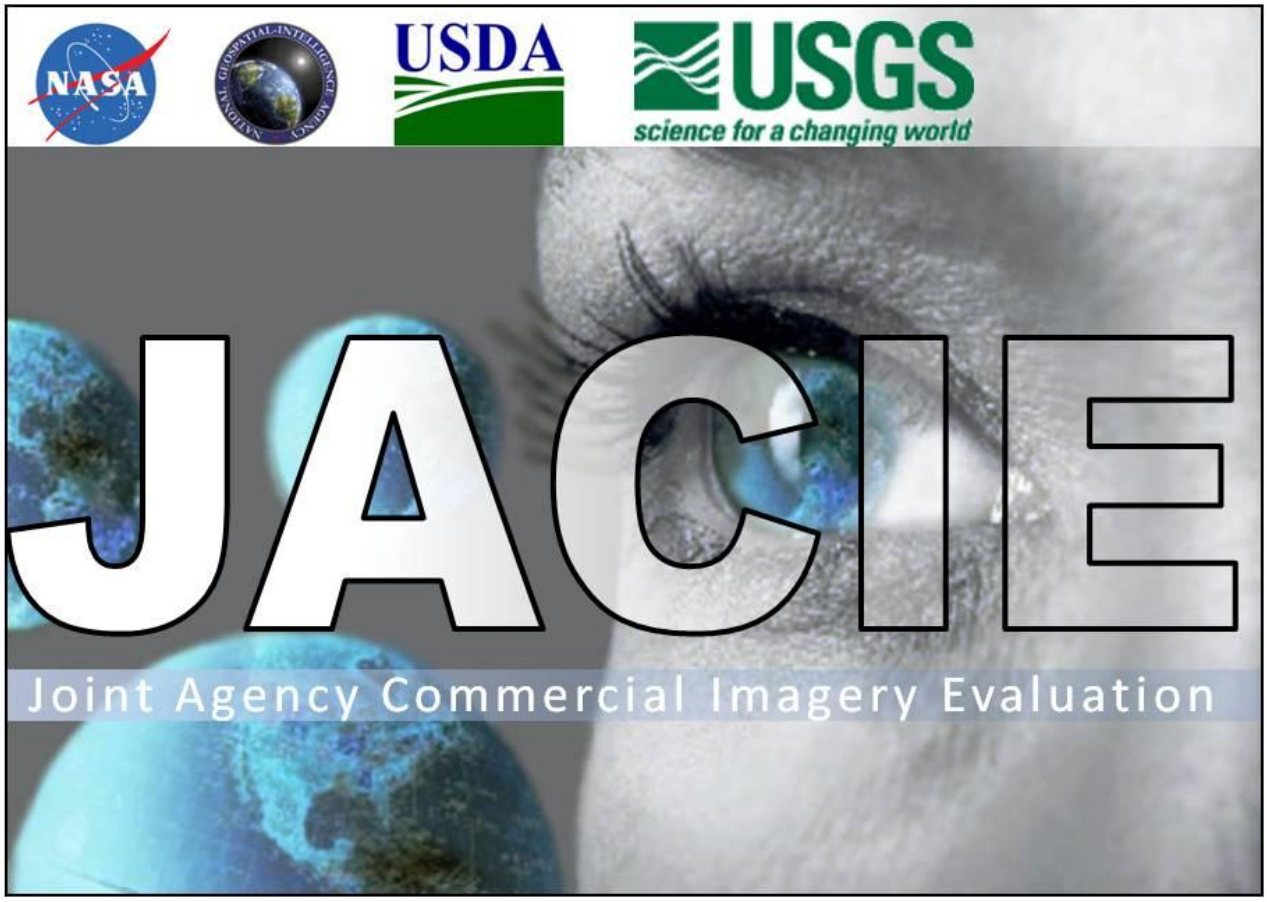
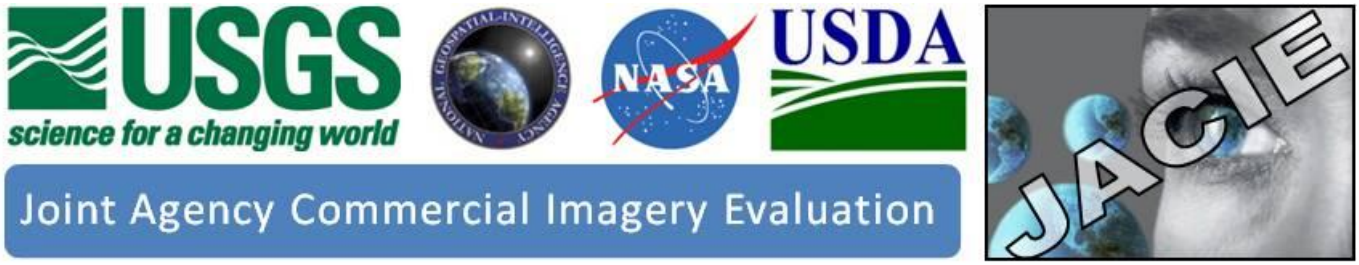
JACIE

Joint Agency Commercial Imagery Evaluation
Civil Commercial Imagery Evaluation Workshop
Renaissance St. Louis Grand Hotel, St. Louis, MO
April 16-18, 2013




USGS
science for a changing world
NASA
USDA
Joint Agency Commercial Imagery Evaluation
JACIE

Joint Agency Commercial Imagery Evaluation

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KEYNOTE SPEAKER
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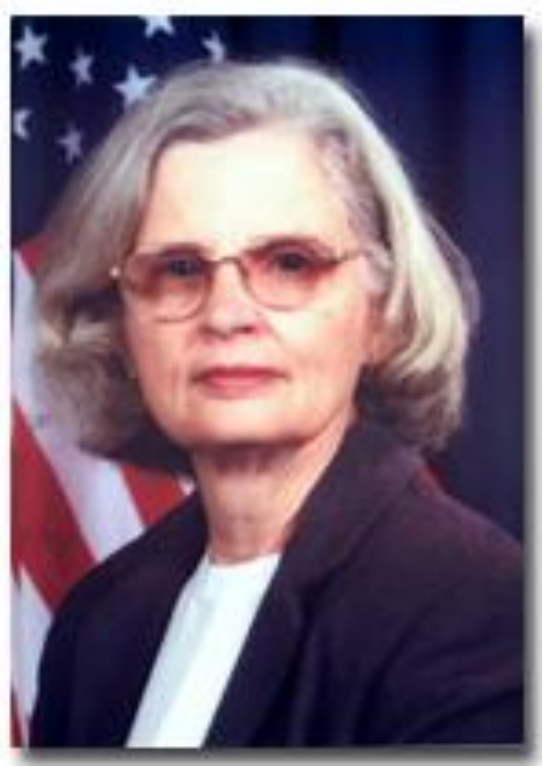
Roberta E. (Bobbi) Lenczowski



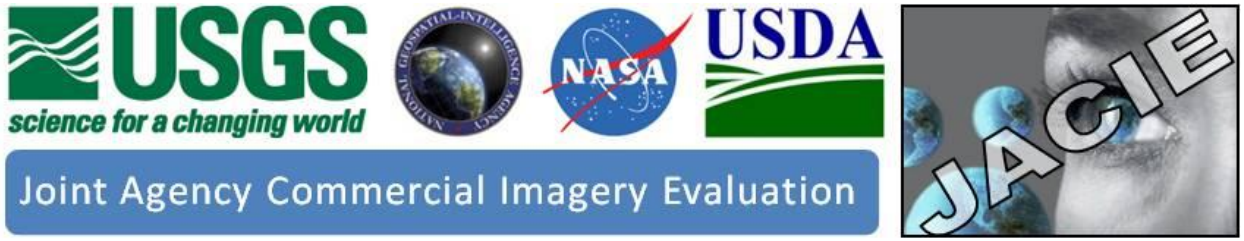
Roberta E. (Bobbi) Lenczowski is an independent geospatial information-intelligence consultant. She serves as an outside Board Director for GeoEye and Fugro EarthData Inc. Her non-compensated professional work includes participating as Board director and secretary for the non-profit Leonard Wood Institute. She is also a member of two technical advisory boards for Intel Vision and Liquid Robotics. In March, 2013 Ms. Lenczowski was appointed to the National Oceanic and Atmospheric Administration's Advisory Committee on Commercial Remote Sensing.

Lenczowski retired, with 28 years of federal service, from the National Geospatial Intelligence Agency (NGA) in 2005, as executive director of the St. Louis operations. During her tenure in Washington, D.C., Lenczowski served three years as NGA's Technical Executive. Prior to that, she was director of Operations with the National Imagery and Mapping Agency (NIMA) for over five years, serving as senior executive manager for the majority of NIMA's professional employees and all imagery collection, geospatial production and imagery analysis.

Lenczowski has served on several national advisory groups and study teams. In the 90s, she represented DOD on the Board of the National Center for Geographic Information and Analysis, a university consortium funded by NSF to build the national research agenda for geospatial studies. During the last five years of her federal career, she represented NGA on the Advisory Committee on Commercial Remote Sensing; the Department of Interior's National Satellite Land Remote Sensing Data Archive Advisory Committee; and, the Security Affairs Support Association.

Recognizing the importance of active participation in professional organizations, Lenczowski is a member of the American Society of Photogrammetry and Remote Sensing (ASPRS), Executive Committee, currently serving as National President. Previously she completed her second term in two decades as president of the ASPRS St. Louis Region. She is an Advisory Board member for the St. Louis Chapter of the National Defense Industrial Association and was among individual members of the U.S. Geospatial Intelligence Foundation and the Open Geospatial Consortium.

Lenczowski holds degrees from Creighton University, St. Louis University, and Washington University. She and her husband, Jerry, are parents to six adult daughters.



