

NIST Agency Report -- CEOS WGCV 25

**May 9 – 12, 2006
Budapest, Hungary
B. Carol Johnson**

*Optical Technology Division
Physics Laboratory
National Institute of Standards and Technology
<http://physics.nist.gov/Divisions/Div844/div844.html>*



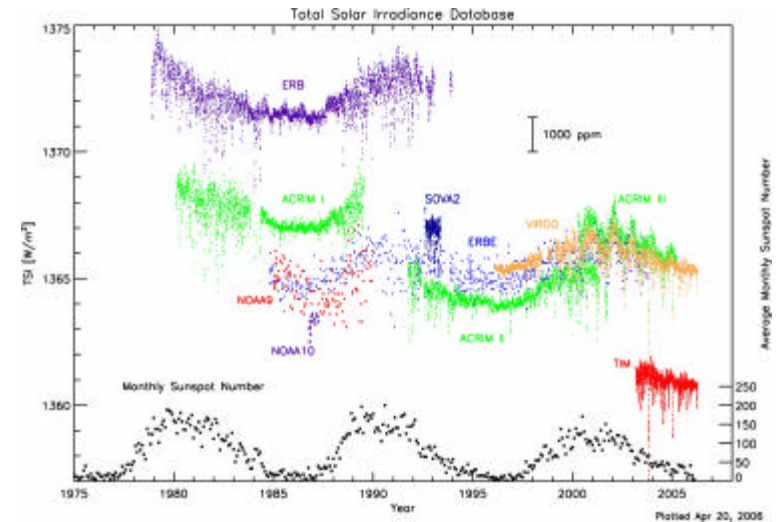
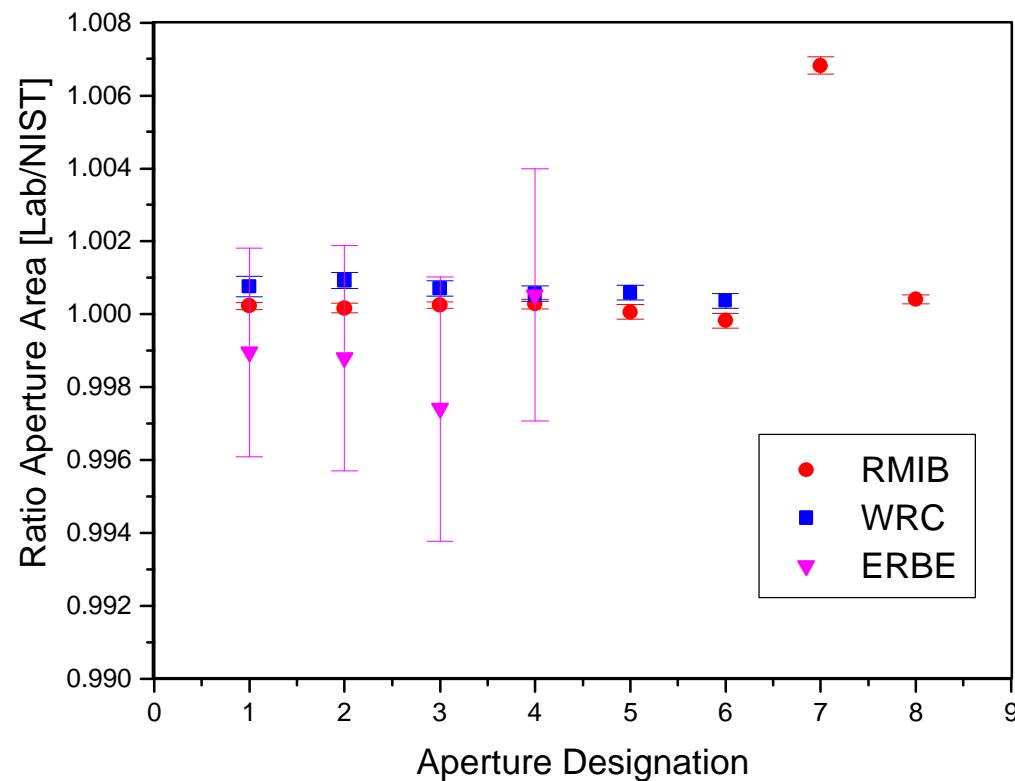
Outline

