SPAN: OCEAN SCIENCE

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I. INTRODUCTION

The Space Physics Analysis Network (SPAN) is a multi-mission, correlative data comparison network which links space and Earth science research and data analysis computers in the United States, Canada and Europe. It provides a common working environment for sharing computer resources, sharing computer peripherals, solving proprietary problems, and providing the potential for significant time and cost savings for correlative data analysis.

SPAN was designed in 1980 as a computer-to-computer communication system, became operational in 1981 with three nodes and has grown rapidly since that time. It was originally configured as a modified star with nearly all of the communications lines radiating from the Marshall Space Flight Center (MSFC). Since the beginning, technical direction and operational support have been provided by the Data System Users Working Group (DSUWG). In 1985, the National Space Science Data Center (NSSDC) became responsible for managing SPAN.

In order to increase performance and reliability and to support the rapid increase of remote nodes, SPAN was reconfigured in 1986 to take advantage of the Program Support Communication Network (PSCN). This new topology provides 56 Kb/s backbone circuits connecting four (4) Routing Centers (located at MSFC, GSFC, JPL and JSC) with the remote nodes connected to the Routing Centers as 9.6 Kb/s tail circuits, based on geographical location. The "mesh" configuration, which provides multiple paths to the nodes, has significantly increased the reliability of SPAN.

As indicated by the original name, SPAN initially linked space plasma physicists working on NASA programs. However, since that time, nodes have been added which support the planetary, astrophysics, atmospheric, land, climate and oceans communities.

This is one of a series of discipline-specific SPAN documents which are intended to complement the SPAN Primer and SPAN Management documents. Their purpose is to provide the discipline scientists with a comprehensive set of documents to assist in the use of SPAN for discipline specific scientific research.

II. OCEAN SCIENCE USE OF SPAN

In the coming years, a number of coordinated ocean experiments will take place to study global scale ocean processes. These studies include: the World Ocean Circulation Experiment (WOCE), the Tropical Ocean Global Atmosphere program (TOGA), and the Global Ocean Flux Study (GOFS). These projects are intimately tied to the flight of NASA's scatterometer instrument (NSCAT) and the joint NASA/CNES TOPEX/Poseidon altimeter mission. In order to insure the quick and timely dissemination of information around the world from these programs, an international computer network is required. The NASA Ocean Processes Branch and the NASA Ocean Data System have begun to develop such a network for satellite related ocean research with the addition of 17 ocean science nodes to SPAN.

The TOPEX/Poseidon altimeter Mission

Interactive requests for many satellite data sets have been already implemented or will be available by the time the satellite is launched. In some cases, interactive browsing of the data is or will be possible. Some examples are:

TOPEX/POSEIDON sea surface heights, winds and waves (expected launch: late 1991) and NASA SCATTEROMETER winds (expected launch: 1992). These data will be available from NODS (see below) for NASA- funded scientists, on a separate computer accessible through NODS for the project's science team, and from NOAA-NESDIS for other users.

DMSP SSM/I ice concentrations (expected launch: mid 1987) and GEOSAT sea surface heights, winds and waves (available March 1987) will be available from NODS for NASA-funded scientists. Other persons can obtain SSM/I from NOAA's NSIDC (see below) and GEOSAT from NOAA's NODC (see below).

NOAA-n AVHRR sea surface temperatures are generally available from NOAA NESDIS Satellite Data Services Division, but several other sites have large subsets of the data usually processed in a somewhat different way. These special AVHRR data subsets can frequently be requested from these other sites: U.of MIAMI - RSMAS (MIAMI::Bob = Dr. Robert Evans), U.of RHODE ISLAND (URI::GEORGE = George Milkowski), NODS, SCRIPPS Satellite Facility. The University of RHODE ISLAND is building a centralized inventory of these various data sets.

NIMBUS CZCS ocean color and chlorophyll pigment concentrations are generally available from NSSDC (National Space Science Data Center, NSSDC::), and special subsets are also available from other sites: NOAA/NESDIS Satellite Data Services Division,

Large-Scale Oceanographic Experiments

The World Ocean Circulation Experiment (WOCE), the Tropical Ocean Global Atmosphere (TOGA) program and the Global Ocean Flux Study (GOFS) have common general requirements for computer networking. Each has needs for program communication, coordination, data exchange, and computation that could be facilitated with networks. Though the three programs have common interests, their specific needs are different.

