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SMALL ON-BOARD ENVIRONMENTAL DIAGNOSTIC SENSOR PACKAGE (SOBEDS)

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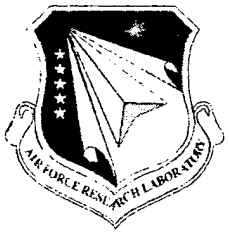

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This technical report has been reviewed and is approved for publication.

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13. ABSTRACT *(Maximum 200 words)*

This report contains the summary of the scientific and engineering work performed during the most recent year as part of the development of the High Energy Proton instrument (HEP) and of the Low Energy Particle and Dosimetry instrument (LEPDOS). These instruments are part of the SOBEDS suite of instruments being developed by Amptek, Inc. The purpose of the HEP instrument is to measure the energy spectrum of energetic protons, specifically to obtain a differential spectrum for 25 < E < 440 MeV and integral counts for E>440 MeV. The purpose of the LEPDOS instrument is to measure: 1) the lower energy protons and electrons that may cause spacecraft anomalies, specifically protons from 0.7 to 80 MeV and electrons from 5 to >250 keV, 2) the dose and dose rate experienced by spacecraft electronics, 3) particles causing single event effects, and 4) to provide real-time warnings to spacecraft and operators of environmental conditions likely to cause anomalies, such as surface charging and deep dielectric charging. During the most recent year, the seventh year of the contract effort, no spacecraft were selected for the remaining instruments. Since the bulk of the remaining effort is spacecraft specific, very little work was carried out on this contract.

14. SUBJECT TERMS

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INTRODUCTION

This report contains the summary of the scientific and engineering work performed during the most recent year as part of the development of the High Energy Proton (HEP) instrument and of the Low Energy Particle and Dosimetry (LEPDOS) instrument. These instruments are part of the SOBEDS suite of instruments being developed by Amptek, Inc. The purpose of the HEP instrument is to measure the energy spectrum of energetic protons, specifically to obtain a differential spectrum for $25 \leq E \leq 440$ MeV and integral counts for E>440 MeV. The purpose of the LEPDOS instrument is to measure: 1) the lower energy protons and electrons which may cause spacecraft anomalies, specifically protons from 0.7 to 80 MeV and electrons from 5 to >250 keV, 2) the dose and dose rate experienced by spacecraft electronics, 3) particles causing single event effects, and 4) to provide real-time warnings to spacecraft and operators of environmental conditions likely to cause anomalies, such as surface charging and deep dielectric charging.

The first five years of this contract effort included the research, development, and fabrication of three flight LEPDOS units, including one with an ESA (electrostatic analyzer), and a flight HEP unit. At the conclusion of this five-year effort, the instruments were as complete as possible, without specifying a spacecraft interface[1]. The second five-year portion of the contract is to cover spacecraft specific engineering efforts, spacecraft integration, and initial flight support. This effort cannot proceed until the AFRL/VSBX contract manager chooses the specific spacecraft and the contract manager tasks Amptek to carry out the spacecraft specific work. One of the instruments, the LEPDOS with ESA, has been integrated on a spacecraft and was launched during the sixth year of the contract effort.

During the most recent year, possible spaceflight opportunities were selected for the remaining instruments. The bulk of the effort this past year involved evaluating these possible opportunities. We discussed the spacecraft interface requirements with the contractors, making clear the unique requirements of our instruments and understanding their requirements. We outlined the possible interface design and estimated the cost and schedule to implement. We supported trade studies being carried out by AFRL/VSBX.

High Energy Proton Telescope (HEP)

The HEP instrument consists of two separate packages, a sensor head and an electronics box. Both the flight sensor head and an engineering model sensor head were completed during the initial effort. They are fully completed, including the sensors themselves, the electronics, and the package. The electronics box consists of five major electronic sub-assemblies: an analog board, a DSP board, a CPU board, an I/O board, and power supply board. Flight analog, DSP, and CPU boards have been completed. The onboard software, I/O board, and Power board are all spacecraft specific. Therefore, they are in protoflight configuration, pending specification of the spacecraft interface. HEP is in storage in Amptek's vault, pending assignment of a spacecraft. During the most recent year, the DSX spacecraft has emerged as a likely flight opportunity. Thus far, we have discussed how we would carry out the spacecraft interfacing efforts. We will support further spacecraft interfacing efforts when directed by the technical monitor.

Low Energy Particle and Dosimetry Instrument (LEPDOS)

Three flight LEPDOS instruments were developed during the initial phase of this contract. Two units, S/N 004 and 005, are now in storage at Amptek. Both units contain power supply boards suitable for a standard 28V power bus. S/N 004 contains a MILSTD-1553B serial telemetry interface, while S/N 005 contains an asynchronous RS422 serial telemetry interface.

In the past year we have provided some support to AFRL/VSBX as they examine possible spacecraft opportunities. A HEO flight opportunity and the DSX spacecraft are now considered likely opportunities. Both would be synchronous serial RS422 interfaces, so would require custom hardware and software. Further, it is now anticipated that both would require ESAs. Thus far, we have discussed how we would carry out the spacecraft interfacing efforts. We will support further spacecraft interfacing efforts when directed by the technical monitor.

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[1] A summary of the first five years is found in AFRL-VS-TR-2001-1620, *Small On-Board Environmental Diagnostic Sensors Package (SOBEDS)*.