ISS Program Manager should:

12. Monitor Boeing's cost and savings performance on the external restructuring activities to ensure that NASA receives an overall savings as a result of the activities.

13. Obtain for NASA the cost and savings requirements in the DFARS applicable to external restructuring and attributable to the ISS Program.

Management's Response. Concur. Management stated it would coordinate with DCMC to monitor Boeing's cost and savings performance and ensure that the cost and savings achieve the benefits required by the DFARS.

Evaluation of Response. The actions planned by management are responsive to the recommendation. The recommendations are resolved but will remain undispositioned and open until agreed-to corrective actions are completed.

Accounting Practice Changes

The S&C Group estimated that $79.6 million of the S&C Group's $152.8 million overall estimated cost increases for CFY 1999 resulted from accounting practice changes at Boeing. Of the $79.6 million, $46 million was charged to NASA programs. The accounting practice changes affected the allocation of the business unit general and administrative expense, common engineering and manufacturing activities, independent research and development costs, bid and proposal costs, and several capitalization and depreciation methods. The S&C Group reports that for the most part, the $79.6 million of increased cost to the S&C Group represents costs that were shifted from another Boeing group,[74] except for $35.7 million, which is attributable to capitalization and depreciation method changes. This $35.7 million cost shift was caused by the S&C Group acknowledging expenses in its current accounting period that should have been acknowledged in future periods, had the accounting change not occurred. Because of the cost shift from another Boeing group, the other group's customers are benefiting at the expense of the S&C Group's customers.

The S&C Group also estimated a cost shift within the Group. Specifically, one of the accounting practice changes[75] modified the way the S&C Group's site costs are allocated to programs at those

[74]The Military Aircraft and Missiles Group.

[75]The accounting practice change revised the indirect cost allocation base methodology (from the Total Cost Input Base allocation methodology to the Value Added Base allocation methodology). The Total Cost Input Base consists of all costs (direct and indirect) charged to final cost objectives (i.e. contracts), excluding incoming Intercompany Work Authorization costs, Cost of Money, and General and Administrative expense. The Value Added Base consists of the Total Cost Input Base (as defined above) less direct Material and Subcontract costs.

sites. The S&C Group's costs did not increase as a result of this change. However, the Group's cost shifted between its programs, resulting in cost increases to certain programs. Table 6 shows that NASA's estimated cost increase due to the cost shift between the sites is $16.1 million in CFY 1999 for the major programs. The $16.1 million does not reflect the effect of the sites' accounting practice changes on other NASA nonmajor program work performed at the sites, which is minimal. As a result, NASA's impact from this cost shift may be slightly understated.

Table 6. Estimated Cost Increases to NASA Programs Attributable to Site Accounting Changes[1]
($ in millions)

Programs	1999	Outyears	Program Totals
International Space Station	($ 1.8)	($ 0.3)	($ 2.1)
Space Flight Operations Contract[2]	10.8	20.0	30.8
Space Shuttle Main Engine	7.1	11.6	18.7
Payload Ground Operations Contract	0	0	0
Spacehab	0	0	0
Space Lab	0	0	0
Total Increase to NASA:	$ 16.1[3]	$ 31.3	$ 47.4

[1]The estimated NASA cost increase might be less, due to the contractor's sharing in the cost increases on cost-plus-incentive-fee type contracts.

[2]The estimated Space Flight Operations Contract cost increase, attributable to the base allocation methodology change, exceeds the overall estimated program cost increase identified in Table 4. Specifically, the $10.8 million in estimated increased costs for CFY 1999 is offset by a cost decrease caused by accounting practice and other changes to net about $8.6 million for CFY 1999 (see Table 4). Also, the $30.8 million in estimated increased costs for CFY's 1999 through 2001 is offset by a cost decrease caused by accounting practice and other changes to net about $17.9 million for the total Space Flight Operations Contract Program (see Table 4).

[3]The estimated $16.1 million program cost increase for CFY 1999, attributable to the base allocation methodology change, is included in the $46 million in estimated increased costs to NASA attributable to accounting practice changes (see Table 3).

Source: S&C Group Rough Order Magnitude Impact Assessment

Other Consolidation and Realignment Activities

The S&C Group estimated that of the $152.8 million overall estimated cost increase for CFY 1999, $73.2 million results from other consolidation and realignment activities (see Table 3). Of the $73.2 million, $35.6 million is charged to NASA programs. The consolidation and realignment activities resulted from the changes in Boeing's office structure, responsibilities, and

policies.[76] The S&C Group reports that for the most part, the $73.2 million of increased costs to the S&C Group represents cost shifts it experienced from the two other Boeing groups.[77] As a result, the other Boeing groups' customers are benefiting at the expense of the S&C Group's customers.

Ongoing Government Reviews

Reviews of External Restructuring. DCMC, Seattle, Washington, is responsible for coordinating the review and approval of Boeing's external restructuring costs. DCMC uses the DFARS Subpart 231.205-70 to determine whether restructuring costs are allowable on DoD contracts. To be allowable, paragraph (c)(1) of the subpart requires that projected restructuring savings and costs be audited, meet or exceed a two-to-one ratio, and be certified by the Under Secretary of Defense (Acquisition and Technology). Although NASA does not have similar guidelines, Boeing agreed to ensure that the proposed costs and savings attributable to NASA would meet the two-to-one ratio, and DCMC is reviewing NASA's costs and savings in accordance with the DFARS guidelines.

On August 2, 1999, Boeing submitted its formal external restructuring proposal, which includes 60 individual restructuring activities, for Government approval. DCMC requested that DCAA audit the proposal; however, the audit has been in progress during 1999. Specifically, DCMC and DCAA officials have participated on Boeing's Integrated Process Teams, which have been proactively evaluating and negotiating the individual proposed restructuring activities on a case-by-case basis as the proposal was being finalized. As a result, the proposal is expected to receive Government approval and certification with minor review and negotiation. DCMC's goal is to obtain certification[78] by September 30, 1999. Subsequently, DCMC and Boeing will execute an advance agreement, which will specify agreed-to costs and savings, amortization schedules, and any other special requirements.

Reviews of Accounting Practice Changes. The Defense Corporate Executive in Seattle, Washington, is responsible for reviewing and approving accounting practice changes and uses the procedure set forth in FAR 30.602-3. After submission of a proposed change by the contractor, the Defense Corporate Executive first obtains assistance from DCAA in determining that the changes are adequate and compliant with cost accounting standards. Next, the Defense Corporate Executive asks the contractor to submit a cost impact proposal and determines whether the impacts result in increased costs paid by the Government, specifically to contracts and subcontracts covered by the accounting standards. If a change has a material effect on a contract, FAR procedures state the change is not allowable unless the Defense Corporate Executive determines that the change is desirable and not

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[76]Boeing allocated the increases to the business units, mainly in the following four categories: (1) business base changes resulting from realignment of business among the three business units, (2) shifts of Boeing office costs, (3) shifts of Shared Services Group costs, and (4) shifts of International Business Machine Global Services contract costs.

[77]The Military Aircraft and Missiles Group and the Commercial Airplanes Group.

[78]Certification, required by DFARS 231.205-70(c)(1), indicates that projections of future restructuring savings are based on audited cost data and should result in overall reduced costs. Such certification precedes the DoD's determination to allow restructuring costs to be charged to DoD contracts.

detrimental to the Government's interest overall. FAR 52.230-6, "Administration of Cost Accounting Standards," further requires that the Defense Corporate Executive consider the potential impact on funds of the various agencies or departments.

Boeing's proposed accounting changes took effect on January 1, 1999. Rather than submitting its proposed changes 60 days earlier, as required by the FAR, Boeing submitted the accounting changes to the Defense Corporate Executive on January 29, 1999. Further, Boeing revised and reissued its submission on April 26, 1999. Boeing's submissions describe the changes and the resulting impacts only on Boeing's internal organizations, not on funds of the various agencies or departments. During its evaluation of Boeing's impact statements, DCAA made a preliminary determination that Boeing's disclosed accounting practices, which incorporated the changed accounting practices, were inadequate. DCAA stated that if inadequacies in the disclosed practices were not corrected, they would likely lead to a noncompliance with the cost accounting standards. In addition, DCAA notified the Defense Corporate Executive that the impacts related to the changes were inadequate because Boeing did not indicate the specific impacts to funding agencies or individual contracts. As a result, DCAA concluded that the Government was unable to assess the materiality of the changes as required by the FAR.

The Defense Corporate Executive agreed with DCAA on the inadequacy of Boeing's impact statements. On May 26, 1999, the Defense Corporate Executive issued a response to DCAA's concerns, stating that "Boeing's change submissions do not entirely fulfill the contractual requirements for the pertinent analysis."[79] In addition, the Defense Corporate Executive concluded that the changes "generally have had a material impact on CAS [Cost Accounting Standard]-covered contracts."[80] On June 7, 1999, the Defense Corporate Executive briefed his conclusion to several major NASA program offices that were materially impacted, including that of the ISS, the Space Flight Operations Contract, and the Space Shuttle Main Engine.

However, based on data received from Boeing, the Defense Corporate Executive believed he had gained a general understanding of the impacts on NASA's major programs. As a result, the Defense Corporate Executive concluded that Boeing did not need to provide more detailed information. In June 1999, the Defense Corporate Executive informed us that he asked DCAA to continue to validate the data Boeing had provided to date. After validation, the Defense Corporate Executive and DCAA will meet with Boeing to determine the impacts on contracts covered by cost accounting standards. The Defense Corporate Executive anticipates that once validated, the information should be adequate to initiate negotiations for contract price adjustments. At this time, the Defense Corporate Executive believes that Boeing will take the position that the changes are desirable but not detrimental to the

[79]FAR 52.230-6, "Administration of Cost Accounting Standards," requires the contractor to submit impact data adequate for the cognizant administrative and audit officials to perform the analysis prescribed in FAR 30.602-3. Specifically, the Defense Corporate Executive and DCAA are required to analyze and determine the impact to the Government and all Cost Accounting Standard-covered contracts and subcontracts.

[80]Cost Accounting Standards are published in compliance with Public Law 100-679 (41 U.S.C. 422), which requires certain contractors and subcontractors to comply with Cost Accounting Standards and to disclose in writing and follow consistently their cost accounting practices.

Government as a whole and, therefore, should be accepted as increased costs to Government contracts. In addition, Boeing's position is that any impacts to individual contracts will be offset by future cost reductions that can be obtained only through the reorganization activities that led to the accounting practice changes. Regardless of Boeing's anticipated position, the Defense Corporate Executive informed us that he would continue efforts to determine the necessity and feasibility of contract price adjustments.

Reviews of Other Consolidation and Realignment Activities. The activities classified in this "other" category include activities to combine facilities and resources and to implement common policies, practices, and systems. However, unlike external restructuring activities, these other activities are ordinary and routine and individually do not effect more than one of Boeing's three companies. In addition, these other activities do not cause a change in Boeing's established accounting practices. As a result, the cost impacts caused by these activities are not covered under the cost accounting standard reviews discussed earlier. Instead, cognizant DCMC and DCAA officials at S&C Group locations will include these impacts in their reviews of the contractor's proposed forward pricing rates. DCMC and DCAA reviews are ongoing, but DCMC has authorized use of Boeing's proposed rates for forward pricing purposes until the reviews are completed.

The Defense Corporate Executive in Seattle, Washington, is also reviewing the cost impacts resulting from other consolidation and realignment activities, specifically on the basis of reasonableness. The Defense Corporate Executive initiated the review because of the materiality of the impacts and the recent concerns expressed by various Government customers, including NASA. Unless the Defense Corporate Executive determines the costs to be unreasonable, the Government has no remedy or authority to disallow the costs or to negotiate contract price adjustments with the contractor.

In early June 1999, DCAA officials informed us that they were evaluating whether some of the other consolidation and realignment activities should be recategorized as accounting practice changes, based on Boeing data provided to date. Specifically, DCAA believes that a significant amount of these other activities not only cause changes in Boeing's office structure, responsibilities, and policies, but also in Boeing's accounting practices.[81] As a result, DCAA may recommend that these other activities be recategorized and that the Defense Corporate Executive review the associated cost impacts under the more rigorous FAR and accounting standard

[81]DCAA gave one example of the International Business Machine Global Service contract. This contract was adopted by Boeing to provide a consistent method and source for obtaining computing equipment and services for the overall company. Boeing charges the International Business Machine Global Service contract costs to Boeing users (i.e. internal Boeing organizations) based on direct machine use, a basis on which some Boeing organizations had previously been charged. But other Boeing organizations had been charged based on direct employee staffing. For those other Boeing organizations, such change in how costs are charged may constitute a change in accounting practice.

guidelines regarding allowability, rather than just on the basis of reasonableness. The Defense Corporate Executive informed us that he would have to review the results of DCAA's evaluation before concurring with the recategorization.

Recommendation, Management's Response, and Evaluation of Response

14. The ISS Program Manager should ensure that significant issues continue to be coordinated with the DCMC Defense Corporate Executive to ensure that ISS Program officials are advised of contract increases resulting from reorganization activities and that ISS Program interests are adequately protected.

Management's Response. Concur. Management stated it is now regularly participating in conferences with the DCMC Defense Corporate Executive where significant issues are addressed with other Boeing government customers.

Evaluation of Response. The actions taken by management are responsive to the recommendation. Management's completed actions are sufficient to close the recommendation for reporting purposes.

