SPIE Defense + Security

Advance Technical Program

Conferences: 17–20 March 2008
Courses: 16–20 March 2008
Exhibition: 18–20 March 2008

Orlando World Center Marriott Resort & Convention Center
Orlando, Florida USA

NETWORK WITH PEERS — HEAR THE LATEST RESEARCH



MATERIALS · TECHNOLOGY · DEVICES · SYSTEMS

Imaging, Sensors, and Displays

- IR SENSORS AND SYSTEMS ENGINEERING
- HOMELAND SECURITY AND LAW ENFORCEMENT
- TACTICAL SENSORS AND IMAGERS
- CHEMICAL BIOLOGICAL RADIOLOGICAL NUCLEAR AND EXPLOSIVES (CBRNE)
- MILITARY AND AVIONIC DISPLAYS
- SPACE TECHNOLOGIES AND OPERATIONS
- INTELLIGENT AND UNMANNED/UNATTENDED SENSORS AND SYSTEMS

Sensor Data Analysis

- SENSOR DATA EXPLOITATION AND TARGET RECOGNITION
- INFORMATION FUSION, DATA MINING, AND INFORMATION NETWORKS
- SIGNAL, IMAGE, AND NEURAL NET PROCESSING
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PLUS

- MODELING AND SIMULATION
- ENABLING PHOTONIC TECHNOLOGIES

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NETWORK WITH PEERS — HEAR THE LATEST RESEARCH



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Left Cover image: U.S. Marine photo by Cpl. Spencer M. Murphy; *Middle Cover image:* U.S. Air Force photo by Master Sgt. Lance Cheung

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SPIE would like to express its deepest appreciation to the symposium chairs, conference chairs, program committees, and session chairs who have so generously given their time and advice to make this symposium possible.

The symposium, like our other conferences and activities, would not be possible without the dedicated contribution of our participants and members. This program is based on commitments received up to the time of publication and is subject to change without notice.

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EXHIBITION

18–20 MARCH 2008

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Plan now to attend

We invite you to attend SPIE Defense+Security 2008. The DSS 2008 program will offer these exciting highlights:

- The Honorable Jay Cohen, Under Secretary for Science and Technology of the U.S. Department of Homeland Security and former U.S. Chief of Naval Research will speak at a symposium-wide plenary.
- A panel of chief technology officers is being planned to help you discover where this fast growing industry is headed.
- 45+ conferences covering the latest technologies and applications for the defense and security community.
- 400+ product exhibition where you can find the most current hardware, interact with exhibitors, and increase your awareness of product developments across the broad spectrum of infrared, sensing, and image technology.
- An education program featuring courses and workshops designed to bring you up to date on the hottest technologies or get you up to speed with the background basics you need.

An added bonus is that DSS is scheduled the week before Easter this year, making it possible for many families to come along for spring break.

We have a great event in the works and look forward to your participation. Come build your future today by attending Defense+Security 2008.

2008 Symposium Chair: **Dr. Larry B. Stotts,** DARPA, Deputy Director for the Strategic Technology Office

2008 Symposium Co-chair: **Dr. Ray O. Johnson,** Lockheed Martin Corp.
Senior Vice President and Chief Technology Officer

The Honorable Jay Cohen
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

Symposium-Wide Plenary Presentation

Tuesday 18 March · 9:15 to 10:00 am
Free to all registered attendees

The Honorable Jay M. Cohen is a native of New York. He was commissioned in 1968 as an ensign upon graduation from the United States Naval Academy. He holds a joint Ocean Engineering degree from Massachusetts Institute of Technology and Woods Hole Oceanographic Institution and Master of Science in Marine Engineering and Naval Architecture from MIT.

His early Navy assignments included service on conventional and nuclear submarines. From 1985 to 1988 Cohen commanded USS HYMAN G. RICKOVER (SSN 709). Following command, he served on the U.S. Atlantic Fleet as a senior member of the Nuclear Propulsion Examining Board, responsible for certifying the safe operation of nuclear powered ships and crews. From 1991 to 1993, he commanded USS L.Y. SPEAR (AS 36) including a deployment to the Persian Gulf in support of Operation DESERT STORM. After Spear, he reported to the Secretary of the Navy as Deputy Chief of Navy Legislative Affairs. During this assignment, Cohen was responsible for supervising all Navy-Congressional liaison. Cohen was promoted to the rank of Rear Admiral in October 1997 and reported to the Joint Staff as Deputy Director for Operations responsible to the President and DoD leaders for strategic weapons release authority. In June 1999, he assumed duties as Director Navy Y2K Project Office responsible for transitioning all Navy computer systems into the new century.