AGENDA

2013 Civil Commercial Imagery Evaluation Workshop

Data Quality: The Gateway to Remote Sensing Applications

Renaissance Grand Hotel, St. Louis, MO

TUESDAY, APRIL 16, 2013

7:30 AM	**8:30 AM**	**Registration**		
Morning				
8:30 AM	8:40 AM	**Welcome**	Greg Stensaas	Remote Sensing Technologies Project Manager, USGS EROS
8:40 AM	**10:20 AM**	**Government Sponsor Session**		
8:40 AM	9:05 AM	**NASA**	Brad Doorn	Program Manager for Water Resources of NASA's Earth Science Division
9:05 AM	9:30 AM	**NOAA**	Mitch Goldberg	Chief, Satellite Meteorology and Climatology
9:30 AM	9:55 AM	**USDA**	Glenn Bethel	Remote Sensing Advisor
9:55 AM	10:20 AM	**USGS**	Frank Kelly	Director, USGS/EROS
10:20 AM	**10:50 AM**	**Break**		
10:50 AM	**12:00 PM**	**Keynote Session**		

10:50 AM	12:00 PM	**Keynote Speaker**	Ms. Roberta Lenczowski		
12:00 PM	**1:30 PM**	**Lunch *(provided with registration)* Set up posters**			
Afternoon					
1:30 PM	**4:30 PM**	**Small/Special Satellite Session**			
1:30 PM	1:55 PM	13.004	Darrel Williams	Global Science & Technology, Inc.	The Terrestrial Ecosystem Dynamics Mission (TerEDyn): A Small Satellite Concept Offering an Unprecedented Combination of Spatial and Temporal Resolution to Augment Landsat Coverage
1:55 PM	2:20 PM	13.022	Paul Stephens	DMCii	New Sensors; Update on Developments in the DMC Constellation
2:20 PM	2:45 PM	13.014	Michael Oxfort	RapidEye AG	RapidEye Large Area Imaging Capabilities and New Countrywide Mosaic Product
2:45 PM	**3:00 PM**	**Break**			
3:00 PM	3:25 PM	13.036	Fabrizio Pirondini	DEIMOS Imaging S.L.U.	DEIMOS-1Iimage Quality Improvements Through MTF Deconvolution
3:25 PM	3:50 PM	13.009	Brett Thomassie	DigitalGlobe, Inc.	Digitalglobe Incorporated Corporate and Satellite Program Update
3:50 PM	4:15 PM	13.032	Philip C. Abbott	Purdue University	Commercial Value of Satellite Imagery for Agriculture
4:15 PM	4:30 PM	Wrap-up	Day 1		
4:30 PM		**Enjoy the posters**			

WEDNESDAY, APRIL17, 2013

7:30 AM	**8:30 AM**	**Registration**			
Morning					
8:30 AM	**9:45 AM**	**Medium Resolution Session**			
8:30 AM	8:55 AM	13.017	Drew Hopwood	Astrium GEO-Information Services	Continued Monitoring of US Crop Condition Using Deimos-1 & UK-DMC2
8:55 AM	9:20 AM	13.042	Jack Xiong	NASA/GSFC	S-NPP VIIRS On-orbit Calibration and Performance
9:20 AM	9:45 AM	13.007	Chander and Angal	SGT, Contractor to USGS/EROS	Geometric and Radiometric Assessment of the AWiFS-2 Sensors Aboard ResourceSat-2
9:45 AM	**10:15 AM**	**Break**			
10:15 AM	10:40 AM	13.015	Andreas Brunn	RapidEye AG	The Calibration and Validation Activities performed at RapidEye During the Year 2012
10:40 AM	11:05 AM	13.016	Andreas Brunn	RapidEye AG	New MTF Resampling Kernel and Its Effect on RapidEye Imagery
11:05 AM	**12:00 AM**	**High Resolution Session**			
11:05 AM	11:30 AM	13.021	Byron Smiley	BAE Systems	Commercial Imagery and Terrain Models Used in Computer Vision at BAE Systems
12:00 PM	**1:00 PM**	**Lunch *(provided with registration)***			
1:00 PM	**1:30 PM**	**Poster Session**			

Afternoon

1:30 PM	**3:10 PM**	**High Resolution Session**			
1:30 PM	1:55 PM	13.002	Fabio Pacifici	DigitalGlobe, Inc.	An Automatic Atmospheric Compensation Algorithm for Very High Spatial Resolution Imagery and its Comparison to FLAASH and QUAC
1:55 PM	2:20 PM	13.018	Drew Hopwood	Astrium GEO-Information Services	Status of Astrium GEO-Information Services' EO Satellite Constellation
2:20 PM	2:45 PM	13.025	Laura Brindle	DMCii	Reducing the Uncertainty In Radiometric Cross-calibration Over the Libya 4 site – Modelling and Measurement
2:45 PM	3:10 PM	13.026	Robert Arnold	DigitalGlobe, Inc.	Radiometric Calibration and Assessment of DigitalGlobe Sensors
3:10 PM	**3:25 PM**	**Break**			
3:25 PM	**4:40 PM**	**Hi Resolution Session**			
3:25 PM	3:50 PM	13.029	David Mulawa	DigitalGlobe, Inc.	DigitalGlobe Geolocation Assessment and Reporting Update for 2012
3:50 PM	4:15 PM	13.006	A. Sampath	SGT, Contractor to USGS/EROS	Geometric Assessment of Pleiades-1a, Deimos and ASTER Data Sets
4:15 PM	4:40 PM	13.037	Fabrizio Pirondini	DEIMOS Imaging S.L.U.	DEIMOS-2 Pre and Post-launch Calibration and Data Validation
4:40 PM	5:00 PM	Wrap-up	Day 2		
6:00 PM		**Surdex Tour**			

THURSDAY, APRIL 18, 2013

7:30 AM	**8:30 AM**	**Registration**			
Morning					
8:30 AM	**10:10 AM**	**Applications, Testing, and Standards Session**			
8:30 AM	8:55 AM	13.024	Steve Mackin	DMCii	Automated Methods for the Quality Control of Data from the DMCii Satellite Constellation
8:55 AM	9:20 AM	13.027	Carola Braun	Bundeswehr Geoinformation Service (BGIS)	Quality Assessment of Elevation Data Products in the Bundeswehr
9:20 AM	9:45 AM	13.043	Lori Phillips for Authors	USGS/Rolla	Quality Assessment (QA) of LiDAR Data at the USGS National Geospatial Technical Operations Center (NGTOC)
9:45 AM	10:10 AM	13.044	Lori Phillips for Authors	USGS/Rolla	Assessing the Accuracy of the Alaska National Hydrography Dataset
10:10 AM	**10:25 AM**	**Break**			
10:25 AM	**12:30 PM**	**Applications, Testing, and Standards Session, Continued**			
10:25 AM	10:50 AM	13.001	Sebastien Leprince	California Institute of Technology Geological and Planetary Science Division	COSI-Corr Processing: a Solution for Dense Image Registration, Ground Deformation Measurement, and DSM Generation

10:50 AM	11:15 AM	13.003	Dennis Helder	SDSU	An Empirical Absolute Calibration Model for Optical Sensors Using Pseudo Invariant Calibration Sites
11:15 AM	11:40 AM	13.011	Andreas Brunn for Ralf Reulke	DLR	Standard for Image Quality of Optical Remote Sensing Data
11:40 AM	12:05 PM	13.012	Chuanrong Li	Academy of Opto-Electronics, Chinese Academy of Sciences	Assessment of Remote Sensing Optical Payload Performance and Data Quality over Two Comprehensive Sites
12:05 PM	12:30 PM	13.013	Andréa Canhoto	INPE	Assessment of EIFOV Based on Natural Edges for Satellite Images
12:30 PM	**1:30 PM**	**Lunch *(provided with registration)***			
1:30 PM	**1:45 PM**	**Poster Session**			
Afternoon					
1:45 PM	**3:25 PM**	**Aerial/SAR/RADAR Session**			
1:45 PM	2:10 PM	13.019	Mary Pagnutti	Innovative Imaging and Research Corp.	Low Light Applications for Absolutely Calibrated Large Format Large Dynamic Range Digital Imaging Sensors
2:10 PM	2:35 PM	13.020	Robert Ryan	Innovative Imaging and Research Corp.	Aerial Imaging Quality Assurance
2:35 PM	3:00 PM	13.034	Klaus Neumann	Z/I Imaging GmbH	Aerial Mapping Camera Technology from Hexagon

3:00 PM	3:25 PM	13.033	M. Lorraine Tighe	Intermap Technologies	Airborne or Spaceborne?
3:25 PM	**3:40 PM**	**Break**			
3:40 PM	**4:55 PM**	**Miscellaneous Session**			
3:40 PM	4:05 PM	13.010	Amanda O'Connor	Exelis Visual Information Solutions	ENVI Services Engine: Scientific Data Analysis and Image Processing for the Cloud
4:05 PM	4:30 PM	13.030	Brandon Migdal	ITT Exelis Geospatial Systems	Image Quality; Breaking the Paradigm by Leveraging Collaborative, Net-centric Efficiency
4:30 PM	4:55 PM	13.039	Charles Samuels	SI	Harnessing Big Data and Models to Solve User Geospatial Problems and Challenges Using IDEAS (Intelligent Data Exploration and Analytics System)
4:55 PM	**5:10 PM**	**Discussion and Conference wrap-up - Greg Stensaas**			
		Travel Safely			

PRESENTERS and MODERATORS
Biographies (alphabetical order)

Abbott, Philip C.

Philip C. Abbott is a Professor of Agricultural Economics at Purdue University. His PhD is in Economics in 1976 from the Massachusetts Institute of Technology. He has been on the faculty and working on agricultural trade at Purdue since 1981. Professor Abbott conducts research on both international trade and international agricultural development. He has taught courses on mathematical programming, international trade, agricultural development, macroeconomics and trade policy. Professor Abbott has consulted for several domestic and foreign government agencies, the United Nations Food and Agriculture Organization, the OECD, the World Bank, commissions on food policy issues, and private agencies. He has been on the editorial boards of the *American Journal of Agricultural Economics* and the *Journal of Development Economics.* Professor Abbott served on the steering committees of the congressionally-mandated USDA study on Export Embargoes and Surplus Disposal of Agricultural Commodities, the International Agricultural Trade Research Consortium, regional research project NC-194, "Organization and Performance of World Food Systems," and the USDA-USTR Agricultural Technical Advisory Committee for Trade in Grains, Feeds, and Oilseeds. He is also now conducting research on cotton and cocoa in West Africa, on trade and development in Vietnam, on volatile food prices in international markets, and on trade and stabilization policy responses by developing countries.

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Arnold, Robert

Robert Arnold is employed by GeoEye, works in the Performance Engineering group, and supports the radiometric accuracy performance for the GeoEye-1 sensor. He has performed the on-orbit radiometric and focus calibrations of the GeoEye-1 camera, conducted assessments of GeoEye-1 sensor Signal to Noise Ratio (SNR), and supported Ground and Space Segment anomaly investigations. His current responsibilities include calibration and performance support for the GeoEye-2 satellite and associated Space and Ground Segment architecture. He has received an M.S. degree in Electrical Engineering from Washington University in St. Louis.

