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 UNITED STATES GENERAL ACCOUNTING OFFICE
 REGIONAL OFFICE
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 SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO:
 39730

October 27, 1970

Dr. Hans Mark
 Director, Ames Research Center
 National Aeronautics and Space Administration
 Moffett Field, California 94035
 HCC 00899



LM092832

Attention: Mr. Arthur B. Freeman,
 Director of Administration

Dear Dr. Mark:

We have surveyed the management controls over the scientific use of general purpose computers at Ames' central computer facility and identified three areas which we believe warrant management study. In our opinion, revisions and strengthening are needed in these areas to encourage the efficient use of computer facilities and to ensure that the computer facilities are used only for properly approved purposes. Briefly, these problem areas are:

1. The present method of charging users does not act as an effective control over the use of computer time.
2. Computation Division procedures are not now sufficient to prevent computers from being used on jobs for which time has not been approved.
3. Procedures for requesting computer time do not ensure that a proper level of management approves the requests.

Our comments on these areas, together with our recommendations for corrective action, are discussed in the following sections of this report.

NEED FOR MORE EFFECTIVE METHOD OF CHARGING
 COMPUTER USERS FOR THE USE OF COMPUTER TIME

Charging users for actual computer time used is widely recognized as an effective and desirable control over the use of computer time.

At Ames, research programs are charged for computer time through allocations of the central computer facility's costs. However, these charges do not act as an effective control over the use of computer time because (1) they are not based solely upon use of computer time,

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(2) they are not made directly to the job order level, but rather to the overall research program, and (3) they can fluctuate significantly from year to year because all acquisition costs of purchased equipment are charged in the year of acquisition, rather than over the expected useful life of the equipment.

Since fiscal year 1969, a portion of central computer facility costs have been charged to research and development (R&D) programs by distributing such costs through program overhead. We were told that R&D programs were charged because cutbacks in the Research and Program Management appropriation did not provide sufficient funds to operate the central computer facility at its existing level.

Ames' Programs and Resources Office reserves amounts in each research program's R&D funds at various times throughout the fiscal year to finance the costs of the central computer facility. The actual costs of the central computer facility are charged to a carrier account as they are incurred; the costs are later allocated to the research programs' reserved amounts.

During fiscal year 1970, such costs totaled about \$6.7 million, including about \$3.7 million for the purchase of an IBM 360/67 computer system. Distributions were made to research programs infrequently, at irregular intervals during the year, and were not based solely upon the amount of computer time used by each program. As a result, some research programs were overcharged, some undercharged.

We compared the amount of central computer facility costs actually distributed to the research programs with the amounts that would have been distributed if based solely upon the proportion of computer time used. Our analysis showed significant over- and undercharges for 11 of the 25 programs to which such costs had been distributed:

<u>Program code and description</u>	<u>Ames allocation</u>	<u>GAO ^{1/} allocation</u>	<u>Amount overcharged or (undercharged)</u>	<u>Percent overcharged (undercharged)</u>
125 Electronic systems	\$ 376,000	\$ 259,000	\$117,000	31
126 Aeronautical vehicles	1,880,000	1,497,000	383,000	20
129 Research program	668,000	472,000	196,000	29
130 Mission analysis	443,000	156,000	287,000	65
138 Physics and astronomy	119,000	22,000	97,000	81
720 Supersonic aircraft	707,000	1,106,000	(399,000)	(56)
721 V/STOL aircraft	502,000	46,000	456,000	91
722 Hypersonic aircraft	126,000	336,000	(210,000)	(167)
737 Supersonic aircraft	100,000	12,000	88,000	88
811 Project Pioneer	660,000	1,325,000	(665,000)	(101)
914 Apollo Program	38,000	379,000	(341,000)	(897)

^{1/} Based upon Ames' utilization data

We were told that all of the costs - except for the purchase cost of the IBM 360/67 (\$3,708,000) - were distributed according to the proportion of computer time used by each program, and that the purchase cost of the IBM 360/67 was allocated according to each program's ability to pay. In other words, programs without available funds were charged less than pro rata amounts; and programs with available funds made up the difference.