In June 2000, Cohen was promoted in rank and became the 20th Chief of Naval Research. He served during the Iraq war as the Department of the Navy Chief Technology Officer (a direct report to the Secretary of the Navy, Chief of Naval Operations and Commandant of the Marine Corps). Responsible for the Navy and Marine Corps Science and Technology (S&T) Program (involving basic research to applied technology portfolios and contracting), Cohen coordinated investments with other U.S. and international S&T providers to rapidly meet war fighter combat needs. After an unprecedented five and a half year assignment as Chief of Naval Research, Rear Admiral Cohen retired on February 1, 2006.

Under Secretary Cohen was sworn in to his current position at the Department of Homeland Security on August 10, 2006.

Dr. Delores M. Etter

ONR Distinguished Chair in Science and Technology, Electrical Engineering Department, United States Naval Academy

Banquet & Award Presentation

Wednesday 19 March · 7:00 to 9:30 pm

Dinner will start at 7:00 pm followed by a presentation by Dr. Dolores M. Etter. Tickets for the banquet and presentation are $85 per person and are sold separately from conference registration. See your registration form for details. Banquet tickets must be purchased by 17 March at 1:00 pm.

Please join your colleagues to present the DSS Lifetime Achievement Award to the Honorable Delores Etter.

Dr. Delores M. Etter recently rejoined the Electrical Engineering faculty at the United States Naval Academy after serving for two years as the Assistant Secretary of the Navy for Research, Development and Acquisition. Dr. Etter originally joined the faculty at the Naval Academy in 2001. She was formerly a member of the Electrical and Computer Engineering Department at the University of Colorado, Boulder (1990-98), and at the University of New Mexico (1980-89). She was also a Visiting Professor in the Information Systems Laboratory at Stanford University in 1983-84.

From June 1998 through July 2001, Dr. Etter served as the Deputy Under Secretary of Defense for Science and Technology. In that position, she was responsible for Defense Science and Technology strategic planning, budget allocation, and program execution and evaluation for the DoD Science and Technology Program. Dr. Etter was also the Principal U.S. representative to the NATO Research and Technology Board.

Dr. Etter is a member of the National Academy of Engineering. She is also a former member of the National Science Board and the Defense Science Board. She is a Fellow of the Institute of Electrical and Electronic Engineers (IEEE), the American Association for the Advancement of Science (AAAS), and the American Society for Engineering Education (ASEE).

Requires Conference Registration to Attend.

Displays

Monday 17 March · 10:30 to 11:30 am

Display Content in Advanced NVG and HMD Systems: A Pilot/Flight Surgeon's Concerns

Joseph (Chuck) Antonio, M.D., Naval Air Warfare Ctr.

Night vision goggles have been in use for many years and limitations in their use have been well studied through training research and flight experience. However, advances in technology have led to improvements in NVG display capabilities and in some cases helmet mounted display (HMD) technology has begun replacing NVG systems. These advances have led to an increase in the complexity of imaged scene content, thus requiring a greater level of cognitive effort for interpretation, especially when compared to the images provided by current NVG systems. In some cases the complexity of visual imagery has resulted in systems not being classified as operationally suitable. This presentation will focus on a few of the problems noted while testing some of these advanced systems.

This presentation will focus on a few of the problems noted while testing some of these advanced systems. Topics will include: added complexity of imagery in wide-field-of-view (WFOV) NVG systems, effects due to imagery created by sensors displaced from the normal eye position (increased interocular separation), effects due to imagery projected onto see-through visor designs, and effects resulting from cockpit design/geometry (e.g., location and design of large-format head-down displays, and the position of structures such as window frames). Training concerns and potential mitigation strategies for HMD design concepts will also be covered. The issues discussed are important for manufacturers to understand during the early design phase, and for testers to understand during developmental or operational testing.

Chuck Antonio is currently working for NAWCAD in the Human Systems Department where he is supporting several NVG and helmet mounted display (HMD) projects. He also works part time for the National Test Pilot School in Mojave, CA where he serves as an Aerospace Medicine /Night Vision Systems Pilot Instructor. Dr Antonio has written articles for various publications, authored several night vision training instructional guides, presented papers for many national and international organizations, and briefed at all programmatic levels.