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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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Braun, Carola

Dr. Carola Braun received her MSc. degree in Geodetic Science and her PhD in Photogrammetry and Remote Sensing from the Rheinische Friedrich-Wilhelms-Universität at Bonn, Germany.
She works at the Remote Sensing Branch of the Bundeswehr Geoinformation Office (BGIO) at Euskirchen, Germany. Her primary responsibilities include the definition and management of Remote Sensing projects.
The Bundeswehr Geoinformation Service (BGIS) is expected to identify mission-relevant environmental impacts, evaluate them according to space and time, and support and advise users with the help of prepared geospatial and environmental information. The BGIS creates fundamentals and prerequisites in the field of geospatial and environmental information for the employment and routine duty of the Armed Forces. The Bundeswehr Geoinformation Office (BGIO) with its headquarters in Euskirchen is the central specialized agency of the BGIS.

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Brindle, Laura

Laura received a BSc in Geography and Geology from The University of Manchester, UK and an MSc in Environmental Monitoring, Modelling and Management from Kings College London.

She currently works for DMCii as a Satellite Campaign Manager and Calibration Specialist responsible for work on the on-going calibration of UK-DMC2, Deimos-1 and Nigeriasat-X.

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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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Canhoto, Andréa

Education:
Survey Electrical Engineering (1997);
Master´s Degree in Electrical Engineering and Computer Science (1999)
Ph.D. Degree in Electrical Engineering and Computer Science (2011)

Experience:
Currently working in the project "Performance measurement of

optical sensors on-board satellite CBERS-3 and CBERS-4" at the National Institute for Space Research (INPE), the Image Processing Division, Brazil.

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Chander, Gyanesh

Gyanesh Chander received the Ph.D. in Geospatial Science and Engineering (GSE) with specialization in Remote Sensing Engineering, and M.S. degree in Electrical Engineering from South Dakota State University (SDSU), Brookings, in 2011 and 2001 respectively. He is currently a Lead Systems Engineer with SGT, Inc., at the U. S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center, Sioux Falls, SD. His primary responsibilities at EROS include satellite sensor characterization and calibration research to support on-going radiometric projects.

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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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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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Goldberg, Mitch

Dr. Goldberg earned his B.S. from Rutgers University, and M.S., and Ph.D. degrees from the University of Maryland. Dr. Goldberg joined NOAA in 1990 and has had held a number of positions of increasing responsibility. He is the Chief of the NESDIS Satellite Meteorology and Climatology Division in NESDIS STAR and is also serving as the Joint Polar Satellite System (JPSS) Program Scientist. His scientific expertise is in developing scientific algorithms to derive atmospheric soundings of temperature and water vapor from microwave and infrared sounders. At JPSS, Dr. Goldberg serves as independent expert and representative of the science and user communities responsible for

ensuring the scientific integrity at all stages of satellite development. Dr. Goldberg has received three Gold Medals, one Silver Medal, and three Bronze Medals from the Department of Commerce and more recently the 2010 NOAA Administrator's Award for leadership in developing and chairing the international Global Space-based Inter-Calibration System (GSICS) program. He received the University of Maryland Most Distinguished Alumnus Award from the Department of Atmospheric and Oceanic Science in 2004.

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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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Hopwood, Drew

Drew has been with Astrum GEO Information Services since 2004, after obtaining a Bachelor of Science degree in Geography from George Mason University in Fairfax, Va. He started as a member of the satellite programming team. While on the satellite programming team, he studied, designed, implemented and supervised large collection campaigns over North America. Then in 2007 Drew moved into a project management role where he managed various projects for USDA, USGS, and DoD clients as well as commercial clients. Recently he has transitioned into a new role serving as Technical Sales Engineer supporting the sales team and developing new and innovative solutions.

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Kelly, Frank

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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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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Li, Chuanrong

Education: BS–Aerocraft Configuration Mechanics, University of Science and Technology of China, 1982; MS–Center for Space Science and Applied Research, CAS; additional course work in ITC from 1988 to 1990, and senior visiting scholar in CSA from 1994 to 1995.

Experience: EO data quality analysis and calibration technique; EO data ground processing system development; SAR, Hyperspectral optical and 3D-LiDAR data processing; Multi-source remote sensing data fusion, advanced remote sensing technology development and application, etc. Current Projects: Co-PI of ESA-China MOST Dragon Programme; Leader of a CAS Innovation Team International Cooperation Project for developing advanced remote sensing technique based on optical and microwave 'ghost imaging'. Director of National Standard Committee of Remote Sensing Technique; Director of China Space Technology Research Center of Disaster Mitigation. Member of CEOS and CEOS-WGCV, attended recent CEOS Plenary and WGCV Plenary on behalf of China NRSCC.

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Steve Mackin is Chief Scientist for DMC International Imaging. A geologist by training he has been working in Remote Sensing for 25 years for British Petroleum, the British National Space Centre, DLR in Germany and various Universities in Spain and the UK. Interests include hyperspectral remote sensing, application development in general, computer programming and of course calibration and Quality Assurance / Quality Control of earth observation data.

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Brandon Migdal, a graduate of the Imaging Science program at the Rochester Institute of Technology began his career with then Kodak Commercial and Government Systems in 2004. Brandon spent his early years focused on the impacts of compression on image quality and utility for remotely sensed data. Later, he worked with various government agencies looking at the system level impacts on product quality and utility associated with the dissemination and storage of data and products in various systems. Brandon completed his black belt certification in value based lean six sigma while examining the benefits of applying traditional value stream improvement techniques to the transactional software and processing processes associated with specific remotely sensed imaging chains. Brandon now leads a segment of the business responsible for providing high end Image Science and custom software support to the National Geospatial-Intelligence Agency.

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Klaus has a Master Degree in Electronic Engineering from the University of Applied Science in Aalen, Germany. He has been working more than 20 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 the product manager for Z/I Imaging sensor systems. He is a worldwide acknowledged expert for aerial cameras.

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Amanda O'Connor is a graduate from the University of Colorado with her M.S. in geology. She studied cross correlation of AVIRIS and Landsat data for High Plains Vegetation Analysis for her thesis. She worked at Stennis Space Center on calibration projects, sensor effects simulation, and commercialization of remote sensing. She worked at Carnegie Institution Department of Global Ecology on tropical ecology projects using AVIRIS, Landsat and Hyperion. She has been with Exelis Visual Information Solutions for the last eight years supporting government, educational, and commercial customers with the use of ENVI and IDL software.

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Oxfort, Michael

Michael Oxfort is the Chief Technology Officer at RapidEye. He received his aerospace engineering degree (Dipl.-Ing.) from the University of Stuttgart in 1992. After spending four years as a contractor at the European Space Agency in Noordwijk / The Netherlands, he joined Contraves Space / Zurich in 1996 as the Engineering Responsible for the Integral project. Since September 1999 he works for RapidEye in various positions and has successfully led his teams from the initial design up to the nominal operations of the RapidEye constellation consisting of five identical Earth Observation satellites.

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Fabio Pacifici is working at DigitalGlobe as R&D Scientist since 2009. Between 2005 and 2009, he collaborated as Visitor Scientist with the Department of Aerospace Engineering Sciences, University of Colorado, Boulder. He received the Ph.D. degree in GeoInformation from Tor Vergata University, Rome, Italy, in 2010. He also received the Laurea Specialistica (M.S.; cum laude) and Laurea (B.S.; cum laude) degrees in telecommunication engineering from the same university, in 2003 and 2006, respectively.
His research activities include processing of remote sensing images, data fusion, feature extraction, active learning, analysis of multi-temporal data, and land cover classification and change

detection, with special emphasis on machine learning.
Dr. Pacifici is the current Chair of the IEEE Geoscience and Remote Sensing Data Fusion Technical Committee and serves as Associate Editor for the IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (JSTARS). He received the 2011 Best Reviewer Award from IEEE Geoscience and Remote Sensing Society for his service to IEEE JSTARS. He was the recipient of the 2009 Joint Urban Remote Sensing Event student paper competition. He received the first prize in the 2007, 2008 and 2009-2010 IEEE Geoscience and Remote Sensing Data Fusion Contest. He serves as a member of Technical Committee for the Joint Urban Event (since 2011), and for the International Geoscience and Remote Sensing Symposium (since 2009). He has been the Guest Editor of a special issue of IEEE JSTARS on multi-angular remote sensing.

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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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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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Fabrizio Pirondini has a M.Sc.in Aerospace Engineer from the Polytechnic of Milan (Italy) and an Executive MBA from the Instituto de Empresa (IE), Madrid, Spain.
After an experience in the European Space Operation Centre (ESOC) of the European Space Agency (ESA) in Germany working on in-orbit infrastructure for manned missions, in 2001 he moved to Madrid, Spain were he co-founded Deimos Space. With the backing of Elecnor, one of the largest Spanish private companies, Deimos Space has become a multinational group with four companies and more than 500 employees.
In Deimos Space he was responsible until 2010 of the Earth Observation Mission Analysis Division, having worked as Mission Analyst for more than 20 Earth Observation mission studies, mainly for ESA.
He is now the CEO of 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.

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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 and has two pending 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 also supported NASA Stennis Space Center by developing an Instrument Validation Laboratory where he performed radiometric calibration and spatial resolution evaluation of commercial and government electro-optical imaging systems. He is one of the founders of the startup company Innovative Imaging and Research focused on novel applications of solid state lighting and imaging systems. He is currently serving as the Primary Data Acquisition Division Director for ASPRS supporting the development of remote sensing imaging techniques.

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Samuels, Chuck

Dr. Samuels has over 35 years' experience with electro-optical and remote sensing systems, sensors and weapons. Dr. Samuels is employed by the SI Organization in Valley Forge, PA. He is currently the project lead to develop a system which provides geospatial solutions that require easy discovery, access and retrieval of Earth observational data and models. He is integrating best-of-breed COTS and Open Source Information Technology to address challenges related to Big Data, High Compute Performance and Cloud Computing. Dr. Samuels has supported DoD for over 30 years and is considered an expert in various remote sensing phenomenologies and end-to-end system performance analysis. Dr. Samuels has authored over 70 major technical reports and papers. He has given numerous talks and led panels at many large conferences, and has given numerous formal and informal presentations and briefings to the highest levels of industry, governments and military. Dr. Samuels received his Ph.D. in Physics from Drexel University in 1995. Additionally, he has advanced degrees in Mechanical Engineering and Management.

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Smiley, Byron

Dr. Byron Smiley received his Ph.D. in physics from the University of Colorado at Boulder in 2002. He started his career in remote sensing in Sep 2004 when he started working at DigitalGlobe. In May 2011, after DigitalGlobe failed to provide title and compensation commensurate with his degree and accomplishments, he quit without having another job. A few months later in Sep 2011, the Video Understanding and Exploitation (VUE) Directorate of BAE Systems hired him. He started doing research in the field of computer vision, mostly tracking moving objects in video collected from airborne military cameras. In early 2012, VUE required someone to manage commercial imagery and terrain models for other researchers, so he stepped up to fill the role. He's here at JACIE 2013 to discuss what he's done to keep his fellow computer vision researchers honest and informed about the world of remote sensing.

