

**IG-98-021**

**AUDIT  
REPORT**

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**IMPROVED CONTROLS NEEDED OVER NASA'S  
SUPERCOMPUTING INVENTORY**

**JULY 24, 1998**

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National Aeronautics and  
Space Administration

**OFFICE OF INSPECTOR GENERAL**

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## **ACRONYMS**

ARC	Ames Research Center
CoSMO	Consolidated Supercomputing Management Office
CPU	Central Processing Unit
GSFC	Goddard Space Flight Center
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
LaRC	Langley Research Center
LeRC	Lewis Research Center
MSFC	Marshall Space Flight Center
NEMS	NASA Equipment Management System
OIG	Office of Inspector General
OMB	Office of Management and Budget
R&D	Research and Development

W

July 24, 1998

TO: AO/Chief Information Officer

FROM: W/Assistant Inspector General for Auditing

SUBJECT: Final Audit Report on Improved Controls Needed Over NASA's  
Supercomputing Inventory (Assignment No. A-HA-97-056)  
Report No. IG-98-021

The subject final report is provided for your use. Please refer to the executive summary for the overall audit results. Your comments on the draft report were responsive to our recommendations. However, both recommendations will remain open until management corrective actions have been fully implemented.

If you have questions concerning the report, please contact Mr. David L. Gandrud, Program Director for the Information Technology Program Audit, at (650) 604-2672 or Mr. Roger Flann, Audit Program Manager, at (818) 354-9755. We appreciate the courtesies extended to the audit staff. The report distribution is in Appendix C.

[Original signed by Russell A. Rau]

Russell A. Rau

Enclosure

cc:

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241-11/Audit Liaison Representative

258-3/Director, Consolidated Supercomputing Management Office

bcc: AIGA, IG, Reading (w/o Encl.) Chrons  
ARC/204-11/D. Gandrud  
JPL/180-300/R. Flann

# TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	1
BACKGROUND.....	3
FINDING AND RECOMMENDATIONS.....	6
IMPROVEMENTS NEEDED TO IDENTIFY NASA SUPERCOMPUTERS AND SUPERCOMPUTING TIME PURCHASED FROM EXTERNAL SOURCES.....	6
APPENDIX A - OBJECTIVES, SCOPE, AND METHODOLOGY.....	10
APPENDIX B - MANAGEMENT'S RESPONSE.....	11
APPENDIX B - REPORT DISTRIBUTION.....	12

## ***EXECUTIVE SUMMARY***

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### ***INTRODUCTION***

The mission of the Consolidated Supercomputing Management Office (CoSMO) is to meet the National Aeronautics and Space Administration's (NASA) supercomputing requirements through effective and efficient management of NASA's supercomputing resources. In Fiscal Year 1997, CoSMO, located at the Ames Research Center (ARC), initiated a consolidation study to determine the optimal architecture for NASA's supercomputers. CoSMO subsequently clarified the different categories of supercomputers -- a change that is likely to result in a significant reclassification of those machines. CoSMO will undertake a new consolidation study of NASA's supercomputers based on the new classifications.

### ***OBJECTIVE***

Our objective was to determine whether CoSMO had accurately identified NASA's supercomputer inventory and supercomputing "time" (cycles) acquired from external sources.

### ***AUDIT RESULTS***

CoSMO can improve its effectiveness as NASA's office for consolidated supercomputing management by developing an accurate inventory of NASA's supercomputers and supercomputing time purchased. CoSMO's inventory was inaccurate because CoSMO had not developed guidance that NASA managers could use to report the necessary data. Until such guidance is made available, CoSMO cannot effectively and efficiently satisfy NASA's supercomputing requirements.

### ***RECOMMENDATIONS***

We recommend that the CoSMO Director issue guidance to NASA Center Directors and Enterprise managers to:

- identify all NASA supercomputers and outside purchases of supercomputing time; and
- coordinate with CoSMO on their respective acquisition and retirement plans for supercomputing resources.

***MANAGEMENT'S  
RESPONSES TO  
RECOMMENDATIONS***

Management concurred with the recommendations. CoSMO has taken several steps to improve the accuracy of its supercomputer inventory. Further, CoSMO plans to revise its Program Plan to include guidance on how to purchase supercomputing time and describe the coordination efforts for acquiring and retiring supercomputing resources.