TOGA began in 1985. Since the program is well underway, computer network needs mainly will focus on new program components, particularly with the launch of satellites with altimeter and scatterometer. It has a large atmospheric component using globally collected datasets, with a system in place that will likely not rely on SPAN. However, many TOGA ocean data sets are not well coordinated, and SPAN may be important for locating, organizing, and exchanging moderate-sized oceanographic datasets.

WOCE field work should begin about 1990. The planning phase of WOCE is active now. SPAN will be used for communications, program coordination, computation, and exchange of datasets. Because the timing is right, SPAN will be used to set up a WOCE data management network that could serve as a model for other oceanographic programs.

GOFS is in the phase of early planning. The program planners have expressed an interest in developing a system for data management that is compatible with WOCE and TOGA. SPAN may likely be extensively used for purposes similar to those of WOCE.

To serve all three of these major programs, SPAN will have to have nodes at most of the oceanographic research institutions in addition to NODC and other archiving centers.

A considerable amount of data will come from foreign sources, either directly from participating oceanographers or from other national data centers. Overseas SPAN links, particularly to Western Europe, Australia, and Japan will be valuable. Early links will be established on SPAN with national data centers in the United Kingdom and Canada. These should serve as pilots for more extensive international data exchange that is expected to follow.
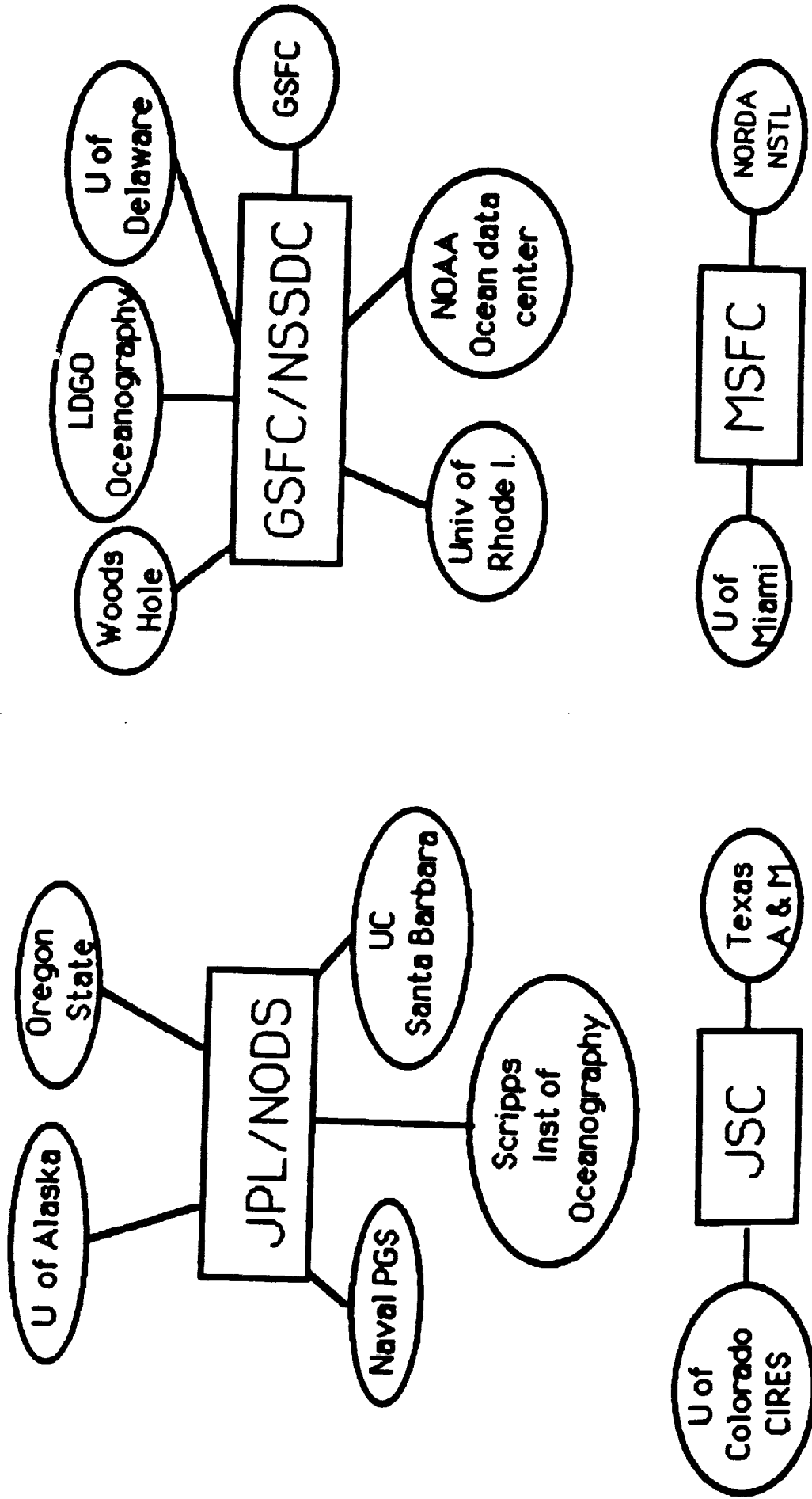
SPAN/OCEAN NETWORK