Efforts to Reduce Indirect Cost Growth

S&C Group officials are targeting areas where its increased costs to customers can be reduced. The S&C Group President told us in late May 1999 that he would like to target enough reductions to offset all cost increases to the S&C Group. However, some of the cost increases are under the control of Boeing Corporate. The Defense Corporate Executive in Seattle, Washington, stated that although Boeing Corporate has identified goals to reduce cost growth, Boeing Corporate is slow in identifying plans on accomplishing its goals. To prompt Boeing Corporate, DCMC's Commander requested that the company have its plan in place by June 30, 1999. However, as of mid-August, Boeing Corporate has not communicated its plan to DCMC. Until Boeing submits its plans and makes progress in accomplishing its targets, the Defense Corporate Executive will be hesitant to consider Boeing's cost reduction efforts as an offset to increased contract prices.

The S&C Group is pursuing reductions under its control. The S&C Group has identified and/or realized $58 million in reductions during CFY 1999, which will offset the Group's increased costs of $152.8 million. The reductions focused primarily on reducing International Business Machine Global Service Contract costs and the Group's independent research and development and bid and proposal costs. A portion of those reductions contributed to a reduction in the Group's general and administrative rate, which was reduced on May 21, 1999, and again on August 4, 1999. The reduced rate should result in lower costs to S&C Group programs, including the ISS Program. The Group is identifying further reductions and is anticipating that its rate will be further reduced by the end of CFY 1999.

Conclusions

As discussed in Finding A, the Program Office has a sound process for assessing contractor performance, identifying risk, and reporting on cost and schedule information to senior Agency management. Additionally, incorporating a discussion of a realistic estimate at completion and cost overruns for the ISS Program at regularly scheduled meetings should give senior managers better visibility of any increase in program costs. Once the Agency (1) initiates periodic independent assessments of the ISS Program, (2) receives Monthly Status Reports from DCMC on total ISS contract costs and schedule performance, and (3) identifies all known risks and ensures that the contractor fully implements related risk mitigation plans, the potential for paying incentive fees not earned by the contractor should be eliminated and management should be better able to control cost growth problems.

NASA major programs have experienced increased costs attributable to both Boeing's reorganization and the manner in which it reported cost data for the ISS Program in particular (see Finding B). Total costs for six major programs for 1999 and beyond are estimated at about $141 million (see Table 4), not including potential increased costs for non-major programs. NASA's increased costs include about $72 million in savings (see Table 5) resulting from Boeing's reorganization activities. To ensure that the Agency receives the estimated savings, NASA needs to monitor Boeing's cost and savings performance and ensure that Boeing applies the savings requirements of the DFARS to the ISS Program.

Appendix A. Objectives, Scope, and Methodology

Objectives

The overall objective of the review was to evaluate performance management of the ISS prime contract with Boeing. Specifically, we determined whether:

- cost and schedule performance was promptly and completely reported to senior NASA management;
- cost and schedule performance reporting processes, including Government oversight, ensure that timely and complete information was provided to NASA management;
- contract cost, schedule, and technical risks were fully disclosed and appropriate risk mitigation plans were in place;
- Earned Value Management data was effectively utilized for Program management;
- indirect cost rate increases were reviewed for allowability, allocability, and reasonableness; and
- contractual issues related to contract cost increases were appropriately addressed.

Scope and Methodology

To satisfy our objectives we:

- Conducted interviews of DCMC, DCAA, and Boeing personnel at:
  - Boeing Huntsville, Alabama
  - Boeing Canoga Park, California
  - Boeing Downey, California
  - Boeing Huntington Beach, California
  - Boeing Seal Beach, California
  - Boeing Houston, Texas
  - Boeing Seattle, Washington
- Conducted interviews with ISS Program personnel at NASA Headquarters, Johnson, Marshall Space Flight Center, and Boeing sites.
- Reviewed performance reports dated from June 1998 through March 1999.
- Reviewed prior General Accounting Office (GAO), DCAA, and NASA Office of Inspector General reports related to Boeing.
- Reviewed DCMC's cost estimate and Boeing's Monte Carlo cost estimate for the ISS prime contract.
- Analyzed cost performance, schedule performance, and future performance on the ISS prime contract.
- Conducted interviews of Boeing subcontractors at Palo Alto and Sunnyvale, California.
- Reviewed Boeing's Cost Accounting Disclosure Statements.
- Reviewed Boeing's Consolidation of Cost Impacts for CY 1999 Cost Accounting Practice Changes.

- Reviewed a bottoms-up Rough Order Magnitude Impact Assessment conducted during April and May 1999, from Boeing Seal Beach, California.

Field Work

We performed field work from April through November 1999[82] at the NASA Headquarters, Johnson, Marshall Space Flight Center, and Boeing sites.

Summary of Prior Audits and Reviews

The NASA Office of Inspector General and GAO have issued numerous reports on the ISS Program. Selected reports are summarized in Appendix L of this report.

Defense Contract Management Command Comments

Although not requested, the Defense Contract Management Command provided comments to a draft of this report. We considered these comments and made appropriate changes to our report.

[82]During the review, we determined that issues identified during the audit of "Adjustment to Space Station Contract Baseline in the Earned Value Management System," Assignment No. A9901000, more closely related to the issues in this report (see Finding A). We performed field work on that assignment from November 1998 through February 1999.

Appendix B. Recommendations for Corrective Action

The ISS Program Manager should:

1. Request discussion of Boeing's cost performance and, in particular, the estimated cost overrun, at regularly scheduled meetings with senior NASA management. (page 7)

2. Establish a process for periodic independent estimates of the cost to complete the ISS contract, and consider requesting that the estimate be performed as part of the Independent Annual Review. (page 9)

3. Request that DCMC provide an independent estimate at completion in its monthly status report for each Boeing site on the same date and consolidate the results for the total ISS contract. (page 10)

4. Consider revising the award fee provisions to require a higher weighting for Cost Management on future ISS-related contract award fee evaluations. (page 12)

5. Reassess budget requirements for the ISS prime contract based on the new estimates provided by the DCMC and the Monte Carlo analysis. (page 13)

6. Identify alternatives to the current practice of having Boeing report a negative management reserve status. (page 15)

7. Request Boeing to identify which known risks are included in their estimate at completion and which known risks are outside their estimate at completion. Mitigation plans should be implemented for all known risks. (page 16)

8. Require that the Memorandum of Agreement for Program reserve funds be formally terminated with Boeing. (page 18)

9. Require ISS procurement officials to expeditiously complete actions to definitize the cost overrun proposals and claims and to modify the contract. (page 20)

10. Conduct an integrated baseline review after definitization of the contract modification that implements the over-target baseline. (page 20)

11. Obtain from Boeing its estimated net cost increases to the ISS Program, by specific category of reorganization activity, and identify estimated net cost increases on the ISS Program that were not included in S&C Group's May 1999 data. (page 25)

12. Monitor Boeing's cost and savings performance on the external restructuring activities to ensure that NASA receives an overall savings as a result of the activities. (page 27)

13. Obtain for NASA the cost and savings requirements in the DFARS applicable to external restructuring and attributable to the ISS Program. (page 27)

14. Ensure that significant issues continue to be coordinated with the DCMC Defense Corporate Executive to ensure that ISS Program officials are advised of contract increases resulting from reorganization activities and that ISS Program interests are adequately protected. (page 32)

Appendix C. Boeing Contract Cost and Fee

The ISS prime contract was signed on January 13, 1995, and 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 provide ground and orbital support operations. The contract combined the efforts of previous contracts from the Space Station Freedom Program. Boeing is also required to provide technical support and data for NASA's operation and utilization of the ISS and is responsible for ISS system performance.

Table C-1 shows the total costs in the Boeing Earned Value Management System and baseline for the ISS contract as of March 28, 1999.

Table C-1. International Space Station Contract Baseline
NAS15-10000
($ in billions)

Description	Amount
Original contract target cost	$ 5.205
Negotiated contract changes	+ 1.342
Current target cost	$ 6.547
Estimated cost of authorized, unpriced work	+ 1.137
Contract budget base*	$ 7.684
Total allocated base	$ 7.684

*Contract budget base is the negotiated contract cost plus the estimated cost of authorized but unpriced work.

As of March 22, 1999, the total amount allotted by the Government to the ISS contract was $6.953 billion, which included a provisional amount of about $295 million associated with the over-target baseline[83] submitted by Boeing on February 19, 1999. The over-target baseline proposal includes the $600 million variance between the contractor's estimate at completion and the budget at completion,[84] as delineated in the June 1997 performance report, the cut-off period for the over-target baseline proposal. The $6.953 billion allotment is for all items and covered the period of performance through June 28, 1999. An additional $405 million is obligated under the contract for fee payment. These amounts are applicable to the prime contract effort and do not include all activities supporting the ISS Program. As of March 31, 1999, the total obligated cost, including provisional cost plus fee, was about $7.358 billion. Of that amount, NASA has paid about $6.789 billion.

[83]An over-target baseline is a formal reprogramming of the contract's original performance baseline that results in a new performance measurement baseline. See the "Over-Target Baseline Proposal" section of this report in Finding A for more details.

[84]Budget at completion is the sum of all budgets allocated to the contract. It is also synonymous with the term Performance Measurement Baseline.

Work to be Performed on the ISS Contract

Work to be performed on the ISS is specified in the ISS contract Statement of Work, (Exhibits A and D). Exhibit A describes the design, development, manufacture, integration, test, verification, and delivery to NASA of the U.S. On-Orbit Segment of the ISS. The ISS contract also includes the procurement of spare parts. Replacement spares were considered outside the scope of the original contract; therefore, procurement actions to acquire replacement spares increases the contract target cost and target price. Spares procurement as of March 31, 1999, was about $285 million and should total about $585 million by the end of CY 1999. Exhibit D in the ISS contract includes sustaining engineering,[85] multi-element integrated testing,[86] and logistics and maintenance post-production support,[87] which are "level of effort"[88] support activities. These activities were considered outside the scope of the original ISS contract. Therefore, similar to the procurement process for replacement spares, separate procurement actions that increase contract target cost and target price are required for these efforts. Through the end of FY 1999, the contract includes ISS contract Exhibit D activities, totaling $170 million. For FY's 2000 and beyond, the Exhibit D activities have not been added to the contract. When negotiated, about $541 million will be added to the contract for FY's 2000 and 2001, respectively. ISS contract Exhibit D activities for FY 2002 and beyond are yet to be determined. The Exhibit D portion of the ISS contract and spares procurements will increase the total contract price. The activities are fee-earning activities and will increase the scope of work and, in turn, the performance measurement baseline.

The contractor is required to use appropriate financial control disciplines throughout the Program for early identification and resolution of potential threats to Program success. The contractor is also required to assure compliance with Federal financial reporting requirements. The contractor must define, develop, and maintain a financial management system for the accumulation, analysis, and documentation of cost and staffing data to the appropriate level of the prime contract and maintain an Earned Value Management system to provide an assessment of the integrated cost

[85]Sustaining engineering is the design engineering support provided after the development of hardware and software items is completed and after the Government has provisionally accepted those items. Sustaining engineering includes the predelivery planning and preparation work required to ensure efficient implementation and includes such tasks as test bed/facility requirements identification, maintaining facility readiness, critical skill retention, process definition, mission evaluation room training, model and tool development, etc. Maintenance and modification of provisionally accepted software products is also included.

[86]Multi-element integrated testing provides element to element and Orbiter to cargo element testing. Such testing of the flight elements occurs prior to launch in order to mitigate on-orbit risk and prove flight interface capabilities.

[87]Postproduction support effort provides logistics support for all contractor-provided core ISS hardware. The support includes the maintenance and repair of failed hardware and replenishment/procurement of spares and repair parts for all hardware.

[88]Level of effort is effort of a general or supportive nature that does not produce definite end products or results. Level of effort is measured only in terms of resources actually consumed within a given time period.

and schedule performance data. The Government determined that Boeing's Earned Value Management System was compliant with the approved system descriptions at each location, and we considered the Earned Value Management data maintained by the systems to be reliable.

Cost Variance Trends

Table C-2 reflects the continued degradation of Boeing's performance during the period after the $783 million cost overrun was acknowledged in June 1998. Significant negative cost variances (overruns) were occurring each month during this period. Also, the gap was increasing between actual cost performance as reflected by the monthly cost performance index[89] and the performance required to meet the $783 million cost overrun, referred to as the "to complete performance index."[90] For example, by the end of December 1998, actual cost performance was significantly less than required to meet the $783 million cost overrun for 6 consecutive months and additional actual cost overruns during this period exceeded $107 million. However, Boeing chose not to revise its cost overrun forecast in the monthly performance reports to NASA despite this compelling information.

[89] A cost performance index is the value earned for every measurable unit of actual cost expended. It is also a reliable and objective indicator of the cost efficiency achieved on the work accomplished.

[90] The "to complete performance index" is the projected value to be earned for every measurable unit to be expended in the future. It is also the performance efficiency required on work remaining in order to stay within a program objective.

Table C-2. Boeing's Cost Variance Trends
($ in thousands)

Month	Variance at Completion[1]	Budgeted Cost of Work Performed[2]	Monthly Cost Variance	Cost Performance Index[3]	To Complete Performance Index[4]
June 1998	$ 783,000	$ 85,426	($ 8,365)	91.1%	93.4%
July 1998	$ 783,000	$ 74,551	($ 23,050)	76.4%	94.5%
August 1998	$ 783,000	$ 77,165	($ 12,997)	85.6%	95.0%
September 1998	$ 783,204	$ 86,829	($ 18,347)	82.6%	95.2%
October 1998	$ 783,204	$ 67,487	($ 19,130)	77.9%	96.6%
November 1998	$ 783,204	$ 71,267	($ 9,280)	88.5%	97.1%
December 1998	$ 783,077	$ 58,364	($ 16,026)[5]	78.5%	98.0%
January 1999	$ 782,671	$ 60,641	($ 22,543)	72.9%	99.7%
February 1999	$ 782,975	$ 61,826	($ 20,110)	75.5%	101.2%
March 1999	$ 986,012	$ 54,941	($ 20,694)	72.6%	88.9%

[1]We added $600 million to the amount reported in Boeing's performance report to include the over-target baseline adjustment.

