

SPACELAB, SPACEHAB, AND SPACE STATION FREEDOM  
PAYLOAD INTERFACE PROJECTS

Final Report

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## ABSTRACT

Contributions were made to several projects. Howard Nguyen was assisted in developing the Space Station RPS (Rack Power Supply). The RPS is a computer controlled power supply that helps test equipment used for experiments before the equipment is installed on Space Station Freedom.

Ron Bennett of General Electric Government Services was assisted in the design and analysis of the Standard Interface Rack Controller hardware and software. An analysis was made of the GPIB (General Purpose Interface Bus), looking for any potential problems while transmitting data across the bus, such as the interaction of the bus controller with a data talker and its listeners. An analysis was made of GPIB bus communications in general, including any negative impact the bus may have on transmitting data back to Earth.

A study was made of transmitting digital data back to Earth over a video channel. A report was written about the study and a revised version of the report will be submitted for publication. Work was started on the design of a PC/AT compatible circuit board that will combine digital data with a video signal. Another PC/AT compatible circuit board is being designed to recover the digital data from the video signal. A proposal was submitted to support the continued development of the interface boards after the author returns to Memphis State University in the fall.

A study was also made of storing circuit board design software and data on the hard disk server of a LAN (Local Area Network) that connects several IBM style PCs. A report was written that makes several recommendations.

An preliminary design review was started of the AIVS (Automatic Interface Verification System). The summer was over before any significant contribution could be made to this project.

## INTRODUCTION

Contributions were made to several projects as part of the NASA/ASEE Summer Faculty Fellowship Program. Most of the summer was spent on the design of computer interface boards that will permit digital data to be transmitted over a video channel. However, contributions were also made to the SSRPS (Space Station Rack Power System) and the SIRC (Standard Interface Rack Controller). A study was made of using a LAN to support design software. A preliminary design review was started on AIVS (Automatic Interface Verification System). The projects and contributions are briefly described below.

### THE SPACE STATION RPS

The SSRPS (Space Station Rack Power System) is a computer controlled power supply that simulates power supply conditions on the Space Station Freedom. The RPS is being developed by Howard Nguyen of the Science Operations Branch (SE2) under the direction of Walter Hanby. The power supply will be used to test equipment that will support experiments on the space station before the equipment is installed in the orbiting laboratory.

The design of the Space Station RPS was reviewed with Mr. Nguyen. The design of the software was reviewed with Sheri Brackett of General Electric Government Services. Several suggestions and alternatives were discussed in several meetings with Mr. Nguyen and one meeting with Ms. Brackett. The design was also reviewed in a meeting with Ken Caldwell, Walter Hanby, Rand Nichols, Mr. Nguyen, and Ms. Brackett.

### STANDARD INTERFACE RACK CONTROLLER

Versions of the SIRC (Standard Interface Rack Controller) are currently being used in Spacelab and Spacehab, and a somewhat modified version is expected to be used in the Space Station Freedom. The SIRC provides a standard rack interface to support equipment used for experiments flown on Spacelab, Spacehab, and Space Station Freedom. Each version of the SIRC adds some new features, but tries to maintain compatibility with the earlier versions of the SIRC.

The design of several aspects of the SIRC was reviewed with Ron Bennett of General Electric Government Services who is working with Walter Hanby on the project. The hardware for the SIRC was discussed and several suggestions were made. The possibility of making the serial interface compatible with both RS-232C and RS-422 was discussed.

The design of the system and the software was discussed

with Mr. Bennett, and the software was discussed with David Altmeyer and Robert Deutschman, both of whom also work for General Electric Government Services. Several suggestions were made. The software design was also reviewed at a meeting attended by Walter Hanby and several employees of GEGS.

The SIRC uses a GPIB (General Purpose Interface Bus) for control and low data rate transfers. The GPIB is sometimes referred to by its standard number, IEEE 488. Several issues involving the GPIB were discussed with both Mr. Bennett and Mr. Deutschmann, including how to suspend communication between a talker (data sender in GPIB parlance) and a listener (data receiver in GPIB terminology).

#### MULTIPLEXING DATA AND A COMPOSITE VIDEO SIGNAL

Most of the summer's effort was spent developing a communication system that will transmit digital data over a composite video signal. The system will be used to increase the digital data communication channel capacity for some of the experiments flown on the Orbiter.

A review was conducted of the pertinent literature. A report was written that describes some of the techniques that have been successfully implemented or proposed. [1] The report makes several design recommendations. A modified version of this report will be submitted to IEEE AES Magazine for publication.

Work was started on specifications for the data communications system. [2] A preliminary design was started on two interface boards for IBM PC/AT or compatible computers. One board will combine the data with the composite video signal. [3] The other board will strip the data from the video signal. [4] A proposal was submitted to support the work after the author returns to Memphis State University in the fall. [5]

#### CIRCUIT BOARD DESIGN LAN

A study was made of storing circuit board design software and data files on the hard disk server for a LAN that connects several high performance IBM style PCs (Personal Computers). The study was made with the assistance of Hasan Rahman, James Hodges, and Ron Bennett, all of General Electric Government Services. The results of the study are reported elsewhere. [6]

#### AUTOMATIC INTERFACE VERIFICATION SYSTEM

The design of the AIVS (Automatic Interface Verification

System) was discussed with Ron Bennett of General Electric Government Services. However, no additional work was performed on this project.

#### REFERENCES

- [1] Dean Lance Smith, "A study of transmitting digital data on the Spacelab's analog video channel," to be submitted to *IEEE AES Mag.*
- [2] Dean Lance Smith, "Preliminary specifications for the data on composite video system," memo to Walter Hanby, Aug. 7, 1992.
- [3] Dean Lance Smith, "Preliminary design of the data on composite video generator board," memo to Walter Hanby, Aug. 7, 1992.
- [4] Dean Lance Smith, "Preliminary design of the data on composite video receiver board," memo to Walter Hanby, Aug. 7, 1992.
- [5] Dean Lance Smith, "Digital data, composite video multiplexer and demultiplexer boards for an IBM PC/AT compatible computer," Informal Proposal to the Summer Faculty Fellows JSC Director's Grant Program, NASA/JSC, July 22, 1992.
- [6] Dean Lance Smith, "Preliminary report on installing CADstar, Maxi/PC, and Maxi/Route on a LAN hard disk server," memo to Walter Hanby, July 31, 1992.

