JACIE

Joint Agency Commercial Imagery Evaluation
Civil Commercial Imagery Evaluation Workshop
Galt House Hotel, Louisville, KY
March 26-28, 2014

NASA NOAA USDA USGS science for a changing world

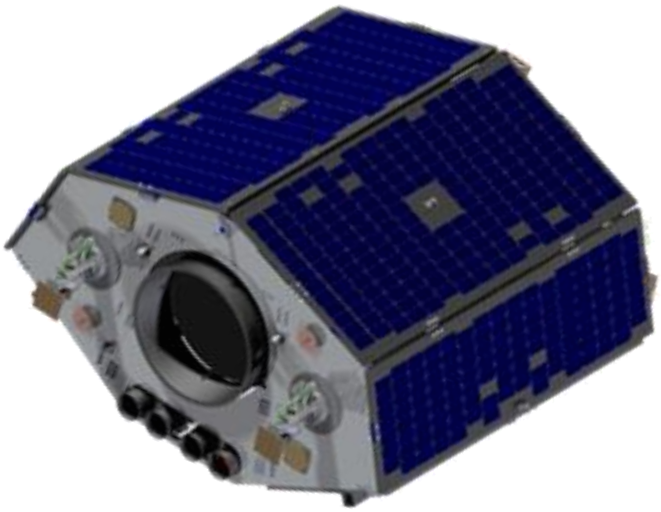
Contents

KEYNOTE SPEAKERS

Biographies

David Hodgson

David Hodgson is the CEO of DMCii (DMC International Imagining Limited) with over 20 years of satellite and service industry experience. He holds an MBA from Warwick business School and degree in computing from Surrey University. David has served for 6 years, and twice lead, the Executive Secretariat of the International Charter, 'Space & Major Disasters' and is a past chairman the British Association of Remote Sensing Companies (BARSC).



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Dr. Frank Kelly

Dr. Frank P. Kelly, USGS EROS Center Director and USGS Space Policy Advisor, comes to the USGS from Anchorage, Alaska, where he served as the NOAA National Weather Service (NWS) Regional Director. Prior to being stationed in Anchorage, Dr. Kelly served in several senior leadership positions at NWS Headquarters in Silver Spring, Maryland, including a key leadership role in the implementation and activation of the national deployment of inter-agency capability to transmit time-sensitive information of all hazards, including weather, hydrologic, environmental and homeland security threats.

He started his professional career in the US Air Force, where he served in several capacities, including HQ USAF Satellite Acquisition Manager for Defense Meteorological Satellite Program. After retiring from the Air Force, he worked in the private sector as Senior Staff Scientist and later as Vice-President at Atmospheric and Environmental Research, Inc.

Dr. Kelly holds a PhD, Colorado State University, Atmospheric Science (with focus on satellite meteorology, statistics, and environmental forecasting applications), an MS, Colorado State University, Atmospheric Science, and a BS, Montana State University, Earth Science.

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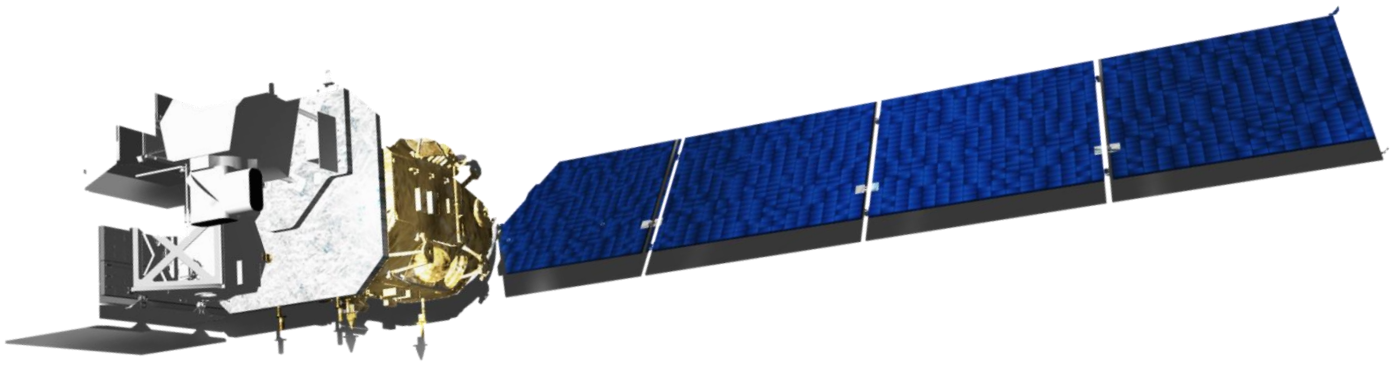

JACIE AGENDA

Wednesday

7-8 a.m.
JACIE Breakfast
Registration

Keynote Session - Joint w/ ASPRS 8-9:15 a.m.

Speakers:
David Hodgson, Managing Director, DMCii
Dr. Frank Kelly, Director USGS EROS

Beverage Break in Exhibit Hall

JACIE Session #1a: 9:30 – 11 a.m.

JACIE Sponsoring Agency Briefings
90 Minutes
4 presentations
USDA, NOAA, NASA, USGS
NASA: Dr. Stephen Volz
NOAA: Dr. Changyong Cao
USDA: Glenn Bethel
USGS: Jenn Lacey
Moderators: Kurt Thome and Greg Stensaas

JACIE Session 1b: 11-12 p.m.

Q&A Session for Keynotes & Agencies
60 minutes
Ask questions of Keynotes and Agency Reps
Moderators: Kurt Thome and Greg Stensaas

12-1:30 p.m.
JACIE Lunch
(included with JACIE registration)

JACIE Session #2: 1:30 – 3 p.m.
Moderator: Jon Christopherson

14.023 Michele Kuester: Validation of the WorldView-2 Absolute Radiometric Calibration

14.003 Ajit Sampath: A Look at Data From Astrium's New Satellites: SPOT-6 and Pleides 1A & 1B
14.002 Sebastien LePrince: COSI-Corr Processing: A Solution for 3D Change Detection Using Optical Remote Sensing
14.030 Andreas Brunn: Combining Relative and Absolute Calibration Methods to Achieve Radiometric Calibration of the RapidEye Constellation

Beverage Break in Exhibit Hall

JACIE Session #3: 3:30 – 5 p.m.
Spotlight Session, Moderator: Kurt Thome

14.025 Brian Cutler: Airbus Defense and Space's Complete Optical Constellation

14.034 Klaus Neumann: Airborne Imaging Sensor from Hexagon Geosystems

14.040 Michael Gruber: UltraCam Osprey - Calibration, Aerial Operation and Data Processing
14.039 Ellis Freedman: An Update on the Constant MTF Interpolator: An Image Resampler with Minimal MTF Losses and Geometric Error
14:047 David Mulawa: Geolocation Accuracy Performance of the Digitalglobe Constellation During 2013

5 p.m.
Cheese and Crackers Reception for Posters
Live music by Tommy Jordan, Jesse Winch, Chris McClone, Dave Furr

Thursday

8-9 a.m
JACIE Registration Open

Breakfast w/Exhibitors
Passport Contest Prize Drawing
. Exhibit Hall Open

JACIE Session #4: 9-10:30 a.m.
Moderator: Jon Christopherson

14.027 DongHan Lee: Calibration and Validation for KOMPSAT-3

14.029 DongHan Lee: Definition of KOMPSAT-3 product Quality

14.035 DooChun Seo: Overview of KOMPSAT-3 Geometric Calibration and Accuracy

14.044 Beau Jarvis: A New Axis of Data: Rapid Cadence, Broad Coverage Satellite Imagery

Beverage Break in Exhibit Hall

JACIE Session #5: 11-12:30 p.m.
Joint Special Session: Landsat 8 Data Quality
Moderator: Ron Hayes

14.007 Ron Morfitt: Radiometric Performance of the Landsat 8 OLI and TIRS Sensors

14.008 James Storey: Geometric and Spatial Performance of Landsat 8

14.009 Ron Hayes: Measuring and Monitoring Landsat 8 Data Quality

14.010 Pat Scaramuzza: L8 Higher Level Product Development

JACIE Lunch
(included with JACIE registration)

JACIE Session #6: 1:30 – 3 p.m.
Moderator: Jon Christopherson

14.018 Dirk Robinson: High-Resolution Imagery and Video from SkySat-1

14.017 Byron Smiley: On-Orbit Calibration Activities and Image Quality of SkySat-1

14.020 Jorge Gil: DEIMOS-1 cross-calibration with Landsat-7 and Landsat-8;

14.021 Jorge Gil: DEIMOS-2 cross-calibration with Dubaisat-2

Break

JACIE Session #7: 3:30 – 5 p.m.
Moderator: Ajit Sampath

14.001 Mike Tully: The Rise of the [Geospatial] Machines: The Future with Unmanned Aerial Systems (UAS)
14.033 Scott Perkins: A Case Study on Using Commercial Airborne Imagery to Perform Rapid IA & PA Damage Assessments in Less than 24 Hours

14.024 Brian Cutler: WorldDEM

14.042 Lori Phillips: Integrating Multi-resolution Lidar-derived DEMs into the National Elevation Dataset

(END)

Friday

7:30 – 8:30 a.m.
Lite Breakfast
JACIE Registration Open

JACIE Session #8: 8:30 – 10 a.m.
Moderator: Kurt Thome

14.011 Brad Doorn: Sustainable Land Imaging Architecture

14.012 Darrel Williams: Temporal Repeat Frequency Needed to Achieve Cloud-Free Imagery from Landsat-Class Observatories: An Analysis from 10 Years of MODIS TERRA Daily Coverage
14.043 Dath Mita: Operational Challenges to Contemporary Changes of Satellite Imagery Characterization
14.046 Sebastien Saunier: Coordinated Quality Control (CQC) : Coordinating and monitoring quality information within the GMES/Copernicus Space Component Data Access System

Break

JACIE Session #9: 10:30 – 12 p.m.
Moderator: Dath Mita

14.031 Mary Pagnutti: High Spatial Resolution Visible through SWIR Multispectral Image Product Simulation

14.013 Haile K. Tadesse: Land Cover Classification and Analysis Using Radar and Landsat Data in North Central Ethiopia
14.005 Jon Christopherson: Summary of Characterization Work at the USGS EROS
14.036 Dmitry Varlyguin: Open Data Policy for Landsat Imagery: New Opportunities for Regional and Global Crop Mapping

12-1:30 p.m.
JACIE Lunch
(included with JACIE registration)

JACIE Session #10: 1:30 – 3 p.m.
Moderator: Dennis Helder

14.026 Jeffrey Czapla-Myers: The Absolute Radiometric Calibration of Earth-Observing Sensors using Ground-Based Techniques
14.015 Dennis Helder: Absolute Radiometric Calibration Using Pseudo Invariant Calibration Sites

14.032 Robert Ryan: Advanced LED illuminated Calibration Sphere

14.016 Tom Heinrichs: A New Alaska, US, and Global Capability: Near-real-time, Multi-satellite, Optical, Radar, and Elevation Products

Break

JACIE Session #11: 3:30 – 5 p.m.
Moderator: Greg Stensaas

14.006 Ajit Sampath: Developing Standards for Lidar Quality

14.037 Dean Merchant: ASPRS Guidelines For Geometric Calibratrion of Optical Aerial Camera Systems
14.014 Kurt Thome: Sensor Interconsistency to Achieve Climate-Quality Measurements

Closing items and re-cap (Greg Stensaas)

(END)

Joint Agency Commercial Imagery Evaluation

PRESENTERS and MODERATORS
Biographies (alphabetical order)

: JACIE Planning Committee
: JACIE Co-Chair
: Agency Speaker
: Moderator

Bethel, Glenn

Mr. Bethel currently serves as USDA's Remote Sensing Advisor. In this capacity, he represents USDA agencies; focusing on national policy, synergy with other departments and the application of remote sensing technologies for USDA mission support. Mr. Bethel plays a national role in the coordination and consolidation of remote sensing and geospatial information for disasters. Before his current position, Mr. Bethel served as the Chief of the Farm Service Agency Remote Sensing Section, where he was responsible for National GIS implementation. He has served as Chief of the Foreign Agricultural Service, Remote Sensing Section where he was responsible for processing of global imagery, geospatial database development, and crop model implementation for global agricultural monitoring. Before joining the federal government, Mr. Bethel worked on contracts supporting FEMA, FAA, DoD, and USDA.