- Earth Observing System (EOS)
- National Polar-orbiting Operational Environmental Satellite System (NPOESS) & NPOESS Preparatory Project (NPP)
- Geostationary Operational Environmental Satellite (GOES)
- Collaborations
- Recommendations to Plenary

NIST Activities for the EOS Program

- Aperture area comparison—at final set of measurement activities (with JPL/ACRIM)
- Laboratory comparison for Total Solar Irradiance (TSI) will occur
- Spectral out-of-band algorithm for primary GSFC scanning monochromator

TSI Aperture Area Comparison

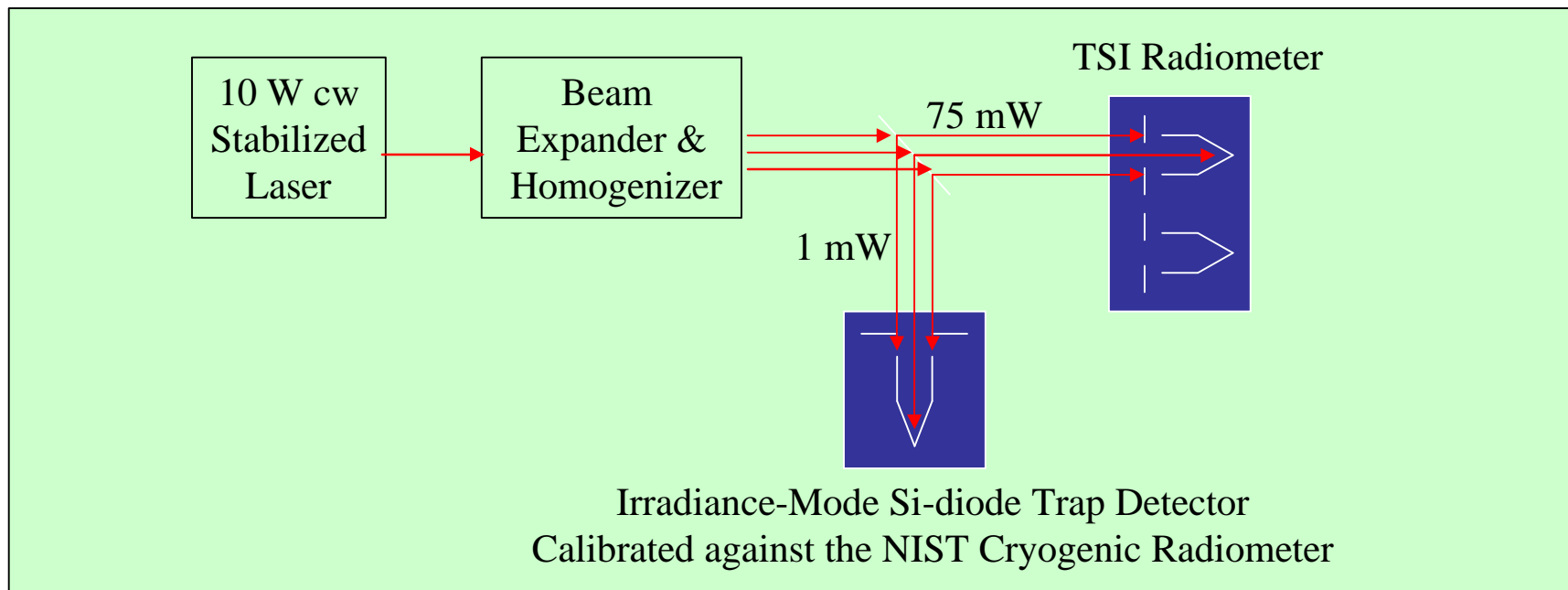


<http://spot.colorado.edu/~koppg/TSI>

ACRIM
measurements
are in progress

TSI Instrument Comparison at NIST

- Direct system-level comparison with representative TSI radiometer in a vacuum chamber.
- Beam expander for variable beam diameters up to 15 mm: both irradiance and power modes.
- Homogenizer produces a top-hat profile: simulates solar irradiance geometry.
- Beamsplitter ratio (transmittance/reflectance) measured in a separate step.