[2]This is the monthly budgeted cost of work performed.

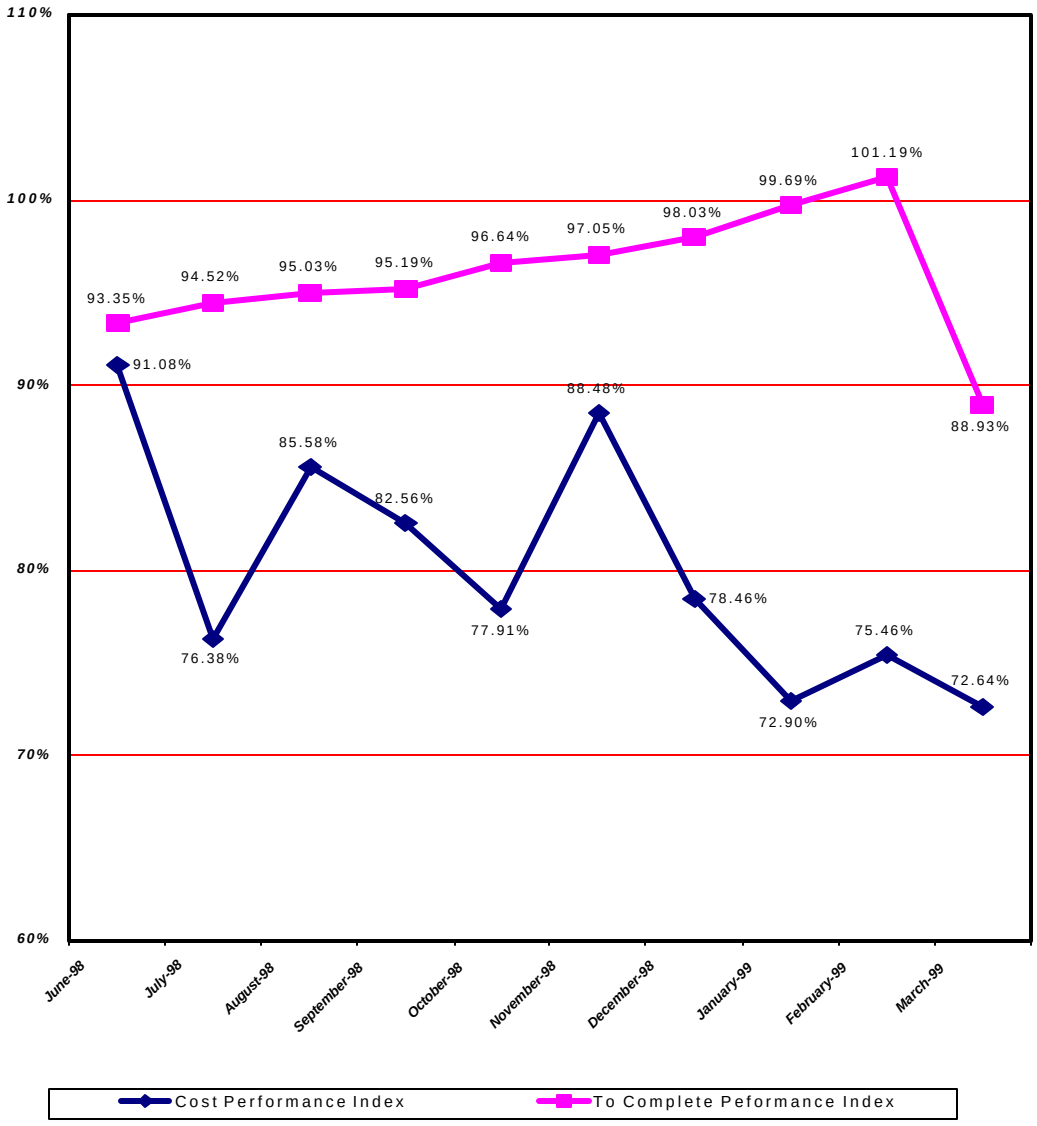
[3]A monthly cost performance index is based on the budgeted cost of work performed, divided by actual cost of work performed.

[4]This index is based on budget at completion less cumulative budgeted cost of work performed, divided by estimate at completion less cumulative actual cost of work performed.

[5]Cost overruns from June through December 1998 totaled $107 million on the budgeted cost of work performed, which totaled $521 million.

The following figure contains a comparison of Boeing's monthly Cost Performance Index and To Complete Performance Index from June 1998 through March 1999. By March 1999, Boeing's monthly cost performance had degraded to its lowest point in the 15-month period since the over-target baseline was implemented in November 1997.

Comparison of Boeing's Monthly Cost Performance Index and To Complete Performance Index



The $203 million increase in the cost overrun reported on March 25, 1999, was attributed to:

- Team Growth $81 million
- Inclusion of High Probability Risk $95 million
- Increase of Management Reserve $27 million

The $81 million team growth was due to problems at these Boeing sites:

- $5 million at Huntsville due to valve rework, laboratory tests, and rates;
- $31 million at Canoga Park due to subcontractor performance, rates, and electrical orbital replacement units;
- $16 million at Huntington Beach due to mechanism qualification failures, operations, laboratories, avionics, and rates; and
- $29 million at Houston due to software; rates; operations and utilization rate negotiations; communications and tracking; and guidance, navigation, and control.

The $95 million high-probability risks[91] were due to problems at these Boeing sites:

- Huntsville $12 million
- Canoga Park $15 million
- Huntington Beach $32 million
- Houston $36 million

During the same time period that Boeing held its estimate at completion constant, Boeing informed the ISS Business Manager of low and medium risks and associated costs that it had not included in its estimate at completion. For example, Boeing advised NASA officials of an additional $129 million in risks[92] not included in the estimate at completion in December 1998 at the following sites:

- Huntsville $9 million
- Canoga Park $35 million
- Huntington Beach $56 million
- Houston $29 million

The risks were in addition to the cost growth included in the cost overrun in December 1998 for which Boeing claimed that offsetting cost saving opportunities of $101 million would be realized. In other words, Boeing had potential cost growth of $230 million as of December 1998 that was not included in the reported cost overrun of $783 million due, in part, to reported cost saving opportunities of $101 million and risks of $129 million not identified in the estimate at

[91]Examples of the high-probability risks are qualification test failures, software problems, rate issues, and rework.

[92]Examples of the low and medium risks are integrated equipment assembly refurbishment, system integration, test and verification, vehicle integration, and structures and mechanisms.

completion. On December 22, 1998, Boeing executives[93] informed the ISS Business Manager that the ISS contract cost overrun could range from $783 million to $964 million. Boeing based the $964 million cost overrun on the cumulative cost performance on the contract projected over the remaining life of the contract. However, this disclosure of the additional risks and costs is not a substitute for reporting a well-supported and documented estimate at completion to the Government in support of the contract. The underreporting of the estimate at completion is inconsistent with Boeing's Integrated Management System Description[94] which requires Boeing to provide its best estimate. Boeing's Integrated Management System Description states:

> The EAC [estimate at completion] consists of the cumulative actuals to date plus the estimate to complete the authorized work remaining. An EAC is used to predict total costs to be incurred on an entire contract or a specific portion of it. EACs are developed by reviewing performance to date, current and future conditions, and the tasks to be accomplished.

In addition to the high, medium, and low risks Boeing identified, Boeing also estimated the cost of risk associated with the unknown unknowns category. Although we agree that the unknown unknowns category of risk should not be included in the cost overrun, we believe that these risks are possible, but not likely to occur. These risks would affect both cost and schedule. The specific items are listed in Table C-3.

Table C-3. Unknown Unknowns
($ in millions)

Unknown Unknowns Categories	Amounts
Lab multiple element integrated test issues	$39
Electrical protection system and thermal control system failure	$25 to $53
Truss element test failures	$50 to $92
Software	$17
Systems/subsystems integration	$44
Total	$175 to $245

[93]Boeing executives included the Deputy Program Manager for Business, Deputy Program Manager for Technical, and ISS Business Manager.

[94]The Boeing Company, Defense and Space Group, document D950-10001-1, July 1997.

Even though NASA's analyses of the Earned Value Management data indicated continued cost performance deterioration, Boeing and ISS Program officials continued to report understated cost overruns for extended periods of time. Also, corrective action plans required in the performance reports as a result of unfavorable cost variances and schedule variances were not always effective.[95]

Equitable Adjustments

Request for Equitable Adjustment. In June 1996, Boeing entered into agreements to cap two of its subcontracts with AlliedSignal Incorporated, Aerospace Equipment Systems (AlliedSignal).[96] Boeing initiated the cost caps due to substantial cost growth over the original negotiated cost.

In November 1998, AlliedSignal submitted a request for an $82.4 million price and schedule adjustment.[97] On June 8, 1999, AlliedSignal and Boeing executed a Memorandum of Agreement and Release of Claims for $36.5 million.[98] On June 22, 1999, Boeing submitted the settlement for NASA's review and approval. NASA consented to the subcontract changes via letter on September 21, 1999, and adjusted the ISS contract value by $33 million (Modification No. 807) on September 23, 1999.

Reporting at Station Development and Operations Meetings

The Program Office should place more emphasis on the reporting of its and Boeing's cost overrun estimates in the monthly Station Development and Operations Meetings. Boeing and NASA Program officials normally do not present their respective cost overrun estimates in the Station Development and Operations Meetings and do not show comparisons of their estimates to independently calculated cost overruns. The standard briefing charts used in the meetings do not highlight areas of significant cost and schedule risk and do not identify risk mitigation efforts identified by Boeing in required corrective action plans. Additionally, the charts do not clearly reflect the impact of continued degradation in cost performance on the probability of achieving a particular estimate at completion. For example, during mid-1998, Boeing determined its $783 million cost overrun based on a partial application of a Monte Carlo analysis; this cost overrun is estimated to have a 75-percent probability of occurrence. Over the remainder of CY 1998, Boeing's cost performance declined. This is evidenced by the decrease in the cost performance index during this period (see Table C-2). With the steady decline in cost performance and the incremental cost overruns being recognized each month on the work performed, the probability of achieving the $783 million cost overrun decreased significantly to a point of being an unrealistic expectation. For those reasons, Program officials should have been increasingly skeptical of

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[95]This was identified in Audit Report IG-99-007, "Space Station Corrective Action Plans," January 28, 1999.

[96]These two subcontracts with AlliedSignal are located at Boeing Huntsville and Boeing Huntington Beach. A cap is a limit on the amount that AlliedSignal will be reimbursed for work performed, without regard to cost incurred to perform the work.

[97]The request included $76 million for the two capped subcontracts, $3.7 million for two fixed-price subcontracts, and $2.6 million for proposal preparation.

[98]The agreement includes a target cost adjustment of $27.7 million for the equitable adjustment request; a target cost adjustment of $5.4 million based on removal of the caps effective February 1, 1999; and a cost and fee adjustment of $3.4 million for changes.

the $783 million cost overrun reported by Boeing over the same period of time and should have challenged the contractor's use of the cost overrun by December 1998.

Liens and Threats

In December 1998 when Boeing stated that the cost overrun could increase to $964 million, the Program Office identified a "threat"[99] of $100 million to the $848 million cost overrun it reported. The recognition of a threat is less encumbering on the ISS Program than recognition of a lien[100] and suggests relative uncertainty with regard to realization of the associated cost growth. Accordingly, the identification of a threat did not increase the Program Office cost overrun estimate but merely identified the possibility that the estimate could increase. In December 1998, when Boeing projected more than $100 million in cost savings and showed that cost risks of $129 million had not been included in the cost overrun estimate, the Program Office should have increased the cost overrun estimate or identified a lien rather than identify the $100 million as a threat. By not increasing the cost overrun estimate, the Program Office minimized the significance of the contractor disclosures.

Contractor Financial Reporting

The 1998 Boeing Annual Report, issued February 22, 1999, contains Boeing's consolidated financial statements and information reflecting the combined company.[101] Boeing reported net earnings in CY 1998 of $1.120 billion[102] on revenues of $56.154 billion. The S&C Group, one of the three principal business groups within Boeing, reported earnings of $248 million (about 3.6 percent) on revenues of $6.889 billion. In its message to shareholders, Boeing acknowledged dissatisfaction with the CY 1998 results, stating:

> Following a loss in 1997, Boeing posted net earnings of $1.1 billion in 1998. While that is progress, it leaves us in the bottom quartile of S&P 500 companies in standard measures of profitability. Our overriding goal is to return Boeing to the top quartile of companies both in profitability and in total return to shareholders. In working toward our long term goal of 7 percent after-tax for Boeing as a whole, we will need to raise operating margins in each
>
> of our three principal businesses to double-digit levels . . . It means doubling our operating return on revenues in the fast-growing and highly competitive field of space and communication systems.

[99] A threat is a means of recognizing cost risk to the ISS Program by fiscal year.

[100] A lien results in the Program Office actually budgeting a corresponding portion of Program reserve funding.

[101] During CY 1997, McDonnell Douglas merged with Boeing. In CY 1998, the former Information, Space and Defense Systems Programs of Boeing was reorganized into the S&C Group and the Military Aircraft and Missile Systems Group, which Boeing reported as separate business segments starting in CY 1998. The S&C Group is responsible for performance of the ISS contract.