Mr. Bethel has a BS in Agronomy from Virginia Tech and MS in Geographic and Cartographic Sciences from George Mason University. Mr. Bethel serves on numerous working groups including the Civil Applications Committee, Interagency Remote Sensing Coordination Cell (IRSCC), US Group on Earth Observations (USGEO) and leads the USGEO Working group: "Support Sustainable Agriculture and Forestry and Combat Land Degradation." He was appointed to the National Satellite Land Remote Sensing Archive Advisory Committee (Department of Interior), been a member of the Future of Land Imaging Interagency Working Group (Office of the President), chaired the National Digital Orthophoto Program (NDOP) steering committee, and been a member of the National Aerial Photography Program (NAPP) steering committee.

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Brunn, Andreas

Andreas Brunn earned his degree in Physical Geography (Diplom Geograph) with an emphasis in Remote Sensing from the University of Wuerzburg, Germany in 1999 and a PhD (Dr.-Ing.) in Remote Sensing from the Technical University of Clausthal in 2006. After his education he worked first for the Federal Institute of Geosciences and Natural Resources where he was responsible for several projects mainly to use hyperspectral remote sensing data for ecological and environmental problems. Since 2007 Andreas works for RapidEye AG where he is responsible for all questions of image quality and image calibration.

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Cao, Changyong

Dr. Changyong Cao is a research physical scientist at NOAA/NESDIS /Center for Satellite Applications and Research, specializing in the calibration of radiometers onboard NOAA's operational environmental satellites. He is currently leading the Suomi National Polar-orbiting Partnership (NPP) Visible Infrared Imaging Radiometer Suite (VIIRS) Sensor

Data Records (SDR) team as well as the GOES-R calibration working group for the new generation polar-orbiting and geostationary operational satellites. His is responsible for developing and refining the methodology for inter-satellite calibration using the Simultaneous Nadir Overpass (SNO) method, which has been used for the long-term performance monitoring of all radiometers on NOAA's polar orbiting satellites, and is being used by many scientists for quantifying inter-satellite calibration biases in developing long-term time series for climate change detection studies. Before joined NOAA in 1999, he had five years of aerospace industry experience supporting NASA projects, and three years of university teaching experiences. He received his B.S. degree in geography from Peking University 1982, and Ph.D. in 1992 from the Louisiana State University specializing in remote sensing and geographic information systems.

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Christopherson, Jon

Jon Christopherson works at the USGS EROS Center as a contractor for SGT, Inc. With degrees in Electrical Engineering and Space Studies, he has worked with ground, airborne, and space-borne electro-optical sensors for twenty-five years in various defense, aerospace, and civil programs, both domestically and internationally. He currently manages a contractor team supporting the USGS Remote Sensing Technologies Project's work in the assessment of satellite and aerial data as well as other tasks across the broad spectrum of remote sensing.

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Cutler, Brian

Brian has been with Airbus Defence and Space since 2007. During this time he has served as Program Director for the company's many ground receiving stations in North America. In this position he manages the day to day requirements and services for the military, governmental, and commercial contracts supporting the facilities receiving the Airbus satellites' signal information. Prior to joining Airbus DS, Brian worked for Atmospheric Environmental Research (AER) Inc. as a government contractor at the Space Vehicles Directorate (VSBL) of the Air Force Research Laboratory (AFRL). Brian began his career in the U.S. Army as an armor officer. Brian has a B.S. in Mathematics and a M. Ed in Secondary Mathematics.

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Czapla-Myers, Jeff

Jeff Czapla-Myers is an Assistant Research Professor in the College of Optical Sciences at the University of Arizona. He obtained the B.S. degree in Optical Engineering from the University of Arizona in 1997, the M.Sc. degree in Earth and Space Science from York University (Toronto, Canada) in 2000, and the Ph.D. degree in Optical Sciences from the University of Arizona in 2006. His research interests include remote sensing, radiometry, ground-based vicarious calibration of airborne and satellite systems, and the design, development, and laboratory characterization of radiometers. His current effort includes the in-flight radiometric calibration of Landsat 7 ETM+, Landsat 8 OLI, and the RapidEye constellation of satellites.

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Doorn, Brad

Dr. Doorn is the Program Manager for Water Resources in the Applied Science Program of the Earth Science Division of NASA. With over 25 years of experience in applying remote

sensing data to earth application issues, Dr. Doorn now manages over 20 applied research projects led by investigators across the U.S. He also serves as the Applied Sciences Project Scientist for Agriculture-Forestry related initiatives and serves on multiple satellite mission support teams and national committees.
Previously, Dr. Doorn was the Division Director of the International Production Assessment Division in the Office of Global Analysis, Foreign Agricultural Service (FAS), USDA. He also spent nearly 10 years on active duty as a Topographic Engineer for the U.S. Army.
Dr. Doorn spent five years in private industry as a manager and specialist in remote sensing, GIS, and mapping for numerous engineering and environmental projects. He is a long time member and officer (including President) of the American Society for Photogrammetry and Remote Sensing (ASPRS).
Dr. Doorn received his doctorate and master's degrees from The Ohio State University in Geodetic Science and Surveying and his bachelor's degree in Geological Engineering from South Dakota School of Mines and Technology.

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Freedman, Ellis

Ellis Freedman has a B.S. from Temple University and an M.S. from Northeastern University, both in physics, and over 34 years' experience in remote sensing. In 2010, after 27 years with Lockheed Martin Co., he left the position of Fellow to form his own consulting firm, Serious Science, LLC. He has been Chief Engineer for the calibration of electro optic sensors and the processing of raw data into imagery for large government and commercial remote sensing systems. As a project lead, he has designed the high level architecture for large data processing systems and developed mathematical algorithms and modeling tools for the correction, enhancement, and exploitation of imagery, and the characterization, detection, and removal of artifacts and noise. He has also led the development, integration, and implementation of a variety of visible, infrared, radar, multispectral and hyperspectral hardware and software systems. He is currently focusing his efforts on providing technical and systems engineering support to commercial imaging systems and pursuits of future civil remote sensing programs.

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Gil, Jorge

Jorge Gil has a degree in physics from the University of Valladolid (Spain).
In 2005 he joined the Remote Sensing Laboratory of the University of Valladolid (LaTUV) where he specialized in image processing, working with MODIS, Landsat, NOAA, Meteosat and other earth observation systems. In 2006 he was hired by Elecnor Deimos Imaging, the company of the Elecnor group devoted to Earth Observation, which owns, operates and manages the Deimos-1 and Deimos-2 satellites. He is responsible of the image processing chain and the calibration activities.
3) POC info. Please include Name, Title, Organization, full address, telephone and e-mail:

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Gruber, Michael

Michael Gruber holds a Master Degree in Surveying and Photogrammetry at the Technical University Graz. From 1984 - 1990 he was employed at the Institute for Image Processing and Computer Graphics of Joanneum Research, where he was responsible for projects in Close Range Photogrammetry and Analytical Photogrammetry. From 1990 -1992 he was on the staff of the Department of Remote Sensing, Image Processing and Cartography of the Technical University Graz. After a short period in a private mapping company he joined the Institute for Computer Graphics of the Technical University of Graz to lead the working group for 3D Object Reconstruction. He was responsible for several student lectures at the School of Information Engineering as well as for the supervision of student projects and diploma theses projects. In 1997 he got his PhD degree from the Technical University of Graz.From October 1999 to May 2006 Michael Gruber is full time staff of Vexcel

Imaging Austria. He was responsible for all photogrammetric issues (Chief Scientist Photogrammetry) at Vexcel.

In May 2006 Vexcel was acquired by Microsoft Corp., Redmond, WA. Since then Michael Gruber is full time employee at Microsoft. He is still responsibility for all photogrammetric issues at the Graz office of Microsoft. Michael Gruber holds several US patents for developments in digital photogrammetry, among them the basic concept of the digital aerial camera family UltraCam.

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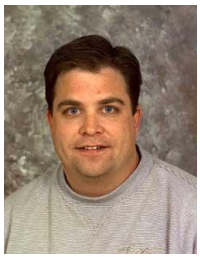

Education: BS Geography, 1989, SDSU, Brookings, SD; MS Geography, 1992, SDSU, Brookings SD. Experience: Digital Data Production data processing analyst, Geometric Calibration Analyst, Data Analyst for the Remote Sensing Technologies Project (RST), and Calbration Validation Team lead.

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Heinrichs, Tom

Tom Heinrichs is Director of the Geographic Information Network of Alaska (GINA) at the University of Alaska Fairbanks. He has been instrumental in creating partnerships and joint projects among the University, agencies, and the private sector. Over the past decade, Tom has lead GINA's growth into becoming Alaska's largest in-state archive and distributor of geospatial data. Prior to going to work for UAF, Tom was a Hydrologist and Project Manager in Alaska, first with the USGS, then with Michael Baker, an engineering consultancy. He holds a B.S. in Physics from Stanford and a M.S. in Geophysics from the University of Alaska Fairbanks.

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Helder, Dennis

Dennis Helder received the B.S. and M.S. degrees in electrical engineering from South Dakota State University and the Ph.D. in engineering from North Dakota State University. He has been involved with radiometric calibration of the Landsat series of instruments since 1988. He founded the SDSU Image Processing Laboratory in 1991 and is the current director. He has been involved with the Landsat 7 Science Team, the EO-1 Science Validation Team, and the Landsat Data Continuity Mission Science Team. Helder is currently the Associate Dean for Research in the College of Engineering at South Dakota State University.

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Jarvis, Beau

Beau Jarvis has worked in business development and project management in the geospatial industry since 1998. Beau manages business development activities at Planet Labs. He has been active in a number of LiDAR & aerial photography projects across North America. Beau has also worked as a geospatial consultant utilizing commercial imagery for burned area mapping efforts for the US Forest Service. Beau received his MS in environmental management from Duke University.

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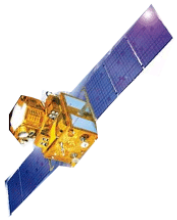

Kuester, Michele

Dr. Michele Kuester has ten plus years of experience in the radiometric calibration and validation of both space and airborne earth remote sensing instrumentation. At DigitalGlobe, Kuester is focused on the absolute radiometric calibration efforts for WorldView-2, GeoEye-1, IKONOS and the upcoming WorldView-3 sensors. Prior to DigitalGlobe she worked with the SDSU team supporting NASA on pre-launch radiometric characterization of both instruments onboard the LDCM payload. Kuester helped to develop the airborne platform and labs at NEON Inc. in Boulder, CO. In addition, while at Ball Aerospace she lead an initiative to develop and fly proof-of-concept Earth observing sensors and the team that designed the Ball Heliostat Test System. Kuester holds a Ph.D. in Atmospheric and Oceanic Sciences from the University of Colorado-Boulder. She also has a M.S. in optical sciences and B.S. in Physics from the University of Arizona-Tucson, where she worked with the Remote Sensing Group participating in the reflectance-based vicarious calibration of sensors such as Landsat, MODIS and SPOT.

