1994

NASA/ASEE SUMMER FACULTY FELLOWSHIP PROGRAM

MARSHALL SPACE FLIGHT CENTER
THE UNIVERSITY OF ALABAMA

A REPORT OF WORK ACTIVITIES ON THE NASA SPACELINK PUBLIC ELECTRONIC LIBRARY

Prepared By: Willard A. Smith

Academic Rank: Associate Professor

Institution and Department: Tennessee State University
Department of Physics,
Mathematics and Computer Science

NASA/MSFC

Division: Public Affairs Office
Branch: Education

MSFC Colleague: Bill Anderson

INTRODUCTION

NASA Spacelink is a comprehensive electronic data base of NASA and other source Educational and Informational Materials. This service originates at Marshall Space Flight Center (MSFC) in Huntsville, Alabama. This is and educational service of NASA Headquarters, through the MSFC Education Office, that first began in February of 1988. The usage of this public-access network grew from less than three thousand callers per year in 1989, to over three thousand callers per month in 1993.(1) During the concurrence of the twenty-fifth anniversary of the Apollo Moon Mission, the flight of STS-65, and the crash of P-Shoemaker-Levy 9 into Jupiter the old system answered fourteen hundred plus calls per day and denied two to three times more callers.(2)

NASA Spacelink provides a wide variety of information including: NASA News, History, Projects, the Astronauts, the Space Agency and it's Centers, Space Vehicles, Educational Materials for teachers of K-12 and beyond, and Aeronautics. The materials on NASA Spacelink include not only text, but, maps, drawings, photos, and other computer produced graphic representations of data and visual materials.

The new NASA Spacelink Public Electronic Library was the result of a study conducted to investigate an upgrade or redesign of the original NASA Spacelink.(3) The need for new user interfaces and access methods resulted in a radical departure form the old system on the Data General hardware, using the customized adaptations of Data General's Operating System and Applications Software that made the original Spacelink operational.

The UNIX Operating System was chosen to be the host operating system for the new NASA Spacelink Public Electronic Library. The UNIX system was selected for this project because of the strengths built into the embedded communication system and for its simple and direct file handling capabilities.

The host hardware of the new system, is a Sun Microsystems SPARCserver 1000 computer system. The configuration has four 50-MHz SuperSPARC processors with 128 megabytes of shared memory;

three SB800 serial ports allowing 24 cable links for phone communications; 4.1 giga bytes of on line dick storage; and ten (10) CD-ROM drives. Communications devices on the system are sufficient to support the expected number of users through the Internet, the local dial services, long distance dial services; the MSFC PABX, and the NPSS (NASA Packet Switching System) and 1-800 access service for the registered teachers.

UNIX AS A UNIQUE APPLICATION

The application of the UNIX Operating System in the manner done on the NASA Spacelink project seemed to be unique. A search of the literature and contact with other users indicated that the use of UNIX as the Data Base manager, with support for such a divers group of user protocols, and across so many different access mediums was a new application of the UNIX Operating System.

The unique features of the NASA Spacelink system are most evident in the software configuration. The foundation of the system is Solaris 2.3 with SunOS 5.3, Open Network Computing (ONC), Open Windows, and the Desk Set.(4) This is Sun Microsystems Version of the Standard UNIX SVR4 with some Sun enhancements. The Operating system through it's built in features and linked with World Wide Web (WWW), Gopher, File Transfer Protocol (FTP), and Bulletin Board Software (BBS) servers are handling all of the communications and the data base management tasks. No other data base management software is running on the system. The UNIX Operating System Software, SunOS Solaris 2.3, is running as it came from the supplier.

The client server software packages, running on NASA Spacelink, were selected from the public domain software whenever possible. The exception was the ZMAX XChange Bulletin Board Software. The selection of public domain software kept down the cost to NASA and to the users. World Wide Web (WWW) through Internet supports the MOSAIC Protocol. MOSAIC is a public domain software package. Developed at The University of Illinois it has many powerful features in its text and graphic handlers. Gopher is a public domain software package developed originally at the University of Minnesota. It, like MOSAIC, is free to the user and accesses NASA Spacelink through the Internet. Gopher supports text and graphics file transfer and viewing. File Transfer Protocol (FTP)

is also a free access software package and a part of UNIX. FTP supports text and graphics with the assist of graphic viewing software on the receiving client computer.