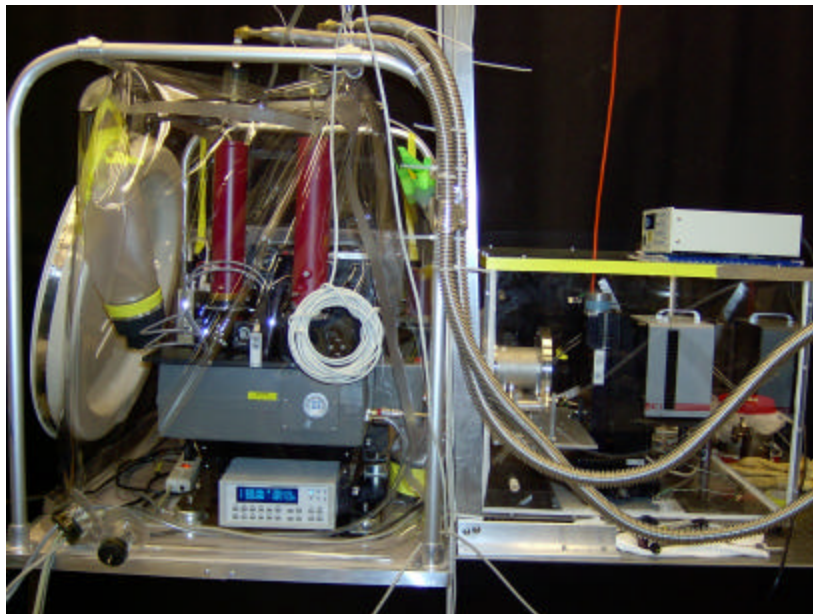


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Calibration Support for CrIS*

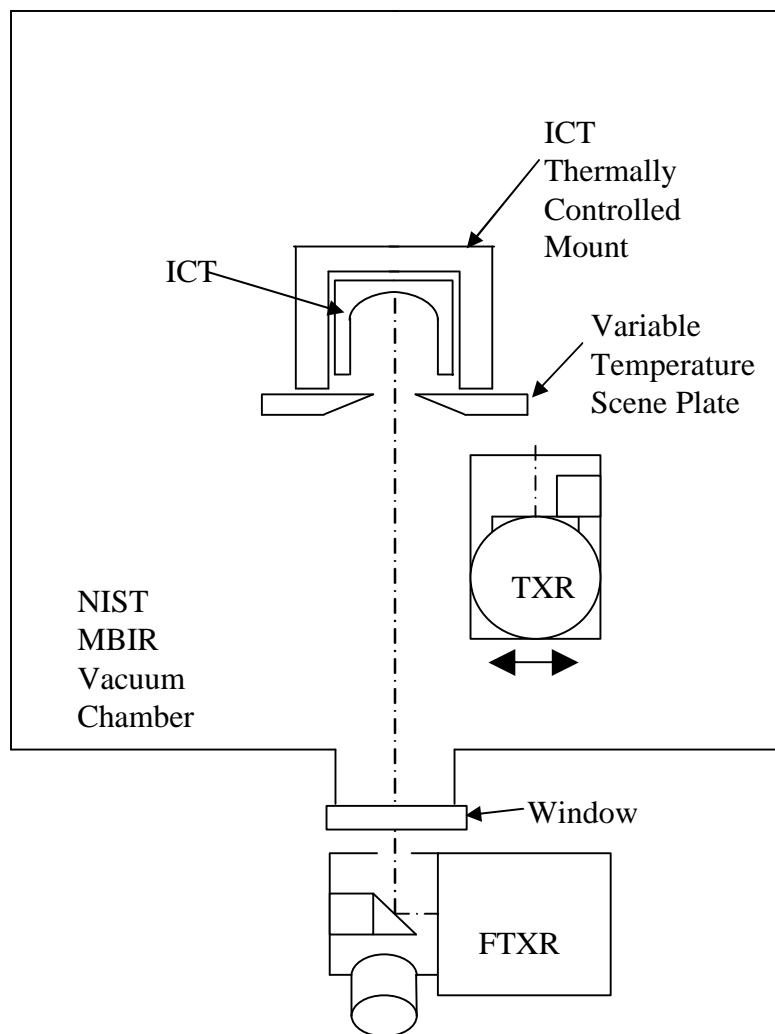
- NPP/NPOESS CrIS blackbody: Planned study at the NIST MBIR Facility.
 - A preparatory experimental is in progress with NIST blackbody in the MBIR Facility.
 - The CrIS ECT blackbody testing is expected to take place in FY07.
 - The CrIS ICT blackbody testing is planned for FY08



