Quarterly Eos Contract Report -- Report #9

Period: July 1 - September 30, 1992

Remote Sensing Group (RSG), Optical Sciences Center, University of Arizona

Principal Investigator: P. N. Slater

Contract Number: NAS5-31717

Report compiled by: K. J. Thome

Task Progress:

S. F. Biggar, J. M. Palmer, P. N. Slater, and K. J. Thome met with A. Kahle, S. Larson, D. Nichols, and C. Voge of the ASTER team on 29 July 1992 to discuss algorithm and software development. They also discussed the science computing facilities of the RSG. Slater attended the MODIS Internal Ground Support Equipment PDR at SBRC on August 18. Biggar and Slater reviewed the materials presented at this meeting to determine the RSG's responsibilities regarding preflight cross-calibration. They also reviewed an SBRC internal memo describing the relationship between changes in radiometric accuracy, registration, and MTF for MODIS. Biggar, Slater, and Thome reviewed the descoping proposed for MODIS and the proposed descoping of ASTER and MODIS products. Thome faxed comments regarding ASTER product descoping to team leader Kahle. Slater faxed responses to suggested MODIS sensor descopes to team leader V. V. Salomonson. Biggar, Palmer, and M. W. Smith attended the TIR Symposium/TIR Peer Review in Logan, Utah, September 14-17. Smith presented a poster regarding the SWIR spectrometer. Biggar also attended the MODIS Calibration Peer Review on September 24 and the WGA of EOS Cal/Val Panel meeting at SBRC on September 25.

D. I. Gellman upgraded the reflectomobile. Exposed parts were galvanized, and he reinforced the trailer's wall at determined stress points. He also constructed a device for transporting and storing the parts of the reflectomobile on the trailer. Gellman and Thome travelled to Maricopa Agricultural Center to collect atmospheric data in conjunction with SPOT-2 and Landsat-5 overpasses on July 26, while representatives of the USDA Water Conservation Lab collected surface reflectance measurements of the ground targets. Biggar and Gellman made plans for a field experiment at White Sands, August 14-18 for calibrating Landsat-5 TM, SPOT-1 and -2 HRVs, and NOAA-11 and -12 AVHRRs as well as for testing the reflectomobile.

Gellman and Slater travelled to White Sands on August 12, to perform tests of the reflectomobile and determine the transects of the site to be used for the calibrations. On August 14, M. R. Brownlee, Palmer, and Thome arrived at White Sands accompanied by M. S. Moran of the Agricultural Research Service and A. F. Rahman a graduate student from the Soil and Water Science Department at the University of Arizona. Palmer collected data with the refurbished thermal IR radiometer to coincide with the Landsat

overpass on August 15. These data will be compared with data collected by Moran. Gellman updated data reduction software and reduced the White Sands data sets, as well as data collected at Edwards Air Force Base the end of May and Maricopa Agricultural Center in July. Gellman, C. L. Grotbeck, and Smith collected atmospheric data at Walnut Gulch watershed as part of an ongoing project.

Smith continued work on the SWIR spectrometer. He added shielding, buffering, and filtering to the A/D conversion electronics with only a slight reduction in electronic noise. Smith presented a paper on the instrument at the recent SPIE meeting in San Diego, July 19-24, and had the Paravant computer for the SWIR spectrometer repaired. To maintain SNR, the system will be operated at a constant temperature of 298 K, using heating and cooling as necessary. A thermo-electric cooler and other electronics were installed for this purpose. Anti-reflection coated versions of the cold filter and dewar window, as well as cold stops for the dewar, were installed. Smith verified the anti-reflection coating on the silicon filter was improperly applied by the vendor. He removed this coating and sent the filter for recoating. Smith anticipates an increase in the SNR of a factor of two because of this. Laboratory radiometric calibration of the instrument was begun.

Brownlee investigated possible detector systems for the BRDF meter. Biggar, Brownlee, and Slater met with representatives from Photometrics to discuss a custom-made CCD system. The detector system for the BRDF was respecified to increase the digitization from 8 to 14 bits. This will require cooling the CCD array to maintain the desired SNR. The respecification increases the size of array to completely cover the fisheye lens image. The new specification will improve accuracy as well as simplify the automation of the instrument. Brownlee also began an extensive survey and study of past solar radiometer data to determine temporal changes in instrument response. Brownlee and Thome will use these data to test the rules-based algorithms for processing solar radiometer data. As part of this study Thome, accompanied by groups from the Atmospheric Sciences and Electrical and Computer Engineering departments at the university, travelled to Mt. Lemmon, Arizona to calibrate the group's solar radiometers.

Biggar continued constructing the cross-calibration radiometer and procured parts to improve the amplifier of our solar radiometer. He also looked at the spectral calibration of an Analytical Spectral Devices, Inc., Personal Spectrometer II and compared retrieved panel reflectances with those of a 4-band Exotech instrument. The study will help evaluate whether this system is appropriate for our diffuse-to-global measurements. Biggar modified software used to compute surface reflectance from reflectomobile data.

Thome continued adding the water vapor retrieval algorithm to the Langley method program and completed work on the algorithm survey and SCF block diagram requested by D. Nichols and C. Voge of ASTER. Data flow diagrams were started for the software package. These diagrams will be used as for documentation, for developing pseudocode, and for code maintenance.

Palmer proceeded with work on the Cary spectrophotometer. System administration work was performed by H. He, who also continued developing software to read satellite tape images onto the UNIX-based-Sun network. She modified existing software to enable reading of the new Landsat tape format. S. A. Recker and A. J. McKinney performed all administrative tasks during the period.

Problems/Corrective Actions:

A preliminary comparison between reflectances obtained from reflectomobile data to those obtained from the yoke-based data show the reflectomobile data having higher reflectances and larger standard deviations. The differences between the results of the two methods are not statistically significant, but because the differences appear to be biased further studies are being made. Work will concentrate on two aspects, the reflectomobile and the site. R. J. Parada began a comprehensive survey of reflectance data collected at White Sands since 1984. This study will look at both the retrieved reflectances and their standard deviations to determine if the reflectomobile data is consistent with past data. Gellman has made arrangements to have the axle of the reflectomobile shortened so as to match the wheel base of the tow vehicle. This will allow the trailer to have a smoother ride, and allow the driver to keep the trailer on more level ground. Tests will be performed to examine the sensitivity of the retrieved reflectance to instrumental tilt.

Anticipated Activities:

A large portion of the group's efforts will be involved in moving to a new building. The move is expected to occur in mid-October. We will use this as an opportunity to send our black lab equipment out for calibration. Our new address is:

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Suite 100
1600 N. Country Club
Tucson, AZ 85716-3119

Thome will continue developing data flow diagrams and will implement the aerosol size distribution inversion, including the ozone retrieval. He will also begin constructing test data sets for testing the software. Brownlee will order the BRDF meter detector and begin construction of the instrument. Biggar will complete construction of the absolute radiometer and begin laboratory testing of the instrument. The laboratory radiometric calibration of the SWIR spectrometer will be completed and field testing of the instrument started.