[102] Boeing's CY 1998 net earnings totaled about 2 percent of revenues.

Profit recognition by Boeing on the ISS contract occurs on a percentage-of-completion basis. Generally Accepted Accounting Principles describe this method of accounting as a method of recognizing revenues, costs, and earnings as progress is made toward completion on a long-term contract. To apply the percentage-of-completion method, there must be a basis or standard for measuring the progress toward completion at interim periods.

As discussed below, cost overruns on the ISS prime contract can reduce the amount of award fee earned by Boeing. However, the cost overruns have a more direct and material effect on the amount of incentive fee earned. Also, based on the reported revenue and net earnings of the S&C Group during CY 1998, the ISS contract may comprise a material portion of Boeing's revenue and net earnings.

Award Fee Provisions and Payments

NASA established Award Fee Plans in the ISS contract to motivate Boeing to strive for excellence in managerial, technical, schedule, and subcontracting performance. The plans allow Boeing to earn award fee from a minimum of zero dollars to the maximum amounts as shown in Tables C-4 and C-5. The plans call for evaluations of Boeing's "on-ground" performance and "level of effort" performance every 6 months based on factors established at the beginning of each evaluation period. The award fee curves are based on ratings,[103] as well as a numerical scoring system from 0 to 100. The earned award fee dollars are calculated by applying the total numerical score to available dollars. However, Boeing cannot earn "on-ground" performance or "level of effort" award fee dollars for any evaluation period when the interim score is "poor/unsatisfactory," a numerical score of less than 61. Further, any "on-ground" or "level of effort" performance factor receiving a rating of "poor/unsatisfactory" will be assigned zero dollars for the period. Boeing's program management, technical, and small disadvantaged business performance is assessed under the ISS contract "on-ground" performance. Contract Management is one of four subfactors assessed under the Program Management section of the evaluation, and Cost Management is one part of that assessment. While poor cost performance can affect Boeing's Cost Management scores, NASA considers the contractor's efforts to keep costs under control for award fee purposes. Cost performance for "on ground" work is not addressed under Cost Management, but specifically addressed by the incentive fee provisions of the contract. Table C-4 shows a minimum of zero dollars to the maximum amounts that can be earned and the amounts that were earned in prior rating periods.

[103]The ratings are excellent, very good, good, satisfactory, or poor/unsatisfactory.

Table C-4. "On-Ground" Award Fee

Period Number	Start Date	End Date	Maximum Available (Mod. No. 763)*	Earned
1	04/01/96	09/30/96	$ 30,616,000	$ 21,431,200
2	10/01/96	03/31/97	33,748,833	$ 0
3	04/01/97	09/30/97	28,150,368	$ 19,705,258
4	10/01/97	03/31/98	25,611,365	$ 18,696,296
5	04/01/98	09/30/98	29,031,884	$ 23,515,826
6	10/01/98	03/31/99	18,393,506	$ 14,898,740
7	04/01/99	09/30/99	11,123,161	$ 8,564,834
8	10/01/99	03/31/00	8,560,146	TBD
9	04/01/00	09/30/00	7,023,002	TBD
10	10/01/00	03/31/01	3,557,367	TBD
11	04/01/01	09/30/01	4,071,396	TBD
12	10/01/01	03/31/02	2,953,344	TBD
Final[1]	04/01/02	12/31/02	351,671	TBD
Total			$ 203,192,043	TBD

[1]All dollars unearned will be subject to a final assessment at the final "on-ground" performance evaluation.

*Source: NAS15-10000, Contract Modification No. 833, November 8, 1999

The ISS contract has a unique feature linking the "on-ground" award fee to on-orbit performance of the hardware. NASA will evaluate the on-orbit performance of the hardware at Milestones A through F, and the cumulative evaluation of on-orbit performance will determine the amount of the previously earned "on-ground" award fee the contractor will be allowed to retain. NASA will consider a specified percentage of the "on-ground" award fee earned at each of the seven defined on-orbit award fee evaluation milestones (for example, Milestone A – 10 percent, Milestone B – 20 percent, etc). The on-orbit score at each milestone will determine the amount of evaluated "on-ground" award fee that the contractor will retain. As with the "on-ground" award fee assessment, all on-orbit dollars not retained from Milestones A through F will be subject to a final assessment, along with all remaining earned "on-ground" dollars. Once NASA has determined the final dollars for the final milestone, any fee to be refunded to NASA will be calculated by subtracting the total dollars retained on-orbit from the total dollars earned "on-ground."

NASA is currently revising the on-orbit milestones. Changes in the launch sequence could result in the contract being completed before some of the segments listed in the contract milestones have been

launched. The revised milestones and final on-orbit assessment will have to be based on the station segments that are already on-orbit at contract completion.

The Agency addresses Boeing's technical performance, management, and cost performance under the ISS contract, "level of effort" for sustaining engineering, multi-element integrated testing, and postproduction support. As Table C-5 shows, the current contract presents only two award fee periods for the "level of effort" work. However, those tasks will continue to grow, and additional award fee periods and available award fee dollars will be added to the contract. The award fee for each "level of effort" assessment period is final at the end of each period.

Table C-5. "Level of Effort" Award Fee

Period Number	Start Date	End Date	Maximum Available	Earned	Target Hours
1	10/01/98	03/31/99	$ 5,145,500	$ 4,425,130	601,258
2	04/01/99	09/30/99	5,145,500	$ 4,270,765	601,259
Total			$10,291,000	TBD	1,202,517

Source: NAS15-10000, Contract Modification No. 833, November 8, 1999

Incentive Fee Provisions and Payments

The incentive fee provisions of the contract address Boeing's cost performance on the contract. The incentive fee is expressed as a percentage and ranges from 2 to 15 percent of the negotiated target cost, which is about $4 billion. The target incentive fee for the contract is 5 percent of the target cost and is based on Boeing achieving the target cost plus or minus $80 million. The payable incentive fee is the target fee increased by 15 cents for every dollar under the target cost, minus $80 million, or target fee decreased by 15 cents for every dollar over target cost plus $80 million. As a result of the additional $203 million cost overrun as of March 1999, Boeing is now earning the minimum 2-percent incentive fee.

While the incentive fee is based on cost performance (a comparison of total allowable costs to the target cost), the fee is paid incrementally based on percentage of completion. The incentive fee is shown on the periodic vouchers Boeing submits for cost reimbursement. As of April 19, 1999, Boeing had submitted 68 vouchers, which included incentive fees, and five of the vouchers included incentive fee refunds. NASA has paid a total of about $61.1 million for incentive fees.

If NASA pays excess incentive fees because Boeing underestimated cost overruns, Boeing must refund the excess fees. When the $203 million additional cost overrun resulted in the payment of excess incentive fee to Boeing, on March 29, 1999, the ISS Contracting Officer directed Boeing to refund the excess incentive fee. On April 5, 1999, Boeing submitted a voucher refunding about $18.6 million of

incentive fee. Table C-6 shows that the identification of major cost overruns has resulted in several significant incentive fee refunds.

Table C-6. Incentive Fee Refunds
($ in millions)

Date	Recognized Cost Overrun	Incentive Fee Percentage	Incentive Fee Refund
08/11/97	$ 600	2.878	$ 17.8
08/11/98	183	2.459	17.1
04/05/99	203	2.000	18.6
Total	$ 986		$ 53.5

The target cost, which is the basis for determining the amount of the incentive fee, is increased for change orders that increase the contract scope of work and for equitable adjustments that result in cost increases that are not the contractor's responsibility.

Budget Process

Each year, the Office of Management and Budget issues guidelines to Federal agencies for use in the preparation of a 5-year budget submission to Congress. NASA follows a time-sensitive budget process. The process begins each February when the NASA Chief Financial Officer, after consultation with the NASA Administrator, issues broad funding guidelines and instructions to the Agency's Enterprise Associate Administrators.[104] By March, the Enterprises issue guidelines to the Centers after determining the allocation of funding to support the Enterprises' strategic goals. From March through May, the Centers integrate program estimates, hold reviews, and begin to prepare a budget submission for approval. From June through August, the Lead Center Director reviews and approves the total program budget and submits the program budget to the responsible Enterprise. In August, the NASA Chief Financial Officer integrates all the input from the Enterprises to develop an Agency budget. In September, NASA submits its budget to the Office of Management and Budget. The President's budget is submitted to Congress in February for the following fiscal year, which begins October 1. Thereafter, congressional oversight committees may hold hearings in the course of formulation of additional appropriation bills.

In February and March 1999, Congress held hearings on the FY 2000 NASA budget. Boeing carefully monitors this process due to the potential effects on ongoing programs and future business and was aware of the budget hearings in February and March 1999. Boeing should have recognized the importance of providing accurate and up-to-date information to NASA before the hearings. As a result, NASA testified before Congress with understated Boeing estimates that Boeing increased by $203 million within a few days after the hearings.

[104]There are four Enterprise Associate Administrators that are responsible for the NASA Centers.

Appendix D. Contractor Reorganization

Most of Boeing's reorganization efforts occurred during the latter part of 1998 and were largely driven by the need to reduce costs and attain uniformity in its operations. Through the reorganization, Boeing aligned its facilities and resources to product lines, thereby eliminating duplicate company headquarters and organizations, and creating "host" facilities. Boeing also identified best practices among the three consolidated companies[105] and implemented the practices company-wide. Since Boeing and McDonnell Douglas conducted some of their administrative and accounting functions similarly, a number of the best practices adopted matched those already used at Boeing and McDonnell Douglas. However, because Rockwell conducted some of the functions differently, its segments underwent significant change to conform to the company's chosen best practices.

The resulting organization structure consists of three business units: (1) S&C Group, (2) Military Aircraft and Missiles Group, and (3) Commercial Airplanes Group. Boeing also formed its Shared Services Group, which centralized Boeing's common support services for the three business units, including payroll/timekeeping, training, computer support, safety, environment, and health. S&C Group, which performs the majority of NASA's business with Boeing, is composed primarily of former Rockwell sites and conducts Government and commercial space launch services, space-based communication services, some national missile defense work, and an array of communication and electronics programs. The Military Aircraft and Missiles Group is composed primarily of former McDonnell Douglas sites and contracts primarily with DoD for weapon systems and other defense services. Aside from absorbing McDonnell Douglas' commercial airplanes business, the Commercial Airplanes Group was relatively unchanged and conducts commercial aircraft development and manufacturing.

From the company-wide perspective, Boeing's costs increased significantly as a result of the reorganization activities, but the company achieved a significant amount of savings to offset the increased costs. During the next 5 years, Boeing estimated that it will spend about $237.6 million for external restructuring activities, but achieve $839.3 million in cost reductions as a result. During CFY 1999, Boeing estimated that its company office[106] administration costs will increase an estimated $27 million, but that the company will save an estimated $25 million in offsetting costs.

However, from the business-unit perspective, a significant amount of costs shifted between the individual business units. S&C Group estimated that the majority of its cost increases resulted from costs that were shifted from the Military Aircraft and Missiles Group and the Commercial Airplanes Group. Boeing provided us preliminary estimates of reorganization costs that showed the costs were related to the Military Aircraft and Missiles Group and the Commercial Airplanes Group. Compared to the S&C Group's estimated $153 million in increased costs, the company

[105] Boeing, Rockwell, and McDonnell Douglas.

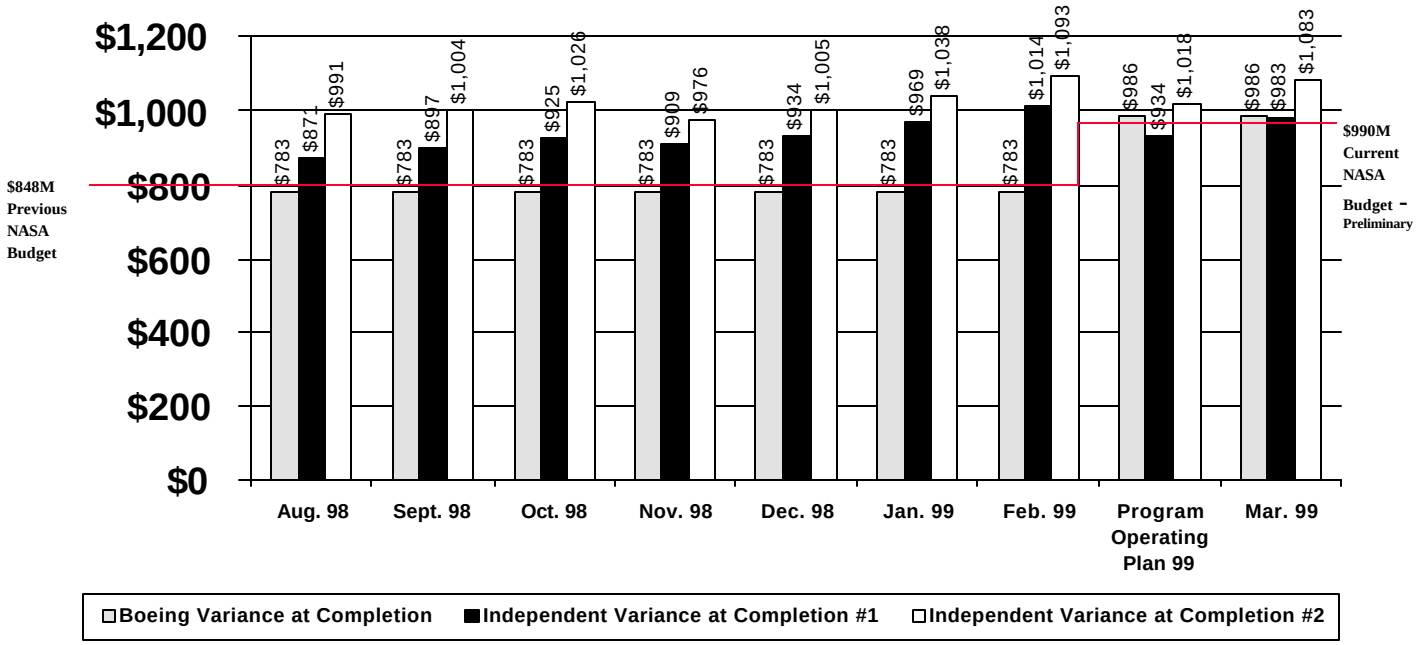
[106] The company office is the Boeing Corporate home office.

showed that the Military Aircraft and Missiles Group decreased an estimated $37 million and that the Commercial Airplanes Group decreased an estimated $75 million. However, since Boeing has not estimated the effects on all categories of costs, this estimate is not all-inclusive.