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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 is currently 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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He is responsible for developing the rapidly growing commercial activities of DMCii, which provides responsive satellite imaging services, a forest mapping service, and disaster response through the International Charter.

After a decade in strategic business consultancy Paul became involved in space when, in 1997, he sought to raise venture capital for a constellation of radar satellites to monitor ocean storms.

He then joined the world leader in small low cost satellites, Surrey Satellite Technology Ltd., and has been active in developing the six-nation Disaster Monitoring Constellation (DMC). Paul also served for several years as a committee member of the British Association of Remote Sensing Companies (BARSC).

Since October 2004 he has served as a Director of DMC International Imaging Ltd., a wholly owned subsidiary of Surrey Satellite Technology Ltd., and since 1st January 2009 part of the EADS Astrium Group.

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Mr. Thomassie has over twenty-eight years of experience in the remote sensing/GIS industry and joined DigitalGlobe in 1999. He assumes responsibility for managing DigitalGlobe's U.S. Federal Civil Government Programs segment. Prior to joining DigitalGlobe, Mr. Thomassie was a Program Manager for NASA/ITD – SpectralVisions and Project Manager for Lockheed Martin under the auspices of the NASA's Commercial Remote Sensing Program (CRSP) at Stennis Space Center in Mississippi.

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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 is serving as the calibration lead for the thermal instrument on the Landsat Data Continuity Mission and is the Deputy Project Scientist for CLARREO for which he is also the instrument lead for the Reflected Solar Instrument.

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Ms. Tighe has just finished a PhD in Earth Sciences at Ottawa-Geoscience Centre of Carleton Ottawa University. Ms. Tighe is currently the Director, Geospatial Solutions at Intermap Technologies Incorporation, ensuring that our customers' needs are understood, that our market research is current. She has been involved in the research of IFSAR data for topographic, forestry, and Geological mapping for the past 21 years.

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Dr. Darrel Williams joined Global Science & Technology, Inc. (GST) as Chief Scientist in February 2010 upon retiring from a distinguished 35-year career in NASA Goddard's Earth Science Division. Dr. Williams received BS and MS degrees in Forest Science from the Pennsylvania State University in 1973/74, began working at NASA Goddard in 1975, and attained his PhD in Physical Geography from the University of Maryland in 1989. At NASA he conducted remote sensing research to develop enhanced techniques for assessing forest ecosystems worldwide. Over time he assumed science management positions of increasing responsibility, including international field campaign manager, Branch Head, Landsat Project Scientist, Laboratory Associate Chief and Acting Chief. He received NASA medals for Outstanding Leadership (1997) and Exceptional Service (2000), 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 for the highly successful Landsat 7 mission. In 2006 he received an "Outstanding Alumni Award" from the School of Forest Resources at Penn State, and in 2012 was appointed to the Advisory Board of the Department of Forest Resources and Environmental Conservation at Virginia Tech University. Since joining GST, Dr. Williams has been developing a robust, low-cost smallsat concept to acquire Earth observation imagery that could be blended seamlessly with Landsat imagery, thereby enhancing temporal repeat and reducing the probability of a crippling data gap. Dr. Williams has authored or co-authored ~100 publications in the field of quantitative remote sensing in such categories as refereed journal articles, book chapters, or proceedings articles.

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Xiong, Jack

Dr. Xiaoxiong (Jack) Xiong is an optical physicist at NASA Goddard Space Flight Center (GSFC). He is currently serving as the MODIS Project Scientist and the technical lead for both the MODIS Characterization Support Team (MCST) and the VIIRS Characterization Support Team (VCST). He received a B.S. degree in optical engineering from Beijing Institute of Technology, Beijing, China and a Ph.D in physics from University of Maryland, College Park, Maryland. Before joining the NASA/GSFC, Dr. Xiong had also worked in the fields of optical instrumentation, nonlinear optics, laser and atomic spectroscopy, and mass spectrometry at private industry and at the National Institute of Standards and Technology (NIST).

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ABSTRACTS
(numeric order)

13.001

COSI-Corr Processing: A Solution for Dense Image Registration, Ground Deformation Measurement, and DSM Generation

Presenter: Sebastien Leprince
Authors: Sebastien Leprince, Francois Ayoub, Jiao Lin, 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 change detection between multi-temporal and multi-spectral images, and the calibration of pushbroom cameras. In particular, COSI-Corr provides a powerful correlation tool, which allows for accurate estimation of surface displacement with accuracy typically better than 1/10 of the pixel size. In addition to discussing the fundamental principles of sub-pixel registration, examples drawn from recent collaborative studies are shown: (1) First, we show examples involving accurate registration capabilities of multispectral images to enhance crop yield monitoring accuracy using satellite and aerial imagery. We also show how dense registration capabilities can be used to enhance traditional change detection techniques to automatically detect the occurrence of landsliding events or bombing events. (2) Second, we demonstrate how 3D ground deformations can be recovered using multi-angle high resolution satellite imagery. In particular, using Worldview imagery, we reconstruct the 3D displacement field induced by the Baja California 2010 El-Mayor Cucapah earthquake. Results are validated against LiDAR measurements. (3) Finally, we show that using Worldview imagery, COSI-Corr can extract high resolution urban DSM that competes with urban LiDAR DSM. We present an application following the New Zealand Christchurch earthquake of 2011, where the collapse of individual buildings are accurately detected using high resolution DSM produced using COSI-Corr.

13.002

An Automatic Atmospheric Compensation Algorithm for Very High Spatial Resolution Imagery and its Comparison to FLAASH and QUAC

Author & Presenter: Fabio Pacifici

This talk illustrates the results produced by a fully automated method to atmospherically compensate very high spatial resolution multi-spectral and panchromatic imagery, and its comparison to FLAASH and QUAC.

The method has been validated on a set of 12 QuickBird scenes acquired over various locations in the U.S.A. where calibrated tarps were deployed. This set of tarps included four spectrally-flat targets having nominally 3.5, 22, 34, and 52% reflectance in the visible through NIR spectral region.

Further, a two year image time-series over Longmont, CO, was used to analyze the stability of the proposed method under different weather and viewing conditions. The data set was composed by more than 150 multi-spectral and panchromatic QuickBird, WorldView-1, and WorldView-2 images acquired between 2009 and 2011. Two sets of bidirectional reflectance distribution function of asphalt and concrete (about 20% and 40% reflectance, respectively) have been acquired during the summer of 2011 and used as reference.

13.003

An Empirical Absolute Calibration Model for Optical Sensors Using Pseudo Invariant Calibration Sites

Presenter: Dennis Helder
Authors: Dennis Helder, Nischal Mishra, Ameya Vaidya, David Aaron

Pseudo Invariant Calibration Sites (or PICS) have been used to provide radiometric calibration trending information for a variety of optical satellite sensors. A high degree of precision is possible using these methods, changes of as little as 0.2 percent per year are measurable with satellites that have been trended over a decade. However, absolute calibration models are also possible using both empirical and physical methods. In this paper we present an empirical absolute calibration model based on sensor observations of the well-known Libya 4 site. In this model Hyperion observations are used to provide the spectral information, while MODIS sensors are used to provide an absolute radiometric calibration anchor. Variations in illumination and viewing geometries are accommodated through multiple observations and the major atmospheric effects can be modeled through seasonal observations. Thus, the model is useful for all reflective band sensors with a variety of viewing angles, spatial and spectral resolutions, viewing times, and for any day of the year. Multiple sensors have been used to validate the model with typical accuracies of 3% for most sensors.

13.004

The Terrestrial Ecosystem Dynamics Mission (TerEDyn): A Small Satellite Concept Offering an Unprecedented Combination of Spatial and Temporal Resolution to Augment Landsat Coverage

Presenter: Darrel Williams, PhD
Authors: Williams, Darrel L. and Goward, Samuel N.

A unique attribute of Earth is the capacity of ecosystems to convert incident sunlight into carbohydrates via photosynthesis. Photosynthesis is a fundamental building block of most all forms of life on this planet, including forests, grasslands, agricultural crops and other ecosystem products. The rapidly expanding human population is increasingly dependent on these photosynthetically produced resources for sustenance and building materials, while at the same time our modern societies are placing increasing demands on the Earth system that negatively impacts the capacity to carry out photosynthesis. Clearly it would be wise to monitor these vital resources more intensively. To date, most studies that have attempted to assess global land photosynthesis have had to use relatively coarse spatial resolution (250 m to 8 km) satellite observations. More frequent temporal repeat afforded by coarse spatial resolution measurements has been attractive because it enables intra-annual analyses of terrestrial photosynthetic capacity. However, such coarse spatial resolution seriously limits inference about specific land cover types and uses, and their associated human drivers. The proposed Terrestrial Ecosystem Dynamics (TerEDyn) mission is an innovative, low risk, low cost passive optical, multispectral smallsat mission. A primary goal of the TerEDyn concept is to return data sets that will permit Earth scientists to substantially refine their understanding of the current state and dynamics of land photosynthetic capacity as a function of planetary geography, land cover type, seasonal vegetation growth cycles and human activities. TerEDyn will support routine global studies of land surface dynamics at an individual “field scale” via the global collection of wall-to-wall 15 m – 30 m visible, near infrared and shortwave IR imagery every 8-days; a low-cost thermal IR capability is also being investigated so that TerEDyn imagery will be more fully compatible with Landsat ETM+ data sets. TerEDyn takes advantage of evolving small satellite and data handling / processing technologies to collect and assess these robust data sets via end-to-end mission costs that are reasonable and sustainable. Implementation of the TerEDyn concept is low risk because it draws heavily from both hardware and software lessons learned via NASA’s historical scientific oversight of

missions such as Landsat, AVHRR, SeaWIFS, and EOS Terra / Aqua MODIS, as well as Surrey's development and oversight of their evolving Disaster Monitoring Constellation (DMC) capabilities. TerEDyn data sets have also been designed to blend seamlessly with the 40-year archive of Landsat imagery, thus offering enhancements to scientific, humanitarian, strategic and commercial applications as well.

