The Stabilized Radiometer Platform (STRAP) – A New Tool for High Accuracy Aircraft Radiometry

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Background

- For many years solar and IR radiometers have been mounted on research aircraft to characterize the radiative budget of the atmosphere
- The radiometers are typically hardmounted directly to the aircraft

Problem:

Radiometers tilt in pitch and roll along with the aircraft



Definition of Irradiance



Simple Case: Direct Solar Radiation Only



Heading towards sun



Heading away from sun



Effect of solar zenith angle, pitch, and heading on the cosine of the solar zenith angle wrt the radiometer



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Real Measurement Example



STabilized RAdiometer Platform (STRAP)



- Developed through ONR SBIR with L-3 Comm Sonoma EO (previously Sonoma Design Group) and partnership between CIRPAS, NRL, and Sandia
- STRAP is next generation version of platform developed by Sonoma EO and the DOE ARM-UAV program at Sandia: more modular, increased pitch/roll range=>+/- 10 degrees

Dimensions of STRAP



STRAP with fairing on CIRPAS Twin Otter



Radiometer Configuration on STRAP for DOE IOP in May 2003



Zenith Twin Otter Radiometers

- CM22: modified Kipp & Zonen CM22 solar pyranometer (courtesy Sandia)
- CG4: modified Kipp & Zonen CG4 IR pyrgeometer (courtesy Sandia)
- SSFR: NASA Ames Solar Spectral Flux Radiometer (Pilewskie et al.)
- Identical CM22s mounted on STRAP and hardmounted to aircraft

Illustration of Stability of STRAP



Platform remains level to within +/- 0.02 deg (when aircraft within +/- 10 deg pitch, roll)

Performance of STRAP During Maneuvers



Performance of STRAP During Maneuvers



Utility of STRAP in Partly Cloudy conditions



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Rare Ability of STRAP to Obtain Radiometer Data in Spiral Ascents or Descents



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