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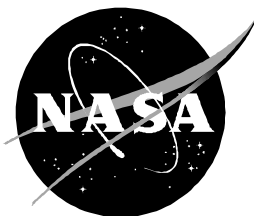
**AUDIT  
REPORT**

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**EARTH OBSERVING SYSTEM DATA AND  
INFORMATION SYSTEM (EOSDIS)  
FEDERATION PLAN**

**MAY 9, 1998**

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National Aeronautics and  
Space Administration

**OFFICE OF INSPECTOR GENERAL**

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## **ACRONYMS**

<b>CGCR</b>	Committee on Global Change Research
<b>DAAC</b>	Distributed Active Archive Center
<b>EDC</b>	Earth Resources Observation System Data Center
<b>EOS</b>	Earth Observing System
<b>EOSDIS</b>	Earth Observing System Data and Information System
<b>FY</b>	Fiscal Year
<b>NRC</b>	National Research Council
<b>USGCRP</b>	United States Global Change Research Program

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## BACKGROUND

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The Earth Observing System (EOS) Data and Information System (EOSDIS) will serve as the mechanism for generating, archiving, and distributing Earth Science Program data to a worldwide pool of planned users. A total of eight Distributed Active Archive Centers (DAACs), in various regions of the United States, will carry out this activity. NASA selected the DAACs during the 1991 to 1994 time frame based on their host institution's existing expertise in various scientific areas relating to the study of changes in a global environment. NASA has invested significant funds to build, outfit, and rent space for the DAACs. Currently, NASA funds the DAACs at a level of approximately \$25 million per year. Total planned funding for the DAACs from Fiscal Year's (FY) 1997 through 2002 is approximately \$243 million.

In July 1995, the National Research Council's (NRC) Committee on Global Change Research conducted a workshop to review the U.S. Global Change Research Program (USGCRP) and NASA's Earth Science/EOS programs. They conducted the workshop in response to (1) the longstanding commitment of the NRC to providing scientific guidance and periodic review of the USGCRP and its component programs and plans, and (2) requests from congressional leaders of both houses for a timely review of the USGCRP with an early specific focus on the Earth Science/EOS programs in the light of budgetary pressures.

The NRC concluded that the current EOSDIS performance

requirements were stressing the boundaries of affordability. Further, new capabilities in computer telecommunication and recent experience by the scientific community in the management of large and diverse data sets could permit a significant change in the conceptual model that governs the management and operation of the system.

The NRC formally recommended that NASA should: (1) retain but streamline the components of EOSDIS under development for flight control, data downlink, and initial processing, and (2) transfer to a federation of partners selected through a competitive process, the responsibility for product generation, publication, and user services.

In response to the NRC's recommendations, NASA issued a program plan on May 31, 1996, for a prototype EOSDIS federation. The program plan calls for NASA to streamline operations and develop a pilot program to compete the product generation, publication, and user services functions of the DAACs. The pilot program will identify, demonstrate, and validate technical approaches that could be used to transition major EOSDIS functions to a federation of competitively-selected partners. The total estimated budget for the pilot federation program is approximately \$93.6 million from FY 1997 through FY 2002.

# OBJECTIVES, SCOPE, AND METHODOLOGY

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## *OBJECTIVES*

The overall audit objective is to determine if the NASA planned pilot program for the EOSDIS federation will benefit the Earth Science/EOS programs. Specific objectives are to determine:

- (1) If NASA HQ has adequate justification for conducting a pilot program.
- (2) If the EOS budget can support the cost of the pilot program.
- (3) What effect the federation pilot program will have on DAAC operations.

## *SCOPE AND METHODOLOGY*

This is one of three audits performed to assess various scientific aspects of the Earth Science/EOS programs. We performed this audit because the federation concept represents a significant change in the Earth Science/EOS programs. Besides being a potentially significant change, the federation pilot program will be implemented at a significant cost to NASA during a time when the overall Earth Science/EOS program's budget has been reduced by more than 50 percent, and a significant amount of NASA funds have already been expended on the existing DAACs.

The scope of the audit included reviewing the NRC report "Review of the U.S. Global Change Research Program and NASA's Mission to Planet Earth/Earth Observing System" dated September 1995, and a subsequent NRC report dated July 3, 1996, on the "Results of March

1996 Committee on Global Change Research Meeting.” In addition, we reviewed budget and procurement documents concerning the pilot program. We also interviewed personnel from (1) NASA Headquarters and the Goddard Space Flight Center (GSFC), and (2) DAACs at GSFC, the Langley Research Center (LaRC), and the U.S. Department of Interior’s Earth Resources Observation System Data Center (EDC).

***AUDIT FIELD WORK***

We conducted audit field work from February through December 1997 at NASA Headquarters, the GSFC, the University of Wisconsin, and at the EDC, GSFC, and LaRC DAACs. We performed the audit in accordance with generally accepted government auditing standards.