13.006

Geometric Assessment of Pleiades-1A, Deimos and ASTER Data Sets

Presenter: Jon Christopherson or A. Sampath
Author: A. Sampath

This study will assess the geometric performance of Pleiades 1A, Deimos and ASTER, sensors using imagery acquired over USGS National Test Ranges (NTRs). Pleiades data aim to provide high resolution (0.5 m Pan and 2.0 m Multispectral) data products. The geometric accuracy of these products were assessed against ground control points and high resolution data sets available for Sioux Falls and Pueblo USGS NTRs. Deimos provides data at 22 m GSD in green, red, and near-infrared regions of the spectrum. The geometric accuracy of these data was also assessed with GLS as reference. ASTER data sets are processes in three different methods. An analysis of these different ASTER data products was performed by comparing them against the Global Land Survey (GLS) data sets.

13.007

Geometric and Radiometric Assessment of the AWiFS-2 Sensors Aboard ResourceSat-2

Presenter: G. Chander
Authors: Gyanesh Chander, Amit Angal, Aparajithan Sampath, A. Senthil Kumar, Taeyoung (Jason) Choi, Xiaoxiong (Jack) Xiong

The ResourceSat-2 satellite was launched in a polar sun-synchronous orbit on April 20, 2011. Similar to ResourceSat-1 (also called IRS-P6), it carries three sensors: the High Resolution Linear Imaging Self-Scanner (LISS-IV), the Medium Resolution Linear Imaging Self-Scanner (LISS-III), and the Advanced Wide Field Sensor (AWiFS). These three sensors are used together to provide images with different resolution and coverage. To understand the relative radiometric calibration accuracy of ResourceSat-2 AWiFS sensors, 14 images acquired over the stable Libya-4 desert site were compared to images from the Terra and Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) sensors. The approach involved comparison of near-simultaneous surface observations based on image statistics from these sensors. Since most of the near-simultaneous MODIS overpasses were off-nadir, a MODIS-based semi-empirical bidirectional reflectance distribution function (BRDF) model to account for the off-nadir acquisitions was developed. In addition real-time water-vapor content over Libya-4 site was extracted using MODIS water-vapor product and a spectral band mismatch correction was performed using MODTRAN and real-time water-vapor information to reduce the uncertainty in the cross-comparison results. Geometric assessment was performed to study the positional accuracy of the image datasets. The positional accuracy was assessed by using the Image to Image (I2I) registration assessment tool by comparing the ResourceSat-2 AWiFS imagery against the Global Land Survey (GLS) 2005 dataset as a reference image. The R2 AWiFS data acquired over Sioux Falls, SD and Pueblo, CO were used for this study. The results showed that the root mean square errors (RMSE) were found to be much higher than the ones obtained from ResourceSat-1 AWiFS images in previous study.

13.008 (poster)

Overview of the Land Product Validation System (LPVS)

Authors: Gyanesh Chander, Kevin Gallo, Calli Jenkerson, Greg Stensaas, John Dwyer, Ryan Longhenry

National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) Earth Resources Observation and Science Center (EROS) Center are collaborating on the development of a Land Product Validation System (LPVS) that will facilitate the application of multi-satellite and in-situ data for characterization and validation of Geostationary Operational Environmental Satellites (GOES)-R and Joint Polar Satellite System (JPSS) land-related products (e.g., surface reflectance, Normalized Difference Vegetation Index, and Land Surface Temperature). The system is planned to utilize data anticipated to be available from the USGS Landsat 8, European

Space Agency (ESA) Sentinel series of satellites, and other relatively high and medium resolution sensors, to validate GOES-R Advanced Baseline Imager (ABI) and JPSS Visible Infrared Imager Radiometer Suite (VIIRS) products. The VIIRS products from the Suomi National Polar-orbiting Partnership (NPP) satellite will also be integrated into the system as available.

The LPVS includes data inventory, access, and analysis functions that will permit selection of data housed within multiple archive facilities to be easily identified, retrieved, co-registered, and compared statistically through a single interface. This functionality is evolving through a prototype phase (2012) and a beta operational phase (2013) before becoming operational in 2014. The USGS EROS Center is planning to develop and distribute terrestrial Landsat-derived Environmental Climate Variables (ECV) making this facility uniquely qualified for the development and operation of LPVS. Additionally, many of the functional requirements for the envisioned LPVS exist within current USGS EROS systems or are planned for future systems and will provide for efficiency and commonality in development of the LPVS.

13.009

DigitalGlobe Incorporated Corporate and Satellite Program Update

Author and Presenter: Brett Thomassie

DigitalGlobe continues to launch and operates a growing constellation of high resolution earth imaging satellites (QuickBird and Worldview systems) and also offers 30cm resolution Precision Aerial orthorectified imagery from its 2010-2012 Advanced Ortho Aerial Program (AOAP) to complement its satellite product offerings.

The DigitalGlobe satellite constellation's current capability to collect over 2.6 million square kilometers of imagery data daily equates to collecting 6X the world's landmass each year. This large satellite collection capacity is well suited for temporal applications, analysis of large study areas globally, and contributes to the rapid population and updating of DigitalGlobe's growing image library (over 2-billion km2 of archived imagery coverage).

WorldView-2 (WV2), was successfully launched October 8, 2009. WV2 enables DigitalGlobe to provide half-meter panchromatic resolution and 1.8-meter multispectral resolution (8-bands) and allows DigitalGlobe to substantially expand its imagery product offerings. The unique spectral diversity allows the ability to perform precise multispectral analysis, change detection, bathymetry and other spectral applications in a more robust fashion. WV2 incorporates the industry standard 4 multispectral bands (R, G, B, NIR) and also includes 4 new spectral bands (coastal, yellow, red edge, and near-infrared 2).

WorldView-3 (WV3), launching in 2014, will be the first multi-payload, super-spectral, high-resolution commercial satellite. WV3 includes 31 cm panchromatic resolution, 8 multispectral bands at 1.24 m multispectral resolution, and 8 SWIR bands at 3.7m resolution.

DigitalGlobe offers its imagery products delivered via traditional offline methods and also via DigitalGlobe's Cloud/Web Service online access.

In addition, DigitalGlobe's Analysis Center specializes in producing and delivering a range of value-added analysis offerings tailored to customer needs. DigitalGlobe imagery and value added products/services are designed to support a wide range of projects and science/research applications worldwide and examples of these will be covered.

13.010

ENVI Services Engine: Scientific Data Analysis and Image Processing for the Cloud

Presenter: Amanda O'Connor
Authors: Bill Okubo, Greg Terrie, Amanda O'Connor, Patrick Collins, Kevin Lausten

The growing adoption of cloud computing by the geospatial industry has identified business requirements that are driving cloud-based deployment of image analysis capabilities.

- The volume of image data and processing requirements are rapidly increasing

- "Best-in-class" analytics such as atmospheric correction, calibration, and image QA/QC verification and metrics are highly valued
- Users expect simplified software workflows that can be accessed from a web browser or mobile devices
- Federal, state and local agency budgets are shrinking
- Desktop hardware and software resources need to be streamlined

In response to these emerging trends, Exelis Visual Information Solutions (VIS) has created the ENVI Services Engine. ENVI is a remote sensing, image analysis software application that contains hundreds of well established analytic functions including many tools for calibration and validation of imagery. The ENVI Services Engine provides ENVI's processing analytics as web services in a client-server architecture. ENVI Services Engine supports open standards including the HTTP REST protocol and OGC WPS/WMS/WCS. Its interoperable design works with Esri's ArcGIS® for Server or other middleware to bring the image analysis capabilities of ENVI to the cloud. ENVI Services Engine delivers online, on-demand access to information derived from remotely sensed data which is a benefit to a community of users working to ascertain the scientific usability of imagery in a client server environment.

13.011

Standard for Image Quality of Optical Remote Sensing Data

Presenter: Andreas Brunn
Author: Dr. Ralf Reulke

Photogrammetry and remote sensing provide procedures for deriving geometric and thematic information from image data. A variety of aircraft and space-based sensors are available to capture image data. According to the applications of German remote sensing and photogrammetry users DIN 18740 (DIN = German ISO regulations) defines this standard and specifies the quality requirements on optical remote sensing data.

Due to the possibilities of absolute geometric and radiometric calibration digital sensors provide new promising opportunities to create value added products like Digital Elevation Models, land-use maps etc. Such cameras combine the high geometric quality with the radiometric standards of earth observation systems.

The determination of the quality of remote sensing data can in principle be distinguished by (spectral) radiometric and geometric aspects. The standard contains different metrics for accuracy issues (spectral, radiometric and geometric accuracy) and for performance parameters like SNR, MTF . Image artifacts are another topic of the described standard.

The paper gives an overview of the current debate and the possibility of standardization.

13.012

Assessment of Remote Sensing Optical Payload Performance and Data Quality over Two Comprehensive Sites

Presenter: Chuanrong Li, Lingli Tang, Lingling Ma, Jian Hu, Ziyang Li
Authors: Chuanrong Li, Lingli Tang, Lingling Ma, Jian Hu, Ziyang Li

Assessment of remote sensing payload performance is the guarantee of the application of its measurements in various domains. With the development of quantitative remote sensing, the assessment of remote sensing payload performance has attracted widespread attention, and thus various calibration and validation (C&V) sites have been built up in the world to monitor radiometric, spectral, spatial and geometric performances of payloads during their life period.

To assess the payload performance and data quality for high-resolution airborne and satellite imaging systems, two comprehensive C&V sites (North China site and South China site) with standard artificial targets (knife-edge target, fan-shaped target, three-bar target, gray-scale target, colored target) for optical payloads and natural ground targets

(crops) have been established since 2010. In the two sites, three flight campaigns have been carried out for characterizing the performances of two standard optical sensors (offner convex grating hyperspectral camera and large field multispectral camera), which were developed by the Chinese Academy of Sciences (CAS). With the aid of self-developed processing/analyzing system, radiometric (radiometric accuracy, signal to noise ratio, dynamic range, response linear degree and radiometric resolution), spatial (ground resolution, MTF) and geometric (geometric distortion, band-to-band registration accuracy) and spectral performances (central bandwidth and FWHM for hyperspectral camera, spectral response function for multispectral camera) have been assessed successfully. In addition, surface reflectance, spectral vegetation index [SVI, for example, chlorophyll absorption ratio index (CARI) and modified CARI (MCARI)] and leaf area index (LAI) were retrieved from the hyperspectral data and have been validated in the two comprehensive sites. The validation results demonstrated the application potential of sensors, which are beneficial to improve the retrieval methods and promote the application in various scientific fields.

13.013

Assessment of EIFOV Based on Natural Edges for Satellite Images

Presenter: Andréa de F. F. Canhoto
Authors: Andréa de F. F. Canhoto, Leila M. G. Fonseca, Guaraci J. Erthal

Due to limitations of the sensor components and the satellite movement during the imaging process, the generated images undergo a blurring effect, which reduces the quality of the images and impairs its analysis. Therefore, it is important to estimate performance metrics after the launch of the satellite to check if calculated values are in accordance with design specifications. In this work, we have implemented a method to estimate EIFOV (Effective Instantaneous Field of View) of optical sensors on board satellites. The EIFOV is estimated using a set of subimages of natural edges, with different directions, extracted from a scene. For each selected subimage, a standard deviation is calculated and the spatial resolution estimation in along-track and across-track is obtained through an ellipse fitting. The method is evaluated for images of CBERS satellites.

