Introducction

- The Arctic Climate is changing more rapidly than models predict.
- With declining ice cover, the Arctic Ocean will be subject to increased shipping traffic and exploration activity for natural resources.
- Monitoring Greenhouse Gas (GHG) emissions from these new sources requires high spatial resolution.
- Some of the important atmospheric species that contribute significantly to climate change are methane (CH₄) and carbon dioxide (CO₂).
- This poster report on progress developing instrumentation to measure these gases as well as O₂ A-band for producing temperature profiles.

Objectives

- Development of a demonstrator Imaging Fourier Transform Spectrometer (IFTS) intended for flight on a high-altitude balloon or satellite platform.
- Demonstrating the capacity of this instrument to measure atmospheric mixing ratios of CH₄ and CO₂ and the O₂ A-band in near-space conditions.
- Develop software and electronics to support these measurements.
- Achieve these goals autonomously.

Instrument

- Based on the Michelson interferometer.
- Uses corner cube mirrors to maintain wave front alignment.
- Flexure-pivot scanning mechanism.
- Standard off-the-shelf design provided by ABB.
- Detectors:
  - Xenics VisNIR InGaAs 320 x 256 Pixel CCD camera.
  - Flare 4MP NIR Silicon 2048 x 2048 Resolution Camera.
- Interferogram sampling: 100-500 Hz.
- Two spectral channels centered at:
  - 762 nm for the O₂ A-band.
  - 1600 nm for CO₂ and CH₄.
- Spectral Resolution: 0.5 cm⁻¹.
- Aperture: 50 mm.
- Dimensions: 60 x 45 x 15 cm.
- Weight: 22 kg.

Optical Layout

Novelty

- Simultaneous measurement of an approximately 3800 by 3000 km (FOV) spatial element with a spatial resolution of 10-12km from a highly elliptical three apogee orbit or a geostationary orbit (36000-40000 km altitude).
- Intended for observing a 3x3 panel of the northern latitudes, approximately 9000x9000km from HEO.
- Will take 75 minutes at 100 Hz scan resolution.

Simulated Spectra

References

1. York University, Toronto, Canada; 2. Seneca College, Toronto, Canada; 3. ABB Inc., Quebec City, Canada