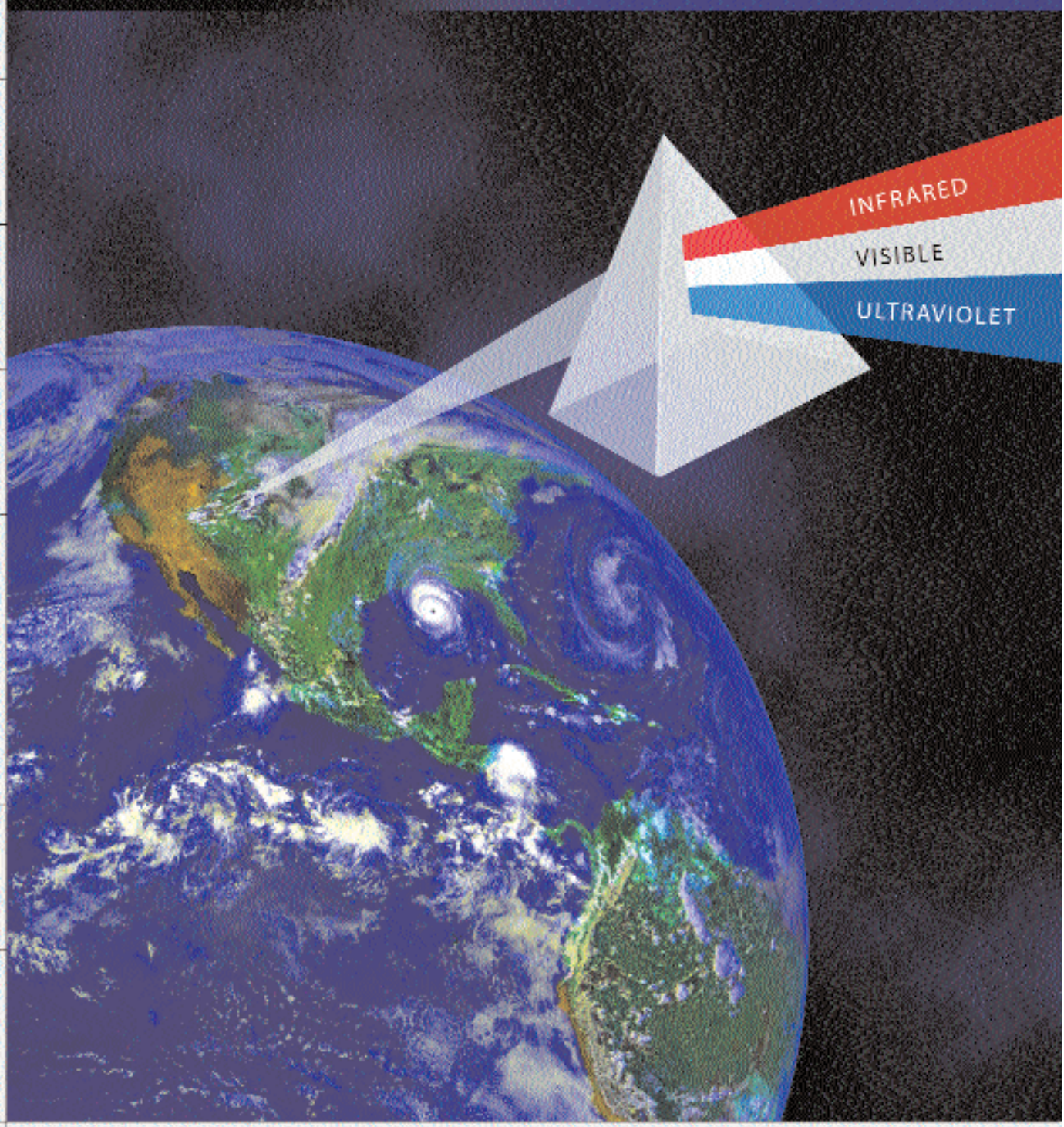
CALCON 2003 CONFERENCE

# Characterization and Radiometric CALIBRATION FOR REMOTE SENSING

Space Dynamics Laboratory / Utah State University, Logan, Utah

September 15 - 18, 2003

## 2003 CALCON PROGRAM




**Sponsored by:** Space Dynamics Laboratory (SDL), The Missile Defense Agency (MDA), The National Institute of Standards and Technology (NIST), Utah State University (USU)