***EVALUATION OF  
MANAGEMENT'S  
RESPONSES***

The actions taken and planned are responsive to the recommendations.

# IMPROVED CONTROLS NEEDED OVER NASA'S SUPERCOMPUTING INVENTORY

## ***BACKGROUND***

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The Ames Research Center (ARC), through the Consolidated Supercomputing Management Office (CoSMO), is responsible for acquiring, maintaining, operating, managing, upgrading, and budgeting for NASA's supercomputers, regardless of location. CoSMO's stated mission is to meet NASA's supercomputing requirements, while realizing an overall cost savings through effective and efficient management of NASA's supercomputing resources.

On October 1, 1996, NASA established CoSMO in response to a National Performance Review recommendation for Government-wide data processing consolidation and modernization and to NASA's Zero Base Review. The Zero Base Review directed changes in the way NASA was organized and operated. These reviews and the establishment of CoSMO are consistent with Office of Management and Budget (OMB) Bulletin 96-02, "Consolidation of Agency Data Centers" (dated October 4, 1995). OMB Bulletin 96-02 identified the need for reducing the number of agency data centers and the total cost of their data center operations.

In 1996, CoSMO developed a management plan that it coordinated with key personnel at the NASA Center, Enterprise, and Headquarters levels. A major element of the plan is the determination of the "optimal architecture" (a supercomputing structure that meets Enterprise requirements, is cost-effective, provides customer satisfaction, reduces technical risk, provides equal or improved capability over current configurations, and provides leading edge technology). The plan identified a total of 31 supercomputing machines (defined later in this section), as follows:

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- 14 production machines at 6 NASA locations -- ARC, Goddard Space Flight Center (GSFC), Johnson Space Center (JSC), Langley Research Center (LaRC), Lewis Research Center (LeRC), and Marshall Space Flight Center (MSFC);
  - 13 research and development (R&D) machines at 5 NASA locations -- ARC, GSFC, the Jet Propulsion Laboratory (JPL), LaRC, and LeRC; and
  - 4 secure machines at 2 NASA locations --ARC and LaRC.

The plan also identified some limitations in CoSMO's responsibilities related to R&D and secure supercomputing. Specifically, users of R&D and secure supercomputers will retain responsibility for programmatic (purchasing and use) decisions and will be responsible for funding capital investment, operations, and maintenance costs. During Fiscal Year 1997, CoSMO initiated a consolidation study of NASA's production and secure supercomputers to determine the optimal architecture.

In July 1997, the Office of Inspector General (OIG) announced an audit to determine whether CoSMO's cost-benefit analysis adequately supported the planned supercomputer consolidation(s). The OIG issued a draft audit report to NASA management entitled, "Consolidation Decision for Secure Supercomputers," (A-HA-98-008) in May 1998.

During our audit of CoSMO's supercomputer consolidation effort, the OIG questioned CoSMO's rationale for excluding R&D supercomputers from its consolidation study and for classifying several production supercomputers as R&D supercomputers. As a result, CoSMO clarified its definition of R&D supercomputers and, hence, the scope of its consolidation plan. CoSMO later reclassified the R&D machines to production machines and issued draft guidance to its management plan.

According to the guidance, an R&D supercomputer is a research computing system that tests hardware and software configurations. R&D supercomputing results in frequent system crashes and maintenance. A production supercomputer is a computer system that produces scientific and technical results that support NASA missions and programs. Production supercomputing requires a high degree of operational stability and dependability. A secure supercomputer is a computer system used to support classified programs for which systems software and physical access must be controlled for security purposes.

The CoSMO Director believes the new definition of R&D supercomputing will result in a significant reclassification of R&D machines to production machines. CoSMO plans to conduct a new consolidation study for production supercomputing once all R&D supercomputers have been addressed in the context of the new definition.

As a result of CoSMO's planned consolidation study, we terminated our original audit objective. (See Appendix A for additional information on audit objectives, scope, and methodology.) Notwithstanding this change in audit direction, we identified improvements that CoSMO can make to more effectively perform its stated mission. These areas are discussed in the Finding and Recommendations section of this report.