The ZMAX XChange Bulletin Board Software was selected for the diverse features it supports. Many of the teachers using NASA Spacelink do not have access to the Internet. The Bulletin Board Software specifications for the system required this plus broad services for the schools. ZMAX XChange met those requirements. There was no public domain software package that met the specifications of the new system. This BBS allows for dial in access and support of any computer that can emulate a VT100 Terminal.

FILE DESIGN

The file structure for Spacelink, adapted by the NASA development team, uses the standard structure of UNIX files.(5) This required the development of logical names for the files to be placed in the UNIX File Structure. A set of Naming Conventions were developed to implement file names in UNIX that could be commonly shared by all the user interfaces of the system.(6) This allowed for the most direct transfer of many of the files in the "Old Spacelink" data base to the New Spacelink. The only change in many of the transfers was the change of the old file name to the the new file structrue. This allowed for the transfer of some 5000 plus documents in a short period of time with no direct name mapping.

A sample of the file structure and naming comventions are found in Figure 1. This is an abridged section of the NASA Spacelink Public Electronic Library. The figure illistrates the basic structure and the depth of the files under the directories.

The use of the UNIX file structure allows additional files to be added as NASA Spacelink grows. This continual growth requires the addition of several files per day. The use of the directory, to sub directory, to sub directory, and so on, provided for a heirachy of logically organized files. With this simple inverted tree paradigm come effective, efficient access for all to NASA Spacelink.

Figure 1 below is also an illustration of the file structure of the section of Educational Services and Instructional Materials.

```
Instructional.Materials
  "  Careers
  "     "  Careers.in.Aerospace
  "     "     "  Astronaut
  "     "  Civil.Service.Requirements
  "     "  Specialties.of.Aerospace.Technology
  "  Curriculum.Materials
  "     "  Art
  "     "  Geography
  "     "  History
  "     "  Language.Arts
  "     "  Mathematics
  "     "  Sciences
  "     "     "  Astronomy
  "     "     "     "  Astronomical.Keydates
  "     "     "     "  Comet.Shoemaker-Levy9
  "     "     "     "     "  Comet.Fact.Sheets
  "     "     "     "     "  Images
  "     "     "     "  Small.Bodies
  "     "     "     "  Space.Astronomy.Update
  "     "     "     "  The.Earths.Moon
  "     "     "     "  The.Night.Sky
  "     "     "     "     "  Sky.Charts
  "     "     "  Biology
  "     "     "  Chemistry
  "     "     "  Environmental.Science
  "     "     "  General.Science
  "     "     "  Geology
  "     "     "  Microgravity
  "     "     "  Physical.Science
  "     "     "  Physics
  "     "  Technology
  "  Interdisciplinary.Materials
  "  Software
```

Figure 1.
Abridged Section of the NASA Spacelink Public Electronic Library

This key section of the NASA Spacelink format came from intensive interaction with teachers. One of the primary goals of this project was to make the materials on Spacelink as accessible as possible to the classroom teachers. This section of NASA Spacelink was reviewed by several groups of teachers. Figure 2 below illustrates the earliest view of this section and shows the impact the teachers had on the final design of this area of the Spacelink Directory.

```
"  Instructional.Materials
"     "  .readme
"     "  Aerospace.Careers
"     "  Curriculum
"     "     "  Historical
"     "     "  Life.Sciences
"     "     "  Mathematics
"     "     "  Physical.Sciences
"     "     "  Technology
"     "  Software
"     "     "  Apple.II
"     "     "  IBM.PC
"     "     "  Macintosh
```

Figure 2
Original Section on Instructional Materials

There is considerable work yet to be done on the new NASA Spacelink. Several sections will be enhanced over the coming months and years. The work done by the development team on the NASA Spacelink Public Electronic Library should serve NASA well into the future as an effective server on the Information Super Highway.

REFERENCES

1. Spacelink Monthly Report, *Internal Documents,* NASA, MSFC, Alabama, Jan. 1994.

2. Spacelink.Monthly.Report. *InternalDocuments,* NASA, MSFC, Alabama, July 1994.

3. Cunningham, Alan, Engineering Study for "Replacement of Existing NASA Spacelink" Requirement 97748, NASA/MSFC *Internal Documents,* July 1993.

4. Helsop, Brent and Angell, David; Mastering Solaris 2, San Francisco, California, Sybex, 1993

5. Cobb, Jeff; Cunningham, Alan; Wild, Flint; NASA Spacelink Public Electronic Library, *Internal Documents,* NASA, MSFC, Huntsville, Alabama, May, 1994.

6. Smith, Willard A. et.al., *Internal Documents,* NASA, MSFC, Huntsville, Alabama, May, 1994.