*Cross-track Infrared Sounder (CrIS)

The NIST FTXR

Test in preparation for NPOESS CrIS Calibration Blackbody (ICT)



- Purpose is to validate vendor's radiance scale.
- TXR is a filter radiometer.
- FTXR is an FTIR spectroradiometer.
- CrIS blackbody and TXR are in vacuum.
- FTXR views blackbody thru window.
- ICT controlled over its temperature range and radiometers measure emitted radiance.
- Separately, by widely varying temperature of the Scene Plate in front of the ICT, reflected radiance from the ICT is measured and used to infer ICT emissivity.

Characterization Support for VIIRS*

*Visible/Infrared Imager/Radiometer Suite (VIIRS)

- Half Angle Mirror: infrared reflectance scale comparison
 - Update NIST instrument with BIB detector
- Bi-directional reflectance distribution function (BRDF)
 - Measurements of samples (UV, Vis, Near IR)
 - Consultation on reflectance scales
- System testing through the solar view aperture
 - “Apparent” BRDF of VIIRS solar diffuser target

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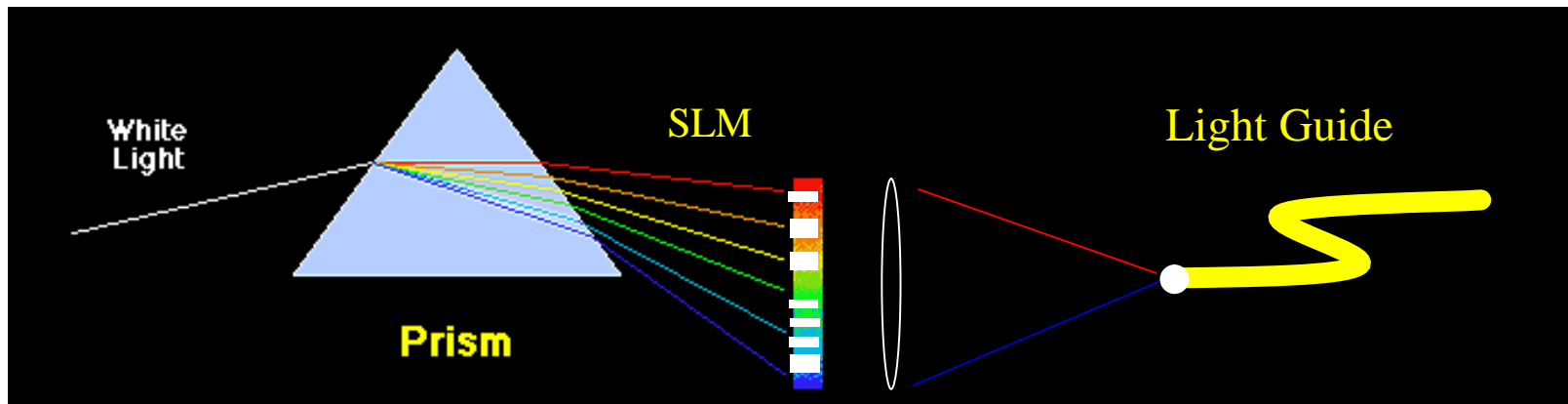
Novel Sources for GOES-R

- Principle Design of the Spectral Platform

Dispersing element

Spatial Light Modulator
(SLM)

