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TESTING AND MANAGEMENT OF FLIGHT INSTRUMENTS AND THEIR DATA

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by

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Activities supported by this grant have focussed on flight hardware and the resulting data. These activities have involved all parts of the life cycle of flight programs; and, since the time period was limited, necessarily involved several different instruments at different phases of their life cycle. For purposes of the present review, we can conveniently summarize hardware activities separately from software and management activities.

Hardware activities were concentrated on the Low Energy Ion Facility (LEIF), which is used for testing and calibration of most of the flight instruments for near-Earth observations being developed by the Solar Terrestrial Division, Space Science Laboratory. We participated in the fabrication and testing of a number of components and fixtures used in the LEIF. We also helped troubleshoot, modify, and test several pieces of diagnostic equipment used in the LEIF for the testing and calibration of flight instruments and of other diagnostic equipment. In particular, considerable time was spent working with and on the particle and photon imager, used to diagnose ion beam characteristics in the LEIF. The ion beam generated by the ion source in the LEIF has been required for the proper testing and calibration of the primary components of the Thermal Ion Dynamics Experiment (TIDE) to be flown on the POLAR spacecraft of the Global Geospace Science (GGS) flight program.

Additional extensive work has been done on equipment and techniques for diagnosing and testing microchannel plates. These plates are used in the imager, noted above, as well as in flight instruments, such as the TECHS (Thermal Electron Capped Hemisphere Spectrometer) and TIDE instruments. We also participated in extensive testing of the TECHS instrument, as it was undergoing development. Later we participated in the calibration of this instrument and in the analysis of the calibration data.

In terms of management of flight instrument hardware development and flight data, we have been involved in several different types of activities. We brought in a consultant to provide guidance and assistance in tailoring off-the-shelf management software to the particular problems of instrument management. He helped analyze the program management requirements and aided in setting up management operations for the GGS TIDE instrument, as well as the GGS Ultraviolet Imager (UVI). Formats were developed for Lotus 123 spreadsheets to implement easy data entry and report generation. He also helped tailor Harvard Total Management software to convert the input data into reports with the required formats. The resulting software configurations were tested with sample data to assure that proper results in the necessary formats were produced.

We helped develop methods for adapting commercial software to prepare instrument cable drawing in the MSFC format, suitable for release qualification. The Orcad program was selected because it is user-friendly and easy to use for drawing electrical schematics. Drawings produced by Orcad were converted to a.DXF format, compatible with Autocad, which is the basis for the MSFC format. This procedure was tested on cable drawings for the Imaging Spectrometric Observatory (ISO). The resulting cable drawings were then successfully run through the release cycle, verifying the acceptability of the final product.

We also adapted software called File Express to meet the needs of inventory management for flight hardware. The tailored program was used to create a data base for the parts inventory. The program could sort by part numbers or descriptions; and it could import or export files, as needed. It was also used to create a data base for requisitions, making it much more efficient to find information for ordering parts. The system was tested on the management of parts for ISO and found to function very well.

In addition, we examined how the data reduction necessary for preparation of flight data for analysis by scientists (e.g. the merging of orbital and attitude data with the instrument data stream) impacted the use of the resulting reduced data by the scientists, due to the competition for limited computational resources. A number of methods for reducing the negative effects were examined, including a priority system giving priority to scientific analysis and scheduling techniques to minimize production activities during peak (daytime) working hours. Adequate computational resources was the primary key; in some cases this meant additional computer resources and in others additional storage or IO resources. The present mix of isolation of production activities to one machine, dedication of reasonable disk storage to the production activity, appropriate scheduling of significant workload to evenings and weekends and a system of priorities, have achieved a generally satisfactory schedule of production without serious negative impact on the productivity of the scientists. Results of these activities have meant that more data has been made available for use by local scientists and more data is made available to the community in a timely fashion from the archiving activity which has been a part of this production process, This has all really been made possible, however, by the continuing addition of computational resources over the course of time. Planning for such resources should be made early in the development of any flight program.