13.014

RapidEye Large Area Imaging Capabilities and New Countrywide Mosaic Product

Presenter: Michael Oxfort
Authors: Michael Oxfort, Harald Konstanski, Scott Douglass, Brian D'Souza

RapidEye has been operating its own constellation of 5 identical earth observing, multispectral imaging satellites for more than 4 years. The system is capable of acquiring up to 5 Million km2 of global imagery data per day, with 6.5 m nadir resolution and in 5 spectral bands..

The flexibility and capacity of its constellation makes the RapidEye system the ideal candidate for covering very large areas in very short time periods, and, if required, with a high repetition rate. The presentation describes the steady evolution of RapidEye's capabilities to provide high quality image data to its customers. Several successful projects are described, from the feasibility evaluation to the actual execution, involving imaging and data delivery. The potential of the RapidEye system is characterized by the achieved performances, such as the complete coverage of Mexico (nearly 2 M km2) in just 8 days and the yearly coverage of the entire territory of China (more than 9 M km2) in less than three months.

Leveraging on this large area and rapid imaging capability, RapidEye has recently enhanced its product offering by a ortho-rectified mosaicked image product. The presentation will describe the product in more detail.

13.015

The Calibration and Validation Activities performed at RapidEye During the year 2012

Presenter: Andreas Brunn
Authors: Andreas Brunn, Cody Anderson, Michael Thiele

RapidEye operates its own constellation of 5 identical multispectral Earth Observation satellites. The system

has the ability to access any point on earth every day and to acquire up to 5 Million km2 of data per day, with 6.5 m resolution and in 5 spectral bands.

The consistent and stable quality of the generated imagery data in terms of radiometric and geometric accuracy is one of the key drivers for the Calibration and Validation team at RapidEye. The execution of frequent and well established internal processes - being accompanied by the support of external experts - allows RapidEye to continuously meet the stringent image quality requirements. This presentation will provide details about these processes and will present the latest results reflecting the actual status of the image quality of RapidEye data products.

In addition, this paper will report on the results of RapidEye's latest absolute calibration campaign which again has been conducted jointly with the University of Arizona. The key objectives of the campaign were to identify the potential need to adjust the absolute radiometric performance of the whole constellation as well as to assess the relative and temporal radiometric performance between the individual satellite cameras, in relationship to the absolute calibration results.

Finally, a summary of MTF characterization, SNR monitoring, and the overall geometric accuracy of the products is presented.

13.016

New MTF Resampling Kernel and Its Effect on RapidEye Imagery

Presenter: Andreas Brunn
Authors: Andreas Brunn, Ellis Freedman and Robert Fleming

RapidEye operates its own constellation of 5 identical multispectral Earth Observation satellites. The system acquires up to 5 Million km2 of global imagery data per day, with 6.5 m resolution and in 5 spectral bands. Serious Science LLC is a company specializing in the analysis of electro-optical imaging systems and their associated algorithms.

MTF (Modulation Transfer Function) is an important measurement in the assessment of remotely sensed images by providing a measure for the sharpness of the images. The MTF value is influenced by the camera design and performance, and by the processing algorithms used to convert the raw data into orthorectified image products.

These algorithms can be enhanced and optimized also after launch to further improve the MTF.
In general, a kernel used to perform image resampling has a direct influence on the image quality. The simplest resampling kernel, Nearest Neighbor (NN), preserves the original image values but introduces artifacts. The Cubic Convolution (CC) kernel avoids these artifacts but reduces the sharpness of the image, to varying degrees across the image.

The resampling kernel developed by Serious Science LLC has proved to be an excellent alternative. Improvements to the radiometric as well as geometric accuracy have been confirmed. Additionally, the kernel improves the MTF behaviour compared to the standard CC and NN kernels.

This presentation introduces the new resampling kernel and shows the improvements it achieved on RapidEye imagery.

13.017

Continued Monitoring of US Crop Condition Using Deimos-1 & UK-DMC2

Presenter and Author: Drew Hopwood

For the past two years, Astrium GEO-Information Services has been collecting imagery over the lower 48 states to support USDA users. In total, more than 300 million square kilometers of imagery has been collected and delivered for this project. To collect this quantity of imagery, Astrium relied on two satellites: DEIMOS-1 and UK-DMC2. Both satellites are capable of collecting a 620km swath of 3-band, 22m resolution imagery. In 2011, the

USDA used a combination of DEIMOS-1, UK-DMC2, and Landsat-5 to monitor crop conditions. With the uncertainty of Landsat-5 in 2012, the USDA heavy relied on DEIMOS-1 and UK-DMC2 to provide imagery to support agency requirements. In this presentation, we will review the technical specification of each satellite, discuss the collection strategy that was employed to ensure the maximum delivery of imagery, review the past two years of collections and look forward into 2013 and beyond.

13.018

Status of Astrium GEO-Information Services' EO Satellite Constellation

Presenter and Author: Drew Hopwood

Astrium GEO-Information Services, a worldwide leading provider of geospatial information from Earth observation satellites, has launched three new satellites within a year. Pléiades 1A, a very high-resolution optical satellite, launched in December 2011 and has been commercially operational since June 2012. SPOT 6, a high-resolution optical satellite, launched in September 2012 and will be commercially operational in early 2013. Finally, Pléiades 1B, the twin to Pléiades 1A, was launched in November 2012. We will present an overview of each satellite's capabilities along with a comparison of SPOT 6 to the previous generation of SPOT satellites. 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.

13.019

Low Light Applications for Absolutely Calibrated Large Format Large Dynamic Range Digital Imaging Sensors

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

Aerial framing cameras such as the Z/I DMC and DMCII, Leica RCD30, and others can acquire high quality imagery over an enormous dynamic range by carefully controlling aperture and exposure time settings. Recent experiments have demonstrated that these types of sensors are capable of successfully imaging under illumination conditions that vary over nearly three orders of magnitude including artificially illuminated scenes at night. Low light imaging and imaging at night enable these sensors to be used to characterize light pollution, estimate lighting energy use, perform illumination surveys and identify outdoor light types. The ability to acquire quantitative information under varying illumination conditions is highly dependent on both relative and absolute radiometric sensor calibration. Although many advanced large format CMOS and CCD-based multispectral cameras are capable of being absolutely radiometrically calibrated, the derived benefits from absolute calibration has been limited. This is due in part to: the complexity of the calibration source required to provide illumination that spans the wide dynamic range that these sensors operate under; and the need to automate the calibration process due to the sheer number of pixels and operating parameters associated with these systems. This paper discusses an approach to absolutely radiometrically calibrate framing camera systems based on a novel software controlled hybrid Tungsten Halogen/LED illuminated integrating sphere source. This novel calibration source enables rapid automated camera radiometric calibrations over the entire dynamic range of advanced framing cameras. The paper applies this approach to absolutely radiometrically calibrate Z/I DMCII aerial multispectral cameras and low cost UAS sensors and also discusses low light application examples.

13.020

Aerial Imaging Quality Assurance

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

Multispectral digital aerial imaging is in a period of rapid growth and change. New and challenging application requirements are driving imaging system technology development. Over the past few years tremendous advancements have been made in terms of array size, image swath, radiometric sensitivity and bit depth. The quality of these acquired data must be objectively determined and then periodically validated in order to establish their long term usefulness. To begin addressing this need the American Society of Photogrammetry and Remote Sensing

(ASPRS) Primary Data Acquisition Division (PDAD) is currently developing an interactive Digital Imagery Guideline and a Radiometric Guideline to assist the user community in understanding the significance of the several parameters used to quantify image quality and radiometric performance. The Digital Imagery Guideline is presented in a user-friendly interactive environment whereby a user can specify spatial resolution parameters to generate simulated image products. The Radiometric Guideline describes the methodology to absolutely radiometrically calibrate an aerial sensor and articulates the benefits of absolute radiometry. This presentation will provide a status and overview of these guidelines.

13.021

Commercial Imagery and Terrain Models Used in Computer Vision at BAE Systems

Presenter: Dr. Byron Smiley
Authors: Dr. Byron Smiley, Dr. Victor Tom

In the Video Understanding and Exploitation (VUE) Directorate of BAE Systems, engineers use overhead imagery and terrain models to develop computer vision algorithms. The large number of imaging platforms, sensors, pixel sizes, and map projections makes it challenging to use remote sensing products properly and accurately in computer vision research.

During 2012, VUE leveraged a variety of commercially available remote sensing products to aid in the development of computer vision algorithms. This talk will discuss the steps taken to select and pre-process these products: USGS imagery from the Landsat satellites; high resolution aerial orthophotos from USGS, USDA, and North American Mapping; the ASTER terrain model derived from NASA's Terra sensor; the National Elevation Dataset from USGS; the 2011 National Land Cover Dataset from USGS; and free LIDAR data hosted by NOAA's Digital Coast website. The mutual consistency of the different imagery and terrain models will be discussed, especially NOAA's free LIDAR data.

These data sets support computer vision "matchers" that compare attributes of a photograph or video clip to something in the real world, such as skylines or man-made objects. Examples from a few matchers will be presented, showing how they use various remote sensing products to achieve their goal.

13.022

New Sensors; Update on Developments in the DMC Constellation

Presenter: Paul Stephens
Author: Paul Stephens

The Disaster Monitoring Constellation (DMC), coordinated by DMCii, pioneered daily repeat imaging capability at 30m resolution in 2004, and continues to deliver greatly improved performance through the three satellites which carry the new generation of 22m sensors. The quality of the 22m DMC multi-spectral imagery has provided the USDA with improved crop classification accuracy over 2011 and 2012.

In 2013 DMCii demonstrates commitment to continuity of service with the purchase of its next generation 22m satellite from SSTL.

The company also has three new DMC3 satellites in construction by SSTL for launch in 2014, which will deliver daily 1m capability, and will also distribute data from the SSTL NovaSAR S-band satellite.
DMCii also supplies 2.5m pan and 5m multispectral imagery from an agile SSTL satellite platform, NigeriaSat-2, which is a member of the Constellation.
This presentation will provide an update on the operational and future DMC imaging sensors, and the operational applications of constellation services.

