WORK EXPERIENCE REPORT
November 15, 1987 to March 21, 1991

Name and address of business:	Institute of Space and Atmospheric Studies University of Saskatchewan 116 Science Place Saskatoon, SK S7N 5E2 tel: (306) 966-6403 fax: (306) 966-6400
Title of position held:	David P. Steele, B.Sc., M.Sc. Candidate for M.Sc. degree in Physics
Nature of business:	Upper atmospheric and space research using observations from ground- and space-based observing systems
Name of direct supervisor:	Prof. D. J. McEwen, Ph.D.
Phone No:	(306) 966-6440

Describe in detail your experience gained during the reporting period, grouped under the following headings:

1. APPLICATION OF THEORY

i. Analysis

- I analyzed digital images of the ultraviolet aurora and dayglow acquired by the Ultraviolet Imager (UVI), a breakthrough Canadian-made experiment flying on the Swedish Viking satellite. I estimated UVI electronic gain levels on-orbit, using the observed mean and variance of uniformly-emitting regions in the field of view and the theoretical characteristics of the intensified CCD system. I correlated UV auroral intensities with precipitating electron energy fluxes measured by a lower-altitude satellite flying across the aurora within the UVI's field of view, taking account of imager orientation and image timing. I used a state-of-the-art auroral energy deposition and atmospheric excitation code to model the auroral excitation resulting from measured electron spectra, and modeled the UV radiances reaching the UVI from these events. These comparisons required taking account of photon scattering and absorption in the atmosphere between the excitation region and the imager, and integrating the product of the UV radiance and the imager sensitivity curve.

ii. Design and Synthesis

- None.

iii. Testing Methods

- I determined dark count levels from the unexposed portions of the images, and point-spread functions and pointing accuracy from images of stars. I characterized and subtracted power supply converter interference from the image readout using FFT techniques and spatial filtering.

iv. Implementation Methods

- None.

2. Practical Experience

i. Visits to existing engineering works

- In December 1988 I toured the Ivan A. Getting Space Sciences Laboratory of the Aerospace Corporation, El Segundo, CA. During this tour I gained experience with the data analysis software used there, and was shown through their space hardware development facility.

ii. Application of equipment

- I developed a flexible and compact approximate model for electron energy deposition and ionization in auroras, and applied it to estimate the UVI response to auroras excited by particular electron spectra. I applied the MSIS-86 thermospheric composition model to estimate the target atmosphere for the precipitating electron spectra, and the overlying molecular oxygen density absorbing the auroral radiance throughout the Schumann-Runge continuum. I developed a large and complex computer program to decode and process data from a satellite-borne particle detector. I applied a model of the emission spectrum of the Lyman-Birge-Hopfield band system of molecular nitrogen to calculate the UV radiance reaching the UVI above the atmosphere.

iii. Limitations of practical engineering

- None.

iv. Significance of time in engineering processes

- None.

3. Project Management

i. Planning

- I conceived the project for my Ph.D. work, identified the data resources I would need, acquired or developed the software tools necessary, and carried out the analysis required to answer the question I set.

ii. Scheduling

- None.

iii. Budgeting

- None.

iv. Supervision

- None.

v. Project control

- During the last phases of my Ph.D. project I set and met time goals for myself in order to ensure that my dissertation would be completed and submitted in time for my family and me to move to Calgary, where I was to take up a position on April 1, 1991.

vi. Risk assessment

- None.

4. Communications Skills

i. Preparation of written work

- I kept daily notes of work and results. I prepared technical reports on accessing precipitating particle data from the Defense Meteorological Satellite Program (DMSP), and on a set of software tools I developed to simplify the analysis of precipitating particle spectra. The former report was distributed to colleagues in Australia who wanted to benefit from our experience. While attending a conference in England I attended a meeting ofn global change, attended by scientists from around the world, and wrote a report on the meeting's proceedings on my return to Saskatchewan. I wrote a Ph.D. dissertation presenting the first analysis of simultaneous UV auroral optical and particle observations from two different satellites, which was the University of Saskatchewan nominee for the NSERC doctoral prize.

ii. Oral reports

- I made weekly reports on my research progress to my faculty advisor and his research group. I made four oral presentations on aspects of my research work at international conferences in Canada, the United States, and England.

iii. Public presentations

- None.

5. Social Implications of Engineering

- None.