FIGURE 1

III. SPECIAL OCEAN SCIENCE SPAN NODES

Some of the ocean nodes are special because they provide access to resources that are available to other scientists. These nodes are listed below along with the resources that they offer.

National Space Science Data Center (NSSDC)

The National Space Science Data Center has the responsibility for the dissemination of data and catalogs to any individual or organization resident in the United States. For scientists who reside outside of the U.S., the data are provided through NSSDC's World Data Center A for Rockets and Satellites (WDC-A).

Requests for catalogs and data can be handled via SPAN in several ways. If the requestor knows exactly what he or she needs, then a mail message can be sent to the request account (NSSDCA:: REQUEST or NSSDC::REQUEST). Another way is by logging onto the NSSDC computer ($set host NSSDC and USERNAME NSSDC). Upon logging on, the requestor will be prompted for additional information. When the main menu appears, the requestor must select item 5 to request the data or information. This procedure will also generate a mail message to the request account.

Normally charges are waived for modest quantities of data and when they are requested by an individual affiliated with: NASA installations; NASA contractors or NASA grantees; other U.S. Government agencies, their contractors or grantees; universities and colleges; state and local Governments; and non- profit organizations. When immoderate requests are made, one may expect to be charged for reproduction and processing services, in which case a requestor will be notified in advance and payment must be received prior to processing.

The NSSDC will be archiving data from the Nimbus-7 Coastal Zone Color Scanner (CZCS), the first spacecraft instrument devoted to the measurement of ocean color. CZCS 's spectral bands, spatial resolution and dynamic range are optimized for geographical or meteorological use. Thus, each of its parameters is optimized for use over water to the exclusion of any other type of sensing. On-line data catalogs will be available for manipulation of these data and the actual data will be be available for ordering.

The NASA Climate Data System (NCDS), which provides a comprehensive data management and analysis capability that supports the climate scientists, archives ocean related climate data that are available to the oceans community. The NCDS is an interactive system with on-line information on availability of data sets, provides rapid output for desired

data set subsets and is easy and convenient to use. Its data manipulation features include statistical evaluation, subsetting of large volume data streams, merging of selected data sets and data independent storage structures. Its state-of-the-art graphics capability is comprised of high performance device-independent software that provides multiple two-dimensional and three-dimensional data representation and provides publication/presentation quality graphics products.

For more information on how to access the NCDS, send a mail message to the NCDS Project Manager, Mary G. Reph (NSSDCA::REPH) or Lola Olsen in the User Support Office (NSSCDA::NCDS).

NASA Ocean Data System (NODS)

The NASA Ocean Data System (NODS) is located at the Jet Propulsion Laboratory (JPL) in Pasadena, California. NODS archives and distributes data sets from spaceborne viewing sensors and supports in situ measurements. NODS provides: a catalog of data sets relevant to ocean science; abstracts of documents related to catalogued or archived data sets; data at various processing levels; browse files -- small data subsets designed for quick interactive browsing; the ability to display graphic or tabular data subsets at the user's terminal; the ability to transfer data subsets to the users, either electronically to the user's computer via SPAN or telenet, or shipped as hardcopies, tapes or optical disks.

Catalog, bibliography, data selection requests, and browse file displays are available interactively on SPAN. The Catalog and Bibliography portions are open to any non-commercial user; data browsing and delivery are only available to NASA-funded investigators. If you have an account on NODS, simply SET HOST STANS on SPAN, then log on as usual. If you need an account, either send SPAN MAIL to STANS::DATASPEC, call Ruby Lassanyi at 818-354-8032, or send a Telemail to

[V.Zlotnicki/OMNET] MAIL.

