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WASHINGTON UNIV SEATTLE SPACE SCIENCES DIV  
COORDINATED FIELD OPERATION OF BALLOON-BORNE  
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AURORAL X-RAY AND --ETC(U)  
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6 Coordinated Field Operation of Balloon-borne Auroral X-ray  
and Photometer Experiment from the ATS-F Satellite Conjugate Region

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Office of Naval Research

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Contract Period: March 1, 1974 through January 31, 1978

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## Introduction

This Final Report presents a summary of research performed under Office of Naval Research contract to the University of Washington, Space Sciences Division of the Geophysics Program; ONR Contract No. N00014-67-A-0103-0039; Professor George K. Parks, Principal Investigator. The contract's main function was to provide helium and some personnel support for a scientific research project supported by the National Science Foundation. That project involved launching payloads on high-altitude balloons. The instrument consisted of X-ray scintillation detectors, and the information sought included spatial, temporal, and motional information on electron precipitation phenomena of outer Van Allen radiation.

During the tenure of this contract three separate field trips were made to launch balloons. Two launches, the first in August 1974 and the second in April 1975, were made from Thompson, Manitoba, Canada. The third field trip was to Fairbanks, Alaska, in September 1976. All three trips were successful from the scientific point of view, and information derived from these flights has been published in refereed journals and preprints (see publication list below).

## Scientific Results

Information obtained from the balloons has been compared to detection of electrons and protons on the ATS-6 geosynchronous satellite. This comparison has provided new information on electron and proton precipitation phenomena. These flights, for example, have extended the correlations to particles of lower energies than those found in earlier research with the ATS-1. We now know that the particles responsible for visual and subvisual

aurorae are directly related to 1-80 keV particles detected on the equator. One of the conclusions we have reached is that some of the small-pitch-angle equatorial particles originate in the ionosphere.

Another significant result from our research is that the Fairbanks flight provided us with a relativistic electron precipitation (REP) event, and for the first time a scientific instrument equipped with eight channels of energy has given accurate information on the energy spectra of this very energetic precipitation phenomenon. This event was detected on a balloon that was also equipped with two orthogonal antennas tuned to detect VLF signals. We are pleased to report that VLF signals have been detected during the REP event, and these data are being analyzed by a graduate student and will be used in his PhD dissertation. Preliminary results indicate that the VLF spectra from the REP event differed from those in the non-REP period, and we are planning to report the results at the URSI meeting to be held here in Seattle in the summer of 1979.

#### Publications

The scientific results culminated in several papers which have been presented at national and international meetings and published in refereed journals:

1. Parks, G. K., C. S. Lin, B. Mauk, S. deForest, and C. E. McIlwain, Characteristics of magnetospheric particle injection deduced from events observed on August 18, 1974, J. Geophys. Res., 82, 5208, 1977.
2. Lin, C. S. and G. K. Parks, The coupling of Alfvén and compressional waves, J. Geophys. Res., 83, 2628, 1978.
3. Parks, G. K., J. Chin, C. Gurgiolo, and R. West, Observations of ~200 keV e-folding energy spectra of precipitated auroral electrons deduced from atmospheric bremsstrahlung X-rays, submitted to J. Geophys. Res.
4. Parks, G. K., Auroral zone microbursts, substructures, and a model for microburst precipitation, Proc. X-rays in Space, 2, 849, 1975.

In addition to these papers, Dr. Parks delivered 12 papers at national and international meetings.

Conclusions

This project is considered successful, since we have met the scientific objectives. The results obtained during this contract period have provided a basis for improving and developing new instruments. We have designed a new X-ray imaging detector that is capable of taking snapshots of the sky in X-rays. Results from this detector design will provide additional information on electron precipitation scales and source dimensions.

Mr. William Cross and Mr. Mike Evanick, of the Office of Naval Research Field Office, were very helpful, and were instrumental in achieving the successful operation of the balloon launches.

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