Space Technologies and Operations

Deep Space Flight of Hayabusa Asteroid Explorer

Monday 17 March · 8:00 to 9:00 am

Hitoshi Kuninaka, Junichiro Kawaguchi, Japan Aerospace Exploration Agency

ISAS/JAXA has developed the microwave discharge ion engine myu10, which eliminates all the electrodes for plasma generation so as to realize long life and high reliability. Four myu10 propelled Hayabusa asteroid explorer, launched in 2003, and succeeded in rendezvousing with the asteroid in 2005 after a 2-year flight. Hayabusa caused serious troubles in the proximity operation and postponed the Earth return. The new software to control the attitude by means of a momentum wheel and the thrust vector control by a two-axis gimbal enabled the powered flight toward Earth again since April 2007. It will come back Earth in 2010.

Hitoshi Kuninaka received the B.S. degree from Department of Aeronautics, Kyoto University, in 1983, and the M.S. and Ph.D degrees from Department of Aeronautics, University of Tokyo, Japan in 1985 and 1988, respectively. He was promoted to Full Professor in ISAS/JAXA, in 2005. He holds concurrently the post of Professor in Department of Aeronautics and Astronautics, University of Tokyo. He researches the plasma interaction of satellites and develops electric propulsion. He invented the microwave discharge ion engines for the asteroid explorer HAYABUSA.

Protecting the Moon's Environment

Tuesday 18 March · 8:00 to 9:00 am

Jeffrey Maclure, International Academy of Astronautics and International Institute of Space Law

Following a summary of international treaties, agreements, and the plans of governments and private concerns who soon will voyage to the Moon, essential Earthly tenets related to the Moon are reviewed, including sovereignty, territorial appropriation, and the use of Res Communis. Future human Lunar activities-and their pros and cons for the maintenance of the Moon's environment - are speculated upon, including the Moon as a Body for international scientific and technical research; as a way-station in the exploration of Mars and the rest of the Universe; and as a New World for commercial natural resource exploitation.

Mr. Jeffrey Maughan Maclure is a career US Government Officer experienced in US Government international policy formulation and cooperation in satellite remote sensing programs and other S&T initiatives. He is a skilled negotiator, having represented the US in the UN Committee on the Peaceful Uses of Outer Space, a number of additional UN fora, and in other varied bilateral scientific and technical consultations. Mr. Maclure has served as a Department of State Foreign Affairs Officer since 1990 and, earlier, seven years assisting in the international management of the US Landsat and other satellite programs of the Satellite Service, NOAA. He graduated in 1983 from the Fletcher School, Tufts University, with a Master of Arts in Law and Diplomacy.

[Jeffrey Maughan Maclure, Foreign Affairs Officer, United States Department of State, Washington, D.C., 20520. The views expressed in this article are those of the author, and do not necessarily reflect those of the U.S. Department of State or the Government of the United States of America.]

Tactical Sensors and Imagers

Wednesday 19 March · 11:00 to 11:45 am

Radar Horizons

Joseph R. Guerci, Consultant

From sensing through walls, stratospheric airship antennas, to cognitive radars that adapt both transmit and receive functions on-the-fly in an intelligent manner, this talk surveys the latest developments in both enabling device technologies, signal processing, and entirely new applications. After covering the latest technology developments in innovative aperture technologies, low-cost ESAs, waveform diversity, knowledge-aided radar, and conformal antennas, new systems based on these technologies are discussed that can provide both unprecedented performance improvements, as well as entirely new sensing modalities.

Dr. Guerci has over 23 years of experience in the research and development of advanced sensor systems in industrial, academic and government settings—the latter a seven year term with the Defense Advanced Research Projects Agency (DARPA). He has over 80 peer reviewed publications, 8 US Patents, and is the author of Space-Time Adaptive Processing for Radar (Artech House, 2003). A Fellow of the IEEE, and a member of the IEEE Radar Systems Panel, he is the recipient of the 2007 IEEE Warren D. White Award for "Excellence in Radar Adaptive Processing and Waveform Diversity".

Hot Topics

Hear leaders in government and industry discuss recent advances, current challenges, and opportunities. Requires Conference Registration to Attend.

