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DATA ANALYSIS AND THEORETICAL STUDIES FOR ATMOSPHERIC EXPLORER C, D AND E

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Contract NAS 5-11437

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FINAL REPORT

Principal Investigator

Dr. A. Dalgarno

The research concentrated on construction of a comprehensive model of the chemistry of the ionosphere. It proceeded by comparing detailed predictions of the atmospheric parameters observed by the instrumentation on board the Atmospheric Explorer Satellites with the measured values and modifying the chemistry to bring about consistency. Full account was taken of laboratory measurements of the processes identified as important. The research programs were made available to the AE team members. We also provided regularly updated tables of recommended values of photoionization cross sections and electron impact excitation and ionization cross sections.

The research did indeed lead to a chemistry model in which the main pathways are quantitatively secure. The accuracy was sufficient that remaining differences are small. The small differences are interesting and can be attributed in part to effects of vibrationally excited species and quenching of metstable species. The existing data can be used for further study.

Towards the end of the project, stimulated largely by the observation of a glow on the surface of the Space Shuttle, detailed

attention was given to the contamination glow on the AE C and E spacecraft. The intensity of the glow and the spectrum were extracted from the airglow photometer data. We have tentatively identified the source of the glow as vibrationally excited hydroxyl radicals produced by the bombardment of ambient oxygen atoms on the satellite surfaces.

From the understanding gained of the chemistry of the terrestrial ionosphere, some progress was made on specific questions of the ionospheres of Mars and Venus.

A list of published papers is attached.

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