Because the next release of the NODS Catalog is partially distributed, it will be possible in early 1988 to learn about the holdings at U. Miami, U. of Rhode Island, NSIDC, Scripps-TOGA XBTs, U. of Delaware or NODS by logging on to any one of these sites.

NODS' current and planned holdings include: Seasat, Geos-3, Geosat, selected AVHRR and CZCS for the West Coast of the U.S., SSM/I ice concentrations, TOPEX and NSCAT. It is also possible that NODS may receive European ERS-1 altimetry

and wind data.

National Oceanographic Data Center (NODC)

The National Oceanographic Data Center (NODC) in
Washington, D.C. is the U.S. national facility established
to acquire, process, store, and disseminate global
oceanographic data. NODC operates as a component of the
National Environmental Satellite, Data, and Information
Service (NESDIS) of the National Oceanic and Atmospheric
Administration (NOAA), U.S. Department of Commerce.

NODC's master data files and other data holdings include
data collected by U.S. Federal agencies, including the
Department of Defense (primarily the U.S. Navy); State and
Local government agencies; universities and research
institutions; and private industry. NODC does not conduct any
data collection programs of its own; it serves solely as a
repository and dissemination facility for data collected by
others.

A large portion of the data held by NODC is of foreign
origin. NODC acquires foreign data through direct bilateral
exchanges with other countries and through the facilities of
World Data Center A (WDC-A) for Oceanography, which is
operated by NODC under the auspices of the U.S. National
Academy of Sciences.

Each year NODC responds to thousands of requests from
users in the United States and around the world. NODC data
support research and development in offshore engineering,
ocean resource development, marine environmental protection,
national defense, and theoretical oceanography. As a service
organization NODC welcomes inquiries from all potential users.

The NODC intends to provide two major services to the
ocean community through its SPAN link: a descriptive guide to
its data holdings and customer services; and a series of
catalogs and inventories of its major archives. The "NODC
User's Guide" will be presented in digital form in a volume
which will approximate 300 pages. This reference document
describes each of NODC's 15 major data bases and more than 30
secondary data bases; provides detailed digital formats;
provides summaries of global data distribution for each data
base; describes the products and services available from the
Data Center; and outlines methodologies to be used to request
data services. SPAN users will be provided a "browse"
capability with indices and keywords to read the guide. This
service is expected to be available by early autumn, 1987.

In the Spring of 1987, NODC will begin providing a series
of interactive data inventories of its major, in-situ data
bases. Included will be drifting buoys, bathythermographs,
hydrocast (Nansen) stations, C/STDs, and current meter

archives. Additionally, an inventory of GEOSAT Geophysical Data Records (GDR) held by the Center will be provided. A less detailed catalog of each dataset, based on NASA Ocean Data System GOLD Catalog software, will also be available. Provision of the complete set of inventories will require two years to complete, however GEOSAT and drifting buoy information should be available in FY87.

In concert with other members of the ocean network, the Data Center will also test the feasibility of broadcast and receipt of small ocean datasets through SPAN. Periodic point-to-point transmission of data submissions to the NODC and data requests from the NODC will be attempted through a series of bilateral data management projects.

National Center for Atmospheric Research (NCAR)

The National Center for Atmospheric Research (NCAR) in Boulder, Colorado is operated by the University Corporation for Atmospheric Research under the sponsorship of the National Science Foundation. The Scientific Computing Division at NCAR is involved in providing facilities through national wide area networks in a distributed computing environment which are not available at the user's local facilities. NCAR has or will shortly have access to several networks that are of interest to the oceanography community. NCAR is on the NSF backbone. There is a 56 kbs link to MFEnet and a CSnet/PHONEnet connection operational now. The ARPAnet connection is scheduled to be operational in the second quarter of FY87 at 56 kbs. A connection to BITnet is currently planned for FY87.

A Cray X-MP/48 supercomputer is ready for use at NCAR. Twenty percent of the CRAY has been allocated to ocean science. A gateway to the NCAR network that would allow access to these machines and the networks described above has been proposed.

NCAR users are in the United States, Canada and Europe. The Center is available with operator supervision on a 24 hour-a-day, 365 days-a-year schedule. Use of the Cray X-MP/48 also includes useage of the mass storage system and microfilm facility (microfiche, 16mm, and 35mm film).