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Lacey, Jennifer Sabers

Jenn Lacey is manager of the Observing Systems Branch, in which the primary mission is to collect and populate the archive with Earth imagery. Ms. Lacey specifically oversees the operations of the Landsat satellites, development of the ground system for future missions, new partnership for satellite imagery, calibration and validation of satellite data, as well as the National Land Imaging Requirements effort. She has been with the USGS EROS Center since 1994 and has extensive involvement in remote sensing activities, including mission formulation and development, space policy, project management, software engineering, data processing, and archive and dissemination activities related to earth science data. Specifically, she has managed the Center's Information and Technology Services and Software Engineering and Development activities, the NASA Earth Observation Systems Land Processes Distributed Active Archive Center, and the Commercial Remote Sensing Space Policy Project. Prior to her current role, she served as the Chief Scientist for Remote Sensing Systems in the EROS Director's Office.

Ms. Lacey has a BS and MA in Mathematics from the University of South Dakota and has credits towards her PhD in Geospatial, Science, and Engineering from South Dakota State University.

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Lee, DongHan

DongHan Lee was born in Seoul, South Korea. He received the B.S., M.S. and Ph.D degrees in Astronomy & Space science from Yonsei University, Seoul, in 1990, 1994 and 2011. He has been a chief engineer of the Calibration and Validation for the KOMPSAT series in Korea Aerospace Research Institute (KARI), DaeJeon, from 1995 to now. Dr. Lee is a specialist of the Radiometric and Spatial Calibration and Validation of the high resolution optical remote sensing satellite.

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Leprince, Sébastien

Sébastien Leprince received the Diplôme d'Ingénieur degree from the Ecole Supérieure d'Ingénieurs en Electronique et Electrotechnique, Paris, France, 2003, and the M.S. and Ph.D. degrees in electrical engineering from the California Institute of Technology, Pasadena, in 2003 and 2008. He was a postdoctoral scholar with the division of Geological and

Planetary Sciences, California Institute of Technology from 2008 to 2009. Since 2009, he is a senior research scientist at the California Institute of Technology, where he manages the remote sensing group as part of the Caltech GPS division. Particular emphases are on Earth surface monitoring and geomorphologic processes. He is also the chief executive officer and co-founder of Imagin'Labs Corporation, which provides high accuracy image processing services to the remote sensing industry.

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Merchant, Dean

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- Naval Aviation; "Flying Midshipman USN", March 1946 – April 1949
- Univ. of Illinois, BS Civil Engineering, June 1951
- USAFR, Systems Command, [active duty], June 1951-April 1953
- The Ohio State University, MS Photogrammetry, March 1955
- Aero Service Corp., Field Engineer, March 1955-April 1956
- Fairchild Camera Corp., Photogrammetric Engineer, April 1956-1959
- Syracuse University, Assistant Professor, Civil Engineering, 1960 – 1967
- The Ohio State University, PhD, Geodetic Science
- The Ohio State University, Associate Professor – Professor, Geodetic Science, 1967 – 1988; Professor Emeritus, 1988 to present
- USAFR, Air War College, Student, June 1976 – June 1977
- USAFR, Colonel, [Systems Command], 1977- 1981
- Topo Photo Corp., President, 1988 - present

Licenses [expired]:
PE, New York; PE, PLS Ohio; Cert. Photogrammetrist, ASPRS

Honors:
ASP, Talbert Abrams Award, 1973
ASCE, Surveyor of the Year, 1981
ASPRS, Honorary Member, 2007
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Mita, Dath

Dath K. Mita, PhD: Senior Analyst, Technical Lead and Satellite Imagery Archive Manager, Office of Global Analysis, Foreign Agricultural Service, USDA. Earned PhD and Master of Science (MSc) degrees in Natural Resources Management from North Dakota State University (1995-2006) with emphasis in ecosystems modeling, Geosciences, GIS-Remote Sensing; and a Bachelor of Science degree (BSc) in Agricultural Sciences at the University of Malawi, in Africa. Current lead responsibilities include regional agricultural analyst for South Asia, providing information on agricultural supply and demand analysis including crop conditions and crop production forecast and estimates for the USDA's World Agriculture Outlook Board (WAOB). Also serve as a Technical Lead responsible for enhancing the science and technology capacity in satellite remote sensing and global crop assessment and monitoring as well as the management of USDA's Satellite Imagery Archives. Prior professional engagements include work as a Research Associate at the University of Mississippi GeoInformatics Center (2006-2008), conducted research involving the integration and applications of NASA research results into operational natural resources management models. GIS-Remote Sensing Specialist (2000-2005) for North Dakota State University and North Dakota Agricultural Statistics Service conducting state-wide annual land cover/use classification and change detection for the development of crop statistics and estimates, provided GIS- remote sensing technical support to faculty, staff, and students. Served as a Land Resources Conservation and Evaluation Officer for the Ministry of Agriculture, in Malawi-Africa (1988-1995).

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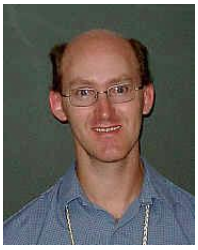

Ron is a Calibration and Validation Analyst for SGT, Contractor to the USGS EROS Center in Sioux Falls, SD.

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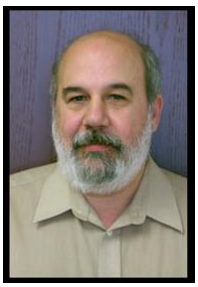
Mulawa, David



David Mulawa is employed by DigitalGlobe in the Remote Sensing Science team and supports geolocation accuracy performance of the satellite constellation. He has 25 years of experience in photogrammetric R&D and working with systems engineering. He has received an M.S. degree in Geodesy and a Ph.D. degree in Photogrammetry from Purdue University.

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Neumann, Klaus

Klaus has a Master Degree in Electronic Engineering from the University of Applied Science in Aalen, Germany. He has been working more than 25 years for Carl Zeiss, Z/I Imaging, Intergraph and now Hexagon Geosystems. He had been involved in hardware and software design of high precision scanners and aerial mapping cameras. Klaus is a worldwide acknowledged expert for aerial cameras. Klaus had recently been appointed as product manager for all airborne imaging sensors at Hexagon Geospatial Solutions Division, which includes the Leica ADS, Leica RCD30 and Z/I DMC II camera systems.

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Pagnutti, Mary

Ms. Mary Pagnutti holds a Master's of Science in Mechanical Engineering from the State University of New York at Stony Brook and has over 25 years of engineering experience ranging from large aerospace defense projects to civil remote sensing applications. From 1998-2007 Ms. Pagnutti supported NASA Stennis Space Center Earth Science programs where she helped to build a nationally recognized in-flight calibration/validation capability. In 2007 Ms. Pagnutti co-founded Innovative Imaging and Research, a company focused on developing technologies that integrate solid state lighting and imaging systems.

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Perkins, Scott

Scott is a certified GIS Professional (GISP) with over 30 years' experience in the geospatial business including owning and operating a small business, as an Officer & Shareholder in an ENR Top 200 A&E firm, as President of T-Kartor USA an International geospatial firm. Scott's current position is VP of Federal Programs at Aero-Metric, Inc. a Quantum Spatial company.
Scott's professional service includes two Federal appointments, he currently serves as vice chair on the NOAA Hydrographic Services Review Panel, a Federal Advisory Committee and in 2011 he completed a four year term on the SBA's Office of the National Ombudsman Regulatory Fairness Board.

Scott earned his associates degree in Photogrammetric Mapping Technology at Ferris State University in 1981 and earned his Business Management degree from Baker University, Overland Park, KS in 2000.

Scott contributes to the Geospatial Profession through serving as Director & Treasurer of the ASPRS Central US Region earning an ASPRS Presidential Citation for Service in 2005. Scott has also served on the Board of Directors of the MAPPS Association from 2004-2012.
Scott resides in Overland Park, Kansas with his wife Kathy of 33 years. His daughter Alex is a cartographer/GIS specialist with the US Army Corps of Engineers, and his son Clayton is an attorney.
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Lori is currently (2013) a Cartographer at the U.S. Geological Survey, National Technical Operations Center. She has been assigned to the Applied Research and Technology group working on elevation and LiDAR processes since 2009. Her previous nongovernmental assignments are as follows: Software Engineer and Photogrammetry Subject Matter Expert at Intergraph and Autometric from 1991 through 2003; Production Manager and Supervisor for Photogrammetric Mapping at Kappa Mapping; and Production Manager and Supervisor for Photogrammetric Mapping Florida Department of Transportation from 2003 through 2009.

Lori has a BS in Surveying Engineering from the University of Maine and is a Certified Photogrammetrist. She maintains her license as a Professional Surveyor and Mapper in Florida.

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Robinson, Dirk

As the Sr. Director of Imagery & Analytics, Dr. Dirk Robinson is responsible for the flow of imagery from photons to information through systems engineering of the SkySat sensor, development of image processing software, and the creation of information products. Dirk has spent the past decade building systems that capture, store, and analyze images including optical system design, image compression and automatic pattern recognition. Prior to Skybox Imaging, he founded the Digital Optics research group at Ricoh Innovations where he developed novel imaging systems for markets ranging from medical to automotive.

Dirk has been awarded 17 patents with over twenty patents pending on his imaging system design research. He has published more than twenty five peer-reviewed publications in the area of imaging and data processing. Dirk received his Ph.D. in Electrical Engineering from the University of California Santa Cruz in 2004.

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Ryan, Robert

Robert Ryan received his PhD in Atomic and Laser Physics from the State University of New York at Stony Brook. He also has an MS in Electrophysics from the Polytechnic Institute of New York and a BS in Physics from Hofstra University. He has earned 11 US patents in the fields of optics and sensors. Dr. Ryan has a broad career that includes developing multispectral, hyperspectral and ultraspectral imaging systems, and biological and chemical weapon sensors. He has supported the NASA Stennis Space Center by developing an Instrument Validation Laboratory where he performed radiometric calibration and spatial resolution evaluations of commercial and government electro-optical imaging systems. He has also served as the Primary Data Acquisition Division Director for ASPRS supporting the development of remote sensing imaging techniques. Dr. Ryan is one of the founders of Innovative Imaging and Research, a company focused on remote sensing image quality and novel applications of solid state lighting and imaging systems.

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Sampath, Ajit

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Current Projects: Digital Aerial Quality Assurance, Camera Calibration, System Characterization

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Received the MS degree in applied Mathematics from Jussieu Paris VII University and MS degree in signal processing from ENSEA School, Cergy Pontoise, in 1999 and 2001 respectively. Works as research engineer at INRIA Rocquencourt France (Research institutes in applied informatics). For the past five years, he has been deeply involved in technical management of the GMES service in charge of coordinating the data quality of remote sensing data. He is involved in long-term data preservation projects as well. In this context, he is supporting operational team for consolidation and re processing of the Landsat archive stored at ESA ground stations. Lastly he leads the pre certification of Landsat 8 ESA ground stations, prior to USGS certification process. Its recent activities are design and implementation of validation methodologies for Landsat 8 data.

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BS Physics,1990, Drexel University; MA Physics, 1993, Temple University
Experience: Sensor calibration, spectral analysis, data mining, algorithm research and prototype development, graphic artist, and principal investigator for vicarious and remote sensing data collections.
Current Projects: LDCM Calibration/Validation, LDCM Cloud Assessment, LDCM Essential Climate Variable research.

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He received the Ph.D. degree in civil engineering from Gyeongsang National University, Korea, in 2002.
He has been at Korea Aerospace Research Institute since 2002, and has been a Senior Researcher of Satellite Cal/Val Department since 2005. His primary research interests and back ground are in satellite photogrammetry, sensor modeling, DEM, Ortho-image generation and geometric calibration of high resolution satellite image data.