Food Safety

Monday 17 March · 8:00 am to 12:30 pm

Chairs: **Moon S. Kim,** USDA Agricultural Research Service; **Kaunglin Chao,** USDA Agricultural Research Service

This special food safety session will focus on optical, spectroscopic, and spectral imaging sensing techniques, and approaches for the use of biosensors, for rapid or non-destructive assessment of safety and quality for meats, fruits, and vegetables. Novel techniques, instruments for real-time measurement and processing, and industrial applications of opto-electronic sensing systems to detect diseases, defects, and fecal or bacterial contamination on meats, fruits, and vegetables will be emphasized.

INVITED PRESENTATIONS:

Optical biosensor platforms for multiplex detection of foodborne pathogens, Arun Bhunia, Purdue Univ.

Modified pressure system for imaging egg cracks, Kurt C. Lawrence, Seung Chul Yoon, Deana R. Jones, Gerald W. Heitschmidt, Bosoon Park, USDA Agricultural Research Service

Optical polarization imaging of skeletal muscle, Xin LI, Janaka C. Ranasinghesagara, Gang Yao, Univ. of Missouri/Columbia

Citrus canker detection by multispectral imaging and PCA-based image classification method, Jianwei Qin, Thomas F. Burks, Timothy Schubert, Mark Ritenour, Univ. of Florida

Evaluation of microbial contamination on fruits using hyperspectral imaging, Won Jun, Kangjin Lee, Manan Sharma, Moon S. Kim, USDA Agricultural Research Service

Multitasking online apple inspection/sorting system, Moon S. Kim, Kangjin Lee, Kuanglin Chao, Alan M. Lefcourt, Won Jun, USDA Agricultural Research Service

Detection of Salmonella Enteriditis from egg components using different immunomagnetic beads and time-resolved fluorescence, Shu-I Tu, Sue A. Reed, Andrew G. Gehring, Yiping He, USDA Agricultural Research Service

SERS technique for rapid species identification of Escherichia Coli, Listeria Monocytogenes, and Salmonella Typhimonium cultures, Yongliang Liu, Kuanglin Chao, Moon S. Kim, Xiangwu Nou, USDA Agricultural Research Service

Visual Analytics for Homeland Defense and Security

Monday 17 March · 8:30 am to 2:20 pm

Chairs: **William J. Tolone,** The Univ. of North Carolina at Charlotte; **William Ribarsky,** The Univ. of North Carolina at Charlotte

Meeting the challenges of homeland defense and security requires the time-sensitive, multi-dimensional analysis of overwhelming volumes of multi-source, multimedia information including high volume imagery, sensor data, text streams, transaction streams, and geospatial data. Human judgment is essential to these analyses as insights and understandings are synthesized from information that are often dynamic, incomplete, diverse, conflicting, and even deceptive. As our ability to collect information is increasing at rates far beyond our ability to analyze, new methods are required to enable analysts to reach better insights and understandings with greater efficacy and efficiency. This conference provides both an introduction to the field of visual analytics as the science of analytical reasoning facilitated by interactive visual displays, and presentations on advances in the application of visual analytics and interactive visualizations to the challenges of information processing, exploration, and analysis, as well as human cognition and sense-making that face homeland security and defense. The intended audience includes government and industry analysts, emergency responders, and research scientists from universities, industry, government, and research institutes. This session will offer a tutorial and presentations.

Visual Analytics and Interactive Visualizations: a Tutorial

This tutorial will provide an introduction to visual analytics as the science of analytical reasoning facilitated by interactive visual displays, will overview the national research agenda as outlined in Illuminating the Path: The Research and Development Agenda for Visual Analytics (http://nvac.pnl.gov/agenda.stm). and will illustrate recent advances in the field by summarizing some of the work of the National Visualization and Analytics Center and its partnering Department of Homeland Security designated Regional Visualization and Analytics Centers.

Visual Analytics for Defense and Security Presentations

Human centric approach for geospatial data fusion in homeland defence and security application scenarios, Eugene Levin, Michigan Technological Univ., Gennady Gienko, Univ. of the South Pacific (Fiji)

Visual analysis for live LIDAR battlefield change detection, Thomas Butkiewicz, Remco Chang, Zachary Wartell, William Ribarsky, The Univ. of North Carolina at Charlotte

Using a human cognition model in the creation of collaborative knowledge visualizations, Tera Marie Green, William Ribarsky, The Univ. of North Carolina at Charlotte

Computation and visualization concept for reconnaissance requirement, