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EOSDIS PROTOTYPING

Executive Summary
Final Report

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Submitted by

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1.0 Introduction

A crucial component of the Earth Observing System (EOS) is its Data and Information System (EOSDIS). The success of EOS depends not only on its instruments and science investigations but also on its ability to help scientists integrate data sets of geophysical and biological measurements taken by various instruments and investigators.

NASA contractors have completed Phase B studies of EOSDIS, in particular its architecture, functionality and user interfacing. The recommendations of these studies have been evaluated by the EOS project and a final design is being specified. Throughout this process there have been various efforts to clearly describe how scientists do research, how they define their data needs, where they expect to find those data, how they locate the data, how they order it and what they do with it once they have it. Much of this information has been obtained by questionnaires and interviews and, to a lesser extent, hands-on prototyping.

At this point in time it may seem impossible to exercise the EOSDIS or any of its components since they do not exist - i.e., if we accept the EOSDIS as a totally new system, distinct from any existing DIS. However, if EOSDIS is seen as evolving from existing data systems, then we can conduct some limited prototyping studies by using currently functioning systems as we have done here with the National Space Science Data Center (NSSDC).

IF EOSDIS is to become something more than what currently exists then it will need to follow through on its commitment to provide usable scientific information to the geophysical, biogeochemical, ecological and interdisciplinary communities. These scientific products must be usable by investigators in any discipline without requiring detailed knowledge of the sensor or of electromagnetic interaction with the earth's surface or atmosphere.

We recognize that the interdisciplinary geophysical research scientist represents a user most likely to exercise EOSDIS in a fashion quite distinct from a single discipline scientist or instrument scientist. In support of both the EOSDIS Science Advisory Panel and the EOSDIS Project a prototyping activity has been carried out by a cross-section of interdisciplinary scientists from the University of Virginia, NASA/Langley Research Center and Simpson Weather Associates and coordinated by NASA/Goddard Space Flight Center. In this executive summary we wish to summarize the prototyping activity and to draw some conclusions that can be used by NASA/GSFC to evaluate and modify the specifications soon to be released in an RFP to build EOSDIS.

2.0 Review of Study Plan

Several steps were identified as necessary to accomplish our main objective which was to provide timely input to the process of defining the specifications for final design and construction of EOSDIS. These steps are expressed as six tasks which have been carried out over the last seven months.

TASK 1 - Research Scenario Construction (untutored)

Each participating scientist provided detailed answers to a series of questions generated by the study management. The questions were designed to characterize the way each researcher currently plans for his data needs and obtains those data. No prompting from the study management was offered during the execution of Task 1 to insure that the experience levels and individual jargons were properly reflected in the responses.

TASK 2 - Data System Scenarios

Each of the first drafts of the research scenarios were then translated into data system interface and use scenarios by the study team members at SWA, LaRC and GSFC. Special attention was paid to the manner and jargon used by the scientists in describing their data needs. The system scenarios included the identification of key data search issues not addressed by the researchers.

TASK 3 - Workshop for Prototyping Participants

A two day workshop was held at NSSDC to demonstrate and exercise the NASA Climate Data System (NCDS) protocols and uses. Each researcher was directed to the DIS(s) that was most appropriate for their research project as defined by their research scenarios. The workshop goals were: (1) to have a tutored "hands-on" session with an interactive DIS and (2) to further learn from the researchers how they conduct or wish to conduct interdisciplinary data based research.

TASK 4 - Revise Research Scenarios (tutored)

After the workshop, the study team sat down with each researcher and reviewed the draft research scenarios for data acquisition and helped construct "executable" scenarios given the available resources.

TASK 5 - Scenario Execution

Each researcher attempted to carry out the research data scenario to the extent possible within his/her budget constraints. The experience of each researcher was monitored and recorded by the study team (SWA personnel).

TASK 6 - EOSDIS Requirement Recommendations

The study team has taken the results of the scenarios contruction and execution and has summarized them for NSSDC who will now cross reference them with the current Level I, II and III EOSDIS requirements.

3.0 Scenario Execution Summary

A final review of the 15 prototyping activities was presented in the December 1990 report. A list of the researchers and their topics is provided in Table 1. Every researcher was able to get access to the NCDS itself and several were also able to gain access to other information systems through the NCDS. As each investigator conducted his/her research, they kept a record of the problems and successes related to eight aspects of the prototyping activity (Table 2). When the project was completed (November 1990), each researcher was asked to summarize his experience by scoring each of the eight criteria on a scale of 0-3 (0 = Total failure; 3 = No difficulty). A tabulation of the scoring is given in Table 2. The following discussion of each criteria and the related prototyping experience are meant to serve as conclusions and recommendations for input to the final set of EOSDIS specifications.

HARDWARE COMPATIBILITY - How compatible was the user's hardware with the computer data system? This includes communications, terminal emulation and graphics support.

The majority of the participants expressed great difficulty with logging into the EOSDIS computer surrogate system, especially in the earlier months of the exercise. The participants were using mainframes, PCs, MACs and Tektronix "dumb" terminals and SUN workstations to access the computer system. Several participants had to struggle 3 to 5 weeks to overcome simple log-in communication problems. Terminal emulation was also strongly criticized. The restraint of having to use VT100 emulation with the NCDS system was a problem for the University of Virginia's IBM computer network. The Tektronix terminals and emulators failed to erase graphic screens before displaying text. Several participants noted that not all keyboards were supported by the computer system. A terminal/keyboard template screen would have been helpful.