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## OBSERVATION AND RECOMMENDATIONS

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***OVERALL EVALUATION*** NASA conducted the pilot program in response to recommendations made by the NRC's Committee on Global Change Research. Further, the EOS budget can support the projected cost of the pilot program. The pilot program has not affected current operations since NASA is running it concurrently with the DAACs, and they have transferred none of the DAACs responsibilities. The audit did identify that NASA has not demonstrated that a federated EOSDIS will enhance the Earth Science/EOS programs, or that the benefits outweigh the costs. Management needs to ensure that all costs and benefits are considered, and that they establish a plan for evaluating the pilot program's success or failure, before proceeding with a federated EOSDIS.

***A COST/BENEFIT ANALYSIS WAS NOT DONE TO SUPPORT THE DECISION TO IMPLEMENT A FEDERATED EOSDIS*** NASA's decision to implement a federated EOSDIS was made without performing a cost/benefit analysis. In addition, there are no definitive criteria or time frames to evaluate the pilot program's success or failure. This condition occurred because NASA implemented the NRC's recommendations concerning a federated EOSDIS without the benefit of a study or analysis of the decision's impact. As a result, NASA may spend approximately \$93.6 million (through FY 2002) for a pilot program to demonstrate a federated EOSDIS that may not be in the best interest of NASA, or the customers of the Earth Science/EOS programs.

***NRC RECOMMENDS  
THAT NASA MOVE TO A  
FEDERATED EOSDIS***

The NRC recommended in July 1995 that NASA transfer the EOSDIS responsibility for data product generation, publication, and user services to a federation of partners selected through a competitive process. In September 1995, NASA assembled a task team to address the NRC's recommendations. The team's initial plan called for recompetition of the DAAC functions concerning the 221 EOS Standard Data Products. In March 1996, the NRC recommended that NASA maintain a strong commitment to the idea of a federated EOSDIS, but utilize a more deliberate approach by using a limited set of pilot or prototype federated projects.

***NASA PROGRAM PLAN  
IMPLEMENTS NRC  
RECOMMENDATIONS***

On May 31, 1996, the former NASA Associate Administrator for Mission to Planet Earth (now the Office of Earth Science), in addressing the NRC's March 1996 recommendation, approved a document entitled "Program Plan in Response to NRC Recommendations with Respect to the EOSDIS." Concerning the decision to implement a federated EOSDIS, the plan contains the following statement:

*"NASA will shift its implementation of EOSDIS production, publishing, and user services to a federation of competitively selected Earth Science Information Partners (ESIP's). This shift will be done in a manner intended to provide high probability of success while controlling the costs of EOSDIS. There will be continuous efforts to bring these costs down while meeting the needs of the Earth Science program. Implementation of this shift will be divided into two sequential phases---working prototype and mature operations; the working prototype phase is to begin with the*

*acceptance of this plan.”*

The program plan allows for the existing DAACs to compete for services under the pilot program. In addition, the plan states that the pilot program will run in parallel with current DAAC operations to determine if a federated EOSDIS is viable. However, the plan contains no definitive criteria or time frames for evaluating the pilot program’s success or failure. NASA officials informed us that a project plan for the federation experiment will be completed in April 1998. The plan will define criteria necessary to provide a sound basis for decisions on how NASA will structure a federation.

***NASA DID NOT  
PERFORM  
COST/BENEFIT  
ANALYSIS***

As stated in NASA’s program plan, the initial decision in September 1995 to proceed with a federated EOSDIS and the subsequent decision to prototype federation projects are based on the assumption that these actions will control or bring down the cost of EOSDIS, while meeting the needs of the Earth Science program. Although the decisions to proceed with a federated EOSDIS and prototype are based on reduced costs, NASA did not perform a cost/benefit analysis supporting these decisions. NASA task team members did attempt to perform a cost/benefit analysis. However, they were not successful because they did not know what form the federation would take or the benefits that NASA would derive.

NASA program personnel interviewed informed us that although they did not believe that there were cost benefits, the NRC’s recommendations concerning a federated EOSDIS were to be followed. This direction is further evidenced in correspondence dated September 19, 1995, from the head of NASA’s task team on

implementing the NRC's recommendations. In this correspondence, the head of the task team states:

*“The questions are how and when, not whether. NASA must shift to a federated approach to EOSDIS.”*

Responses to the task teams request for comments on the NRC report and NASA's program plan also questioned the costs and benefits of a federated EOSDIS. One respondent stated that:

*“NASA seems to have embraced the NRC review's recommendations at face value. I see no attempt to assess the risks or costs of the new approach by performing at least some in-depth analyses or developing a pilot study. NASA's response seems to be driven more by an eagerness to please any critic during difficult budgetary times than by a desire to do things in the best possible way.”*

***A COST/BENEFIT  
ANALYSIS SHOULD  
SUPPORT KEY AGENCY  
DECISIONS***

NASA has recently issued a policy for performing cost/benefit analyses as part of the process for making major decisions. Specifically, in a memorandum dated March 13, 1997, to all NASA Headquarters Offices and Field Installations, the Acting Deputy Administrator stated that decisions must be based on the best information available. The memorandum specifically stated that:

*“A key element in our decision making must be independent, up-front cost/benefit analyses. These analyses should represent a thorough review of the requirement, identifying the costs and benefits of major decisions. These analyses are*

*particularly important where there is a potential impact on safety, where there are high anticipated costs or benefits, and where NASA has indications that the decision has a high level of external interest.”*

This policy was not in effect at the time of the NRC’s recommendations or when NASA finalized the program plan.

