Quarterly Report
July 1, 1996 - September 30, 1996

Contract No. 9F007-5-8005/01-SR
SSC File No. 019SR.9F007-5-8005

Prepared by: David P. Steele
Institute of Space and Atmospheric Studies
Department of Physics and Engineering Physics
University of Saskatchewan
116 Science Place
Saskatoon, SK, CANADA
S7N 5E2

Prepared for: Mr. Glen Rumbold
Scientific Authority
Canadian Space Agency
Space Science Program
100 Sussex Drive, Room 1039
Ottawa, ON, CANADA
K1A 0R6

Part 1:

1. The bulk of my time during this quarter was spent on the Polar Camera: repairing, refurbishing, calibrating, and preparing it to return to Eureka for the winter observing season, and on preparing a proposal to the Canadian Space Agency in response to the Small Payloads Program Announcement of Opportunity. The remaining time was spent on science but little progress resulted.

2. The project is within budget.

3. The project is free of any areas of concern in which the assistance or guidance of Canada is required.

Part 2:

1. Description of progress:

    1.1 Polar Camera repair

    The Polar Camera repair, refurbishment, and redeployment at Eureka was completed during this quarter. The cost was higher than expected in both money and time owing to difficulty in finding the cause of the image degradation problems which had necessitated the repairs.

    The camera systems were returned to the manufacturer, Photometrics Inc. of Tucson, AZ, where the hermetically sealed CCD housings were vacuum-tested, pumped down to the rated vacuum, and baked by way of preventive maintenance. As well, trouble-shooting was performed to identify and correct two different types of image degradation appearing in one of the two camera systems. The problems were ultimately traced to an incorrect jumper setting, which was rectified. Finally, a bad trace on a circuit card in the readout electronics was repaired.

    Repairs performed at Saskatoon included replacing all electromechanical relays used in the housekeeping electronics, as they were well past their design lifetime and one had failed, and cleaning and polishing the camera domes. As well, some time was spent debugging a problem with one system which was traced to incompletely seated integrated circuits on the housekeeping electronics circuit board. The electronics portion of these repairs was assisted by the I.S.A.S. electronics technician, whose services were paid for from my NSERC grant by way of Institute user fees.

    As well, the optical interference filters were recalibrated both in isolation and in the camera system to determine their passbands and peak transmissions, and the system throughputs of both cameras were measured. After this the entire Polar

Camera system was packed and shipped to Resolute Bay to await forwarding to Eureka.

1.2 Search for alternate funding / permanent position

I learned in early July that I was not successful in the competition for the University of Saskatchewan faculty position in the Institute of Space and Atmospheric Studies. The main reason I was not selected was that I am not a Professional Engineer and have a very considerable amount of work ahead of me in order to achieve the academic qualifications necessary for registration as a P.Eng.

In late August I was offered the opportunity to join a team of faculty and graduate students in preparing a proposal to the CSA Space Science Program in response to the Small Payloads Program Announcement of Opportunity. I took advantage of this opportunity, seeing it as a way to gain important experience in preparing proposals, and potentially as a step toward a greater involvement in experimental space science, with funding support, as well as a way to contribute to the future prospects of the many graduate students who became involved in the proposal. In early September I accepted the invitation to serve as Principal Investigator for the proposal, and at that time began to spend the majority of my working time on coordinating the activities of the team preparing the proposal.

1.3 Patch signatures

This task has made minor progress during this quarter. In early July I provided estimates to Dr. Paul Prikryl of the ionospheric effects of precipitating electron fluxes with various characteristic energies, as part of my collaboration in his major project on field line resonances, flux transfer events, *F*-layer patch dynamics and other topics. This work has been referenced in previous quarterly reports. Since the end of this quarter, Dr. Prikryl has received word that both of the large papers he had submitted to the *Journal of Geophysical Research* on the results of this study have been rejected, so the appearance in print of these works, including my contributions to them, await their revision and resubmission to another journal. I am convinced that the work is important and deserves to be published.

1.4 Convection inference study

This task has made no progress during this quarter.

1.5 Faint arc characteristics study

This task has made no progress during this quarter.

1.6 Magnetospheric topology study

This task has made no progress during this quarter.

1.7 Northward IMF convection study

This task has made no progress during this quarter.

1.8 Mesopause wave spectrum study

This task has made no progress during this quarter.

2. Explanation of Variation

During this quarter I attached high priority to restoring the Polar Camera to prime operating condition, in order to make the best use of new opportunities for simultaneous collaborative auroral and airglow observations with the optical instrumentation at the U.S. Polar Cap Observatory (P.C.O) at Resolute Bay, NWT. As mentioned in my previous report, on February 19, 1996 a high-altitude auroral arc was imaged simultaneously from both Eureka and Resolute Bay, and a presentation on the observations and their analysis by tomographic means was made at the Spring AGU meeting. I intend to pursue this promising avenue for magnetospheric and ionospheric studies further this winter by means of ongoing active collaboration with Dr. R. A. Doe of SRI International. I have made my field calibration source available for use at the P.C.O. to minimize calibration uncertainties in our joint observations.

The work on the Polar Camera took more time than I had anticipated, but the results of the work are very satisfactory, and I anticipate a full winter of high-quality data from the instrument.

I decided to make a major time commitment to the Small Payloads Program response effort because of the opportunities for professional growth and extended stable funding that it provided me, as well as to support the professional development of a number of graduate students in physics, engineering, and administration.

3. Trips and Conferences

None.

4. Major Equipment

No major equipment purchases were made during this quarter. Expenses were incurred in connection with the work on the Polar Camera, and its shipment to Resolute Bay.