SECTION I. UPPER ATMOSPHERIC RESEARCH

The NASA program of Upper Atmospheric Research, developed under the Congressional mandates in the FY 1976 NASA Authorization Act and the Clean Air Act Amendments of 1977, is a comprehensive program of research, technology and monitoring. It is aimed at expanding the scientific understanding of the earth's stratosphere and mesosphere and at developing the ability to assess potential threats to the upper atmosphere.

Shelby Tilford

TITLE: POLYATOMIC MOLECULE DECOMPOSITION IN THE STRATOSPHERE DURING A GEOMAGNETIC STORM

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SIGNIFICANT ACCOMPLISHMENTS FY 81:

Some successful case studies were completed on the stratospheric temperature responses to a solar proton event and a geomagnetic storm. In the geomagnetic storm case, the temperature response was observed at the tropopause level in some auroral zone regions.

In GASP observations that were made by chance during a geomagnetic storm time, a temperature decrease, a CO concentration increase, and an O_3 concentration decrease occurred simultaneously in the lower stratosphere in the polar regions.

Radioactive cooling due to polyatomic molecule decomposition in the upper layers is proposed as a possible mechanism. The decomposition is hypothesized to be caused by the bombardment of slow secondary electrons that were produced by the auroral X-rays. A feasible logic is developed.

Auroral X-ray transfers were calculated taking the compton softened component into account. It was found that because of the slow decay rate during transmission large enough concentrations of auroral X-rays remained below 20 km to produce the GASP observations results.

CURRENT FOCUS OF RESEARCH WORK:

Observational confirmation of the polyatomic molecule decomposition during geomagnetic storm is the current concern. Measurements of CO_2, H_2O, and O_3 and temperature by airplane are the main requirements.

PLANS FOR FY 82:

Recommendations for New Research:

(1) Estimations of both the magnitude and extent of the magnetic storm effect on temperature.
(2) Estimations of the influence of the temperature modification on the general circulation.

LIST OF PUBLICATIONS PREPARED SINCE JUNE 1980:

Sekihara, K. Polyatomic Molecule Decomposition in the Stratosphere During Geomagnetic Storms. (Presented at AGU Spring meeting May 26, 1981, Baltimore, and to be submitted to J. Geophys. Research)

TITLE: ATMOSPHERIC EMISSIONS PHOTOMETRIC IMAGER ON SPACELAB

RESEARCH INVESTIGATORS:

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SIGNIFICANT ACCOMPLISHMENTS FY-80:

The Imager was proposed and accepted as a Spacelab 1 experiment. Several experiments have been proposed for future missions and those have been accepted for definition. The Imager as configured for Spacelab 1 has two optical channels. The TV channel has a selectable 6° or 20° FOV and uses an image intensifier in series with an SEC vidicon television tube. This channel is sequenced by a dedicated computer so sensitivity and signal to noise can be optimized for the scientific objectives. The second channel includes a 10 x 10 -channel photon counting array which is bore sighted with the higher resolution TV. The instrument includes its own pointing system and experiment developed software for optimum experiment control. The responsible institutions include LMSC for the optical system and MSFC for the pointing system, computer, software, and environmental test.

This past year's activity was focused on fabrication and verification of the flight hardware and software systems. Several design and fabrication impacts have risen from launch load increases and safety rule changes which impact pointing experiments.

In February, MSFC hosted a 'AEPI reflight' investigators meeting to collect the experimental requirements of the 'Future' spacelab AEPI team. Reflight objectives, including a broad range of thermospheric, mesospheric, and tropospheric emission sensing, were presented by each Co-Investigator attending. Reflight planning has ceased at least temporarily due to budget changes in the Spring of 1981.

We gave considerable attention to image detection devices which would replace the SEC image tube on reflight. We temporarily postponed an effort aimed at upgrading the 10 x 10 diode array to a high resolution imager in favor of existing devices. Currently attention is being given to proximity focused image intensifiers mated to available CCD and CID solid state imagers.

CURRENT FOCUS:

1. Continue to test experiment hardware for delivery to integration in January, 1981.

2. Train the flight crew on experiment operations and associated data interpretation for the Spacelab 1 mission.

3. Develop ground operation hardware and software for Spacelab 1.

4. Experiment with technological improvements in low light level images on ground and balloon borne scientific applications.

PLANS FOR FY-81:

1. Continue 1 & 2 above until delivery to integration.

2. Spend considerable time on POCC activity.

3. Mature future mission plans.

4. Experiment with imaging devices and image processing.

RECOMMENDATIONS FOR NEW RESEARCH:

Pursue detector development for Satellite application to faint source atmospheric emissions in UV-VIS-near IR Wavelengths.

PUBLICATIONS

Sandie, W. G., S. B. Mende, G. R. Swenson, M. E. Polites, "Atmospheric Emissions Photometric Imager Experiment (AEPI) for Spacelab 1," Proceeding of SPIE conference, Feb. 9-13, Los Angeles, 265-38.