The University of Toronto's balloon-borne Fourier transform spectrometer

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The University of Toronto's Fourier transform spectrometer (U of T FTS), derived from a Bomem DA5 Michelson-type interferometer, was rebuilt and flown on the Middle Atmosphere Nitrogen TRend Assessment (MANTRA) high-altitude balloon platform in September, 2004. The U of T FTS has a resolution of 0.02 cm^{-1}, a spectral range covering 1200-5000 cm^{-1}, and InSb and MCT detectors that measure simultaneously.

The spectrometer was originally built in the 1980s and purchased by the Meteorological Service of Canada. To prepare the instrument for flight, the original software was replaced with new LabVIEW control software, creating a robust and easily-controlled instrument, adaptable to either remote control or lab-based work. As a result of replacing the software, most of the electronics had to be replaced, creating a lighter, lower-power, more robust instrument. A description of the refurbishment will be presented.

Despite balloon launch and gondola pointing system failures during the MANTRA 2004 campaign, two spectra were recorded on each detector during sunset from a float height of 35 km. The data indicate that the instrument performed well throughout the flight, and, had the payload pointing been under control, would have retrieved a full set of occultation data. The data that were acquired will be shown.

The U of T FTS has since participated in a ground-based FTS inter-comparison campaign with two other FTS instruments: the University of Toronto's Toronto Atmospheric Observatory (TAO) FTS, a complementary NDACC station (Network for the Detection of Atmospheric Composition Change – formerly NDSC), and the University of Waterloo's Portable Atmospheric Research Interferometric Spectrometer for the Infrared (PARIS-IR), a ground-based version of the ACE-FTS, that also flies on the MANTRA payloads. The TAO FTS is a linear, high-resolution (0.004 cm^{-1}) FTS, whereas the PARIS-IR instrument is a pendulum-style interferometer, with a resolution of 0.02 cm^{-1}. The three instruments measured simultaneously to demonstrate the impacts of instrument design and resolution on retrieved column amounts. Comparisons of column amounts of O_3, HCl, N_2O and CH_4 will be presented.