## ***FINDING AND RECOMMENDATIONS***

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### ***IMPROVEMENTS NEEDED TO IDENTIFY NASA SUPERCOMPUTERS AND SUPERCOMPUTING TIME PURCHASED FROM EXTERNAL SOURCES***

CoSMO can improve its effectiveness as NASA's office for consolidated supercomputing management by developing an accurate inventory of NASA's supercomputers and supercomputing time purchased. CoSMO lacked an accurate inventory because it had not issued detailed, written guidance to NASA managers for use in identifying their supercomputer inventory needs. Until it issues such guidance, CoSMO cannot effectively and efficiently satisfy its mission as described in its management plan.

CoSMO's management plan, dated November 25, 1996, gives CoSMO management the oversight responsibility for all NASA supercomputers. The plan states:

CoSMO's Mission is to meet NASA's supercomputing requirements for each Enterprise office while realizing an overall cost savings through effective and efficient management of NASA's supercomputing resources through the end of the decade and into the next century.

To meet this mission, we believe CoSMO must have an accurate accounting of NASA's existing and future supercomputing resources and requirements, as well as the funding to help NASA realize its optimal supercomputing architecture.

The audit showed that CoSMO had not identified (a) all NASA supercomputer hardware and (b) supercomputing "time" acquired from external sources. CoSMO cannot rely on the NASA Equipment Management System (NEMS) to identify supercomputer hardware because supercomputers are not defined as such in the NEMS records. To illustrate, a supercomputer may consist of multiple central processing units (CPUs), each with its own NEMS identification number. The CPU may bear no resemblance to a supercomputer and, therefore, may not be associated with a supercomputer for inventory purposes. Consequently, CoSMO must rely on NASA Center and Enterprise managers to identify their supercomputer assets.

CoSMO's inventory records omitted two supercomputers. Specifically, in September 1997, CoSMO provided us a listing of supercomputers (consisting of 19 production and R&D machines) based on information it obtained from the various Centers. Absent from the list were two supercomputers: one (SGI power Challenge Array) at ARC and one (MasPar MP-2/1 Cluster) at GSFC. A NASA website described these systems as High Speed Performance and Computing testbeds. After we brought the two systems to the CoSMO Director's attention, he determined that the Centers holding the two machines considered them older R&D supercomputers with no apparent future application and, therefore, did not report them to CoSMO. Nevertheless, we believe the Centers should have reported the machines to CoSMO because they are, in fact, supercomputing resources.

The omissions may not have occurred if CoSMO had set forth written, implementing guidance in its management plan or elsewhere. Such guidance should have delineated Center and Enterprise management duties and responsibilities for inventory reporting and for coordinating with CoSMO on any planned acquisitions or retirements of supercomputers. We believe improved coordination between CoSMO and the Center Directors and Enterprise managers will enhance the accuracy of the supercomputer inventory. Additionally, improved coordination will enable CoSMO to evaluate the most efficient and effective means for assessing the needs of supercomputer users.

CoSMO also has no effective means to identify supercomputing time that NASA acquires from external, non-NASA sources. To obtain an accurate representation of NASA's supercomputer resources, CoSMO must again depend on Center and Enterprise managers to provide the needed information. To illustrate, CoSMO lacked data supporting the extent of supercomputing time the JPL purchased from the California Institute of Technology. JPL told us that its Fiscal Year 1997 supercomputing time purchases totaled \$2,650,000. As in the case of inventory reporting discussed above, formal guidance would give CoSMO

improved visibility over NASA's existing and planned supercomputing resources. Without knowledge of existing supercomputer resources and planned acquisitions of outside supercomputing, CoSMO cannot effectively manage NASA's supercomputing requirements.

***RECOMMENDATION 1***

We recommend that the CoSMO Director issue guidance to NASA Center Directors and Enterprise managers to:

- (1) Identify all NASA supercomputers and outside purchases of supercomputing time.

***MANAGEMENT'S  
RESPONSE TO  
RECOMMENDATION 1***

Management concurred. CoSMO has taken several steps to improve the accuracy of its supercomputer inventory. Specifically, CoSMO has searched NEMS and the Scientific and Engineering Workstation Procurement databases, requested the identification of supercomputers as part of its Information Technology Program Operating Plan for the Year 2000, and will revise its Program Plan to include guidance on how to purchase supercomputing time. CoSMO expects to complete these actions by September 30, 1998.