**Co-Sponsored by:** The Aerospace Corporation, The National Aeronautics and Space Administration (NASA), The National Oceanic and Atmospheric Administration (NOAA), The University of Alabama-Huntsville, The University of Arizona Optical Sciences Center

## Monday, September 15, 2003

**1:00 PM** Pre-Conference Workshop (to be held at the Space Dynamics Laboratory, Calibration & Optics Research Laboratory, 489 East 1650 North, North Logan; all other sessions to be held on the campus of Utah State University)

**Part I:** "Data Uncertainty Traced to SI Units," David Pollock, University of Alabama
**Part II:** "Concepts and Applications of Measurement Uncertainty," W. Tyler Estler, NIST

## Tuesday, September 16, 2003

**7:30 AM** Continental Breakfast and Registration - Campus of Utah State University

**8:30 AM** Welcome by David Norton, Chief Executive Officer, Utah State University Research Foundation
Introduction of Keynote Speaker, Michael Pavich, Director, SDL, Utah State University
Keynote Presentation, Colonel Mark Borkowski, Director, Space Based Infrared System (SBIRS) Program Office

**9:30 AM**

### SESSION I:
### Traceability of Absolute Radiometry in Remote Sensing

Chair: Joseph Rice, NIST
Co-Chair: David Smith, International Telephone and Telegraph Corporation (ITT)

"Sensor Test Chambers Evaluations and Calibrations of the NIST BXR I and the Next Generation BXR II," Adriaan C. Carter, R. Datla, NIST, Optical Technology Division; T. Jung, A. Smith, Jung Research and Development Corporation

"Comparison of Various Blackbody Outputs: Relative Emissivity Measurements Using a Transfer Radiometer," Dave Smith, ITT Industries Aerospace/Communications Division

"Accurate Transfer of the New NIST Calibrations," Edward Zalewski, S. Biggar, Remote Sensing Group, Optical Sciences Center, University of Arizona

"Traceability of Absolute Radiometric Calibration for the Atmospheric Emitted Radiance Interferometer (AERI)," Fred A. Best, H.E. Revercomb, R.O. Knuteson, D.C. Tobin, R.G. Dedecker, T.P. Dirkx, M.P. Mulligan, N.N. Ciganovich, Y. Te, Space Science and Engineering Center, University of Wisconsin-Madison

"Development of NIST Capabilities for Infrared Spectral Emittance Measurements," Leonard M. Hanssen, V. Khromchenko, A. Prokhorov, S. Mekhontsev, NIST

**12:15 PM** Lunch

**1:30 PM** "The Radiance Scale of the NIST Large-area Cryogenic Blackbody," Joseph Rice, J. Fowler, J. O'Connell, D. Allen, NIST

"System Level vs. Piece Parts Calibration; NIST Traceability - When Do You Have It and What Does It Mean?" Steven Lorentz, L-1 Standards and Technology, Inc; J. Rice, NIST

**POSTER:** ~~"Russian/American Terminology on Radiometric Calibration of Space-borne Opto-electronic Sensors," Alexander Prokhorov, Optical Technology Division, NIST; V. Privalsky, SDL; R. Datla, Optical Technology Division, NIST; V. Sapritsky, Vega International, Inc.; V. Zakharenkov, O. Mikhaylov, Vavilov State Optical Institute, St. Petersburg, Russia~~

**POSTER:** "Performance of a Compact Cryogenic Amplifier," Allan W. Smith, T. Jung, Jung Research and Development Corporation; A. Carter, R. Datla, NIST