Although the preponderance of the reorganization activities has been identified, Boeing is identifying additional refinements to its reorganization efforts. Specifically, Boeing has identified six performance improvement initiatives and has assigned process councils, assisted by Deloitte and Touche Consulting, to identify metrics and quantify the financial effects of achieving those initiatives. One of the initiatives focuses on reducing Boeing's overhead costs by combining, eliminating, or reconfiguring overhead work activity. The effects on Boeing's business units are unknown at this time, but Boeing anticipates that the initiatives could have a significant effect on the company's market value.

Appendix E. Comparison of ISS Program Office Independent Variance at Completion Calculations to Boeing Estimates*

($ in millions)



*The Program Office receives the related performance reports about 30 days after the end of each month shown in the comparison.

Source: ISS Business Management Office

Since February 1999, ISS Program officials have included this chart in a monthly ISS metrics package. Copies of the package were sent to NASA Headquarters, Office of Space Flight and to the Johnson Human Resources Office. The Human Resources Office collected similar packages from other Center offices and combined them into one package for the Johnson Director.

Appendix F. NASA's Contract Administration Delegation to the Defense Contract Management Command

International Space Station Contract

Johnson's ISS contract administration delegation requires the DCMC representative, who is the Earned Value Management System Surveillance Monitor (monitor) to provide overall Earned Value Management System surveillance. Specifically, the monitor should assure system and report effectiveness and should perform Boeing management interviews.

Contract Administration Delegation

The ISS contracting officer, as authorized by FAR 42.302, "Contract Administration Functions," delegated contract administration services to DCMC. Under this delegation, DCMC is authorized to perform administrative functions, act as the contracting officer's representative, and provide Earned Value Management system support. DCMC is responsible for assigning an Earned Value Management System Surveillance Monitor. The monitor's duties are:

- develop, implement, and maintain a surveillance plan for accomplishing the surveillance activities;
- provide overall Earned Value Management system surveillance on a monthly basis;
- provide specialized support or program analysis;
- advise the Program Office on the status of the contractor's management control system and related activities;
- evaluate all proposed contractor's management control system changes to ensure continued compliance with approved requirements;
- perform cost account manager interviews (six per quarter), functional manager interviews (two per year), and program manager interviews (one per year);
- report interview results as identified in the surveillance plan;
- summarize interview results in a surveillance evaluation report to the Program Office; and
- maintain a report file to include areas reviewed, findings, actions taken and results obtained, and performance reports.

Earned Value Management

Earned Value Management is a systematic approach to assessing cost and schedule performance. An Earned Value Management system tracks and identifies contract results by work breakdown structure and identifies program elements (variances) that have either exceeded or failed to meet contractually identified thresholds of performance jointly agreed to by the customer and program management. Earned Value Management compares the budgeted cost of work performed[107] to the budgeted cost of work scheduled to quantify schedule variance in dollars. Comparing budgeted cost of work performed to performed quantifies the cost variance. Comparing estimated cost at completion with budgeted cost at completion provides an estimate of contract overrun or underrun.

[107]Budgeted cost of work performed is the sum of budgets for completed work and is also known as earned value.

Appendix G. Defense Contract Management Command Monthly Status Reports

The Program Office[108] uses the Monthly Status Reports from DCMC to identify potential problems. Examples are provided below:

- The ISS Acquisition Office uses the information to identify the status of the sites' systems.[109] The Acquisition Office incorporates the data into a document, which becomes part of each prenegotiation memorandum for definitization of changes to the contract. Additionally, the Acquisition Office identifies and reviews the status of destaffing, overtime, and subcontract issues.

- The Resources Management Office looks for system problems to maximize the quality of data taken from Boeing's management systems. The Resources Management Office reviews the reports in conjunction with an analysis of the monthly performance reports submitted by the various Boeing sites. NASA, Boeing, and DCMC discuss any disclosed systemic issues for actions and/or corrections.

- The Safety and Mission Assurance Office uses the information for its weekly teleconference with Boeing and DCMC. Also, the Safety and Mission Assurance Office uses the reports for inputs into the contractor's quarterly evaluations, quarterly conferences between NASA and DCMC, and monthly metric reviews between NASA and Boeing.

As part of its contract administration function, DCMC prepares Monthly Status Reports for each Boeing site that performs significant work on the ISS contract. The Monthly Status Reports assess the progress and problems identified in Boeing's monthly performance reports. The DCMC reports from June 1998 through March 1999 identified the following indications of a higher estimate at completion than that reported by Boeing in the performance reports.

Boeing Huntsville

- From November 1998 through January 1999, DCMC reported that work was more than 8 weeks behind schedule.

- In February and March 1999, DCMC reported that work was more than 10 weeks behind schedule.

[108] Acquisition, Resources Management, and Safety and Mission Assurance Offices.

[109] These systems include the accounting, estimating, purchasing, and compensation systems.

Boeing Canoga Park

- For June, July, and August 1998, DCMC's estimate at completion was higher than Boeing's most current revised estimate by $151 million, $125 million, and $125 million, respectively.

- In January 1999, DCMC reported that Boeing's latest revised estimate had increased by $22 million from that reported in December 1998, excluding the amounts for management reserve and management risk.

Boeing Huntington Beach

- From June 1998 through December 1998, DCMC cited Boeing's failure to control cost and schedule.

- From January 1999 through March 1999, DCMC cited Boeing's failure to control cost.

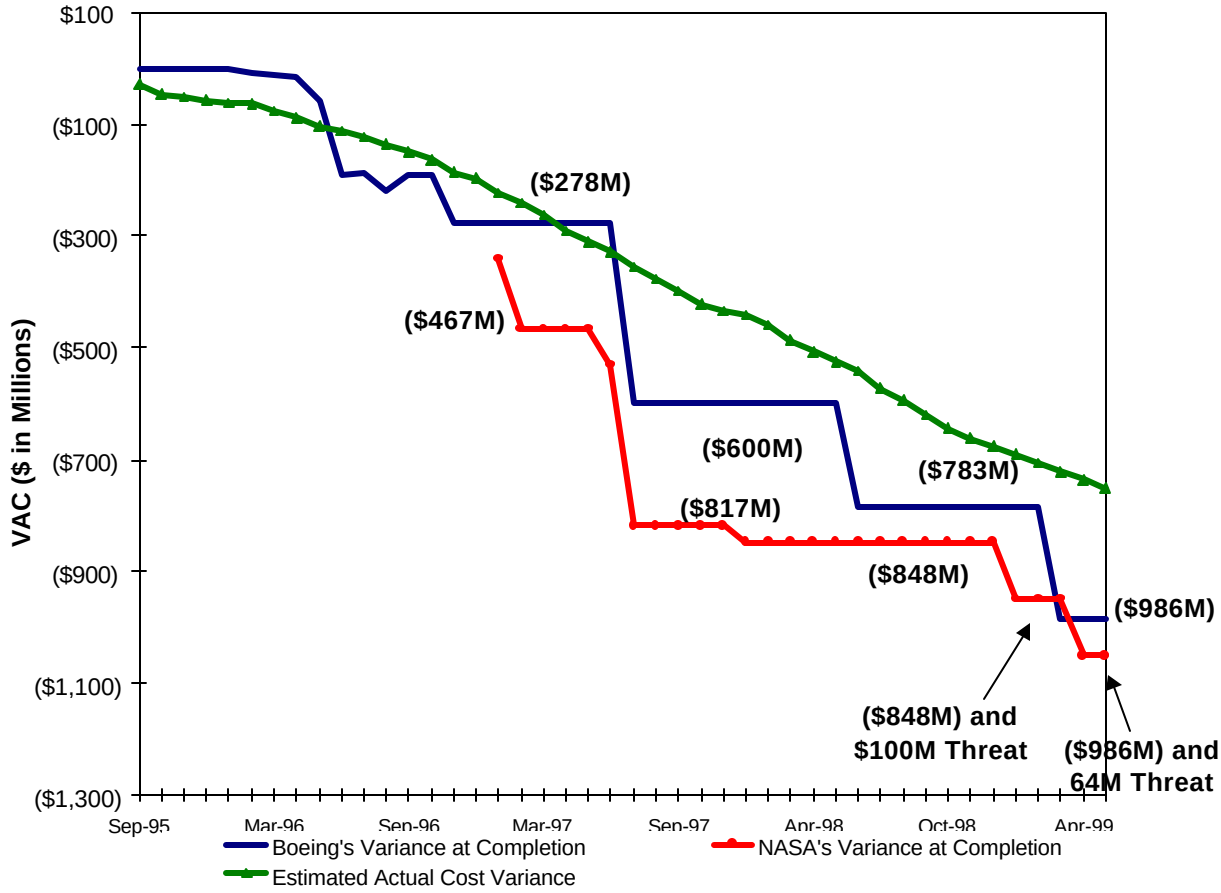
- From December 1998 through February 1999, DCMC reported that mishaps and failures were increasing the estimate at completion.

Boeing Houston

- In February, March, and April 1999, DCMC's estimate at completion was higher than Boeing's most current revised estimate by $18 million, $15 million, and $55 million, respectively, excluding the amounts for management reserve and cost saving opportunities.

- In April 1999, DCMC characterized $39 million of the $60 million Boeing reported as savings as "aggressive, unrealistic, and soft."

Appendix H. Comparison of Boeing and NASA Variance at Completion Estimates to the Actual Cost Variance



Note: M = Million.
VAC = Variance at Completion

Source: ISS Business Management Office

Appendix I. Defense Contract Management Command Estimate

DEFENSE LOGISTICS AGENCY
HEADQUARTERS
8725 JOHN J. KINGMAN ROAD, SUITE 2533
FT. BELVOIR, VIRGINIA 22060-6221

IN REPLY REFER TO DCMC-OC

June 25, 1999

Mr. Russell A. Rau
Assistant Inspector General for Auditing
National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, TX 77058

Dear Mr. Rau:

A request for DCMC assistance was received from National Aeronautics and Space Administration (NASA) Office of Inspector General, Lyndon B. Johnson Space Center, Houston, TX 77058. The request was to evaluate the accuracy of a "bottoms-up Estimate-at-Completion (EAC) for work being accomplished on the NASA International Space Station (ISS) program at four locations: Boeing Canoga Park, Canoga Park, CA (which also includes the Spares Contract); Boeing Houston, Houston, TX; Boeing Huntington Beach, Huntington Beach, CA; and Boeing Huntsville, Huntsville, AL. Specifically, a determination had to be made on whether:

- cost and schedule performance was promptly and completely reported to senior NASA management;
- cost and schedule performance reporting processes, including Government oversight, ensure timely and complete information when provided to NASA management;
- contract cost, schedule, and technical risks are fully disclosed and appropriate risk mitigation plans are in place;
- earned value management data is effectively utilized for program management;
- indirect cost rate increases are reviewed for allowability, allocability, and reasonableness; and
- contractual issues related to contract cost increases are properly addressed.

DCMC Contract Administration Offices (CAOs) and contractor facilities were visited at the Boeing Company Canoga Park, Huntington Beach, and Huntsville. The evaluation at these three facilities indicated that the contractor's method of tracking and reporting the EAC was properly reported as instructed by Boeing Houston. The contractor was tracking risks and opportunities to the WBS level, and in some cases to the work package

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level, as High (H), Medium (M), or Low (L) probability of occurring. At each contractor's location, it was stated that verbal instructions were given by Boeing Houston to include High risks only in the EAC and report medium and low risk in the Performance Measurement System Report (PMSR) under a separate line entry. The Medium and Low risks would be inputted if they occurred which has caused the monthly EAC to change unexpectedly. However, all risks and opportunities were discussed with NASA Space Station Program Office at the NASA POP Reviews, as well as during the monthly Program Manager's Summary Reviews.