13.024

Automated Methods for the Quality Control of Data from the DMCii Satellite Constellation

Presenter: Steve Mackin

Authors: Mackin, S., Brindle, L. and Stephens, P

One of the major issues facing satellite data providers is to generate consistently high quality data rapidly and with a minimum of human interaction in the process. As the numbers of satellites increase in the DMCii constellation along with their improved capabilities, the need for improved automated methods of data quality has grown.

DMCii has been focusing on a range of activities to automate the data quality assessment process, without down time for specific calibration campaigns. Areas investigated include Signal to Noise Ratio (SNR), relative gain calibration and single detector anomalies, as well as the issue of micro-vibration and its detection and mitigation for the VHRI systems (1m PAN) currently being built for DMCii.

The ultimate aim is to have satellite systems which are not only self-managing (capable of changing their own data collection requirements) but also self-calibrating in the absolute sense.

13.025

Reducing the Uncertainty in Radiometric Cross-calibration Over the Libya 4 Site – Modelling and Measurement

Presenter: Laura Brindle
Authors: Brindle, L., Mackin, S., and Stephens, P

One of the key components of data quality is to provide a stable radiometric calibration over the lifetime of the satellite. The DMCii approach has avoided costly on-board systems and the management of short-lived and expensive vicarious calibration approaches. However, there is still a need to provide a very high calibration accuracy for the DMCii satellite systems.

The method chosen has used cross-calibration with a primary site over Libya 4 in North Africa. Two approaches have been used to cross-compare data obtained by Landsat 7 ETM+ and the DMCii satellites over the test site. The first uses a series of empirical corrections based on analysis of many data points collected over a period of several years. This includes corrections for temporal variations in the satellite response and for view angle effects given the complex BRDF of the surface.

The second approach is model based, in which the BRDF of the surface is determined using a suitable model. If the BRDF model can be correctly determined and the contributions due to surface geometry and sand BRDF can be correctly prescribed then it is feasible to achieve very low levels of uncertainty in the final results, the only other factor being the atmosphere.

The comparison of the empirical correction against the model results will be given and differences discussed.

13.026

Radiometric Calibration and Assessment of GeoEye Sensors

Presenter: Robert Arnold
Authors: Robert Arnold and Nancy Podger

An overview of the methods and results associated with Absolute and Relative Radiometric Calibration of the GE-1 and GE-2 sensors will be presented. In the case of GE1, both ground measurements and on orbit data collection activities and analysis will be discussed. In the case of GE2, ground measurements and associated pre-launch calibration results will be discussed.

13.027

Quality Assessment of Elevation Data Products in the Bundeswehr

Author and Presenter: Dr. Carola Braun

The Bundeswehr Geoinformation Service (BGIS) is expected to identify mission-relevant environmental impacts, evaluate them according to space and time, and support and advise users with the help of prepared geospatial and environmental information. The BGIS creates fundamentals and prerequisites in the field of geospatial and environmental information for the employment and routine duty of the Armed Forces.

The Bundeswehr Geoinformation Office (BGIO) with its headquarters in Euskirchen is the central specialized agency of the BGIS. It supplies quality controlled geoinformation including commercial satellite imagery and elevation data. Digital elevation models serve as an indispensable basis for the orthorectification of optical and radar images, for quite a number of integrated GIS-products, for many weapon systems and for simulation purposes as well.

Investigations are repeatedly carried out to identify the need of the users. Continuous assessment of products available on the public market is performed in order to meet future challenges. The quality of offered elevation data products is heterogeneous as are the procedures to generate them. Digital elevation models can be efficiently generated using automatic image matching techniques from optical stereo images, either airborne sensors or high and very high resolution space-borne stereo sensors, e.g. WorldView-1/-2, Cartosat-1- or Pleiades. On the other hand, the TanDEM-X DEM generated through interferometric processing in the context of the German TanDEM-X mission will be globally available from 2014 onward.

Before providing the elevation data from these different sources to the users it is essential to understand their characteristics and do an independent verification of data quality, if possible. The ultimate objective is to verify whether the purchased data fulfills the requirements of the product specification and could be improved by using best available internal data. The BGIS uses selected regions as reference and validation areas, comprising urban and rural areas and forests in flat and medium terrain as well as steep mountain ranges. Digital elevation data is compared to Ground Control, if available, in order to get statistically derived accuracy indicators and a non-numerical description of characteristics and limitations of the data. As the huge volume of incoming data is an increasing challenge, a standardized quality control process is constantly adopted consisting of a combination of automatic tools and visual inspection of the data.

13.029

GeoEye Geolocation Assessment and Reporting Update for 2012

Presenter: Dr. David Mulawa
Authors: Dr. David Mulawa and Gene Dial

The GeoEye-1 and IKONOS high-resolution imaging satellites continue to provide very good geolocation accuracy performance. This update includes geolocation accuracy assessment results from 2012 and Q1 2013. The Field Angle Map and camera interlock angle calibration methods that were used are described.

13.030

Image Quality; Breaking the Paradigm by Leveraging Collaborative, Net-centric Efficiency

Presenter: Brandon Migdal
Authors: Brandon Migdal, Josh Nauman

The establishment that focuses on the validation and verification of image and product quality has long been keen to assure the highest level of accuracy of the results for which they are responsible. While this provides a tremendous utility to the user base and consumer community, it comes at a high cost in terms of both time and resources. We explore the gains in advancing the area of quality that are available as we move to a collaborative, net-centric environment. We demonstrate that leveraging a highly customizable workflow solution allows for a significant gain in resources management while continuing to ensure the accuracy of delivered products. We focus on:

Workflow Management: Discussing the design and development of a fully customizable, net-centric system for product quality and what that means for the future of production and quality management.

Collaboration: Discussing the incorporation and implementation of collaborative workflow solutions which enable significant resource and time saving to be realized by tackling issues within the value stream.

Value Added Processing: We demonstrate the gains associated with the incorporation of net-centric based value added processing being incorporated directly into the production and quality process and tasked directly from the consolidated workflow solution.

Data Management & Dissemination: We demonstrate the value of positive data management across the net-centric enterprise to know the location (both physical and virtual) of data within the network space. Furthermore, we explore ways in which dissemination of data can be managed and streamed to achieve savings in bandwidth and time to the user base.

13.032

Commercial Value of Satellite Imagery for Agriculture

Presenter: Philip C. Abbott
Authors: Philip Abbott, David Boussios, Jess Lowenberg Deboer

Availability of images and data from commercial satellites reflects the potential for that information to generate economic value. While commercial application of satellite generated information is agriculture lags other uses, potential exists for economically viable applications.

Commercial value of satellite images arises when improved information allows decision-makers to make better economic decisions. We identified five areas of application to agriculture where there is this potential: Crop management, insurance, real estate assessment, crop forecasting, and environmental monitoring. Benefits to crop management arise when input applications, including fertilizers, pesticides, growth promoters and organic matter for soil improvement, are applied more precisely; when pests, diseases and other risks can be identified more quickly; and when fields can be divided into differentiated zones for more effective management. Improved farmer decisions include targeted application of inputs and guided scouting of fields to rectify problems. Insurance applications focus on crop damage assessments due to hail, flooding, drought, wind or freezing. Decisions include timely replanting and a better match of monetary compensation to damages. Verification of land condition facilitates land sales and more accurate pricing. Better crop forecasting can improve market outlook information by better establishing area planted, improved yield forecasting, stress assessment, and early warning where there may be risk of famine. Hedging price risk by farmers, livestock producers and food processors is enabled by better market forecasts. Early famine warning enables more responsive action by donors and governments, including advanced stockpiles when crop shortfalls occur. Environmental monitoring allows more effective regulation and compliance monitoring.

Several issues have limited realization of these potentials. Scale economies due to the high price of large images limits cost effectiveness to individual farmers. Insurance, environmental monitoring, and crop management services by cooperatives may be cases overcoming this limitation. Pricing practices for images, especially from commercial satellites, may exacerbate this limitation. Imagery from aircraft and drones (UAVs) or equipment based sensors may be more cost effective. Moreover, cloud cover and other technical issues limit timeliness. More attention has been paid in the past to basic science than to problems limiting commercial application, and very limited research considers where economic value is to be found. Advances in this technology, such as hyper-spectral data, may not solve problems limiting commercial application. Satellite imagery must also be accompanied by "ground truth" data and interpretation, yet science in the more promising applications (e.g. forecasting in developing countries) may be limiting. Science should focus on ways to better forecast yields, and on interpretation of data for commercial application.

We attempt to identify areas where potential commercial value from agriculture is greatest. We assess why a few commercial activities have succeeded when many similar ventures failed. We estimate potential value generated from examples in each of the five areas, and assess limitations to realizing that potential. The greatest opportunities are probably in the crop forecasting area, especially where agricultural statistics services are not as well developed, since public market information benefits a broad range of economy actors, not limited to countries where forecasts are made.

13.033

Airborne or Spaceborne?

Author and Presenter: M. Lorraine Tighe

The benefits of synthetic aperture radar (SAR) imagery such as penetration through clouds, haze, smoke, and light rain, 24/7 data collections, and advanced imagery processing techniques to provide high resolution imagery has proven to provide worldwide coverage of optimal imagery data suitable for a host of applications. Within the last decade the remote sensing community has seen a plethora of spaceborne SAR imagery systems where there are now extensive archives for COSMO-SkyMed, ENVISAT, TerraSAR-X, and Tandem-X sensors. Moreover, a handful of airborne sensors from Intermap, Fugro, and Orbisat are also in operation collection high volumes of SAR data. But which platform air- or space is the most optimal system for a given application? This paper takes a look at the similarities and differences between airborne and spaceborne SAR imagery for a range of applications to provide guidelines that will assist the end user in making a choice between air- and space-borne SAR platforms. Parameters such as image resolution, SAR wavelength, rectification parameters, costs of acquisitions, data availability, to name a few, will be discussed.

13.034

Aerial Mapping Camera Technology from Hexagon

Author and Presenter: Klaus Neumann

This presentation will talk about latest developments for digital aerial cameras. New software developments using SGM Semi Global Matching algorithms allows users to generate dens georeferenced points clouds directly from aerial images. This opens a complete new range of applications for users of digital aerial sensors. 3D point clouds will also add value for remote sensing application like vegetation classification etc. The presentation will include application examples.

This new approach does not intend to replace Lidar. Instead it will be complementary and will provide new products to the end user. The difference between both technologies and its application range will be explained during this presentation.

13.036

DEIMOS-1 Image Quality Improvements Through MTF Deconvolution

Presenter: Fabrizio Pirondini
Authors: Jorge Gil, Alfredo Romo, Mónica Díez, Cristina Moclan, 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 and 2012 it has provided the USDA with the bulk of the imagery used to monitor the crop season in the Lower 48.