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Smiley, Byron

Dr. Byron Smiley is a grizzled, 10 year veteran of the remote sensing industry and the JACIE conference series. In September 2004 he started his first satellite job at DigitalGlobe. He was a Geometric Calibration Engineer who tirelessly measured absolute geolocation accuracy to high precision, and also calibrated the camera models of WV01 and WV02 on-orbit. After leaving DigitalGlobe in May 2011, he decided to try his hand at the mixture of remote sensing and computer vision research being done at the Video Understanding and Exploitation Directorate of BAE Systems. He held the position of Senior Research Engineer from September 2011 to May 2013, assisting programs that tracked moving objects in video collected during surveillance of military operations. When the opportunity arose in September 2013, he transitioned to Skybox Imaging to resume his favorite role of Geodetic Calibration Engineer, analyzing SkySat-1 imagery with ground control points and correcting optical distortion. While he enjoys Skybox so much that he intends to stay there forever, he still made time to attend JACIE 2014, where he lays down the facts about the geometric and radiometric calibration of SkySat-1.

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Stensaas, Greg

Greg Stensaas graduated with a Bachelor of Science degree in Mechanical Engineering from South Dakota State University, and has taken post graduate classes in Engineering and Information Technology at the University of Nebraska–Lincoln and Dakota State University.

Greg has extensive systems engineering and information systems experience; such as; electro-optical and infrared systems exploitation, development, simulation, and test experience as an electronics engineer and operations research analyst for the U.S. Department of Defense; principle engineer for the NASA Earth Observing System Distributed Active Archive Center, and was the systems engineer for the U.S. Geological Survey (USGS) Landsat Data Continuity Mission at the Earth Resources Observation and Science (EROS) Center.

Greg continues to work at USGS EROS in Sioux Falls, South Dakota and is currently serving as the USGS Remote Sensing Technologies Project Manager, where he is responsible for aerial and satellite sensor calibration and system/product characterization and evaluation. He is the USGS point of contact for the system characterization and continues to work many cross-calibration efforts.

Greg is a co-chair of the Joint Agency Commercial Imagery Evaluation (JACIE) program. He was the Primary Data Acquisition Division (PDAD) Director for the American Society of Photogrammetry and Remote Sensing (ASPRS) and was the chair of the Inter-Agency Digital Imagery Working Group (IADIWG). Greg has been the chair of the Committee on Earth Observation (CEOS) Working Group on Calibration and Validation (WGCV), and is leading Global Earth Observation System of Systems Quality Assurance Strategy task for the Group on Earth Observation (GEO).

Greg has strong interest in the areas of sensor design and systems application, laboratory and in situ calibration and characterization processes, information storage and access, and system and data quality assurance. Greg has been involved in many system characterization, calibration, and validation efforts, and has presented and prepared numerous scientific analyses and associated science papers.

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Education: BS Civil and Environmental Engineering, 1979, Cornell University; MS Civil and Environmental Engineering, 1981, University of Wisconsin – Madison; MS Electrical Engineering, 1989, The Johns Hopkins University.

Experience: Sensor and satellite modeling, algorithm design, system engineering, software design and development, system integration, and production operations for sensor data analysis and calibration, image processing, and photogrammetric exploitation systems. Experience with USGS, NASA, DoD and commercial remote sensing customers. Currently the geometric calibration/validation lead for the Landsat Data Continuity Mission.

Current Projects: Landsat Data Continuity Mission, Landsat.
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Tadesse, Haile K.

My name is Haile Tadesse and for the last 7 months I am working in USGS as GIS intern and Cartographic technician. I have educational and practical experiences in remote sensing, geospatial analysis, ArcGIS, Landsat and radar data interpretation, cartography, environmental science, ecology, agriculture, natural resources management, and hydrology.

Currently I am PhD candidate in Environmental Science and Public Policy at George Mason University in Virginia. My research topic is land cover classification and analysis using radar and Landsat data. I graduated from GMU in Geographic Information Science. I have masters of Science in Land resources management from University of Ghent in Belgium and BSc in Soil and Water Conservation from Mekelle University in Ethiopia.

In USGS, I am working in historical Topo Scanning project. I have practical and educational experience in ArcGIS Spatial analysis, Network Analyst, Statistical Analyst, Hydrological models, Watershed analysis and Erosion models such as N-SPECT, AGNPS, RUSLE, and others. I have analyzed remote

sensing data using ERDAS and ENVI for my research. I have analyzed soil degradation issues in Africa as part of my internship in the World Bank, Global Environment facility. I have collected digitized, analyzed and interpreted data for land Evaluation for irrigation in East Africa. I developed suitability map for land use (Cotton and Sesame) using Arc Info and Arc View software. I have also experience in satellite imagery and spatial data analysis.

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Thome, Kurt

Kurt Thome obtained a BS degree in Meteorology from Texas A&M University and MS and PhD degrees in Atmospheric Sciences from the University of Arizona. He then joined what is now the College of Optical Sciences becoming full professor in 2006. He served as the Director of the Remote Sensing Group from 1997 to 2008. Thome moved to NASA's Goddard Space Flight Center in 2008 as a Physical Scientist in the Biospheric Sciences Branch. He has been a member of the Landsat-7, ASTER, MODIS, and EO-1 Science Teams providing vicarious calibration results for those and other imaging sensors. He is a Fellow of SPIE and served as the calibration lead for the thermal instrument on the Landsat Data Continuity Mission. He is the Project Scientist for Terra, Deputy Project Scientist for CLARREO for which he is also the instrument lead for the Reflected Solar Instrument, and is the Instrument Scientist for VIIRS.

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Tully, Mike

Serving as President & CEO of Aerial Services, Mike's duties include managing company endeavors, supervising GIS programming, and overseeing the information technology and technical resources. Mike has managed the company as co-owner since 2000 and was named President & CEO in 2003. Mike is a Certified Photogrammetrist (CP) and Certified Geographic Information Systems Professional (GISP), as well as a member of the American Society for Photogrammetry & Remote Sensing (ASPRS), Management Association for Private Photogrammetric Surveyors (MAPPS), Society of American Foresters (SAF), and National States Geographic Information Council (NSGIC).

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Varlyguin, Dmitry

Dmitry Varlyguin is Vice President & Chief Scientist at GDA Corp since 2004. He has over 25 years of experience working in Remote Sensing with GIS and image processing systems and a range of commercial and public remotely sensed data. His research interests include: automated analysis of Remotely Sensed data, combined spectral, spatial, and contextual image processing, and the design of iterative, self-learning expert systems. Dr. Varlyguin received his B.S. and M.S. from Moscow State University and his Ph.D. from Clark University in Worcester, MA.

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Williams, Darrel

Dr. Williams joined Global Science & Technology, Inc. immediately upon retiring from a 35-year career in NASA Goddard's Earth Science Division. There he conducted remote sensing research to develop enhanced techniques for assessing terrestrial ecosystems worldwide. Over time he assumed science management positions of increasing responsibility, including field campaign manager, Branch Head, Landsat Project Scientist, and Laboratory Associate and Acting Chief. He received NASA medals for Outstanding Leadership and Exceptional Service, and the "Aviation Week and Space Technology 1999 Laurels Award" for outstanding achievement in the field of Space in recognition of his science leadership role of Landsat 7.

Dr. Williams received BS and MS degrees in Forest Science from the Pennsylvania State University in 1973/74 and attained his PhD in Physical Geography from the University of Maryland in 1989. In 2006 he received an "Outstanding Alumni Award" from the School of Forest Resources at Penn State. In 2012 Williams joined the Advisory Board for the Department of Forest Resources and Environmental Conservation, College of Natural Resources and Environment, at Virginia Tech. In addition to fulfilling his Chief Scientist duties at GST, Dr. Williams' recent activities have been focused on the development of highly capable lower cost smallsat solutions for Earth observations.

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Volz, Stephen

Dr. Stephen Volz is the Associate Director for Flight Programs, the Program Director for all of NASA's Earth Science flight missions and associated activities, including 16 satellites currently operating on orbit, nine in formulation and development, and many more in early design stages. Prior to serving as the Program Director, until 2007 Dr. Volz was a Program Executive in the Earth Science Division for a series of Earth Science missions. Dr. Volz worked in industry at Ball Aerospace and Technologies Corporation from 1997 – 2002, where he was the Project Manager for the Space Infrared Telescope Facility superfluid helium cryostat and other flight projects. From 1986 – 1997 Dr. Volz worked for NASA's Goddard Space Flight Center as an instrument manager, an Integration and Test Manager, a systems engineer, and a cryogenic systems engineer on multiple missions and instruments.

Dr. Stephen Volz is an active member of the IEEE, GRSS and AGU professional societies, and serves on the Geoscience and Remote Sensing Society Administrative Committee (2012). He is the recipient of several awards, including from NASA the Silver Snoopy Award (1994) and the Goddard Space Flight Center John Boeckel Award for Engineering Excellence (1992), and the Ball Corporation Award of Excellence (2001). Dr. Volz has a Ph.D. in experimental condensed matter Physics from the University of Illinois at Urbana-Champaign (1986), an M.S. in Physics from Illinois (1981), and a B.S in Physics from the University of Virginia (1980).

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ABSTRACTS
(numeric order)

14.001
The Rise of the [Geospatial] Machines: The Future with Unmanned Aerial Systems (UAS)

Presenter: Mike Tully
Author: Mike Tully

Geospatial paradigms are about to change. Powerful socio-economic and political pressures are bearing down to squeeze diamonds from unmanned aerial systems (UAS). As Google Earth brought web mapping to the masses, UAS will bring mapping into every facet of our lives and work. Remote sensing has been proprietary and expensive. UAS will make it unrelenting and ubiquitous. Our lives and businesses will change. Our 21st century skies are about to become animated like the Jetsonian skies of 2062.

What will the future of remote sensing and geospatial activities look like after unmanned aerial vehicles are fully integrated into national airspace and allowed for commercially across the country?

In this informative session, Aerial Services' Mike Tully will explore what markets, businesses, and new opportunities may look like in the future. UAS promises to be "disruptive" technology and may turn many existing business models on their heads. We'll explore these topics and consider the effects to remote sensing and geospatial in the future.

14.002
COSI-Corr Processing: a solution for 3D change detection using optical remote sensing

Presenter: Sebastien Leprince
Authors: Sebastien Leprince, Francois Ayoub, Jiao Lin, Bruno Conejo, and Jean-Philippe Avouac

The Co-registration of Optically Sensed Images and Correlation (COSI-Corr) is a software package developed at the California Institute of Technology for accurate geometrical processing of optical satellite and aerial imagery. First released to the academic community in 2007, COSI-Corr is used for a wide range of applications in Earth Sciences, which take advantage of the software capability to co-register, with very high accuracy, images taken from different sensors and acquired at different times. Potential applications include accurate generation of digital terrain models and the ability to track changes in 3D. In particular, COSI-Corr provides a powerful correlation tool, which allows for accurate estimation of surface displacement, in 3D, with accuracy better than the pixel size. In addition to discussing the fundamental principles of sub-pixel measurement, examples drawn from recent collaborative studies are shown: (1) First, we show the analysis of a multi-temporal stereo time-series acquired by the Worldview satellite over the Franz Josef and Fox Glaciers in New Zealand. The evolution of the flow of the glaciers in 3D is characterized and validated with local weather records and continuous GPS measurements. (2) Second, we demonstrate the ability of COSI-Corr to produce high-accuracy DTM of urban areas using stereo imagery acquired from Worldview and (3), we show how these high accuracy DTM can be used to precisely map damages to buildings in case of large disasters such as the Hurricane Sandy in 2012 and the Oklahoma tornado in 2013.