***EVALUATION OF  
MANAGEMENT'S  
RESPONSE***

Actions taken to identify all supercomputers in NASA have effectively responded to part of the recommendation. Management's response did not address outside purchases of supercomputing time. However, after submission of the comments, the CoSMO Assistant Director told the OIG that CoSMO will add guidance to its Program Plan that will request users to identify outside purchases of supercomputing time. Based on the additional information provided by the Assistant Director, management's actions are fully responsive to the recommendation.

***RECOMMENDATION 2***

- (2) Coordinate with CoSMO on their respective acquisition and retirement plans for supercomputing resources.

***MANAGEMENT'S  
RESPONSE TO  
RECOMMENDATION 2***

Management concurred. CoSMO will describe in its program plan the means to achieve such coordination. The program plan is to be completed by September 30, 1998.

***EVALUATION OF  
MANAGEMENT'S  
RESPONSE***

The planned action is responsive to the recommendation.

## ***OBJECTIVES, SCOPE, AND METHODOLOGY***

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### ***OBJECTIVES***

The original objective of the audit was to determine whether CoSMO's cost-benefit analysis adequately supported the planned supercomputer consolidation. Specifically, our audit focused on the consolidation of production supercomputers. The consolidation of secure supercomputers is addressed in a draft audit report to NASA management entitled, "Consolidation Decision for Secure Supercomputers" (A-HA-98-008).

During the audit, CoSMO clarified its definition of R&D supercomputers and, accordingly, decided to pursue a new consolidation study in the near future. Because this study will require a new cost-benefit analysis, we discontinued our original audit objective. Our revised audit objective was to determine whether CoSMO had accurately identified NASA's supercomputer inventory and supercomputing "time" (cycles) acquired from external sources.

### ***SCOPE AND METHODOLOGY***

We reviewed OMB Bulletin 96-02, "Consolidation of Agency Data Centers"; the 1996 CoSMO management plan; and related documentation. Also, we interviewed various NASA officials regarding their views on the CoSMO mission.

### ***AUDIT FIELD WORK***

Audit field work was conducted from July 1997 through February 1998. We performed the audit in accordance with generally accepted government auditing standards.

*Management's Response*

National Aeronautics and  
Space Administration  
**Ames Research Center**  
Moffett Field, CA 94035-1000



Reply to Attn of  
J:241-11

June 15, 1998

TO: NASA Headquarters  
Attn: W/Assistant Inspector General for Auditing  
THRU: R/Associate Administrator, Aeronautics and Space Transportation Technology  
FROM: Jana M. Coleman, Director of Center Operations  
SUBJECT: Draft Report on Improved Controls Needed Over NASA's  
Supercomputing Inventory, A-HA-97-056

*J. Michael*  
6/23/98

The Center has reviewed the May 14, 1998, draft report and appreciates the opportunity to respond. The following are the Center responses to the recommendations:

**Recommendation 1:** Identify all NASA supercomputers and outside purchases of supercomputing time.

**Response: Concur.** In preparation for the Information Technology (IT) POP 2000, CoSMO created a database of supercomputers by searching the NASA Equipment Management System (NEMS) and the Scientific and Engineering Workstation Procurement (SEWP) databases. CoSMO requested the identification of NASA supercomputers in the IT POP 2000 to improve the accuracy of its supercomputer database. Guidance on how to purchase supercomputing time from CoSMO will be identified in the CoSMO Program Plan, which is a policy document that will be approved within the Agency at the enterprise level. The estimated completion date of the Program Plan is September 30, 1998.

**Recommendation 2:** Coordinate with CoSMO on their respective acquisition and retirement plans for supercomputing resources

**Response: Concur.** The coordination recommended will be described and required by the CoSMO Program Plan. The estimated completion date of the Program Plan is September 30, 1998.

Should you have any questions regarding our response, please contact Katie Garcia at (650) 604-5669.

*Jana M. Coleman*  
Jana M. Coleman

cc:  
NASA HQ/Code JM

## ***REPORT DISTRIBUTION***

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Budget Examiner, Energy Science Division, Office of Management and Budget

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House Subcommittee on VA, HUD and Independent Agencies

House Committee on Government Reform and Oversight

House Committee on Science

House Subcommittee on Space and Aeronautics

**Congressional Members**

The Honorable Pete Sessions, U.S. House of Representatives

## ***MAJOR CONTRIBUTORS TO THIS REPORT***

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