**POSTER:** "NIST BXR II Design and Capabilities," Timothy Jung, A. Smith, Jung Research and Development Corporation; A. Carter, R. Datla, NIST

**POSTER:** ~~"Cryogenic Radiometers and other State of the Art Technology for Absolute Measurements from the UV to the IR," Steven Lorentz, L-1 Standards and Technology, Inc.~~

**POSTER:** ~~"A New Cryogenic Collimator for the Low Background Infrared Calibration Facility at NIST," Steven Lorentz, L-1 Standards and Technology, Inc.~~

**SESSION II:**

**2:30 PM** **Solar, Lunar, and Stellar Radiometric Measurements**

Chair: Gregg Kopp, University of Colorado
Co-Chair: Tom Stone, United States Geological Survey

"The Aerospace Spectral Energy Distribution (ASED) Stellar Radiometric Calibration Database," Ray Russell, G. Rossano, A. Mazuk, D. Lynch, M. Chatelain, C. Venturini, T. Prater, D. Kim, S. Mazuk, M. Ostrander, The Aerospace Corporation

"ACRIM TSI Results and Composite TSI Time Series," Richard Willson, Principal Investigator, ACRIM Experiments, Columbia University

"Spectral Irradiance Measurements of the Sun in the Visible and Near Infrared Using the SORCE SIM Instrument," Jerald Harder, J. Fontenla, B. Smiley, G. Lawrence, G. Rottman, LASP, University of Colorado

"Post-launch Calibration Status of the Total Irradiance Monitor," Greg Kopp, G. Lawrence, G. Rottman, University of Colorado

"Radiometric Observations of the Moon for On-orbit Calibration," Tom Stone, H. Kieffer, US Geological Survey

**5:15 PM** Adjourn

**POSTER:** ~~"Calibration of SOLSTICE Using Stars," Martin Snow, W. McClintock, G. Rottman, LASP, University of Colorado~~

**POSTER:** ~~"NIST Aperture Area Measurement Method Used in Aperture Area Comparison for Exo-atmospheric Solar Irradiance," B. Carol Johnson, M. Litorja, NIST; J. Butler, NASA~~

## Wednesday, September 17

**7:30 PM** Continental Breakfast and Poster Session

**SESSION III:**

**8:00 AM** **Pre-launch to On-orbit Calibration Transfer: Approaches and On-orbit Monitoring Techniques**

Chair: Jim Butler, NASA
Co-Chair: Bob Barnes, NASA

"Satellite Calibration Requirements for Measuring Global Climate Change: Report of a Workshop," George Ohring, R. Datla, NIST

"Inter-satellite Calibration of High Resolution Infrared Radiation Sounders," Changyong Cao, NOAA/NESDIS/STAR; H. Xu, IMSG Inc.

"In-flight Calibration of SPOT5 High Resolution and Wide Field of View Sensors," François Cabot, B. Fougnie, A. Meygret, P. Henry, CNES/QTIS/GC, France

"Reflectance-based Calibration of Landsat-7 ETM+ as an Example of On-orbit Radiometric Calibration Monitoring," Kurt Thome, C. Stratton, University of Arizona

"Comparison of Spectral Radiance Calibration Techniques used for the Shuttle Solar Backscatter Ultraviolet (SSBUV) Instrument and the Ozone Monitoring Instrument (OMI)," M. Kowalewski, E. Hilsenrath, S. Janz, G. Jaross, Science Systems and Applications, Inc.; M. Dobber, R. Dirksen, Royal Netherlands Meteorological Institute, De Bilt, The Netherlands; J. Groote Schaarsberg, TNO Institute of Applied Physics, Delft, The Netherlands

"On-orbit Characterization of Terra MODIS Thermal Emissive Bands Response vs. Scan Angle," X. Xiong, V. Salomonson, NASA; K. Chiang, A. Wu, S. Xiong, N. Chen, SSAI; W. Barnes, B. Guenther, UMBC