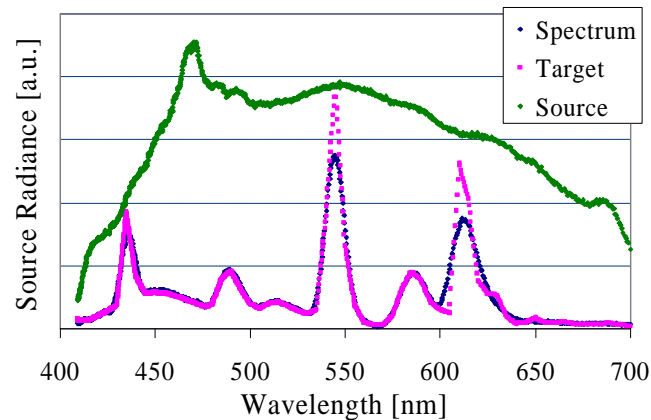
Recombine the Light



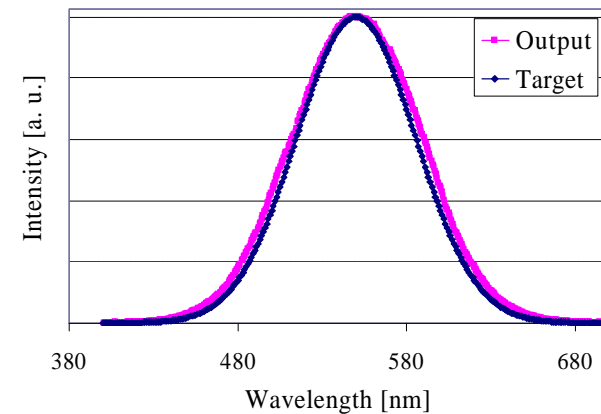
- New Technology: SLM
 - Digital micromirror devices (DMDs)
 - Liquid crystal on silicon arrays (LCOS arrays)