The evaluation also noted that the DCMC CAO tracking and evaluating cost and schedule over-runs and EAC activity was being monitored and reported properly. The DCMC Earned Value Management Monitor from each location sent a monthly evaluation report to the NASA Space Station Program Office at Johnson Space Center. Each report addressed the High, Medium, and Low risks and opportunities and on a quarterly basis, an Independent Estimate-at-Completion (IEAC) was given using the Cost/Schedule Weighted Factor Method. This method is taught at the Defense Systems Management College as one of the EAC methods/techniques used for an IEAC. The formula is as follows:

$$EAC = ACWP + \left((BAC - BCWP)/((.8 \times CPI) + (.2 \times SPI))\right)$$

The Cost Performance Indices (CPI) and Schedule Performance Indices (SPI) are developed using six month data with an assumption that future performance to completion will continue at the average efficiency of the cumulative performance

Using the Cost/Schedule Weighted Factor Method, IEACs which are considered reliable and well founded were developed at these four locations, and also includes the Boeing Canoga Park Spares Contract are as follows:

$ = K

	BOEING CANOGA PARK		**BOEING HOUSTON**
		SPARES	
Budget At Completion	**$1,810,127**	**$136,256**	**$1,439,305**
Contractor LRE	**$1,878,387**	**$137,256**	**$1,410,913**
DCMC IEAC	**$1,944,389**	**$143,580**	**$1,531,679**
DCMC/KTR DIFF	**$ 66,002**	**$ 6,324**	**$ 120,766**

$ = K

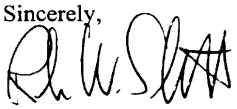
	BOEING HUNTINGTON BEACH	BOEING HUNTSVILLE
Budget At Completion	**$2,568,292**	**$1,756,920**
Contractor LRE	**$2,862,192**	**$1,790,267**
DCMC IEAC	**$2,957,682**	**$1,813,446**
DCMC/KTR DIFF	**$ 95,490**	**$ 23,179**

TOTAL ISS PROGRAM

Budget At Completion	**$7,710,900**
Contractor LRE	**$8,079,015**
DCMC IEAC	**$8,390,776**
DCMC/KTR DIFF	**$ 311,761**

Please address all questions and comments to Dominic A. "Chip" Thomas at (310) 900-6706.

Sincerely,



ROBERT W. SCHMITT
Deputy Executive Director
Contract Management Operations

Appendix J. Cost Estimating Methodologies

Background

Declining budgets and a history of cost overruns have made cost analysts increasingly uncomfortable with providing a specific numerical value for the cost of a system. Experience has shown analysts that single-point cost estimates are always wrong. To satisfy the need for more accurate estimating, analysts often use an "uncertainty analysis" to meet higher standards for a comprehensive program cost estimate and to more accurately characterize the cost and schedule implications associated with program uncertainties.

A cost uncertainty analysis gives the analyst an opportunity to quantify the unknowns and qualifications that accompany most input an analyst receives in the data collection process. Attaching a range and probabilities to input values allows analysts to formally characterize and communicate the uncertainty inherent in the inevitable "soft" or subjective inputs used in a cost analysis.

If the "real" cost of each program element is viewed as a random variable whose set of possible values is a range of numbers determined by some function "x" with a known probability of occurrence, then the cost can be determined by a pictorial graph that shows the range of possible costs and their probability of occurrence, or in other words, a probability density function. To describe a probability density function, three separate pieces of information are needed about the function—the location, the dispersion (variance), and the shape (normal, triangular, beta, etc.). The range of possible costs depicts the probabilities associated with all possible values for each element cost, and the total probability under a distribution curve of each possible cost is equal to one.

If the individual cost elements can be regarded as random variables and their distributions can be determined, then the total system cost can also be expressed as a probability distribution (range of values with a probability of occurrence) around an expected value. This is the basis for using mathematical approaches to estimate total system costs. A mathematical approach simply improves upon the high/low approach by providing a probability distribution for each cost element and by combining the individual cost elements and their measures of uncertainty into a total estimate of cost and uncertainty. The lower level estimate distributions[110] are added up using either a heuristic calculation[111] or a Monte Carlo simulation.[112]

[110] These are the sub-elements that made up the total costs.

[111] A heuristic calculation proceeds along empirical lines, using rules of thumb, to find solutions or answers. For example, the mean of a triangular distribution can be estimated using the formula: (low + most likely + high) / 3.

[112] A Monte Carlo simulation is a statistical software model that draws random samples from a number of lower level distributions and totals them to estimate the costs of the overall system.

Monte Carlo Simulation

A Monte Carlo simulation has been considerably simplified by software modeling applications. The Monte Carlo simulation provides a method whereby resource estimates can be expressed as a probability distribution around a mean value. This permits the cost analyst to express in a quantitative manner the uncertainty of the estimate. The quality of output from the Monte Carlo simulation is directly dependent on the quality of input data used.

With the Monte Carlo approach, a distribution is defined for each cost element (using a beta, triangular, or other empirical distribution) and is treated as a population from which a random sample is drawn. The sample values for each element are added to a total cost, and then the entire process is repeated again. This procedure is repeated many times (for example from 100 to 1,000 times). The result is a distribution of total cost that can be described by its mean and standard deviation and portrayed as a cumulative distribution.

Boeing performed a Monte Carlo simulation to derive a probable cost at contract completion. Boeing analyzed the work breakdown structures at the third level of detail to derive distributions for those work breakdown structures with cost uncertainty. Boeing restricted the analysis to risks identified as of the March 1999 performance report. Risk analysis teams did not include in their simulation any new risks that may have been identified since March 1999; the teams also did not attempt to anticipate the June 1999 estimate at completion.

Teams at each site, composed of finance, risk, and engineering personnel, provided data input. Costs for low, low-medium, high, and unknown risks were included. The teams developed a correlation matrix to anticipate additional costs that would be incurred in a work breakdown structure when a risk event materialized in a correlated work breakdown structure. Risks not included in the correlation matrix were the risks related to the dependence on Government providers and international partners for a number of products. A delay or failure by either constituent to meet schedule or product requirements would have a cost impact on the Boeing contract.

The results of Boeing's Monte Carlo simulation indicated a 50-percent probability that the budget to complete will be $1.584 billion and a 75-percent probability that the budget to complete will be about $1.635 billion resulting in a cost overrun of $1.115 billion. We did not evaluate the quality of the input data Boeing used to arrive at these results.

Earned Value Analysis Methodology

Contractors report summary data from the Earned Value Management system to the Government through the performance reports. The performance report provides cost and schedule performance data broken down by product and by contractor functional organizations. The performance report also provides baseline information on any cost variance and schedule variance. In addition to providing earned value data, the performance reports provide two other important

data elements, the estimate at completion and management reserve. The estimate at completion is of prime interest and must be updated periodically by the contractor using approved procedures and management tools.

Because contractors have an incentive to present the most optimistic estimate, in all probability their estimates will be biased. For this reason, program managers should not depend entirely upon contractor-provided estimates regarding program status, but should instead conduct an independent estimate. Earned value estimates at completion can be obtained from the Earned Value Management data contractors submit in their performance reports. The trends indicated in the reports, by both cost variance and schedule variance, are indicative of past and present performance. The trends can be carefully extrapolated to predict future trends. The extrapolation, added to the actual expenditures to date, supplies the estimator with an estimate at completion. Some useful algorithms to use when analyzing the status of the program include the following:

(a) **CV = BCWP – ACWP.** The project cost variance (CV) is the difference between the budgeted cost of work performed (BCWP) and the actual cost of work performed (ACWP). It is a measure of the project cost underrun (or cost overrun), and is based upon the actual degree of completion on the project.

(b) **SV = BCWP – BCWS.** The project schedule variance (SV) is the difference between the BCWP and the budgeted cost of work scheduled (BCWS). It indicates whether the project is ahead of (or behind) schedule.

(c) **VAC = BAC – EAC.** Variance at completion (VAC) is the contractor's prediction of the cost situation. When budget at completion (BAC) less the estimate at completion (EAC) is a negative number, the contractor is revealing an overrun. As a rule, to arrive at an EAC, contractors simply use the CV and add it to the original BAC. In effect, the contractor is assuming that efficiency will improve and that there will be no further cost overruns in the program. By ignoring any SV, the contractor further compounds the underestimate of the EAC. In a worst-case scenario, the contractor may refuse to acknowledge that there is the risk of cost or schedule overruns and continues to maintain that the program/project will be completed at cost and on schedule.

Performance Indexes

To evaluate the reasonableness of the estimate at completion, program managers can use one of several performance indexes. Several popular performance indexes include the following:

(a) **CPI = ACWP / BCWP.** The cost performance index (CPI) is a backward-looking indicator. A CPI less than 1 implies a cost overrun. Research indicates that the CPI does not change by more than 10 percent once a project is 10-20 percent complete and that any CPI change after that tends to be a decline rather than an improvement in cost performance.

(b) **SPI = BCWP / BCWS.** A schedule performance index (SPI) less than 1 is an unfavorable indicator. An unfavorable trend in the SPI early in the contract is predictive of unfavorable trends in the CPI later in the program.

(c) **SCI = SPI x CPI.** When used, a schedule cost index (SCI) could produce a more realistic EAC because it takes into account both schedule delays and any cost overruns of work actually completed.

(d) **CI = w1(CPI) + w2(SPI).** A composite index (CI) is another combination of CPI and SPI with w1 and w2 being expressed as a percentage so that w1 + w2 = 1. The Air Force favors 0.8 CPI + 0.2 SPI as providing the best EAC.

(e) **$TCPI_{BAC}$ = (BAC – BCWP) / (BAC – ACWP).** The to complete performance index budget at completion ($TCPI_{BAC}$) is a forward-looking indicator. When compared to the CPI, the TCPI identifies the efficiency rate that would be required in order for a contractor to meet the BAC. For example, if the TCPI is three times greater than the CPI, then the contractor would have to achieve an efficiency rate that is three times greater than its current efficiency rate in order to meet the BAC.

(f) **$TCPI_{LRE}$ = (BAC – BCWP) / (LRE – ACWP).** This performance index performs the same function as the $TCPI_{BAC}$, except it is based on the more current estimate of the contractor's Latest Revised Estimate (LRE). If the $TCPI_{LRE}$ exceeds the cumulative CPI by more than 10 percent, then the LRE is too optimistic.

Substituting one of the performance indexes (a - d) above, the program manager or other evaluator can obtain a more realistic EAC using the algorithm **EAC = ACWP + (BAC - BCWP) / Performance Index**.

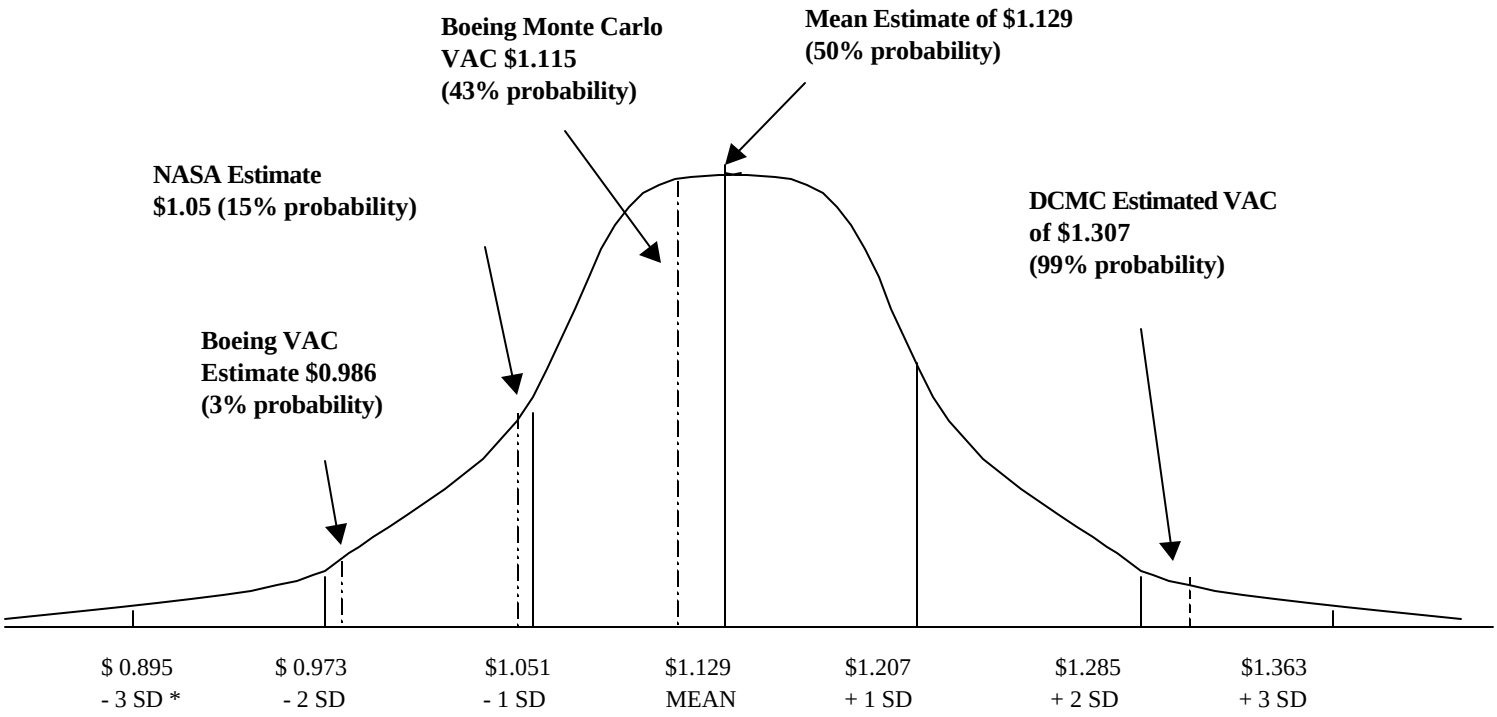
DCMC substituted the formula "d" (0.8 CPI + 0.2 SPI) for its Performance Index to arrive at an EAC of $8.385 billion. Because the Program is more than 80 percent complete and the CPI can be expected to decline henceforth, we believe that this estimate more closely approximates the EAC that the ISS contract will realize.