"Calibration Comparison of Seven On-orbit Images via the Moon," Hugh Kieffer, T. Stone, US Geological Survey

**POSTER:** "On-ORBIT Radiometric Calibration Uncertainty of the Terra MODIS Thermal Emissive Bands," Kwo-Fu Chiang, A. Wu, SSAI; W. Barns, V. Salomonson, B. Guenther, X. Xiong, NASA

**POSTER:** ~~"Cross-comparison of ETM+ and TM Using a Joint Overpass of Railroad Valley Playa," David Moyer, K. Thome Remote Sensing Group, Optical Science, University of Arizona~~

**POSTER:** ~~"Pre-launch and On-orbit Calibration of the Spectral Irradiance Monitor (SIM) on SORCE," Byron Smiley, J. Harder, G. Lawrence, G. Rottman, LASP, University of Colorado~~

**POSTER:** ~~"Early Life Trend line of the Radiometric Calibration of ASTER Using Cross-comparison with MODIS," Quinn Sanford, K. Thome, Remote Sensing Group, Optical Sciences Center, University of Arizona~~

**12:15 PM** Lunch

**1:15 PM**

## SESSION IV:
## Hyper Spectral Remote Sensing

Chair: Hank Revercomb, University of Wisconsin-Madison
Co-Chair: Bill Smith, NASA LaRC

"AIRS In-flight Special Test Results and Operational Lessons Learned," D. Elliott, T.S. Pagano, S. Gaiser, S. Brogerg, T. Hearty, K. Overoye, M. Weiler, J. Gohlke, S. Licata, Jet Propulsion Laboratory

"AIRS Radiometric and Spectral Performance and Calibration Accuracy," T.S. Pagano, S. Gaiser, L. Strow, Jet Propulsion Laboratory

"On-orbit Spectral Calibration of the Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS)," David C. Tobin, H. Revercomb, R. Knuteson, University of Wisconsin-Madison

"A Method for Correcting for Telescope Spectral Transmission in the Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS)," John Elwell, D. Scott, Space Dynamics Laboratory, Utah State University

"Scanning High-resolution Interferometer Sounder (S-HIS) Aircraft Instrument Calibration and Atmospheric InfraRed Sounder (AIRS) Validation," Henry E. Revercomb, D. Tobin, R.O. Knuteson, F.A. Best, W.L. Smith, P. van Delst, D.D. LaPorte, S.D. Ellington, M.W. Werner, R.G. Dedecker, R.K. Garcia, N.N. Ciganovich, H.B. Howell, S. Dutcher, University of Wisconsin-Madison

"An Overview of Ground and On-orbit Characterization and Calibration of the Geosynchronous Infrared Fourier Transform Spectrometer (GIFTS)," John Elwell, D. Scott, Space Dynamics Laboratory, Utah State University; H. Revercomb, F. Best, R. O. Knuteson, University of Wisconsin-Madison

"The Role of NIST in the Calibration of Future High Spectral Resolution Instruments," Joseph Rice, K. Lykke, S. Brown, J. Zhang, G. Eppeldauer, L. Hanssen, NIST

**5:15 PM** Adjourn

**POSTER:** ~~"Radiometric Characterization of a Portable, Fiber-optic Coupled, Spectrometer System," B. Carol Johnson, S. Brown, NIST; J. Butler, M. Hom, B. Markham, NASA~~

**POSTER:** "Radiometric, Spectral and ILS Uncertainty of the NPOESS Cross-track Infrared Sounder (CrIS)," R. J. Glumb, D. Crain, ITT

**6:30 PM** Traditional cookout up Logan Canyon with "The Better Half," a country and western music band with a bluegrass flavor and a bit of humor.