Application-Specific Sources

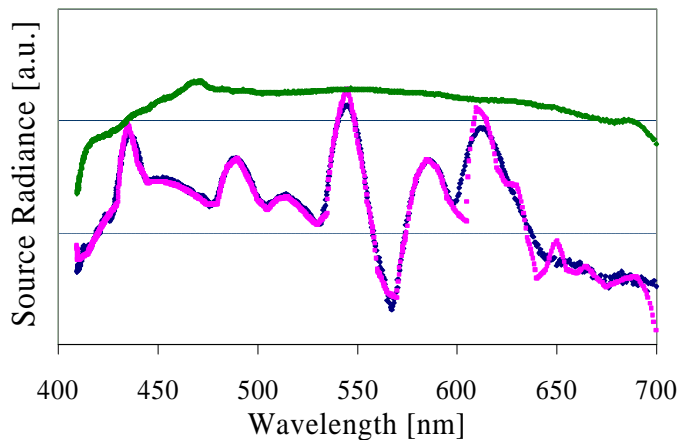
Tri-phosphor Lamp



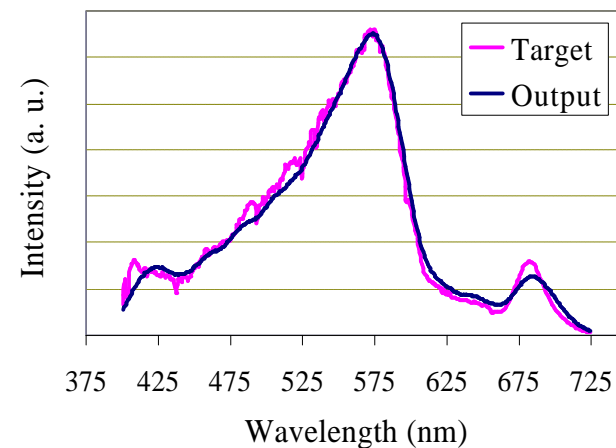
Gaussian



Log Scale



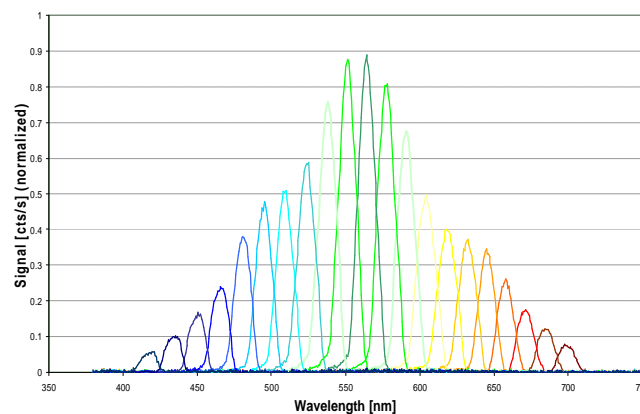
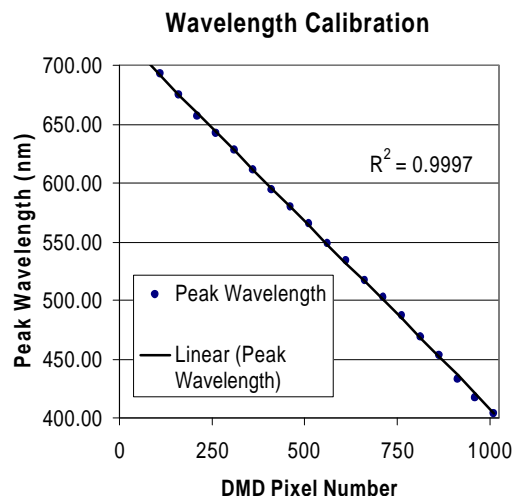
Ocean Color



Tidal Photonics, Inc.

“Spectral Light Engine” Source is Detector-based

- Single-element detector
 - Tune through wavelengths sequentially, measure the power in the beam
 - Take advantage of wavelength stability of spectrographs
- Stable operation



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Collaborations

- NIST participated with NOAA in meetings with WMO (July 05, March 06) for developing the draft Implementation Plan for a Global Space-Based Inter-Calibration System (GSICS)
- NIST and Space Dynamics Laboratory at USU started collaboration to work towards SI traceability for Space Based Sensors.
 - CALCON meeting (October 2006)
 - Workshop on “Achieving Satellite Instrument Calibration for Climate Change” (ASIC3) (May 2006)

Project Summary

- NIST continues to collaborate with Earth observing programs to assess the accuracy of the radiometric characterization and calibration of flight sensors, as well as field equipment.

EOS

Jim Butler, NASA/GSFC cal/val lead

Primary efforts, FY06: TSI, stray light algorithms, prepare for lunar radiometry scale validation

NPOESS and NPP

Karen St. Germain and Steve Mango, IPO

Primary efforts, FY06: CrIS blackbody at NIST with TXR, VIIRS reflectance scale, publication of TXR verification of SBRs VIIRS blackbody radiance

Ocean Color (NOAA/NESDIS)

Menghua Wang, NOAA/NESDIS, Ken Voss, UM, Carol Johnson & Dennis Clark, NIST

Primary efforts, FY06: MOBY operations, Instrument development for vicarious calibration

NPP/NPOESS & GOES-R

GOES and GOES-R

Michael Weinreb, NOAA/NESDIS

Primary efforts, FY06: Plan for ABI calibration verification efforts; application of TXR measurements of the GOES Imager blackbody source; novel source development.

- Collaboration with NOAA for participating in the implementation of GSICS
- Collaboration with USU/SDL for SI traceable Space based Radiometry

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Recommendations to Plenary

Artifacts for down-stream characterization (programs should produce and archive “witness samples”)

“Witness samples” could be from the flight set, in order to ensure reproducibility of determined parameters.

Joint Test Sites should be validated regarding traceability to standards or reference values using targeted, well-defined, specific measurements under the guidance of metrology experts.



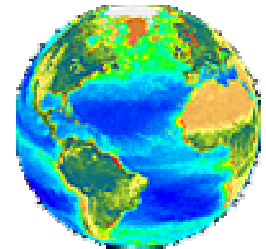
Acknowledgements

NIST Optical Technology Division Collaborators

- Leaders of the NIST Calibration Effort
 - Carol Johnson
 - Joe Rice
 - Steve Brown
- Other NIST Collaborators
 - David Allen
 - Raju Datla
 - Charles Gibson
 - Toni Littorja
 - Keith Lykke
 - Al Parr (Division Chief)
 - Jim Proctor
 - Bob Saunders
 - Howard Yoon

Numerous Other Collaborators, Including

- Jim Butler, NASA Goddard
- Steve Mango, IPO
- Hal Bloom, IPO
- Dennis Clark, NIST
- Steve Kirkner, NOAA
- Mitch Goldberg, NOAA
- Chang Yong Cao, NOAA
- Tom Stone, USGS
- Chuck McClain, NASA Goddard



SeaWiFS 18



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