



UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

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SEPTEMBER 27, 1984

INFORMATION MANAGEMENT  
& TECHNOLOGY DIVISION

B-216267



The Honorable James M. Beggs  
Administrator, National Aeronautics  
and Space Administration

Dear Mr. Beggs:

Subject: Better Management Controls and ADP Requirements Analysis Can Help NASA Lewis Research Center To More Effectively Acquire Future ADP Resources (GAO/IMTEC-84-25)

This letter reports on automatic data processing (ADP) equipment acquisition practices at the National Aeronautics and Space Administration's (NASA's) Lewis Research Center. We conducted this review because (1) the estimated dollar value of the computer equipment being acquired is large and (2) the Congress is interested from an oversight perspective in the acquisition and management of ADP resources that affect aerospace technology, research, and development. The objectives, scope, and methodology of our review are discussed in enclosure I.

One of three research centers in NASA, the Lewis Center is primarily responsible for conducting research and development for power, propulsion, and communications systems in support of aeronautics, space, and land applications. Among the Center's more publicized projects is its effort to adapt the Centaur rocket for the space shuttle program. In its work, the Center is highly dependent on the use of ADP resources.

Our analysis indicated that in an August 1983 Request for Proposals (RFP) for IBM-compatible<sup>1</sup> ADP equipment, the Center stipulated specifications that effectively reduced maximum practicable competition and removed competitive cost advantages potentially held by other IBM-compatible vendors. In addition, due to weaknesses in its analysis of ADP requirements and related management control procedures, such as incomplete ADP cost reporting and inadequate computer performance monitoring, the Center cannot determine the appropriate size and timing for future computer equipment upgrades. As a result, either an excess or a shortfall in computing resources could occur.

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<sup>1</sup>Equipment having characteristics that allow it to accept and process data prepared by IBM equipment without conversion or code modification.

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Based on suggestions we offered to Center officials in October 1983, a revised RFP was issued. The Center has since acquired IBM-compatible computer equipment based on the revised RFP, and should avoid expenditure of about \$10 million as a result of the combined effects of workload reassessment and competition. Center management is also planning to improve its ADP management controls by implementing better procedures for collecting and analyzing requirement, cost, and performance data. Such improvements should lead to more cost-effective management decisions in acquiring ADP resources.

REQUEST FOR PROPOSALS LIMITED COMPETITION  
AND COST SAVINGS POTENTIAL

Federal Procurement Regulation 1-4.1103-1 requires that agencies acquire needed goods and services competitively to the extent practicable, and Federal Procurement Regulation 1-4.1102-9 requires that the lowest overall cost to the government be obtained, price and other factors considered.

On August 16, 1983, the Center issued an RFP to acquire two IBM-compatible computers to augment current scientific and graphics applications. We found that the RFP contained certain equipment performance specifications and system software requirements that, at the time, directly paralleled features offered only in the IBM product line; the Center, however, could not justify these requirements. Secondly, the RFP contained procedures for evaluating proposal costs which also favored selection of IBM equipment by eliminating cost advantages potentially held by competing vendors. We found that the Center did not have sound rationale for including these procedures. In addition, it required all vendors to include IBM operating system software, which was a sole-source proprietary item, in their proposed cost. Because IBM had exclusive knowledge and control over the prices for future releases of this software, this procedure limited competition. In our opinion, the RFP could potentially have had a detrimental impact on competition and price.

We brought these problems to the attention of Center management in October 1983. At that time we suggested such revisions as (1) using a price/performance evaluation based on available funds, (2) expressing disk storage specifications in functional terms, and (3) eliminating credits for providing IBM's newest operating system software at the time of equipment installation. The Center incorporated most of our suggestions in a revised RFP and subsequently received proposals from IBM and from two IBM-compatible vendors--both of whom had said they would not respond to the initial RFP.

On March 29, 1984, the Center announced Amdahl Corporation as the winning vendor with an evaluated offer of \$9.4 million over the 6-year system life. This offer was about \$10 million less than the Center's cost estimate of \$19.4 million, as reported to the Office of Management and Budget in fiscal year 1984.

CENTER DID NOT ACCURATELY DETERMINE  
NEED FOR PLANNED COMPUTER UPGRADES

Federal Procurement Regulation 1-4.1103-2 requires agencies to base their ADP acquisitions on mission needs that are determined by a comprehensive requirements analysis. The Lewis Research Center did not conduct such an analysis for the two IBM-compatible computers. Instead, it relied on management judgment and historical usage trends.

Over \$5.1 million of Amdahl's offer represents the cost of future equipment upgrades planned by Center officials. The Center cannot be certain, however, that the upgrades can be justified on the basis of mission need because a comprehensive requirements analysis was not developed.

When we first questioned the lack of a requirements analysis, Center officials contended that federal guidance, policies, and regulations requiring that ADP acquisitions be based on mission needs determined by a comprehensive requirements analysis were not applicable in a scientific environment. The officials believed that due to the dynamic nature of scientific research, users could not identify and project realistic workload requirements. We believe, however, that realistic workload requirements were not developed because top management did not get involved in determining what kind of data was required or how it would be used.

Our work has shown that a comprehensive requirements analysis is possible in and appropriate for scientific research environments. A review at the Tennessee Valley Authority<sup>2</sup> and other work we conducted during this review at the Departments of Commerce and the Navy indicated that comprehensive requirements analyses were conducted and they resulted in effective and economical computer equipment acquisitions.

As discussed below, we believe the Center's management cannot accurately predict future computer equipment needs because it has not developed the cost and performance information necessary for a comprehensive requirements analysis.

BETTER MANAGEMENT CONTROLS COULD IMPROVE  
THE BASIS FOR ANALYZING FUTURE REQUIREMENTS

Center management has an opportunity to improve its management controls so that data needed to effectively assess future computer requirements will be available. Federal policies, regulations, and good ADP management practices require that these controls include:

--Involving top management in supporting and reviewing the requirements analysis process and in validating the

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<sup>2</sup>TVA's Computer Needs Are Valid and ADP Management Is Improving, GAO/AFMD-82-24, June 9, 1982.

results of this process in light of mission objectives and available funds.

- Reporting ADP costs to all users to improve their cost estimation for new requirements.
- Structuring computing costs by time of day to reduce peak period demands and thus encourage optimum use of ADP resources.
- Monitoring computer performance to ensure that current equipment is used efficiently and that decisions regarding new acquisitions are more accurate.

Center officials plan to implement better controls in some of the above areas to make more accurate ADP resource data available for current use and projected needs.

#### Top management involvement

Top agency management must be actively involved in ensuring that the techniques used to collect and analyze ADP requirements render information it can use in acquisition decisionmaking. Top management further needs to validate this data to ensure it corresponds with mission objectives and available funds.

Generally, surveys of user needs have yielded data that was inconsistent and incomplete, thus preventing the Center from accurately projecting requirements. Therefore, Center top management could not validate the quantitative data in light of mission needs. Center management now recognizes it must become more involved in the data collection and analysis process and plans to implement techniques other scientific activities have used successfully. For example, Center officials plan to focus the Center's new survey questionnaire on functional requirements rather than on such quantitative utilization projections as the number of hours of processing time by type of work. The results of the survey process would then require top management validation.

#### Reporting ADP costs

Federal Government Accounting Pamphlet Number 4 states that costs for ADP should normally be reported--whether reimbursed or not--to the users who receive the benefits as well as to the managers responsible for operations and budgeting for expenses. With that information, users can more fully account for data processing costs, and thus be able to document whether work done through ADP is worth the cost. In addition, such accounting will enable the user to more accurately project costs of any new requirements.

Although the Lewis Research Center reports costs to research and development groups, it does not report costs to support groups that use ADP resources when assisting direct research

programs. Center financial management officials maintained that support group managers are not charged for ADP resources; cost reports, therefore, would not enhance their decisionmaking process. As a result, the Center officials see no benefit in changing their current reporting procedures. In our opinion, without adequate cost information, managers cannot effectively contribute to the decisionmaking process for acquiring and using computer and other information processing resources.

#### Structuring cost by time of day

Peak demand for computer resources is often the determining factor in an agency's decisions about the size of computer system needed. That is, what is the greatest workload demand the system will face during normal working hours? Federal Government Accounting Pamphlet No. 4 suggests establishing different rates for use of the system depending on the time of day--higher rates for peak hours, lower for non-peak. Thus, if there is a financial incentive for using non-peak hours, money could be saved because the existing system could be used more fully, and additional equipment might prove to be unnecessary.

At the Center, peak periods of demand are between 8 a.m. and 6 p.m., when the computers are used for on-line and interactive support. The Center does not now offer different rates for peak and non-peak hours, but Center officials are assessing whether this control would be cost effective.

#### Monitoring computer performance

Performance monitoring, when used effectively, helps managers both to use their current ADP equipment efficiently and to make better decisions regarding acquisitions of new or updated equipment. Although the Center had a monitoring program, it was limited. For instance, it measured use of its main memory, but it did not do so regularly. Consequently, when the Center wanted to prove its assertion that more work could be processed through its IBM computer if the main memory were enlarged, it did not have the statistics to prove the point.

Center officials attributed their limited computer performance monitoring function to shortcomings in the special operating system software used by the Center's IBM computer. This software, developed between 1965 and 1967, had been modified over the years by the vendor to improve overall operational capability. These modifications largely ignored performance monitoring and, as a result, performance information is no longer readily available.

Recognizing the need to improve computer performance monitoring, Center management plans to regularly analyze performance on the newly acquired IBM-compatible computers using software tools that will be available with their operating system software. In addition, the Center has acquired a \$300,000 hardware monitor to overcome current system software problems encountered

on the IBM computer. We believe proper use of the software tools and the monitor should provide effective performance data.

### CONCLUSIONS

Although Center management has taken steps to improve its management controls and its process for analyzing its requirements, we believe it can do more to effectively acquire ADP resources.

Strong ADP management controls should be established to ensure that accurate and useful requirements, cost, and performance information is available to decisionmakers which both fosters competition and helps to ensure that system acquisitions will provide mission support. Center management has recognized the need to take corrective action and is considering actions to improve procedures for identifying users' ADP requirements and monitoring computer performance. These actions will require top management's concurrence and support. We believe, however, that additional actions are needed to improve the process of defining and validating ADP requirements and reporting useful cost and performance information.

### RECOMMENDATIONS

We recommend that you direct the Director of the Lewis Research Center to implement a comprehensive requirements analysis process that will produce appropriate data for estimating future needs before upgrades or additional equipment is required. As part of this process the Center should:

- Require top management to validate the comprehensive requirements analysis process based on mission needs and available funds.
- Report ADP costs to all computer users so they are aware of the value of ADP resources consumed and can use this data when estimating new requirements.
- Structure costs of computer operations by time of day if Center officials determine that this control would be cost effective.
- Regularly analyze performance on the newly acquired IBM-compatible computers using the acquired hardware monitor and the software tools that will be available with the new operating system software.

### AGENCY COMMENTS AND OUR EVALUATION

On August 22, 1984, we received written comments on the draft of this report from the Acting Director, Automated Information Systems, NASA. (See encl. II.) He agrees with our recommendations and believes they will improve the management and acquisition of Lewis Research Center ADP resources. He stated that

actions were underway by Center management to strengthen the procedures to validate computer requirements, provide more complete cost information to all users, review the feasibility of charging users by time of day, and reemphasize computer performance monitoring. The actions, if carried out, will be responsive to our recommendations and will improve the Center's management controls over computer acquisition and operation.

The Acting Director also commented on a proposal in our draft report to delay the acquisition of a hardware monitor for the IBM computer with a new special operating system. We proposed that the acquisition be delayed until sufficient performance data is gathered from the new operating system's software tools to properly assess the cost versus the benefits of such a monitor. He stated that the Lewis Research Center had already purchased the hardware monitor and will use it not only for the IBM system but also for the four other mainframe systems at the Center. He believed that these tools will improve the accuracy of predicting future needs.

Our proposed recommendation was based on the Center's plans to acquire the hardware monitor for use only on the IBM computer with the special operating system. Since then, the hardware monitor has been purchased. Because NASA intends to use the monitor on four other mainframe systems as well, we have withdrawn our recommendation.

NASA did not question that money could be saved if IBM-compatible computers were acquired competitively. The agency was, however, unable to validate the \$12-million cost avoidance shown in our draft report. In its August 6, 1983, acquisition plan, the Center identified total costs of \$21.4 million to acquire scientific/engineering and graphics support. In our review of more recent fiscal year 1984 data NASA provided the Office of Management and Budget in response to Section 43 of Circular A-11, we found that total projected costs had been reduced to \$19.4 million. We conclude, therefore, that the \$10-million difference between this later projection and the Amdahl contract of \$9.4 million represents costs NASA should avoid as a result of the combined effects of workload reassessment and competition. This \$10-million figure is reflected in our final report.

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As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the House Committee on Government Operations and the Senate Committee on Governmental Affairs not later than 60 days after the date of the report, and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report. We would appreciate being informed of the actions you plan to take in response to our recommendations.

B-216267

We are sending copies of this report to the Director of the Office of Management and Budget and to the Administrator of General Services.

Sincerely yours,

  
Warren G. Reed  
Director



OBJECTIVES, SCOPE, AND METHODOLOGY

Our review of the Lewis Research Center's acquisition of computer equipment had the following objectives:

- Assess the validity of the requirements contained in the Request for Proposals.
- Determine whether the Center's acquisition strategy promoted competition and effective mission support at the least cost.
- Evaluate management controls over the requirements analysis process.

We conducted this work at the Lewis Research Center in Cleveland, Ohio, and at the National Aeronautics and Space Administration and General Services Administration headquarters in Washington, D.C. In addition, we did work in the Departments of the Navy and Commerce.

Our review was performed in accordance with generally accepted government auditing standards. We interviewed Center and other federal government ADP managers and users to determine how they identified computing requirements in scientific environments, developed equipment specifications, and implemented ADP management controls. We met with NASA headquarters officials to gain an understanding of their overall ADP management and acquisition policies, and with GSA officials and interested vendors to obtain their views on this procurement. In addition, we reviewed GAO reports and pertinent federal and NASA guidance relating to ADP acquisitions, as well as Center reports and analyses supporting this acquisition.



National Aeronautics and  
Space Administration

Washington, D.C.  
20546

AUG 22 1984

Reply to Attn of NIP

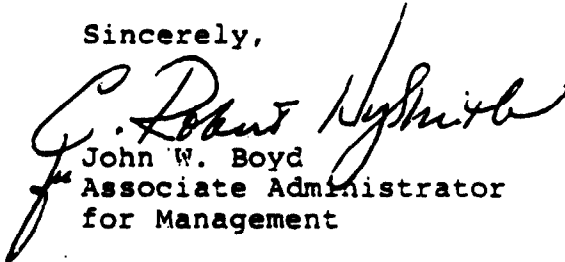
Mr. Frank C. Conahan  
Director  
National Security and  
International Affairs Division  
United States General Accounting Office  
Washington, DC 20548

Dear Mr. Conahan:

Thank you for the opportunity to comment on your draft report,  
"Better Management Controls and ADP Requirements Analysis Can  
Help NASA Lewis Research Center to More Effectively Acquire  
Future ADP Resources" (job code 510014).

In general, NASA is in agreement that the report recommendations  
will improve the management and acquisition of Lewis Research  
Center ADP Resources. Specific Agency comments are provided in  
the enclosure to this letter.

Sincerely,

A handwritten signature in cursive script, appearing to read "John W. Boyd".

John W. Boyd  
Associate Administrator  
for Management

Enclosure

AUG 21 1984

**NASA Comments on "Better Management Controls and ADP Requirements Analysis Can Help NASA Lewis Research Center to More Effectively Acquire Future ADP Resources."**

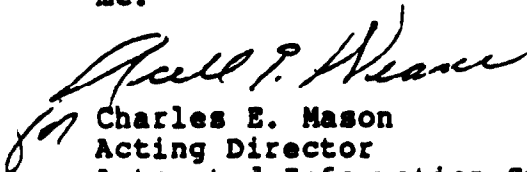
NASA appreciates the considerable time and effort which the GAO put forth in conducting the review. The Lewis Research Center staff was impressed by the thoroughness exhibited by your staff in conducting their analysis.

In general, the recommendations contained in the draft report were found to be quite helpful by Lewis management. They have strengthened their procedures in the validation of future requirements. Additionally, the Center is considering various alternatives to provide more complete ADP cost information to all computer users. Also, the Center is reviewing the feasibility of charging users on the basis of time of day, primarily as a load-leveling technique. The use of hardware and software monitoring devices and techniques as a means of analyzing the performance of all mainframe computer systems has been reemphasized as a result of your review.

In that regard, Lewis management plans to continue to acquire and use software monitors on all large mainframe systems. The software monitors, of course, are custom designed for each major system in contrast to a general purpose hardware monitor which can be used interchangeably on different systems. Lewis has already purchased a hardware monitor and will use it for not only the IBM system but also the four other mainframe systems at the Center. We believe these tools, when used in conjunction with the additional performance controls which the Center has adopted, will provide Lewis management with much improved information on systems loads and will improve the accuracy of predicting future needs.

We are not in full agreement with a few references in the report, but only one we would like to bring to your attention. We do not take issue with the fact that a cost avoidance may occur; however, based on our funding data we are unable to validate the \$12 million cost avoidance shown in your report.

If you require any further information do not hesitate to contact me.



Charles E. Mason  
Acting Director  
Automated Information Systems