14.003

A Look at Data From Astrium's New Satellites: SPOT-6 and Pleides 1A & 1B

Presenter: Ajit Sampath
Authors: Ajit Sampath, Haque

This presentation reports an independent characterization of Astrium's new operating constellation of SPOT and Pleiades satellites. In addition to the radiometric and geometric characterizations, the extraction of DEMs from Pleiades data is discussed along with their accuracy.

14.005

Summary of Characterization Work at the USGS EROS

Presenter: Jon Christopherson
Authors: Christopherson, Sampath, Haque

This presentation will provide a quick synopsis of various characterization work at the USGS EROS of various satellites, creation and monitoring of test ranges, and development of standards.

14.006

Developing Standards for Lidar Quality

Presenter: Ajit Sampath
Author: Ajit Sampath

The current lidar data quality assessment methods are not adequate in the reporting of

a) The quality of calibration of lidar system, which is an essential indicator of the overall quality of data, and
b) The horizontal accuracy of the data.

The availability of standards are particularly important for large projects such as the proposed 3DEP. Recognizing this, the USGS has partnered with the ASPRS to promote industry-accepted guidelines to assess the quality of lidar data. The partnership has created a working group that includes all major lidar instrument manufacturers, data providers, and Government agencies (USGS, NOAA, USACE, NGA).

14.007

Radiometric Performance of the Landsat 8 OLI and TIRS Sensors

Presenter: Ron Morfitt
Author: Ron Morfitt

This will present the radiometric calibration of the Operational Land imager (OLI) and Thermal InfraRed Sensor (TIRS) aboard Landsat 8 both pre- and post-launch, including the first year of operation.

14.008

Geometric and Spatial Performance of Landsat 8

Presenter: James Storey
Author: James Storey

This presentation will describe the geometric and spatial characterization and geometric calibration of the Landsat 8 OLI and TIRS instruments. Additionally, the presentation will discuss ground control findings and the potential for improving the Landsat Global Land Survey.

14.009

Measuring and Monitoring Landsat 8 Data Quality

Presenter: Ronald Hayes
Author: Ronald Hayes

Landsat 8 mission has come up with an operational plan to ensure data quality and that the products delivered exhibit those quality features. A data quality band was developed to give the users a tool to help identify aspects of the data such as snow/ice, water, clouds, and dropped data. This presentation will give an explanation of this new band as well as a description of the operational calibration and data quality monitoring performed for Landsat 8 and the entire Landsat series.

14.010

Landsat 8 Higher Level Product Development

Presenter: Pat Scaramuzza
Authors: Pat Scaramuzza, Calli Jenkerson, John Dwyer

The USGS and the EROS Data Center plans to release several higher level products for Landsat 8 data. This presentation will give a quick overview of the Climate Data Records (CDRs), Essential Climate Variables (ECVs), Cloud masks, and product validation options we intend to provide for the community..

14.011

Sustainable Land Imaging Architecture

Presenter: Bradley Doorn
Author: Bradley Doorn

In FY14 NASA initiated a definition of a sustained, space-based, global land imaging capability for the nation, ensuring continuity following LDCM. Near-term activities led by NASA, in cooperation with USGS, will focus on studies to define the scope, measurement approaches, cost, and risk of a viable long-term land imaging system that will achieve national objectives. The Study is implemented by a multi-disciplinary Architecture Study Team (AST) that is in the midst of evaluating the technical and business options available to NASA and the Nation. This presentation will provide an update to the audience on these activities.

14.012

Temporal Repeat Frequency Needed to Achieve Cloud-Free Imagery from Landsat-Class Observatories: An Analysis from 10 Years of MODIS TERRA Daily Coverage

Presenter: Darrel L. Williams
Authors: Darrel L. Williams[1], Samuel N. Goward[2], and Tatiana Loboda[2]

The Landsat satellite program was originally envisioned to deliver global observations of land surface with a repeat cycle of ~18 days with a single satellite, but advocating for a compliment of about 4 satellites to achieve ~4-day temporal coverage. Such imaging frequency was considered necessary to achieve a clear-view temporal repeat frequency adequate for monitoring vegetation dynamics in the presence of cloud cover. A primary goal for the Landsat program is to ". . . periodically refresh a global archive of Sun-lit, substantially cloud free, land images." Four day temporal repeat has never been achieved for Landsat although in the early 21st century, the fortuitous, simultaneous operation of Landsats 5 and 7 achieved half of the original vision. This 8-day repeat continues today with Landsats 7 and 8. To date, little is known about the impact of repeat frequency on availability of cloud-free land surface observations and how they meet the primary goal of the Landsat program.
In this study we exploit a 10-year historical record of MODIS TERRA observations to quantify the availability of "substantially cloud-free" observations using a suite of modeled repeat frequencies. MODIS TERRA is a lower spatial resolution imager than Landsat but is in a near-simultaneous orbit with Landsat and, in mid-latitudes, achieves near-daily repeat coverage. In this study we use the basic dimensions of a Landsat scene (185 by 170 km) to derive our assessment. A "substantially cloud-free" image is defined as a composited scene over a specified

period of observations (weekly, bi-weekly, monthly, seasonally) with <10% cloud and shadow contamination. Repeat cycles considered include daily, 2-, 4-, 8- and 16-day. The assessment focuses on 3 WRS2 scenes in Maryland, Pennsylvania and Indiana that represent mid-latitude, humid locations where agriculture and forestry are primary activities.
The results from this analysis demonstrate that: daily imaging is necessary to produce a weekly cloud-cleared product reliably; 2-day repeat imaging will yield, on average, a bi-weekly cloud-cleared product; 4-day repeat imaging can be expected to yield a monthly cloud-cleared composite; 8-day imaging can be expected to yield a cloud-cleared look once per season; while 16-day repeat coverage can be expected to yield a cloud-cleared look annually. Clearly, more frequent imaging is needed to meet the goals of the Landsat observatory. While, the "build and launch one at a time" approach to Landsat fails to achieve basic mission goals, it is also clear that in order to create an observatory capable of producing weekly clear-surface observations the cost of building and launching Landsat-like systems must be reduced. Maintaining multi-satellite constellations has the additional advantage of minimizing the on-going threat of data gaps between individual satellite launches if a single asset fails prematurely. The highlights of this cloud cover study and a proposed lower cost imaging system needed to achieve this goal within NASA's sustainable land imaging program will be presented.

14.013

Land Cover Classification and Analysis Using Radar and Landsat Data in North Central Ethiopia

Presenter: Haile K. Tadesse
Author: Haile K. Tadesse

This study examines land cover classification and analysis using radar and Landsat data in North Central Ethiopia. Landsat TM from USGS and radar data from Alaska Satellite facility are used. ERDAS Imagine used for geo-referencing, enhancement, classification and accuracy assessments. For the accuracy assessment, 12229 pixels used which are different from the training pixels used for the classification. The original radar data has low overall classification accuracy (66%). Urban land cover has 17% and 85% producer and user accuracy respectively. Forest and Agriculture have 52.2 and 78.4% producer accuracy respectively. These results indicate it is very hard to use the classification map derived from the original radar data. To improve this classification accuracy, Speckle suppression and Textures measures were used.

The de-speckling methods used in this study are Median, Lee-Sigma and Gamma-Map. Different window sizes were used to see its impact on accuracy assessments. Lee-sigma, Gamma Map and Median de-speckling techniques improved the overall accuracy by about 15, 18 and 20% respectively. The maximum overall accuracy achieved in this study by de-speckling method is 86.4 % when used Median at 27 window size. Urban producer accuracy improved by 58 % by using Median de-speckling at 27 kernel size. Overall, all de-speckling techniques improved the urban user accuracy to more than 90%. Gamma Map and Lee-sigma at 27 kernel size also improved urban producer accuracy by 53 and 33% respectively. Similarly, Median and Gamma Map and Lee-Sigma at 27 improved user accuracy of forest by 38, 36 and 33 % respectively.

Variance texture measure was used using different window size. In this study, the highest overall accuracy result (88.77%) is achieved using window size 51 by 51. This shows 22% improvement as compared to the original radar data (66%). Urban and forest producer accuracy improved by 58 and 26 % respectively at window size 43 by 43. Increasing the window size increased the producer accuracy of agriculture by 21% as compared to the original radar data. However, increasing window size beyond 43 increases the confusion between urban, forest and agriculture. User accuracy improved by 33 and 27% respectively for forest and agriculture at 43 window size.

Landsat data produced an overall classification accuracy of 93.7%. Even if this result is very good, Landsat data availability is very limited in the study area due to cloud cover. Combining Landsat and derived radar data measures improved accuracy assessment by 5% as compared to the Landsat data. The original radar data produced low overall accuracy and individual land cover accuracy results. This study also shows the importance of texture and de-speckling techniques to improve land cover classification accuracy in radar data. Therefore, radar data can be used as an alternative to Landsat data in tropics and Ethiopia for land cover/use classification.

14.014

Sensor Interconsistency to Achieve Climate-Quality Measurements

Presenter: Kurt Thome
Author: Kurt Thome

Abstract: The effort to understand the Earth's climate system will benefit from the wide array of recently-launched sensors and those expected to be launched in the near future. These sensors ranged from research-quality systems such as OLI to operational weather systems such as VIIRS and include commercial systems with varying spectral and spatial resolutions. Developing data sets to understand the climate system will require instruments meeting a rigorous set of accuracy requirements. The Achieving Satellite Instrument Calibration for Climate Change (ASIC3) workshop [1] concluded that climate-quality data sets required accuracies of:

- Total Solar Irradiance (TSI) 0.01% (k=1)
- Solar Spectral Irradiance (SSI) 0.1% (k=1)
- Earth reflected solar radiance 0.3% (k=2)
- Earth emitted infrared (IR) radiances 0.1 K (k=3) (expressed in terms of resultant temperature)

One way to achieve such accuracies is via intercalibration of a wide range of systems to a few high-quality sensors. Applying interconsistency methods to the above systems necessitates approaches that are valid across time and multiple countries to create data sets. Studies related to the TRUTHS (Traceable Radiometry Underpinning Terrestrial- and Helio- Studies) and CLARREO (Climate Absolute Radiance and Refractivity Observatory) missions have that well-calibrated sensors can be used both for direct climate benchmark measurements as well as improving the calibration of other sensors that can be used to develop independent climate benchmarks. Intercalibration approaches have been developed to overcome issues from changes in illumination and view conditions as well as physical changes in the atmosphere and surface over time. A key to these methods and others is the use of hyperspectral data sets to allow convolution of the at-sensor radiance across the specific spectral bands of a given sensor. The current work discusses the role of high-accuracy hyperspectral sensors such as TRUTHS and CLARREO that, with their spectrometer resolution coupled with the unprecedented accuracy, would allow the intercalibration of a range of sensors as well as improved characterization of test sites used in interconsistency efforts. The proposed requirements for such sensors are absolute uncertainties <0.3% in band-integrated albedo and would allow separation of surface effects from atmospheric effects permitting the development of the needed models for the at-sensor radiance prediction. Similarly well-calibrated and characterized ground-based instrumentation and airborne sensors are likewise needed to improve site assessments.