Composite Summary of Estimates

To summarize and compare the Boeing and DCMC estimates, we used a cost risk model developed by the Space and Strategic Defense Command. The Space and Strategic Defense Command cost risk model is based, in part, on an extensive analysis by the Space and Strategic Defense Command that determined that engineering estimates, at best, cover from 70 to 80 percent of the total distribution of any cost estimate. Using the estimates obtained from Boeing's Monte Carlo Simulation and the DCMC Earned Value Analysis as inputs, we established a probability distribution for the total cost overrun for the ISS Program. The results are summarized in the following figure.

ISS Probability Distribution of Variance at Completion

($ in billions)



*The Standard Deviation = $0.078

Acronyms

ACWP	Actual Cost of Work Performed
BAC	Budget at Completion
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
CPI	Cost Performance Index
CV	Cost Variance
EAC	Estimate at Completion
LRE	Latest Revised Estimate
SPI	Schedule Performance Index
SV	Schedule Variance
TCPI	To Complete Performance Index
VAC	Variance at Completion

Appendix K. Cost Increase Parameters of NASA Programs

International Space Station Program

Regarding the effects of the cost increases on the ISS Program, the cost increase to the Program encompasses work authorized as of December 1998, work authorized but not definitized (unnegotiated work which is valued at about 10 percent of Boeing's estimate to complete), and potential other changes that had not been proposed to NASA. The period of contract encompasses work through December 2002.[113]

Non-International Space Station Programs

The estimated cost increases to the non-ISS programs include only work authorized as of December 1998. The estimated cost increase parameters of the non-ISS Programs are as follows:

- Space Flight Operations Contract - Parameters include work authorized through the contract period, which ends sometime within CFY 2002, and does not include any anticipated future work.

- Space Shuttle Main Engine Program - Parameters include work authorized as of December 1998 and work authorized but not definitized (which is valued at less than 10 percent of the estimate to complete). The contract period affected by the increases varies for the individual contracts. For the Marshall Space Flight Center and Stennis Space Center contracts, the affected period is through December 2001. For the Kennedy Space Center contract, the affected period is through September 2002.

- Payload Ground Operations Contract - Parameters include work authorized as of the end of December 1998 and a minimal amount of anticipated, future work through the CFY 2001.

- Spacehab Program - Parameters include only authorized work through the contract period ending sometime in CFY 2000.

- Space Lab Program - Parameters include only authorized work through CFY 2002.

[113]This cost increase estimate for the ISS Program includes authorized sustaining engineering through September 1999. However, this estimate does not include sustaining engineering levels for later fiscal years, which are expected to increase after 1999 and cause the cost increase estimate for the ISS Program to be higher. Sustaining engineering is the design engineering support provided after the development of hardware and software is complete and provisionally accepted by the Government.

Appendix L. Summary of Prior Audit Coverage

Office of Inspector General Reports

IG-99-007, "Space Station Corrective Action Plans," January 28, 1999. Boeing's corrective action plans and Johnson's oversight of the plans needed improvement. The ISS Program had experienced a continued deterioration in cost and schedule performance after a September 1997 adjustment of the contract cost baseline, but variance analyses and corrective action plans had not been effectively utilized to control the negative variances. Additionally, Johnson did not provide effective oversight of Government surveillance of the Earned Value Management System, including verifying whether Boeing took corrective actions related to cost variances and schedule variances. As a result, the ISS Program lacked assurance that negative variances were identified and that corrective actions were taken to reduce associated risk. Further, Johnson did not ensure that Boeing took corrective actions on conditions noted since at least March 1997 to accurately prepare and submit Variance Analysis Reports. As a result, Variance Analysis Reports may not adequately identify cost and schedule risks.

IG-98-032, "Space Station Configuration Management," September 24, 1998. The functional and physical configuration audit processes for the ISS Program were effective in meeting Program needs. In addition, the procedures the ISS Program managers used for reviewing, approving, and obtaining equitable cost consideration for waivers, deviations, and other changes were adequate.

IG-98-002, "Space Station Performance Measurement Cost Data," November 13, 1997. Boeing did not report reasonable cost data in its monthly performance reports on the ISS contract because its monthly reports to NASA did not reflect its best estimate at completion. Instead, Boeing reduced the monthly estimates provided by major subcontractors under the prime contract in order to report a smaller cost overrun. As a result, NASA received inaccurate cost data on the ISS contract.

IG-97-015, "Space Station Change Order Process," March 5, 1997. The ISS Program had not completed an effort to definitize old and high priority changes within a self-imposed deadline. However, the effort was viable in that the Program definitized many of the changes by the deadline and had developed realistic plans to definitize the remaining changes within a 4-month period. Also, the Program had not issued undefinitized changes on an exception basis as recommended by Federal procurement regulations. The Program's extensive use of undefinitized changes was dictated by a need to maintain the schedule. A delay in starting change-directed work pending definitization of the change orders would significantly increase the risk of not completing the ISS on time.

JS-96-004, "Space Station Prime Contractor Performance Management," August 22, 1996. NASA had taken action to effectively manage the ISS contract to control cost, schedule, and performance. However, NASA was concerned about Boeing's lack of timeliness in correcting deficiencies NASA found during a Baseline Surveillance Review. The Agency performed a Baseline Surveillance Review of Boeing's Earned Value Management System in September 1995. The Baseline Surveillance Review was performed to ensure:

- accurate and timely reporting of cost, schedule, and performance data;
- consistent estimating, accumulating, and reporting of contract cost; and
- compliance with NASA procedures and the ISS contract.

As a result of the Baseline Surveillance Review, NASA issued corrective actions to Boeing. However, Boeing had not taken adequate action to remedy some of the corrective actions NASA recommended during the Baseline Surveillance Review. Specifically, Boeing had not:

- revised its monthly performance reports to reflect a reasonable estimate at completion; and
- used an earned value technique that is in compliance with its Earned Value Management System description.

Also, while not designated a corrective action in the Baseline Surveillance Review, Boeing had not completed its annual comprehensive estimate at completion review.

JS-96-002, "Space Station Prime Contractor Performance Management (Rapid Action)," June 11, 1996. Boeing was not revising its monthly performance reports to reflect a reasonable estimate of cost to complete the ISS. Boeing's Earned Value Management System description requires that Boeing review its estimate at completion monthly and update it at least annually unless a completed statistical analysis indicates a need for more frequent updates. The disparity between what Boeing reported as a cost overrun and what we calculated for the work breakdown structure (1.0 ISS), was $127 million ($140 million - $13 million). However, Boeing was reluctant to report cost overruns because its award fee would be penalized and it would receive additional management oversight. Consequently, NASA did not have Boeing's best estimate of future funding requirements.

JS-96-001, "Boeing Indirect Cost Allocations to Space Station Contract," December 12, 1995. NASA was reimbursing the Boeing Defense and Space Group for indirect costs on the ISS contract that do not benefit NASA. A fundamental requirement of Cost Accounting Standard 418 is that costs are allocated to cost objectives in reasonable proportion to the beneficial or causal relationship. However, Boeing was allocating certain indirect costs to the ISS contract from the Engineering Resource and Engineering Computing Cost Centers that do not have the same or a similar beneficial relationship to all cost objectives. This practice caused an inequitable allocation to the ISS contract. This issue has since been settled.

General Accounting Office Reports

"Space Station: Russian Commitment and Cost Control Problems," (GAO/NSIAD-99-175), August 17, 1999. The report stated that the ISS prime contract had experienced significant cost variances and schedule variances between the contract baseline and actual performance. The prime contractor's estimate of cost overruns at completion had been increased several times and currently stood at $986 million. At the same time, the nonprime portion of the Program—activities related to science facilities and ground and vehicle operations was experiencing cost increases. In 1994, the nonprime component of the Program's development budget was $8.5 billion; in August 1999, it was more than $12.4 billion. The increase was largely due to added scope and schedule slippage. NASA had begun to subject the nonprime area to increased scrutiny and made modifications to a centralized database of potential risk areas to include identification of the cost of such risks. These actions could improve NASA's ability to manage future cost growth.

"International Space Station: U.S. Life-Cycle Funding Requirements," (GAO/NSIAD-98-147), May 22, 1998. The report states that the overall estimated U.S. cost to develop, assemble, and operate the ISS was about $96 billion in May 1998, an increase of about $2 billion over GAO's 1995 estimate. Development cost increases are attributable to schedule slippages, prime contract growth, additional crew return vehicle costs, and the effects of delays in delivery of the Russian-made Service Module. The adequacy of the ISS Program's funding reserves had been and was still a concern. The Program had used, or identified potential uses for, a significant portion of its available reserves. Additional schedule slips, contract disputes, and manufacturing problems could affect the current amount or the possible need for additional testing. At the current estimated spending rate, the Program would incur additional costs of more than $100 million for every month of schedule slippage. In October 1997, for reporting purposes, NASA granted approval to Boeing to begin tracking cost and schedule performance using a new performance measurement baseline that had the effect of resetting cost variances and schedule variances to zero. The original baseline shows that the February 1998 cost variance would have been about $50 million higher than the $398 million Boeing reported prior to the change. NASA continued to use Boeing's estimate of cost overruns at completion--$600 million—as the basis for calculating the contractor's incentive award fee. The report contained no recommendations.

"Space Station: Cost Control Problems Are Worsening," (GAO/NSIAD-97-213), September 16, 1997. GAO reported that cost and schedule performance of the ISS prime contractor had continued to worsen. From April 1996 to July 1997, the contract's cost overrun quadrupled to $355 million, and the estimated cost to get the contract back on schedule increased by more than 50 percent to $135 million. NASA and Boeing efforts had not stopped or significantly reversed the continuing deterioration. The Program's financial reserves had also significantly deteriorated, principally because of Program uncertainties and cost overruns. The near-term reserve posture was in particular jeopardy, and the Program may require additional funding over and above the remaining reserves before the completion of station assembly. NASA has taken a series of actions to keep the Program from exceeding its funding limitations and financial reserves. However, to show continuing compliance with

funding limitations, NASA, in some cases, has had to redefine portions of the Program. GAO recommended that the Administrator, with the concurrence of the Office of Management and Budget, direct the ISS Program to discontinue the use of funding limitations. NASA agreed with the recommendation and stated that a flat funding cap, while a fiscal necessity, was inconsistent with a normal funding curve for a development program.

"Space Station: Cost Control Difficulties Continue," (GAO/NSIAD-96-135), July 17, 1996. The report states that as of April 1996, the ISS prime contract was about $89 million over cost and about $88 million behind schedule. Overall, the prime contract was 45-percent complete and the variances were within planned funding levels. However, many cost threats to Program development remain, and financial reserves needed for unexpected contingencies remain limited over the next few years. If available reserves ultimately prove inadequate, program managers would have to either exceed the annual funding limitation or defer or rephase other activities, thus possibly delaying the ISS schedule and increasing its overall cost. NASA had made progress toward ensuring that the ISS prime development contractor and its major subcontractors implemented effective Earned Value Management systems for managing their contracts, but a complete Earned Value Management system was still not in place. Also, NASA had made slower progress implementing effective Earned Value Management systems on its contracts for developing ground-based and on-orbit capabilities for using and operating the ISS. The report contained no recommendations.

"Space Station: Estimated Total U.S. Funding Requirements," (GAO/NSIAD-95-163), June 12, 1995. The report states that the ISS Program faces formidable challenges in completing all its tasks on schedule and within its budget. The Program estimates through FY 1997 showed limited annual financial reserves—about 6 percent to 11 percent of estimated costs. The reserves were even lower when reduced by the estimated value of pending items that had a medium to high probability of being added to the Program. Inadequate reserves would hinder the program managers' ability to cope with unanticipated technical problems. If a problem could not be covered by available reserves, program managers could be faced with either spending more than planned on the Program or deferring or rephasing other activities, thus possibly delaying the ISS development schedule or increasing its future cost. GAO did not make recommendations.

Appendix M. Management's Response

National Aeronautics and
Space Administration
Lyndon B. Johnson Space Center
2101 NASA Road 1
Houston, Texas 77058-3696

Reply to Attn of: BD

FEB 0 7 2000

TO: NASA Headquarters
Attn: W/Assistant Inspector General for Auditing

FROM: AA/Director

SUBJECT: Management Response to the Draft Review of Performance Management of the International Space Station Contract, Assignment Number A9904200

We submit our response to the subject draft review which discusses the management of the Boeing contract. The review began in April 1999 and some of the data contained in the draft report is no longer pertinent as the life of the contract and the Program continues to develop. The existing contract was modified on December 22, 1999, to make a number of planned improvements to the contract. As noted in the enclosure, this modification effectively completed the actions that address several of your recommendations.

We have individually addressed each recommendation from your review, as shown in the enclosure. If you have any questions regarding this response, please contact Ms. Pat Ritterhouse, Audit Liaison Representative, at 281-483-4220.

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Enclosure

cc:
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Management Response to the Draft Review of Performance Management
of the International Space Station Contract, Assignment Number A9904200

Auditor Findings

"The Program Office should strengthen policies and procedures to ensure that Program cost estimates are realistic. The performance management of the contract can be improved through discussion of Boeing's cost performance and, in particular, cost overruns, at regularly scheduled meetings with senior NASA management."

Recommendations for Corrective Action

1. The ISS Program Manager should request discussion of Boeing's cost performance and, in particular, the estimated cost overrun, at regularly scheduled meetings with senior NASA management.

JSC Comments

Concur. Boeing's performance (including the cost overrun) is reviewed at monthly Program Management Reviews (PMRs), Space Station Development and Operations Meetings (SDOMs), and other management meetings. The ISS Business Manager now prepares a monthly written report with distribution to the ISS Program Manager, the JSC Director, the Associate Administator, Office of Space Flight, and the NASA Comptroller. The report includes overrun status and range of variance at completion estimates.