***FEDERATION MAY NOT  
BE IN NASA’S BEST  
INTEREST***

Because NASA did not perform a cost/benefits analysis before deciding to implement the NRC recommendations, NASA may have taken actions regarding the federation that are neither cost effective nor in the best interest of NASA. Funding budgeted for the pilot federation program from FY 1997 through FY 2002 is \$93.6 million. With such a significant amount of funds involved, NASA should ensure that any final decision made is adequately supported and in the agency’s best interest. NASA can do this by performing a cost/benefit analysis before they make a final decision concerning a federated EOSDIS.

***SUMMARY***

NASA implemented the NRC’s recommendations concerning a federated EOSDIS without performing a cost/benefit analysis. In addition, the NASA program plan contains neither criteria nor definitive time frames to measure the success or failure of the pilot federation program. Such analysis, criteria, and time frames are necessary to provide a sound basis to decide whether to fully implement the federation upon completion of the pilot program.

***RECOMMENDATION 1***

The Office of Earth Science should immediately establish a plan to

evaluate the pilot federation program's success or failure before proceeding with a federated EOSDIS. The plan should define specific criteria and definitive time frames for the evaluations.

***RECOMMENDATION 2***

The Office of Earth Science should perform a cost/benefit analysis before making any final decision to proceed with a federated EOSDIS. Any decision made should be fully supportable and in the best interests of the government.

***Management Response to Recommendations 1 and 2***

Concur. The Earth Science Enterprise has always intended to produce a plan to evaluate the federation experiment pilot program's success or failure before proceeding with a federated EOSDIS. This plan will be completed in spring 1998 in order to include input from a National Research Council (NRC) Federation Workshop and from the pilot projects themselves. We will also perform a cost/benefit analysis at the appropriate time. That analysis will occur after the pilot phase of the federation experiment has generated data that allows us to assess the costs and benefits of this alternate way of providing Earth Science data and information system and services.

***Evaluation of Management's Response***

The actions planned by Management are considered responsive to the intent of the recommendations. Management's plan to evaluate the pilot program's success or failure and perform a cost/benefit analysis will ensure that any decision to proceed with a federated EOSDIS is in the best interest of the government.

We would like to provide the following comments with respect to Management's comments that several inaccuracies still exist in the report. Specifically, the response states that "the OIG retained other

language that implies that the Office of Earth Science has decided to implement a federated EOSDIS, thus creating contradiction within the narrative and causing a disconnect with the recommendations.” In our opinion, there is no contradiction in the report concerning the agency’s intention to implement a federated EOSDIS. The current pilot program resulted only after the NRC recommended in March 1996 that NASA maintain a strong commitment to the idea of a federated EOSDIS, but utilize a more deliberate approach. However, our audit showed that both prior and subsequent to the March 1996 NRC recommendation, there was clear indication that NASA intended to implement a federated EOSDIS. This is clearly evidenced by not only interviews with program personnel, but also various correspondence and program plans.

The response also states that the anonymous quote of one individual’s opinion is not evidential in nature and should be stricken from the report. We took this quote directly from a response to the NASA task team’s request for comments to the NRC recommendations and the program plan. The respondent’s opinion directly supports our position that NASA could implement a federated EOSDIS without the benefit of performing a cost/benefit analysis.

Finally, the report states that the OIG cost figures in the report need to be corrected. Specifically, that the budgeted costs for the federation experiment alone are approximately \$4.1 million for FYs 1997 through 2002. Further, NASA is conducting and evaluating the federation experiment using pilot projects at an additional cost of \$55.4 million. NASA’s position is that these pilot projects provide desired innovative science and applications data products regardless



of the outcome of the federation experiment. It is our position that the report accurately depicts the budgeted cost of \$93.6 million for the pilot federation program from FY 1997 through 2002. NASA personnel provided this amount during the audit and it is documented in the February 3, 1997, "EOSDIS Federation Summary." This summary indicates that the total cost of federation implementation was \$93.6 million composed of \$86.8 million for Earth Science Implementation activities and \$6.8 million for NRC workshops and meetings.

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## **MAJOR CONTRIBUTORS TO THIS AUDIT**

---

Daniel J. Samoviski      Program Director, Earth/Space Science Programs

Kevin J. Carson          Director, Audit Quality

Kenneth C. Wood        Auditor-in-Charge, Goddard Space Flight Center

Diane Choma             Auditor, Goddard Space Flight Center

Sandra Laccheo         Auditor, Langley Research Center

Iris Purcarey            Program Assistant, Goddard Space Flight Center