14.015

Absolute Radiometric Calibration Using Pseudo Invariant Calibration Sites

Presenter: Dennis Helder
Authors: Dennis Helder, Nischal Mishra

One of the least expensive and increasingly popular methods of on-orbit calibration of optical sensors has been to use pseudo invariant calibration sites (PICS). The advantages of using these sites are they are spatially uniform, they have stable spectral response over time and with their high reflectance, the atmospheric effect on upward radiance is minimized. As a result, different satellite sensors acquire images over these PICS regularly and are used extensively by researchers to monitor the multi-temporal and multi-angular stability of satellite sensors using time series analysis and for cross-calibration, using a well calibrated sensor, especially in the visible to shortwave- infrared domain. However, PICS alone have the potential to be used for absolute calibration. Two approaches for absolute calibration model development are possible. The first uses a calibrated radiometer, for instance a well calibrated satellite sensor, and the second approach uses the sun as a calibrated source. The empirical approach developed at SDSU used Terra MODIS as the radiometer and EO-1 Hyperion to derive the spectral signature of the target. Using off-nadir acquisitions from these sensors, the model could be expanded up to 20 degrees. This model was validated with different satellite sensors with absolute accuracy approaching 3%. In this paper we will report an absolute calibration from a first principles approach using the sun as a calibrated source. A full atmospheric model will be developed where atmospheric data from NOAA database and different satellite measurements will be used as an input to MODTRAN radiative transfer model. An appropriate surface model, such as the Snyder model, will be used

to account for the surface BRDF. The full model is then evaluated against observational data from different satellites such as Landsat 7 ETM+, Landsat 8 OLI, Terra and AQUA MODIS, ENVISAT MERIS, UK-2 DMC etc.
Unlike the empirical model, the first principles model is not sensor dependent, hence the model can be used an independent method of calibrating a satellite sensor or can be used in conjunction with other calibration techniques. It is a low cost approach compared to other forms of calibration as the only expense incurred would be scheduling and collecting images over PICS. Development of these PICS based models can lead to a reliable, less expensive and more repeatable calibration with accuracies of 3% or better.

14.016

A New Alaska, US, and Global Capability: Near-real-time, Multi-satellite, Optical, Radar, and Elevation Products

Presenter: Tom Heinrichs
Authors: Tom Heinrichs, Brian Minster

Alaska-based GeoNorth has entered into agreements with Astrium and the University of Alaska Fairbanks to bring a globally unique, real-time satellite data capacity to Alaska. This talk will describe the new class of products and applications being delivered through this partnership. The first of its kind--a multi-satellite terminal from Astrium--will capture and process data in near-real-time from the Astrium constellation, including TerraSAR-X, TanDEM-X, Pleiades 1A and 1B, and SPOT 5, 6, and 7. This unique partnership among GeoNorth, Astrium, and the University of Alaska brings a new capability to US soil for capture and rapid product generation. Why Alaska? Fairbanks is an established center for satellite reception due to its high latitude and well-trained workforce who work at several major NASA, NOAA, University, and private sector ground receiving stations. The University of Alaska Fairbanks is also a recognized leader in satellite remote sensing and mapping, as home to NASA's synthetic aperture radar (SAR) global archive and with scientists who have run continental-scale projects using both SAR and high-resolution optical orthoimagery. In addition to the University research capacity, GeoNorth brings long-experience as an Alaska-based geospatial services provider to a large portfolio of government and private sector clients. Satellite data will be captured in real-time as the satellite passes over Alaska, providing an immediate view of Alaska and Arctic land and oceans. Satellite data recorders will also be downlinked to Fairbanks, allowing very low latencies between the time and capture and product generation for data captured anywhere globally. The combination of technical expertise, real-time access to data from numerous satellites, and a commercial distribution network will enable a new class of remote sensing applications to be delivered more rapidly and with greater value to public and private sector clients.

14.017

On-Orbit Calibration Activities and Image Quality of SkySat-1

Presenter: Byron Smiley
Authors: Byron Smiley, Josh Levine, Mike Shearn, Randy Sage

On-orbit geometric and radiometric calibration is essential to selling high resolution satellite imagery from SkySat-1. The geometric calibration involved characterizing the absolute geolocation error with ground control points, and also eliminating relative geolocation error by modeling the image distortion introduced by the camera optics. The ground control points and methods used to assess and refine the absolute geolocation accuracy of SkySat-1 will be discussed. Additionally, the camera calibration techniques used to refine the sensor model of SkySat-1 will be presented, which not only removed warping from each of the individual spectral bands, but also ensured mutually consistent geolocation accuracy between the bands, or good band-to-band registration. Pléiades-1A reference imagery obtained from Astrium Services was a crucial ingredient in the camera calibration process. Finally, the performance of the rational polynomial coefficients (RPCs) that accompany the geometrically corrected L1B product will be revealed, i.e. how well they reproduce the fully calibrated rigorous camera model.

The methods used to accomplish the radiometric calibration the SkySat-1 sensor will be discussed as well. Many different measurements were performed between launch and final operating capacity (FOC), many of which continue today: deep space images to measure dark counts, images of uniform sites to characterize the flat field response, using the dark and flat field responses to map out bad pixels, using moon images to maintain the relative radiometric response over time, quantifying and removing blur from mismatched scan rates and integration times,

and characterizing the modulation transfer function (MTF) using both traditional edge targets and also natural edge targets like airport runways. Results from these measurements and activities will be presented, with emphasis on the final image quality of the radiometrically corrected L1B product.

14.018

High-Resolution Imagery and Video from SkySat-1

Presenter: Dirk Robinson
Authors: Dirk Robinson, Dan Berkenstock, Julian Mann, Jonny Dyer, Mike Trela

With the successful launch of SkySat-1 into orbit on 21 Nov 2013 from Yasny, Russia, Skybox Imaging became an official provider of timely satellite imagery and data services. SkySat-1 is a low-cost, high-performance satellite capable of providing 5-band, high-resolution sub-meter class imagery. Operating in a sun-synchronous orbit of 600 km, SkySat-1 also provides the first commercial high-definition full-motion video from space at 30 frames per second. In this presentation, we introduce the SkySat satellite, Skybox ground system, and imagery and video products. We will describe the top-level performance specifications of our system including revisit time, radiometric, and geometric accuracy as well as introduce unique aspects of the SkySat imaging platform design. Most importantly, we will show sample imagery and video from SkySat-1.

14.020

DEIMOS-1 cross-calibration with Landsat-7 and Landsat-8

Presenter: Jorge Gil
Authors: Jorge Gil, Alfredo Romo, Mónica Díez, Cristina Moclán, Fabrizio Pirondini

The DEIMOS-1 satellite, owned and operated by ELECNOR DEIMOS Imaging (Spain), provides 22m, 3-band imagery with a very wide (620-km) swath. Through the contracts awarded to Astrium GEO-Information Services, in 2011, 2012 and 2013 it has provided the USDA with the bulk of the imagery used to monitor the crop season in the Lower 48.

The DEIMOS-1 satellite has been designed to expand Landsat's capabilities and applications. Its payload is the SLIM6-22 (Surrey Linear Imager Multispectral 6 channels) sensor, which provides high-resolution images of the Earth's surface along the 620 km of its swath.

DEIMOS-1 measurements have a tight correlation with historical Landsat data, achieved through design and cross-calibration. DEIMOS-1 sensor has three bands whose spectral response is very close to Landsat-7's ETM+ 4, 3 and 2. Moreover, the spatial resolution is very similar on these bands (22m GSD for DEIMOS-1 and 30m GSD for Landsat-7 at nadir). In addition, DEIMOS-1 cross-calibration with Landsat-7 is monitored continuously and corrected yearly or more often if needed.

The arrival of Landsat-8 poses a challenge if we want to add its sensor measurements to DEIMOS-1 and Landsat-7 data collections. The spectral response of Landsat'-8's bands is different and there are additional changes, like radiometric resolution (8 bits for Landsat-7, 10 bits for DEIMOS-1 and 12 bits for Landsat-8)
The purpose of this presentation is to provide an overview of Landsat-7 cross calibration with DEIMOS-1 and to show the methodologies used to integrate Landsat's-8 data with DEIMOS-1 and Landsat-7 to provide consistent measurement continuity.

We will also show the procedures followed to properly calculate the cross-calibration parameters taking into account the differences between sensors and the restrictions that apply for ground measurements, such as time gap between passes and viewing geometry differences.

14.021

DEIMOS-2 cross-calibration with Dubaisat-2

Presenter: Jorge Gil
Authors: Jorge Gil, Alfredo Romo, Mónica Díez, Cristina Moclán, Fabrizio Pirondini

ELECNOR DEIMOS (Spain) has designed and developed, in partnership with Satrec Initiative (South Korea), the DEIMOS-2 very-high resolution Earth Observation satellite, due to be launched in 2014.

DEIMOS-2 is an agile platform, based on the SI-300 architecture which has flight heritage from Malaysia's RazakSAT of UAE's DubaiSat-1. Its architecture is designed to accommodate an Earth observation and/or science payload. An Hall Effect Propulsion System (HEPS) is installed for orbit control and maintenance. Accurate and agile three-axis attitude control supports precise imaging operations.

The payload, known as EOS-D is a push-broom type camera (TDI linear array) with 1m Ground Sampling Distance (GSD) for a panchromatic band and 4 m GSD for four multi-spectral bands (NIR, red, green and blue), which will produce 75-cm pan-sharpened imagery. Swath width of the generated image is wider than 12 km. A high performance solid-state recorder is installed to receive, process, store, and transmit the image data in high speed. During the transmission of the stored image data using X-band transmitter, the solid-state recorder compresses, encrypts, and encodes the data in real time.

UAE's agency EIAST is also planning to launch a DEIMOS-2 twin, Dubaisat-2 before the end of 2013. In order to be able to use the pair as a two-satellite constellation, it is crucial to cross-calibrate the sensors. The purpose of the cross-calibration is to provide datasets from DEIMOS-2 and Dubaisat-2 with consistent geometric and radiometric quality as it were a single, absolutely calibrated, sensor. DEIMOS-2 and Dubaisat-2 payloads share the same design, so the radiometric and geometric models of both systems will differ only on parameterization.

This paper will describe the methodologies that will be used to carry out the parameter calculation such as the measurements of spectral band transmisivity profiles, LOS, MTF, TOA radiance, etc. To properly obtain these measurements, a set of restrictions will apply, such as time gap between acquisitions and viewing geometry differences. We will also describe the procedures that will be followed to comply with these restrictions.

14.023

Validation of the WorldView-2 Absolute Radiometric Calibration

Presenter: Michele A. Kuester
Authors: Michele A. Kuester, David Aaron, Dennis L. Helder, Brett Bader, William Baugh, Ashley Contreras, Milan Karspeck, Dan Lester, Nathan Longbotham, Gregory Miecznik, Fabio Pacifici, and Nancy Podger

This paper describes the work done in 2013 to validate the WorldView-2 (WV-2) absolute radiometric calibration coefficients. The WV-2 satellite was launched by DigitalGlobe on October 8, 2009. WV-2 has 8 spectral bands covering the range from 400 nm to 1050 nm and a panchromatic band covering 450 nm – 800 nm. A summary of the current coefficients is given and compared to recent reflectance-based vicarious calibration efforts. The data have been collected by two groups, one from DigitalGlobe and the other from South Dakota State University during the summer 2013. The ground calibration targets included a vegetated site in Brookings, SD (USA) and two large, spatially and spectrally uniform calibrated tarps deployed in Longmont, CO (USA). Important additional considerations to this type of calibration for very high spatial resolution, agile sensors include the incorporation of bidirectional reflectance measurements of the calibration targets. The implementation and sensitivity of these considerations are discussed. DigitalGlobe is committed to providing ongoing updated radiometric calibration and will present its implementation for in-house capabilities providing on-orbit radiometric validation and calibration of the fleet with the dissemination of ongoing updated radiometric calibrations. In addition, cross calibration of the fleet, including the new WorldView-3 sensor suite slated to be launched in the summer of 2014 is presented as a planned high priority service. The up-to-date and continuing validation of radiometric performance of the DigitalGlobe sensors is especially critical in anticipation of a surface reflectance product that is being developed. This product is anticipated to provide a powerful tool for scientists, government and the commercial realm for remote sensing science and applications.