ON-LINE HELP - Help menus providing software assistance for the user.

One of the most common complaints made by the participants was that the on-line help only provided terse descriptions of possible commands, but failed to provide insight in how a user could easily move through the system to accomplish his/her goals. The help menus were desribed as inconsistent and confusing. Many users had to go to hardcopy documentation for assistance or had to call NCDS.

DATA EXISTING - The existence of the user's desired data described by computer system (Metadata).

Several groups stated that no data existed in the computer system for their scenarios. Others found that data existed but was not current. The temporal and spatial resolution of some existing data sets made the data useless to several of the scientists.

DATA FOUND - Finding the user's desired data in the computer system.

Once data was found to exist, most participants could locate the data using the computer system.

DATA AVAILABLE - Accessing the user's desired data from the computer system.

Several groups were able to find descriptions of desired data sets only to discover that the data was not made available through the computer system. Their only option was to contact the owner of the data.

DATA BROWZE - Capability to browze a data set.

Most of the participants had great difficulty trying to browze through data sets. The browzing of data by graphics proved to be slow and clumsy. Often the system would become overloaded and crash. Many participants had applications where quickly scanning through imagery would have been helpful. The majority of the users concluded that unless EOSDIS can provide quick and easy methods to browze image data, EOSDIS will fail its users.

DATA ORDER - Ordering the data.

Only a four participants ordered data using the computer system.

DATA CORRECT - Data ordered was what is expected.

Three participants obtained desired data sets using the computer system. The turnaround time was 3-4 months.

4.0 Recommendations

Based upon the efforts of more than 23 interdisciplinary scientists at the University of Virginia and Simpson Weather Associates, the following recommendations are made regarding the interdisciplinary demands on the EOSDIS design. These demands are not necessarily unique to the interdisciplinary scientists but have been highlighted by the prototyping effort.

- A broad range of user terminals must be supported by the EOSDIS interface;

- On-line help information must have several levels of detail which serve users of different computer experience;

- Access to non-EOSDIS data is critical to the successful integration of data from various data systems;

- To insure the economy of resources (time and money), a browze capability must be supported by EOSDIS which will allow the interdisciplinary user to recognize the suitability of a data set to his needs and to allow him to identify the spatial and temporal subset of data he wants to order.

TABLE 1

RSCH #	RESEARCH TOPIC	RESEARCHER(s)
1	Environmental hazard data base	Emmitt/Calvin
2	Coastal morphology	Dolan/ Trossbach
3	Cirrus climatologies	Emmitt/ Davenport
4	Volcanic eruptions	Furman/Goodell Ingersoll/ Davenport
5	Carbon monoxide transport	Garstang/Dowty
6	Satellite estimated rainfall	Garstang/Greco
7	Tracking oil spills	Goodell/Wei
8	Shrimp population dynamics	Hayden/Wood
9	Desert dust transport	Howard/Groves
10	Delmarva fox squirrel habitats	Porter/Dueser
11	Submerged coastal vegetation	Kelly/Durden
12	Pacific sea surface temperatures and east coast climate	Michaels/ Stenger/ Knappenberger
13	Leaf area index	Shugart/ Carlson
14	East African wildlife habitats	Shugart/Wallin
15	Tropical rainforest models	Shugart/ Weishampel

TABLE 2

EOSDIS Prototyping Activities Chart

	HRDWR CMPTY	ONLINE HELP	DATA EXTNG	DATA FOUND	DATA AVLB	DATA BRWZ	DATA ORDER	DATA CRRCT
RSCH 1	2	2	3	3	0			
RSCH 2	3	3	3	3	2	3	3	3
RSCH 3	3	1	3	3	2	1		
RSCH 4	1	2	2	1	1	1		
RSCH 5	1	2	3	0				
RSCH 6	1	2	3	3	2	2		
RSCH 7	2	1	0	2	0			
RSCH 8	2	1	1	2	1	1	1	
RSCH 9	3	2	1.5	2	1.5	1.5		
RSCH 10	3	3	2	2	2	1	2	3
RSCH 11	2	1	0					
RSCH 12	3	2	3	2	1	1	1	1
RSCH 13	1	1	1	0				
RSCH 14	2	2	0					
RSCH 15	2	2	2	2	1			
AVG RSP	2.07	1.80	1.80	2.00	1.23	1.19	1.75	2.33

0 = Total Failure
1 = High Degree of Difficulty
2 = Moderate Degree of Difficulty
3 = No Difficulty

NOTES:

HRDWR CMPTY - Hardware compatibility. This includes communications, terminal emulation and graphics support.

ONLINE HELP - Computer help menus and user assistance software.

DATA EXTNG - The existence of the user's desired data described by computer system. This includes the use of METADATA.

DATA FOUND - Finding the user's desired data in the computer system.

DATA AVLB - Accessing the user's desired data from the computer system.

DATA BRWZ - The capability to browze a data set. This includes data manipulation and graphical capabilities.

DATA ORDER - Ordering of the data.

DATA CRRT - The data ordered is what the user wanted.

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