Many of the Ames research personnel at the branch, division, and directorate levels indicated to us that they view the present charging procedure as a type of tax, not directly related to actual usage. When viewed in this light, the charges do not operate as an effective control mechanism; this is illustrated by the comments of

some research personnel. One individual stated that research personnel at the division and branch levels feel that once the Programs and Resources Office has reserved a portion of their program funds for the carrier account distribution, they are free to use as much computer time as they see fit. Another individual said that his program seemed to be charged for the equivalent of eight hours of computer time daily, regardless of actual usage. In our opinion, charges which are not based solely upon actual usage do not provide an incentive for efficiency.

Cost distributions are made to the overall program level rather than directly to the job orders of the individual projects within the program, which use the computer time. The job order is the level at which units of research are performed, and it is the lowest point for controlling resources. Research expenditures other than program overhead are charged to job orders.

We were told by 12 of 14 research managers that researchers would more closely scrutinize the need for using computers if Central Computer Facility costs were charged directly to job orders in the same manner as other research expenditures. One assistant division chief stated that it would impress upon the branch chiefs that they are actually paying for their use of the computer, and they would thus examine their requests for computer time more closely. A division management official told us that it would be an incentive to him to improve the control of computer time within his branch because any funds saved by using less computer time to accomplish a given research objective would be available to him for alternative uses.

This charging method also results in program charges which can fluctuate significantly from year to year, because the full cost of purchased equipment is charged in the year of purchase, resulting in higher charges than in years when no major purchases are made. The effect of this procedure is illustrated by Ames' 360/67 interagency sharing rate. Currently, Ames interagency rate is \$290 per hour, based upon a five year amortization of equipment purchase costs. However, if in the year of purchase the full purchase cost was charged, the rate would climb to about \$1,080 per hour. In the following years the rate would drop to about \$90 per hour, since there would be no purchase cost to be charged. In our opinion, this method, with widely fluctuating rates, makes it difficult for research managers to plan and budget for computer use, and reduces any incentive to avoid unwarranted use of computer time.

In September 1967, a consultant to the Office of Tracking and Data Acquisition reported that NASA could take a very significant step toward insuring effective utilization of ADP sources by requiring all users of ADP services to pay for them, and that payment should be made from funds that could be used at the user's option, for other research expenditures. He also pointed out that large aerospace companies and other corporations have clearly demonstrated that such a system is necessary to achieve effective utilization. We were told by an official of the Lawrence Radiation Laboratory at Livermore, that its research projects are charged for the actual central facility computer time which they use. The University of California and Stanford University also operate central computer centers, and similarly charge users for actual use of their facilities.

Recommendation

We recommend that Ames implement a new user charge procedure which directly charges research projects at the job order level for computer time actually used. User charges should be based upon consistent hourly rates applied on a regular basis to actual computer time used.

We believe that the implementation of a direct user charge procedure would require little redesign to the existing accounting system, which already develops the amount of time used by each job order. We were told by an official of the Fiscal Division that adapting the present system to charge users' job orders and program funds would not be difficult.

More careful control of computer time could in the short run result in additional computer time for high priority in-house applications and for other agency users. In the long run, it could postpone both the saturation of the central computer facility and future system acquisitions.

NEED FOR STRONGER ENFORCEMENT OF PROCEDURAL CONTROLS

The procedural controls over the use of the two principal systems of the central computer facility have not been sufficient to prevent unapproved computer time usage. At one time last fiscal year, the estimated value of computer time used but not approved by management was about \$220,600.

The present controls over the use of the 360/67 and 7094/7040 direct coupled system (DCS) require that each proposed computer run submitted by a user be identified by a specific user account number. A computer program (CP) number and a job order (JO) number, together comprise what we refer to as an account number. To obtain a CP number a user must submit and have approved by the Computation Division a form describing the nature of the application. After a CP number is assigned, the amount of time necessary to process the application is requested on a form which shows, among other things, the approved CP number, JO number, and the amount of computer time requested (in minutes). This form must be approved by the user's superior.

Each time a job is run, the computer records the time used and deducts it from the time requested. The remaining balance is available for future jobs. The Computation Division, however, does not verify that approved time is available in each account before processing a user's job. Each day, the Computation Division verifies the CP and JO numbers which had time charges. This is done by verifying both numbers separately rather than as a combined account number--the basis upon which time is requested. As a result, users have had jobs processed under account numbers which (1) had no approved time, (2) had no approved time remaining, or (3) had insufficient approved time to fully process a job. The following table shows the balances at month end (in minutes and dollar value) of unapproved time for the last six months of fiscal year 1970:

<u>Date</u>	<u>DCS</u>		<u>360/67¹</u>		<u>Total Value</u>
	<u>Minutes</u>	<u>Value</u> ²	<u>Minutes</u>	<u>Value</u> ³	
January 31	43,400	\$137,600	14,300	\$69,100	\$206,700
February 28	45,400	143,900	13,800	66,700	210,600
March 31	48,100	152,500	14,100	68,100	220,600
April 30	51,300	162,600	10,600	51,200	213,800
May 31	18,500	58,600	7,200	34,800	93,400
June 30	20,400	64,700	8,600	41,500	106,200

¹Excludes unapproved time used in 360/67 timesharing software development.

²Based upon Ames' DCS interagency sharing rate of \$190 per hour.

³Based upon Ames' 360/67 interagency sharing rate of \$290 per hour.

This unapproved usage - the majority of which has been accumulating over four months or longer - was charged to about 200 accounts, or about 22 percent of all accounts. Of these, 13 percent had no approved time; while 9 percent had once had time approved, but none remained unused.

Although the time used was unapproved, it should be noted that this time is not necessarily unjustified. We did not attempt such an evaluation during our review. The important point is that management is not meeting its responsibility for controlling computer use. We recognize the difficulties of accurately estimating in advance the amount of computer time required by some scientific computer applications, and the desirability of not imposing unreasonable restrictions on the use of computers in a research environment. We believe, however, that improved control is warranted to prevent unapproved use and to promote efficient and productive use.

Recommendation

We recommend that the Computation Division implement procedures which verify that a user has approved time available before processing a job. If a user has no approved time remaining in his account, his job would not be processed until time is approved.

Computation Division officials told us that while the 360/67 can check time availability on a real-time basis (i.e. before-the-fact), this capability is not now being utilized. We were told that the DCS does not have this real-time capability; and therefore a manual procedure would be necessary. We believe that a manual review against those active accounts previously known to have insufficient or no approved time, would not involve a great deal of effort, since in June these accounts amounted to only about 60, or about seven percent of all accounts.

NEED FOR IMPROVED INSTRUCTIONS FOR REQUESTING COMPUTER TIME

The Computation Division's written instructions for requesting computer time are not adequate to ensure that the proper level of management approves the request.

In August 1968, the Computation Division issued written instructions to users for requesting computer time. These instructions specify levels of approval, depending upon the dollar value of time

requested. The instructions do not, however, specify the period of time which a request should cover. Therefore, a user is able to request time in small increments and avoid higher level approval requirements. For example, a user who estimates that his research project will require a total of 1,200 minutes of DCS time during one year would not have to obtain his Assistant Director's approval if he made twelve requests of 100 minutes each.

Varying practices are now being followed. One branch chief told us that his researchers ask for the entire amount of computer time estimated for a project in one request. On the other hand, a division manager told us that he thought researchers within his division request their time in small increments in order to bypass higher level approval requirements.

The instructions do not reflect current actual costs: they were issued in August 1968, prior to the replacement of a 360/50 by the 360/67, and have not been updated. Based upon the approval levels in the instructions, the rates now used in valuing computer time are \$83 per hour for the 360/50 and \$125 per hour for the DCS. The hourly rates charged by Ames to outside agency users, however, are \$290 per hour for the 360/67 and \$190 per hour for the DCS. Many users are using even different rates in valuing computer time requested, ranging from \$100 to \$500 per hour among the users we interviewed.

Recommendation

We recommend that the Computation Division prepare and issue new instructions to users at Ames concerning the approval for requesting computer time. The instructions should specify the period of time to be covered by the request and a proper rate for valuing computer time. In our opinion, these revisions are necessary to ensure that the proper level of management approval is obtained in a consistent and meaningful manner.

We wish to acknowledge the cooperation given our representatives during the review. We would appreciate your comments and advice of action to be taken on the above matters. A copy of this report is being forwarded to the Administrator, National Aeronautics and Space Administration.

Sincerely yours,

K. A. POLLOCK

For
A. M. Clavelli
Regional Manager

cc: Dir., CD
Dir., OPSS ✓
Asso. Dir., CD -
L. G. Smith