14.024
WorldDEM

Presenter: Brian Cutler
Author: Brian Cutler

The WorldDEM is a product of the TanDEM-X Mission (**T**erraSAR-X **a**dd-o**n** for **D**igital **E**levation **M**easurements). The goal of this mission is to produce a seamless global DEM of unprecedented quality.

In order to achieve the final high quality product, TerraSAR-X & TanDEM-X have together acquired the entire landmass of the Earth twice, and in regions of difficult terrain up to four collections have been made. With the source acquisition complete, production of the global elevation model has begun. In the presentation, we will review the TerraSAR-X and TanDEM-X satellites and discuss the global acquisition campaign. We will present an overview of the various standard elevation products which will be offered. The presentation will conclude with information on the performance of the elevation products produced to date, with a focus on vertical and horizontal accuracy and overall product quality.

14.025
Airbus Defense and Space's Complete Optical Constellation

Presenter: Brian Cutler
Author: Brian Cutler

Airbus Defense and Space, a worldwide leading provider of geospatial information from Earth observation satellites, has launched four new electro-optical satellites in just over two years. The launch of the fourth and final satellite, SPOT-7, completes the constellation. We will present an overview of each satellite and the unique capabilities this constellation brings to the user community. The presentation will conclude with information on each satellite's performance and/or commission status with a focus on geometric, radiometric, and overall image quality.

14.026
The Absolute Radiometric Calibration of Earth-Observing Sensors using Ground-Based Techniques

Presenter: Jeffrey Czapla-Myers
Author: Jeffrey Czapla-Myers
Ground-based vicarious techniques have been instrumental in ensuring that the data retrieved from airborne and spaceborne platforms are of the highest quality. The 40-year Landsat program is one example of a long-term data set that has benefited from vicarious calibration, and as more and more sensors are used to create earth science data records, it becomes increasingly important to ensure that their radiometric calibrations remain on the same traceable scale. The Remote Sensing Group of the College of Optical Sciences at the University of Arizona routinely collects vicarious calibration data at various test sites for the purpose of calibrating airborne and spaceborne sensors. The two main methods currently is use are the traditional reflectance-based approach, which uses ground personnel at a suitable test site, and more recently the Radiometric Calibration Test Site (RadCaTS), which is an automated facility at Railroad Valley, Nevada. This work presents examples of the current radiometric calibration results obtained using the reflectance-based approach and RadCaTS for a variety of sensors including Landsat 8 OLI, Landsat 7 ETM+, SNPP VIIRS, Terra and Aqua MODIS, and the RapidEye constellation of satellites. The results are also used to analyze the uncertainty and scaling effects of RadCaTS when using sensors with spatial resolutions ranging from 5 m to 1 km.

14.027

Calibration and validation for KOMPSAT-3

Presenter: DongHan Lee
Authors: DongHan Lee, DooChun Seo, HeeSeob Kim, EungSik Lee, HaeJin Choi

KARI has done Calibration and Validation (Cal/Val) activities for the KOMPSAT-3 (KOrea Multi-Purpose SATellite-3) after launch at May 18th 2012. In Cal/Val Phase I, the Cal/Val for KOMPSAT-3 has been done to characterize, calibrate and validate the requirements and the performance of KOMPSAT-3. In Cal/Val Phase II by the end of December, the image data restoration has been done for the final KOMPSAT-3 image data quality with the requirement. The item and content of KOMPSAT-3 Cal/Val defined before launch has been checked after launch. After launch, most of the item and the content have been identical with before, but a little new and different phenomenon has been found out from analyzing the KOMPSAT-3 image data directly. In Cal/Val phase, firstly, we checked and characterized the status of KOMPSAT-3 (e.g. PAN Primary/Redundant, TDI set, Noise, Initial MTF/SNR/Location accuracy, etc.). Secondly, every KOMPSAT-3 Cal/Val parameter was validated, and then KOMPSAT-3 was calibrated with the validated and uploaded initial value of them (e.g. PRNU+DSNU table, KPD for AOCS, MPT table, Focusing, etc.). Finally most of the KOMPSAT-3 requirements have been checked and complied in Cal/Val Phase I and II.

One of the main items in KOMPSAT-3 Cal/Val is the Focusing to get the optimal MTF. For the Focusing, KOMPSAT-3 has imaged the star, the night lamp and the edge target. Since the star imaging for the Focusing is higher reliability than the others, we have gotten the optimal Focusing value with the star image data, and additionally a little aberration has been found out. The optimal PSF has been also made from the star image data and used into the input of the MTF Compensation (MTFC) of the KOMPSAT-3 image data.

14.029

Definition of KOMPSAT-3 product Quality

Presenter: DongHan Lee
Authors: DongHan Lee, Mina Kim, DooChun Seo, JaeHeon Jung, KyeongMi Jun

After finished the KOMPSAT-3 Calibration and Validation, the normal operation has been started, and the product of the KOMPSAT-3 image data; Level 1R and Level 1G has been generated and distributed to users. Before distributing to users, the KARI Cal/Val team defined the quality of the KOMPSAT-3 product. Firstly, the eleven (11) quality items of the KOMPSAT-3 product were decided; Dynamic range, Saturation, Abnormal Pixel, Equalization: inter-Detector, Pattern noise, Center Pattern, Pixel burst, Compression noise, Registration (MS-MS), Registration (MS-PAN) and Location accuracy. And then every constraint value of them also were determined from surveying more than 1000 KOMPSAT-3 products. The four standards for the KOMPSAT-3 product quality are the definition of the KOMPSAT-2 quality from users, the characteristics of the KOMPSAT-3 image data, the testing result of them from users, and the operator's determination of them objectively.

14.030

Combining relative and absolute calibration methods to achieve radiometric calibration of the RapidEye Constellation

Presenter: Andreas Brunn
Authors: Andreas Brunn, Michael Thiele, Cody Anderson and Brian D'Souza

RapidEye takes large effort to perform Radiometric Calibration over its constellation of 5 earth observation satellites. The main goals are to achieve absolute calibration over all spacecraft and over time. For this reason RapidEye applies a relative temporal calibration approach which is based on the statistical analysis of a large number of invariant calibration sites which are imaged on a bi-weekly basis. This approach, which has been revised significantly very recently, is mainly used to achieve relative calibration between the satellites and over the mission lifetime. To link this relative calibration to the absolute radiance level, RapidEye, in collaboration with the

University of Arizona, performs vicarious calibration field campaigns over Railroad Valley. From late 2011 to early 2013, 30 field measurements have been performed.

This presentation will give a detailed description of the two basic methods and how those methods are combined to achieve absolute calibration over the full constellation and over time with a limited number of absolute vicarious calibration field campaigns.

14.031

High Spatial Resolution Visible through SWIR Multispectral Image Product Simulation

Presenter: Mary Pagnutti
Authors: Mary Pagnutti, Robert Ryan, Kara Holekamp

Although many remote sensing applications would benefit by utilizing visible through short wave infrared (Vis-SWIR) hyperspectral imagery, the tremendous amount of data that can be generated to conduct high spatial resolution, large swath applications with these types of sensors causes significant challenges. In addition, even though SWIR bands can be extremely useful in a multitude of applications including atmospheric correction, cirrus cloud detection, smoke penetration, fire detection, volcano monitoring, cellulose and mineral mapping applications, SWIR detectors are relatively expensive and not widely available. As a consequence, most high spatial resolution systems have a limited number of bands and operate solely in the visible through near infrared (VNIR) wavelength region. A multispectral system can however be designed to address a large percentage of the applications that Vis-SWIR hyperspectral solutions can, with a fraction of the required spectral information. This can be achieved by carefully selecting and optimizing a limited number of VNIR and SWIR band passes. System designers need tools to perform the trades necessary to assess coverage, spectral region and number of bands or spectral capacity since these trades can be complex and their results drive the cost of systems. This presentation discusses a tool that uses AVIRIS Next Generation and other high spatial resolution hyperspectral imagery to simulate multispectral products at spatial resolutions approaching that of high resolution satellite systems. The presentation will present methods and simulations of a set of potential high resolution Vis-SWIR sensors and discuss how objective trades can be performed.

14.032

Advanced LED illuminated Calibration Sphere

Presenter: Robert Ryan
Authors: Robert Ryan, Mary Pagnutti,

Many image quality metrics and quantitative investigations, including those that compare data sets acquired with multiple sensors, require absolute radiometric calibration. Although many advanced multispectral cameras are capable of being absolutely radiometrically calibrated, the benefits associated with absolutely radiometrically calibrated imaging systems has not been widely exploited by the aerial remote sensing community, partially due to the cost of calibration. The cost and complexity of a radiometric calibration source scales approximately with the square of the sensor package aperture. In some cases the calibration source is comparable to the cost of a sensor limiting the use of calibration. This paper discusses a new lower cost large calibration sphere system for absolutely radiometrically calibrating large camera systems. This calibration sphere is based on a novel software-controlled high powered LED illuminated NIST traceable integrating sphere source. A new type of efficient LED illuminated external phosphor light source is used to generate the visible spectrum. This light source along with high powered NIR LEDs enables large integrating spheres to be constructed at a fraction of the cost of traditional ones. Since these light sources have high efficiencies, a smaller number are required. This novel calibration source enables simple automation due to the fact that the light source can be varied by adjusting the current applied to the LEDs. The paper applies this approach to absolutely radiometrically calibrate Z/I DMC aerial multispectral cameras, but should also be useful for small satellite and UAS sensors.

14.033

A Case Study Using Commercial Airborne Imagery to Perform Rapid IA & PA Damage Assessments in Less Than 24 Hours in a Cloud Computing Environment

Presenter: Scott Perkins
Author: Scott Perkins

Background:
In 2013 the Department of Homeland Security made awards to four contractors to provide Remote Sensing to Support Incident Management and Homeland Security. The services under this contract may be performed in any of the fifty United States or its territories, for government agencies under contract #HSHQDC-13-D-RS001.

The primary requirement of these contracts is to acquire fresh airborne imagery or LiDAR and upload onto FEMA's geospatial portal fully GIS useable E/O imagery or LiDAR within 48 hours from receipt of Notice to Proceed (NTP). In June of 2013 all four contractors received an initial tasking, an 'emergency response exercise' to test their capabilities to meet or exceed the 48 hour delivery requirement.

After the 'exercise' in follow on meetings with FEMA and DHS, Geospatial Management Office (GMO) within the Office of the Chief Information Officer (OCIO) a need was identified to provide very rapid IA & PA damage assessments using commercial airborne imagery. The goal was identified as providing the IA & PA damage assessment as soon as possible, even in advance of the ortho corrected imagery if possible.

Case Study:
Granbury, Texas. May 16, 2013 EF-4 Tornado

Aero-Metric collected 4-band E/O imagery using a large format DMC sensor of the impacted area. Imagery was ortho corrected and image tiles created referenced to the US National Grid within 24 hours after acquisition, available on Aero-Metric's cloud based map service.

Using the NIR band an IA (individual assistance) damage assessment was performed using FEMA's protocol identifying four (4) levels of damage. The rapid IA was completed in less than 4 hours.

Conclusion:
The results of the Granbury, TX case study on rapid damage assessment clearly demonstrated that rapid IA or PA damage assessments can be performed in less than 24 hours from acquisition of airborne commercial imagery and can be fully GIS useable via a map service or Geospatial portal in advance of the delivery of the ortho corrected image tiles.

Next Step(s):
Further study is planned to test tools, techniques and processes for automation of the IA & PA damage assessment task. Of particular interest is the potential of utilizing algorithms developed for pattern recognition applications in the biometrics field for identification of debris, roof damage and other damage assessment applications.