National Snow and Ice Data Center (NSIDC)

The National Snow and Ice Data Center (NSIDC) in Boulder, Colorado is the United States national facility established to acquire, process, store, and disseminate global snow and ice data. NSIDC operates as a component of the National Environmental Satellite, Data, and Information Service (NESDIS) of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce.

NSIDC includes the World Data Center (WDC-A) for glaciology (snow and ice). It is one of three international data centers serving the discipline. The major purpose of these centers is to facilitate the international exchange of data on all forms of snow and ice. WDC-A also serves as a national retrieval center for all materials relating to snow and ice research. The topics include: avalanche research, freshwater ice, glacier fluctuations, glacier mass balance, ground ice(permafrost), paleoglaciology, polar ice sheets, sea ice, and seasonal snow cover.

WDC-A serves as an archive for both published and unpublished data on snow and ice. It has an automated system for the storage and retrieval of bibliographic data and can provide copies of research papers and data on request, either on an exchange or cost-reimbursable basis.

NSIDC will be operating a Cryospheric Data Management System (CDMS) in 1987. This system will be the primary distribution point for snow and ice products derived from the Special Sensor Microwave Imager (SSM/I) data to be collected by a Defense Meteorological Satellite Program (DMSP) satellite.

The CDMS will operate as a node of the JPL-NODS system and, as such, will mirror the capabilities of the NODS system. CDMS like NODS will provide: a catalog of data sets relevant to ocean science; abstracts of documents relevant to catalogued or archived CDMS data sets; data at processing levels 0, 1, 2 (swath oriented), 3 and 4 (gridded); browse files -- small data subsets designed for quick interactive browsing; the ability to display graphic or tabular data subsets at the user's computer via SPAN or TELENET or shipped as hardcopies, tapes or optical disks. Catalog, bibliography, data selection requests, and browse file displays will all be available interactively on SPAN.

Users will be able to log onto the CDMS via SPAN, commercial telephone, and TELENET (via SPAN) communication systems. Inquiries about the CDMS and requests for login accounts should be addressed to the NSIDC-CDMS system manager, Mr. Vince Triosi at the following address:

> National Snow and Ice Data Center
> CIRES, Campus Box 449
> University of Colorado
> Boulder, Colorado 80309
>
> SPAN   KRYOS::VINCE
> E-MAIL (Omnet Science.Net) V.Troisi
> Telephone (303) 492-1827

University of Delaware, WOCE/TOGA Data Management Unit

In support of the WOCE and TOGA programs, the University of Delaware, College of Marine Studies is setting up a data management unit to support the use of networks, including SPAN. As a first step, a simple directory to the OCEAN SPAN net has been created, and can be read by entering:

```
        $TYPE DELOCN::OCEAN.LIS
    or
        $TYPE 6289::OCEAN.LIS
```

A simple primer to guide oceanographers in using the SPAN net is being developed and will be mounted in an accessible way at this node.

LIST OF ACRONYMS

AVHRR	- Advanced Very High Resolution Radiometer
BITNET	- Because Its Time Network
CSNET	- Computer Science Network
CZCS	- Coastal Zone Color Scanner
DMSP	- Defense Meteorological Satellite Program
DSUWG	- Data System Users Working Group
GDR	- Geophysical Data Records
GEOS	- Geostationary Operational Environmental Satellite
GSFC	- Goddard Space Flight Center
JPL	- Jet Propulsion Laboratory
JSC	- Johnson Space Center
kbps	- Kilobit per second
MB	- Mega Bytes
MFENET	- Defense data network
MSFC	- Marshall Space Flight Center
NCAR	- National Center for Atmospheric Research
NCDS	- NASA Climate Data System
NESDIS	- National Environmental Satellite, Data, and Information System
NODC	- National Oceanographic Data Center
NSCAT	- NASA Scatterometer Instrument
NSIDC	- National Snow and Ice Data Cente
NSSDC	- National Space Science Data Center (at GSFC)
SPAN	- Space Physics Analysis Network
TOPEX	- The Ocean Topography Experiment
WDCA	- World Data Center A
WOCE	- World Ocean Circulation Experiment

REFERENCES

1. Green, J. L, D. J. Peters, N. Van der Heijden, and B. Lopez-Swafford, Management of the Space Physics Analysis Network (SPAN), Second Edition, NSSDC Technical Report, January 1987a.

2. Green, J. L., V. L. Thomas, B. Lopez-Swafford, and L. Z. Porter, Introduction to the Space Physics Analysis Network (SPAN), NSSDC Technical Report, January 1987b.

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