THE DEVELOPMENT OF A HIGH ENERGY COSMIC RAY DETECTOR FOR SPACELAB-2*

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We have constructed a large cosmic ray detector aimed at measurements of the energy spectra and of the elemental abundances of cosmic ray nuclei at very high energies, up to several TeV/nucleon. The instrument is an electronic counter telescope with a geometric factor of $5m^2$ster. It accomplishes measurements of the particle energies through the use of gas Cerenkov counters and of transition radiation detectors. A first space flight of this instrument is scheduled onboard Spacelab-2 in July 1985.

In this report, we shall discuss the solutions of a number of technological problems that are encountered when developing such instrumentation for Shuttle missions. The main issues that make the Space Shuttle quite different from, e.g. the balloon vehicle,, are considerations of mechanical integrity, as well as thermal control in orbit. As our instrument has to be kept in a container at atmospheric pressure, a substantial effort is required to ensure the safety of this "pressure vessel". Further, this instrument is mounted directly to the Shuttle orbiter, without the use of a pallet. The design of the support structure involves a major engineering effort.

Our instrument uses a variety of gaseous detectors. Consequently, the gas servicing under remote control represents a significant technical problem. This problem is compounded by very strict requirement on the acceptable pressure differential across the windows of the large area multiwire proportional counters ($\Delta p < 10^{-5}$ atmospheres).

The Space Shuttle can perform a variety of orbital maneuvers, subjecting the cargo bay to great extremes in solar radiation. The corresponding temperature excursions are large and we require an active thermal control system to maintain the instrument at a reasonable operating temperature.

Instrumentation for Spacelab missions must be delivered well in advance of the actual launch, and must undergo a lengthy integration procedure (one year). During this period, the instruments are essentially inaccessible to the investigator. This necessitates design for reliable operation under remote control via sophisticated electronics circuitry and data interfaces.Once in orbit, an instrument such as ours is essentially self-contained and should require little attention by the astronauts onboard. Still, a number of safety-critical instrument parameters must be processed and displayed on-board in order to permit human intervention in emergencies.

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We shall discuss and illustrate these and related technical problems, and we hope to be able to describe the performance of the instrument in its first space flight.