14.034

Airborne Imaging Sensor from Hexagon Geosystems

Presenter: Klaus Neumann
Author: Klaus Neumann

Hexagon Geosystem offers a wide range of aerial imaging sensors including medium to large format frame cameras, line sensors and oblique camera systems. This presentation includes a product overview and latest update on new developments in particular on the new common sensor platform which includes enhanced sensor management and new GNSS/IMU systems.

Example for customer applications will be given, which include large area orthophoto production (e.g. US NAIP), 3D city mapping with oblique cameras and remote sensing projects using reflectance images.
On outlook on future developments will round up this presentation.

14.035

Overview of KOMPSAT-3 Geometric Calibration and Accuracy

Presenter: DooChun Seo
Authors: DooChun Seo, DongHan Lee, SunGu Lee, MoonGyu Kim

KOMPSAT-3 AEISS PAN data can be used various researched to investigate different aspects and experiments of mapping using KOMPSAT-3 data: geometric accuracy, DEM extraction, image content, extraction of planimetric features, and integration of raster and vector data. The first object of this research is to describe overview of KOMPSAT-3 geometric calibration, a description of the KOMPSAT-3 system, ground system and satellite system which the characteristics of the AEISS sensor and attitude GPS sensor such as star tracker, gyro, and GPS. Secondly, we explain the direct geo-referencing model of KOMPSAT-3. The KOMPSAT-3 IRPE system has two type of sensor model, one is direct sensor model based on look vector another is rational function model. Finally, we devoted to explain the geometric calibration, location and geometric accuracy of KOMPSAT-3.

14.036

Open Data Policy for Landsat Imagery: New Opportunities for Regional and Global Crop Mapping

Presenter: Dmitry L. Varlyguin
Authors: Dmitry L. Varlyguin, Stephanie Hulina, Dath Mita, Paul Provance

In June 2007 USGS began offering Landsat imagery free of charge. This decision has had a profound impact on remote sensing applications and has created a wealth of new business opportunities. It may have also started a global trend as, in June 2010, the European Parliament and the European Space Agency (ESA) announced their plans for an open-access data policy for the imagery from the upcoming ESA Sentinel satellites.
GDA relies on free Landsat imagery for in-season mapping of regional and global crops. GDA spatial crop analytics are provided via the GeoSynergy webGIS service. The presentation will overview operational data flow in support of this effort and will discuss two modes of in-season crop analysis: an off-line operational near-real time crop analysis following preset schedules and an on-line, user driven crop analysis performed in real time via GeoSynergy. Advantages and limitations of each mode will be discussed.
The presentation will review current status of GDA regional and global crop mapping with Landsat and will look into 2014 and beyond.

14.037

ASPRS Guidelines for Geometric Calibration of Optical Aerial Camera Systems

Presenter: Dean Merchant
Author: Dean Merchant

Primary concerns of the JACIE community are the characterization of geo-positional, spatial and radiometric qualities of image data. This paper addresses the geometrical calibration of geo-spatial and spatial image data collection systems employed by the photogrammetric community.
The announcement by the USGS in March of 2011 indicating they would no longer offer calibration services for airborne optical sensors, both film-based and digital cameras, ignited a strong interest in establishing suitable alternative sources of camera calibration. At the March meeting of the ASPRS in Milwaukee, the "Camera Calibration Committee" was established to address future camera calibration issues. It is noted that the USGS subsequently decided to continue laboratory calibrations of film-based cameras as funds permit.
Working with a committee of more than fifty people that expressed interest, the Calibration Committee developed a suitable draft expressing specifications for the metric calibration of both the film-based and digital airborne optical camera systems. The specifications included guidelines for establishment of suitable test and calibration fields. The resulting document, published in the July 2013 issue of Photogrammetric Engineering and Remote Sensing, titled "Guidelines for the In Situ Geometric Calibration of the Aerial Camera System", was accepted by the ASPRS board of Directors at their October, 2013 meeting in San Antonio.
This presentation/paper will discuss the history, technical basis, application, and future of the ASPRS guidelines for camera calibration.

14.039

An Update on the Constant MTF Interpolator: An Image Resampler with Minimal MTF Losses and Geometric Error

Presenter: Ellis Freedman
Authors: Ellis Freedman, Dr. Robert Fleming

The geometric remapping of pixel values during the processing of digital imagery can significantly affect the final image quality. Most remote sensing systems include a resampler/interpolator as part of their processing, such as bicubic, that not only degrades the Modulation Transfer Function (MTF) of the image and increases blurring, but varies the degradation with the fractional pixel relocation distance. Thus the MTF of the image is often degraded in an almost random pattern for which accurate compensation cannot be applied. This reduces image interpretability, degrades radiometric accuracy, and hampers attempts to measure the true MTF of the system using ground targets in imagery. To counter this, a replacement table of interpolation kernels has been developed that imposes virtually the same MTF degradation for any pixel shift distance. The inverse MTF can then be applied such that there is minimal MTF degradation to the image after interpolation. An early version of this Constant MTF interpolator (CMTF) was presented at the 2012 JACIE. This paper provides the latest results of analyses and simulations comparing the performance of the improved Constant MTF Interpolator (CMTF) to other interpolators. These results indicate that the CMTF provides dramatically better image quality than all other tested interpolators, preserves radiometric fidelity, and enhances the placement accuracy of pixels in the resampled grid.

14.040

UltraCam Osprey - Calibration, Aerial Operation and Data Processing

Presenter: Michael Gruber
Author: Michael Gruber

For over a decade now oblique images are collected from airborne platforms on a regular basis. Several camera products have been presented from distinct camera vendors and their image products are well known. The UltraCam Osprey is the new oblique sensor by Microsoft / UltraCam Business Unit and was introduced into the market at the ASPRS 2013. This camera combines a metric nadir subsystem creates one panchromatic high resolution image, one true-color RGB image, one near-infrared image and six oblique true-color wing images taken at an off-nadir angle

of 45°. This specific camera design supports exceptional productivity and quality during acquisition and processing. Camera specification parameters as well as results from aero-triangulation, DSM production, and oblique image processing are presented in this article.

The UltraCam Osprey was presented for the first time at the ASPRS 2013 conference and exhibition in Baltimore, MD, March 2013. While this is not the first oblique camera introduced to the market, the UltraCam Osprey incorporates several new and unique concepts with a clear emphasis on professional photogrammetry and collection productivity. First there is the metric nadir component which has been derived from the well-known UltraCam Lp camera. This nadir camera constitutes the "geometry backbone" of the UltraCam Osprey and enables traditional photogrammetric processing from an oblique aerial camera system. For example, Osprey images are compatible with the UltraMap software supporting the full workflow from aero-triangulation to dense surface modelling and ortho image creation. Secondly, adding the six oblique camera heads makes the pixel harvest extremely productive. The wing cones are pointing in the four cardinal direction at 45° off-nadir. There are dual cones forwards and backwards, and single cones left and right.

14.042

Integrating Multi-resolution Lidar-derived DEMs into the National Elevation Dataset

Presenter: Lori A. Phillips
Authors: Samantha T. Arundel, Lori A. Phillips, and Karen F. Adkins

The US Geological Survey (USGS) is currently implementing Esri's Mosaic Dataset functionality to improve the data management and conversion processes required to maintain and update the National Elevation Dataset (NED). The NED update process integrates raster elevation terrain models from a variety of sources and resolutions into the 1/9-, 1/3-, 1- and 2-arc second resolution NED data layers. The new NED generation process is controlled within an ArcGIS Workflow Manager (WMX) framework and consists of importing new raster Digital Elevation Models (DEMs); inspecting new DEMs to assess quality; assigning hierarchies to overlapping DEMs; and exporting NED DEM products in a variety of resolutions and raster formats. The USGS uses Mosaic Dataset functionality throughout the process to organize, manage, and ensure seamlessness of terabytes of data.

14.043

Operational Challenges to Contemporary Changes of Satellite Imagery Characterization

Presenter: Dath K. Mita
Authors: Dath K. Mita; Bill Baker; Michael Toomey; Tatiana Nawrocki; Christiana Townsend

The USDA Office of Global Analysis's primary mission is a complex undertaking of global agriculture monitoring. This involves, among others things, operational crop forecasting approach based on a number of factors or processes including, but not limited to, monitoring and simulation of crop growth and crop development. The USDA's extensive satellite imagery archives, weather databases, and historical crop production and supply databases provide a vital resource for historic land use/cover analysis, change analysis, natural hazards assessment, and vegetation mapping. The rapid advancement in satellite sensor development has enhanced the capability in image acquisition with improved characterization of spatial, spectral and temporal resolutions. On the other hand, these developments are also increasingly creating operational data/information integration and analytical challenges and opportunities. To address some of the challenges the USDA recognizes the need to "reconfigure" the primary workflows by identifying operational constraints, establishing new or improved data input protocols, modeling approach and processes.

14.044

Planet Labs

Presenter: Beau Jarvis
Authors: Frank Warmerdamn, Mike Safyan

Planet Labs launched the largest ever fleet of earth-imaging satellites in January 2014. These will enable high-resolution imagery of the entire planet to be captured on a very frequent basis. The data is of significant global value. Applications range from humanitarian-related information to monitoring large-scale vegetation changes, disaster relief and improving agriculture yields. Planet Labs data will also be of benefit to the mapping, infrastructure, financial services and insurance sectors. The company will provide universal access to this entirely unprecedented data set, with the goal of enabling maximum utility of the data. Following the release of an API, Planet Labs will launch tools to assist developers, individuals, companies, and organizations index, interpret, and consume data connected to the changing conditions of any location on the globe. This will allow the company to gather input and feedback in order to continually improve the product.

14.046

Coordinated Quality Control (CQC): Coordinating and monitoring quality information within the GMES/Copernicus Space Component Data Access System

Presenter: Sebastien Saunier
Authors: Sebastien Saunier, Giuseppe Otavianelli, Patrick Floissac, Nathalie Camlong

One of the key elements of GMES is its Space Component (GSC). Beyond the development of the Sentinel missions, the GSC also entails the coordination of assets made available by the data providers GCMs (i.e. GMES Contributing Missions) to realise a synergistic and complete operational system-of-systems in Europe for the provision of Earth Observation (EO) data. In the framework of GMES, ESA is therefore in charge of developing an efficient and harmonised system to facilitate access to relevant EO data and services by the GMES Service Projects (GSPs). This is achieved through the implementation of the GMES Space Component Data Access (GSCDA).

The Coordinated Quality Control (CQC) is the GSCDA component in charge of monitoring the quality of the EO DataSets and of coordinating the provision of data quality information to the users. Quality information is based upon GCM input specifications and quality parameters, that are made available to the users in a harmonized way. The CQC thus monitors that the data providers maintain the specified quality level and also monitors the related user satisfaction. More in details, the CQC gathers reference data specifications for each type of product or instrument, perform regular data quality checks to ensure that the delivered products are conform to the specifications, initiates and discusses harmonisation and standardization possibilities across data providers and provides helpdesk support to process data quality related issues.
The paper introduces the dynamics of the GSCDA and explains the role of the CQC with respect to data providers and data users. It then presents the activities that are performed by the CQC to achieve this objective within this system-of-systems. The concept of Quality Information Item is presented and detailed. Finally the future perspectives and guidelines concerning the benefits from the work of the CQC are presented.

14.047

Geolocation Accuracy Performance of the Digitalglobe Constellation During 2013

Presenter: David Mulawa
Author: David Mulawa

The DigitalGlobe constellation of high-resolution imaging satellites continue to provide very good geolocation accuracy performance. This update includes geolocation accuracy assessment results from 2013. This presentation also includes preperations for geometric calibration of WV03.

2014 JACIE Planning Committee

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NOAA: Mitch Goldberg
USDA: Dath Mita
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*Denotes contractor

Thank You for attending the 2014 JACIE Workshop!

Program compiled by Carrie Jucht, SGT, contractor to the USGS/EROS