## Thursday, September 18

**7:45 AM** Continental Breakfast and Poster Session

**8:15 AM** **SPECIAL POSTER SESSION**
Poster authors will accompany their posters during this session.

**9:30 AM** **SESSION V:**
**Polarization Issues**
Chair: James Peterson, SDL
Co-chair: Joseph Shaw, Montana State University

"Imaging Continuously Spinning Polarimeter (ICSP) - Uncertainty Budget and Analysis," Scott Hansen, James Peterson, Space Dynamics Laboratory, Utah State University

**POSTER:** ~~"Polarization Issues in Blackbody Calibrations," James A. Fedchak, T. Jung, A. Smith, Jung Research and Development Corp.~~

**10:00 AM** **SESSION VI:**
**Recent and Current Programs**
Chair: Mark Larsen, SDL
Co-Chair: Ed Zalewski, University of Arizona, Optical Sciences Center

"Demonstration of the Stierwalt Effect Caused by Scatter from Induced Coating Defects in Multilayer Dielectric Filters," J.D. Barrie, P.D. Fuqua, The Aerospace Corp.

~~"Off-axis Scatter Response of Limb Emission Sensors Derived from Lunar Scans," Larry Gordley, Y. Wang, GATS, Inc.; J. Russell, Hampton University; M. Mlynczak, NASA; J. Tansock, J. Stauder, SDL~~

**POSTER:** ~~"Non-contact Absolute and Relative Aperture Area Measurements for Small Apertures," James A. Fedchak, T. Jung, A. Smith, Jung Research and Development Corp~~.

**POSTER:** ~~"Stray Light, Ocean Color and Chlorophyll a," Stephanie J. Flora, M. E. Feinholz, M. A. Yarbrough, Moss Landing Marine Laboratories; B. C. Johnson and S. W. Brown, NIST; D. K. Clark, NOAA~~

**POSTER:** ~~"Evaluation of Cirrus Cloud Radiances for Use in Radiometric Calibration," Courtney Stratton, K. Thome, J. Reagan, Remote Sensing Group, University of Arizona Optical Sciences Center~~

**POSTER:** ~~"Characterization and Pre-launch Radiometric Calibration of Pushbroom CCD Sensor Using Diffused White Screen Method," M. Ridwan Hidayet, A. Arshad, Astronautic Technology, Kuala Lumpur~~

**12:00 PM** Lunch

**SESSION VII:**

**1:15 PM** **Calibration Planning Efforts for New and Emerging Programs**

Chair: Randy Nicholson, Sverdrup Technology

"Current Program Support and Status of the 7V and 10V Chamber Sensor Test Facilities at the AEDC," K.D. Mead, R. A. Nicholson, Sverdrup Technology, Arnold Engineering Development Center

"Calibration of IR Sources in the AEDC 7V and 10V Chambers," R. A. Nicholson, K. D. Mead, Sverdrup Technology, Arnold Engineering Development Center

"Infrared Internal Calibration Sources developed at SSGPO, Inc.," E. C. Kintner, E. S. Jacobs, J. Hartley, P. J. Cucchiaro, L. Wall, SSG Precision Optronics, Inc.

**SESSION VIII:**

**3:00 PM** **Developing National Calibration/Certification Standards for EO/IR Systems**

Chair: Randy J. Jost, Utah State University
Co-Chair: LTC Kevin Ayer, Air Force Research Laboratory

"Lessons Learned in Applying ANSI/NCSL Z-540 to the RCS Community and Transferring Those Lessons to the IR Measurement Community," R.W. Davis, EG&G Technical Services, Inc.; R. Jost, Utah State University

~~"Infrared Calibration and Measurement Standards: A Navy Field Measurement Perspective," K. Young, NAVAIR, Point Mugu; K. Snail, USN NRL; M. Falco, NAVAIR, Patuxent River~~

"A Strawman Rangebook to Support Range Characterization for the IR Measurement Community," Randy Jost, Utah State University

**SESSION IX:**

**4:50 PM** **Focus on the Future - A Summary with the Eight Session Chairs**

Chair: Joe Tansock, SDL

Wrap up: Joe Tansock, Conference Chair

**5:00 PM** Adjourn