THE ATMOSPHERIC CHEMISTRY EXPERIMENT (ACE): HIGH RESOLUTION SPECTOSCOPY FROM ORBIT

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The ACE mission goals are: (1) to measure and to understand the chemical and dynamical processes that control the distribution of ozone in the upper troposphere and stratosphere, with a particular emphasis on the Arctic region; (2) to explore the relationship between atmospheric chemistry and climate change; (3) to study the effects of biomass burning in the free troposphere; (4) to measure aerosol number density, size distribution and composition in order to reduce the uncertainties in their effects on the global energy balance.

ACE is making a comprehensive set of simultaneous measurements of trace gases, thin clouds, aerosols, and temperature by solar occultation from a satellite in low earth orbit. A high inclination (74 degrees) low earth orbit (650 km) gives ACE coverage of tropical, mid-latitudes and polar regions.

A high-resolution (0.02 cm^{-1}) infrared Fourier Transform Spectrometer (FTS) operating from 2 to 13 microns (750-4100 cm^{-1}) is measuring the vertical distribution of trace gases, and the meteorological variables of temperature and pressure. The ACE concept is derived from the now-retired ATMOS FTS instrument, which flew on the Space Shuttle in 1985, 1992, 1993, 1994.

Climate-chemistry coupling may lead to the formation of an Arctic ozone hole. ACE will provide high quality data to confront these model predictions and will monitor polar chemistry as chlorine levels decline.

Aerosols and clouds will be monitored using the extinction of solar radiation at 0.525 and 1.02 microns as measured by two filtered imagers as well as by their infrared spectra. A dual spectrograph called MAESTRO was added to the mission to extend the wavelength coverage to the 280-1000 nm spectral region. The principal investigator for MAESTRO is T. McElroy of the Meteorological Service of Canada.

The FTS and imagers have been built by ABB-Bomem in Quebec City, while the satellite bus has been made by Bristol Aerospace in Winnipeg. ACE was selected in the Canadian Space Agency's SCISAT-1 program, and was successfully launched by NASA on August 12, 2003 for a 2 year mission. The testing of ACE, commissioning activities and first results will be presented.