2. The ISS Program Manager should establish a process for a periodic independent estimates of the cost to complete the ISS contract, and consider requesting that the estimate be performed as part of the Independent Annual Review.

JSC Comments

Concur. The Advisory Committee on the International Space Station (ACISS) has conducted two independent estimates. The ISS Program Manager will request that the next Independent Annual Review include an independent assessment of the completion cost on the contract. Estimated completion date is January 30, 2000. The Space Station Business Office also performs internal independent assessments of contract overrun.

3. The ISS Program Manager should request that the Defense Contract Management Command (DCMC) provide an independent estimate at completion in its monthly status report for each Boeing site on the same date and consolidate the results for the total ISS contract.

Enclosure

JSC Comments

Partially concur. The DCMC currently reports estimates at completion by site on a monthly basis. The Space Station Business Office consolidates DCMC assessments and includes their total estimate in its monthly business report. The DCMC is not organized by the Program and therefore the Business Office consolidates their individual site estimates.

4. The ISS Program Manager should consider revising the award fee provisions to require a higher weighting for Cost Management on future ISS-related contract award fee evaluations.

JSC Comments

Concur. The Program had taken steps to improve the award fee structure to put more emphasis on cost performance. Contract modification #836 formally changed the contract to incorporate this new fee structure.

5. The ISS Program Manager should assess budget requirements for the ISS prime contract based on the new estimates provided by the DCMC and the Monte Carlo analysis.

JSC Comments

Concur. The ISS Program routinely considers a number of independent estimates including the DCMC, performance analyzer, and other sources in arriving at its budget estimate for cost overrun.

6. The ISS Program Manager should identify alternatives to the current practice of having Boeing report a negative management reserve status.

JSC Comments

Concur. We will identify options associated with reporting the risk within the contractor's scope of work.

7. The ISS Program Manager should request Boeing to identify which known risks are Included in their Estimate At Completion and which known risks are outside their Estimate At Completion. Mitigation plans should be implemented for all known risks.

Concur. We have requested the contractor to identify risk in accordance with this recommendation, and have put a rigorous process in place to verify the adequacy of Boeing's performance in this regard.

8. The ISS Program Manager should require that the Memorandum of Agreement for Program reserve funds be formally terminated with Boeing. (Note: We changed the number to be in sequence, it was improperly numbered as 7 in the draft review.)

JSC Comments

Concur. The Program will rescind this Memorandum of Agreement in February 2000.

9. Require ISS procurement officials to expeditiously complete actions to definitize the cost overrun proposals, claims and modify the contract.

JSC Comments

Concur. Expeditious completion of contract actions is standard operating procedure. Actions are staffed and completed based on overall Program priorities and available resources. This action was completed by contract modification #836.

10. Conduct an Integrated Baseline Review after definitization of the contract modification that implements the over-target baseline.

JSC Comments

Partially concur. We agree with the intent of conducting an Integrated Baseline Review (IBR) but would recommend a functional equivalent. Our quarterly review of the Boeing Estimate at Complete (EAC) provides substantially the same benefit as an IBR. We review the work remaining, the schedules for achieving the work, and the sufficiency of resources for completing the work. We engage our technical resources in this function but not to the extent an extensive exercise such as an IBR would require. At this stage of the development program, this appears to be the most efficient and effective approach to this requirement.

11. The ISS Program Manager should obtain from Boeing the estimated net cost increases to the ISS Program, by specific category of reorganization activity, and identify estimated net cost increases on the ISS program that were not included in the S&C Group's May 1999 data.

JSC Comments

Partially concur. Because the DCMC is the sole Government agency with authority to approve or disapprove the re-organizational activities, the Program will work through the DCMC Defense Corporate Executive (DCE) rather than directly with Boeing. This will be done to obtain required data which clarifies the cost increases, including those costs not included in the Space and Communications (S&C) Group's May 1999 letter. We will ensure that NASA interests are represented by DCMC.

12. Monitor Boeing's cost and savings performance on external restructuring activities to ensure that NASA receives an overall savings as a result of the activities.

JSC Comments

Concur. The Program will follow through with the DCMC to monitor Boeing's performance on external restructuring activities.

13. Obtain for NASA the cost and savings requirements in the DFARS applicable to external restructuring and attributable to the ISS Program.

JSC Comments

Concur. The DCMC settlement, currently pending approval, achieves the cost and savings benefit required in Defense Federal Acquisition Regulation Supplement.

14. The ISS Program Manager should ensure that significant issues continue to be coordinated with the DCMC Defense Corporate Executive to ensure that ISS Program officials are advised of contract increases resulting from re-organization activities and that ISS Program interests are protected.

JSC Comments

Concur. The Space Station Procurement Office is now participating in DCE conferences where significant issues are addressed with other Boeing government customers. Periodic teleconferences ensure ongoing coordination.

Appendix N. Report Distribution

National Aeronautics and Space Administration (NASA) Headquarters

A/Administrator
AI/Associate Deputy Administrator
B/Chief Financial Officer
B/Comptroller
BF/Director, Financial Management Division
G/General Counsel
H/Associate Administrator for Procurement
J/Associate Administrator for Management Systems
JM/Director, Management Assessment Division
L/Associate Administrator for Legislative Affairs
M/Associate Administrator for Space Flight
P/Associate Administrator for Public Affairs
Q/Associate Administrator for Aero-Space Technology
S/Associate Administrator for Space Science
U/Associate Administrator for Life and Microgravity Sciences and Applications
Y/Associate Administrator for Earth Science
Z/Associate Administrator for Policy and Plans

NASA Advisory Officials

Chair, NASA Aerospace Safety Advisory Panel
Chair, NASA Advisory Council
Chair, Advisory Committee on the International Space Station
Chair, Aeronautics and Space Transportation Technology Advisory Committee

NASA Centers

Director, Lyndon B. Johnson Space Center
  Space Station Program Manager
Chief Counsel, John F. Kennedy Space Center

Department of Defense

Director, Defense Logistics Agency
Director, Defense Contract Audit Agency
Commander, Defense Contract Management Command

Non-NASA Federal Organizations and Individuals

Assistant to the President for Science and Technology Policy
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Branch Chief, Science and Space Programs Branch, Energy and Science Division, Office Management and Budget
Associate Director, National Security and International Affairs Division, Defense Acquisitions Issues, General Accounting Office
Professional Assistant, Senate Subcommittee on Science, Technology, and Space

Chairman and Ranking Minority Member - Congressional Committees and Subcommittees

Senate Committee on Appropriations
Senate Subcommittee on VA, HUD, and Independent Agencies
Senate Committee on Commerce, Science, and Transportation
Senate Subcommittee on Science, Technology, and Space
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on VA, HUD, and Independent Agencies
House Committee on Government Reform and Oversight
House Subcommittee on Government Management, Information, and Technology
House Subcommittee on National Security, Veterans Affairs, and International Relations
House Committee on Science
House Subcommittee on Space and Aeronautics, Committee on Science

Congressional Member

Honorable Pete Sessions, U.S. House of Representatives

Glossary

Accounting Practice. Any disclosed or established accounting method or technique that is used for allocation of cost to cost objectives, assignment of cost to cost accounting periods, or measurement of cost.

Accounting Practice Change. Any alteration in a disclosed or established accounting method or technique used for allocation, assignment, or measurement of cost. See also Accounting Practice.

Actual Cost of Work Performed. The actual cost for work completed.

Allocate. To assign an item of cost, or group of items of cost, to one or more cost objectives. This term includes both direct assignment of cost and the reassignment of a share from an indirect cost pool.

Award Fee. 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.

Budget at Completion. The sum of all budgets allocated to the contract. Budget at Completion is synonymous with the term Performance Measurement Baseline.

Budgeted Cost of Work Performed. The sum of budgets for completed work. Also known as earned value. See Earned Value.

Business Unit. Any segment of an organization or an entire organization if not divided into individual segments.

Contract Budget Base. The negotiated contract cost plus the estimated cost of authorized but unpriced work.

Cost Performance Index. The value earned for every measurable unit of actual cost expended. A reliable and objective indicator of the cost efficiency achieved on the work accomplished.

Cost Variance. The numerical difference between Budgeted Cost of Work Performed and Actual Cost of Work Performed.

Defense Contract Audit Agency (DCAA). A DoD component Government agency that provides accounting and financial services on contracts.

Definitization. To settle and sign a contractual action that would include a new contract or modification to an existing contract.

Earned Value. Earned value is a method for project managers to objectively measure the amount of work accomplished on a contract. Earned value provides managers valid, timely, and auditable contract performance information to base management decisions.

Earned Value Management (EVM). Earned Value Management is a tool that allows effective execution, management, and control of the project and the integrated evaluation of cost, schedule, and technical performance against the performance measurement baseline. Earned Value Management provides project managers a means to better estimate contract costs over the total duration of contracts. Formerly called Performance Measurement System.

Estimate at Completion. A value developed to represent a realistic appraisal of the final cost of the total contract.

Estimate to Complete. An estimated value developed to represent a realistic appraisal of the cost of work still to be performed on the contract.

External Restructuring. Activities occurring after a business combination (two or more independent companies are combined) that affect the operations of companies not previously under common ownership or control. The activities do not include restructuring activities occurring after a business combination that affects the operations of only one of the companies not previously under common ownership or control, or when there has been no business combination. The activities normally will be initiated within 3 years of the business combination.

Forward Pricing Rate Agreement. A written agreement negotiated between a contractor and the Government to make certain rates available during a specified period for use in pricing contracts or modifications. The agreement may include rates for things such as labor, indirect costs, material obsolescence and usage, spare parts provisioning, and material handling.

Ground Support Equipment. Deliverable items that do not go into orbit but stay on the ground in support of mission-essential launch activities and launch site operations.

Incentive Fee. Element of a contract that provides for the initially negotiated fee to be adjusted later by formula based on the relationship of total allowable costs to total target costs, on-time delivery, and/or on-orbit performance.

Independent Annual Review. An analysis of the status of the commitments (performance, cost, and schedule) in a Program Commitment Agreement as compared to the program/project baseline and established thresholds.

Indirect Cost Rate. The calculated rate used to distribute indirect costs to final cost objectives on the basis of the relative benefits received. An indirect cost is any cost not directly identified with a single, final cost objective, but identified with two or more final cost objectives. An example of an indirect cost would be the rent on a building where work is performed on more than one contract.

Integrated Baseline Review. A joint review of the contractor's planning to ensure complete coverage of the statement of work, logical scheduling of the work activities, adequate resources, and identification of inherent risks.

Level of Effort. Effort of a general or supportive nature that does not produce definite end products or results. Level of effort is measured only in terms of resources actually consumed within a given time period.

Management Reserve. A portion of the budget that the contractor holds for management control purposes to cover the expense of unanticipated program requirements. It is not part of the contract's performance measurement baseline.

Monte Carlo Analysis. A simulation using a statistical software model that draws random samples from a number of lower level work package distributions and totals them to estimate the parameters of the overall system.

Negative Management Reserve. When the estimated amount of unanticipated program requirements is greater than the amount that was withheld for control purposes. Management reserve is in an overrun status.

Novation Agreement. Agreement enacted to recognize a successor in interest to a Government contract. By the novation agreement, the transferor guarantees performance of the contract, the transferee assumes all obligations under the contract, and the Government recognizes the transfer of the contract and related assets.

Over-Target Baseline. The formal reprogramming of the contract's original performance baseline that results in a new performance measurement baseline. An over-target baseline requires the approval of the customer prior to implementation of the new budgeted baseline amount.

Performance Measurement Baseline. The timed-phase budget plan against which project performance is measured. It equals the total allocated budget less management reserve.

Performance Measurement System. Former name of the Earned Value Management System. See Earned Value Management.

Program Commitment Agreement. The contract between the Administrator and the cognizant Enterprise Associate Administrator for implementation of a program.

Program Management Council. The Senior Management group, chaired by the Deputy Administrator, responsible for reviewing, recommending approval of proposed programs, and overseeing their implementation according to Agency commitments, priorities, and policies.

Program Operating Plan. A time-phased projection of resource requirements in terms of planned rates of obligations, which the Centers submit periodically to Officials-in-Charge of Program Offices; those officials then submit the plan to the NASA Chief Financial Officer.

Rebaselining. See Reprogramming.

Reprogramming. A comprehensive replanning of the effort remaining in the contract that results in a revised total allocated budget, which may exceed the current contract budget.

Segment. One of two or more divisions, product departments, plants, or other subdivisions of an organization reporting directly to a home office, usually identified with responsibility for profit and/or producing a product or service.

Station Development and Operations Meeting. Monthly meetings to discuss the status of the ISS.

Sustaining Engineering. The design engineering support provided after the development of hardware and software is complete and provisionally accepted by the Government.

Target Cost. The negotiated cost for the original, definitized contract and all contractual changes that have been definitized.

Target Price. The target cost plus profit or fee.

To Complete Performance Index. The projected value to be earned for every measurable unit to be expended in the future. The performance efficiency required on work remaining in order to stay within a program objective.

Unencumbered Management Reserve. Amount of management reserve that has not been identified to a specific task.

Variance at Completion. The mathematical difference between the Budget at Completion and the Estimate at Completion.

Weights. The numerical percentages applied to each evaluation factor denoting the relative importance of each factor for calculating the total amount of award fee each period.

Work Breakdown Structure. A product-oriented family tree division of hardware, software, services, and program-unique tasks that organizes, defines, and graphically displays the product to be produced, as well as the work to be accomplished to achieve the specified product. A work breakdown structure displays and defines the product, or products, to be developed and/or produced. It relates the elements of work to be accomplished to each other and to the end product.

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