The heart of the Deimos-1 payload is the SLIM6 (Surrey Linear Imager Multispectral 6 channels) sensor, which is designed to provide high-resolution images of the Earth's surface in three spectral bands (NIR, Red and Green) along its swath.

As any signal processing system, there is always a distortion between the signal and the measurement. In the case of the optical system of Deimos-1, the satellite motion, the electronics, the atmosphere and the optic system itself causes that the footprint of a pixel in the ground to be bigger than the GSD, causing the contamination of the signal by the neighboring area and the loss of image sharpness.

ELECNOR DEIMOS Imaging has developed a procedure to characterize this distortion in order to restore as much as possible the original signal, that is, to measure the modulation transfer function (MTF) and to use it to deconvolve

the image. As a result, we obtain sharper images, where more details are visible, while keeping a good radiometry consistency.

In this presentation we will explain the procedure we developed, including point spread function (PSF) and edge spread function (ESF) determination, the selection of the MTF deconvolution method, and present results of the improvements obtained.

13.037

DEIMOS-2 Pre and Post-launch Calibration and Data Validation

Presenter: Fabrizio Pirondini
Authors: Jorge Gil, Alfredo Romo, Fabrizio Pirondini, Diego Lozano, Enrique Gonzalez, Jesus Quirce

ELECNOR DEIMOS Imaging (Spain) owns and operates Deimos-1, the first Spanish Earth Observation satellite. Launched in 2009, Deimos-1 satellite is among the world leading sources of high resolution data, providing yearly coverages of Africa to ESA-GMES and bimonthly coverages of US Lower to USDA (through Astrium GEO-Information Services) during the 2011 and 2012 crop seasons.

The ELECNOR DEIMOS group is currently building the Deimos-2 satellite, which will be a very-high resolution, agile satellite capable of providing 75-cm pan-sharpened and 4-m multispectral (4 bands) imagery, with a 12km-wide swath. The launch is currently scheduled for December 2013. The whole end-to-end Deimos-2 system has been designed to provide a cost-effective and highly responsive service to cope with the increasing need of fast access to very-high resolution imagery.

The Deimos-2 payload, known as EOS-D, is a push-broom type camera (TDI linear array) with four multi-spectral bands (NIR, red, green and blue). ELECNOR DEIMOS is currently characterizing the sensor before launch to gather the radiometric parameters necessary for accurate measurements. These parameters include the accurate spectral response of all bands, non-linearities, dark signal measurement, pixel response non uniformity, signal-to-noise ratio and saturation values for different imager setups.

In this presentation we will show the results of the pre-launch sensor characterization, and describe in details the process that will be followed for the sensor equalization and absolute calibration, including the long-term monitoring of the degradation trends.

13.038 (poster)

Impact of Terra MODIS Collection 6 on Long-term Trending with Landsat 7 ETM+ Reflective Solar Bands

Presenter: Gyanesh Chander
Authors: Amit Angal, Xiaoxiong (Jack) Xiong, Gyanesh Chander, Taeyoung (Jason) Choi, Dennis L. Helder

In recent years, the Moderate Resolution Imaging Spectroradiometer (MODIS) Characterization Support Team (MCST) has worked closely with the MODIS Science Team members and data users on a number of issues that are related to sensor long-term calibration biases in several of its short wavelength bands. The magnitudes of the biases, which are scan-angle dependent, have gradually increased over the years. As a result, new approaches (algorithms) have been developed by the MCST to address the identified issues and to mitigate their impact on sensor calibration and data quality. Several improvements have been included in MODIS Level 1B (L1B) Collection 6 (C6) calibration and data production. This paper provides an overview of changes made in the latest L1B C6. It demonstrates long-term calibration improvements in Terra MODIS reflective solar bands (RSB) through inter-comparisons with spectrally matching bands of Landsat 7 (L7) Enhanced Thematic Mapper Plus (ETM+) sensor over the Committee on Earth Observation Satellites (CEOS) reference pseudo-invariant calibration sites (PICS). Results from the newly processed Terra MODIS L1B C6 products have shown significant improvements over its predecessor Collection 5 products in terms of sensor long-term radiometric calibration stability.

13. 039

Harnessing Big Data and Models to Solve User Geospatial Problems and Challenges Using IDEAS (Intelligent Data Exploration and Analytics System)

Presenter: Dr. Charles Samuels
Authors: Dr. Charles Samuels, John Kelley, Dr. Shawana Johnson

IDEAS consists of a web-deployed intuitive user interface, Smart Engine and High Performance Cloud Computing backbone which provides for data and model discovery and access to federated NASA and other U.S. agency data repositories, and available model repositories. Innovative methods for data and model discovery, learned workflows for discovery based on users' problem sets, access and management is used to provide near real-time Model as a Service (MaaS) services. These MaaS services provide for model set up, calibration, utilization, and product generation. Data and model quality is implemented through the use of appropriate data and model meta-data and standards compliance. Many users of satellite earth observational data have a difficult time discovering and accessing data and models. The Intelligent Data Exploration and Analytics System (IDEAS) developed by The SI Organization, Inc. systematically addresses these challenges through intelligent compute responses and guidance and in addition provides the ability for users to access data and models, and develop products on-demand.

In this paper, we will present the challenges faced by these users currently, how IDEAS addresses those challenges, and conclude with an IDEAS demonstration indicative of how several different user problems are solved.

13.042

S-NPP VIIRS On-orbit Calibration and Performance

Presenter: Jack Xiong
Authors: Jack Xiong, Changyong Cao, Frank DeLuccia, Bruce Guenther, and Jim Butler

Launched in October, 2011, the first Visible-Infrared Imaging Radiometer Suite (VIIRS) on-board the Suomi-National Polar-orbiting Partnership (S-NPP) spacecraft has successfully operated for more than 1 year. The VIIRS collects data in 22 spectral bands with wavelengths ranging from 0.41 to 12.5 □m. One of the bands is a day/night band (DNB) centered at 0.7 □m and several bands can make observations at high/low gain state. VIIRS produces a total of 22 Environmental Data Records (EDRs) from its calibrated and geolocated radiances and reflectances, also referred to as the Sensor Data Records (SDRs). To assure its on-orbit calibration quality, the VIIRS carries a set of on-board calibrators (OBC) designed and built from MODIS heritage, which include a solar diffuser (SD) and a solar diffuser stability monitor (SDSM) for the reflective solar bands (RSB) calibration and a blackbody (BB) for the thermal emissive bands (TEB) calibration. Since launch, VIIRS has completed all the initial Intensive Calibration and Validation (ICV) activities, which include different types of spacecraft calibration maneuvers. In addition to observations from the OBC, lunar observations are regularly scheduled in support of RSB radiometric calibration. This paper provides an overview of VIIRS on-orbit calibration activities, methodologies, and strategies implemented to date. It illustrates early results derived from OBC measurements, lunar observations, and calibration maneuvers and highlights their applications to maintain and improve sensor calibration quality. Key sensor performance parameters and their on-orbit stability will be examined and compared with sensor design requirements. Issues identified, such as large response degradation in several VISNIR channels, their impact on sensor performance, and future calibration efforts, including the Long-Term Monitoring (LTM) activities and calibration inter-comparison with other sensors, are also discussed.

13.043

Quality Assessment (QA) of LiDAR Data at the USGS National Geospatial Technical Operations Center (NGTOC)

Presenter: Lori Phillips
Author: Amanda Lowe

Airborne Light Detection and Ranging (lidar) is an active laser scanner that has become a preferred method for measuring the elevation of the earth surface and is the source of most of the currently available high-resolution digital elevation models. The National Geospatial Technical Operation Center (NGTOC), under the leadership of the National Geospatial Program, provides the review and approval of lidar and other high-resolution elevation datasets that will be used to update the USGS National Elevation Dataset (NED). The Elevation Unit of the NGTOC, located in Rolla, Missouri and Denver, Colorado assess the elevation data derived from lidar through a Quality Assessment (QA) process. This workflow process involves a complete review of all deliverables received at the Center which entails a visual inspection of the derived bare-earth model, complete metadata and verification of lidar swath files, LAS classifications and vertical accuracy to ensure that they meet lidar base specifications for the USGS. A project QA report is completed upon review and can carry a recommendation of acceptance or rejection based on the outcome of the review. Results that are accepted are sent to the Earth Resources Observation and Science Center for integration into the NED and Earth Explorer. If a delivery does not meet required specifications, these data are submitted to the data originator for correction. Upon correction, the data are re-reviewed to ensure that they are ready for integration into the NED. The NGTOC Lidar QA process is constantly evolving to ensure quality data is provided for the public.

13.044

Assessing the Accuracy of the Alaska National Hydrography Dataset

Presenter: Lori Phillips
Authors: Dr. Kristina Yamamoto, Dr. Samantha Arundel, Kim Mantey, Jeremiah Vinyard-Houx, Eric Constance

Alaska is the final state to be included in the U.S. Geological Survey's US Topo project. Although hydography is available at a 1:63.360 map scale, the US Topo maps to be produced will be at the larger 1:25,000 scale. Therefore, a study to determine if the spatial accuracy of the current dataset is suitable for the 1:25,000 maps needed to be conducted. The National Hydrography Dataset (NHD) for Alaska was compared to breaklines derived from IFSAR datasets collected over regions of Alaska. Various methods were developed to identify common issues in the NHD and create an efficient method of highlighting which features are more in need of updates. These methods are transferable to other studies comparing a polygon or polyline tested source to a reference source.

13.045 (poster)

Lidar and the National Map

Presenter: Lori Phillips
Author: Lori Phillips

LiDAR has emerged as the preeminent source for elevation data and a host of derivative products. These data sets are potentially useful to the scientific community and are an integral part of the United States Geological Survey's (USGS) data acquisition and delivery programs. However, not all LiDAR data or LiDAR-derived products are created equal and data intended for The National Map needs to meet certain specifications and requirements.

The National Elevation Dataset (NED) serves as the elevation layer of The National Map, and provides elevation data for scientific and mapping applications. The NED is a seamless elevation surface produced from a variety data sources. Over the past 15 years, LiDAR technology has matured into a proven mapping tool used for generating bare earth digital elevation models (DEMs) and has become the most common source for new elevation data being incorporated into the NED. The USGS obtains LiDAR-derived DEMs through direct contracting, partnerships with other government agencies, and through donations from other sources. Challenges for

incorporating LiDAR-derived DEMs into a consistent national dataset include varying partner requirements and processing anomalies.

This poster depicts different examples of derivative bare earth DEMs and illustrates required characteristics for these data to be incorporated into the NED.

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Thank You for attending the 2013 JACIE Workshop!

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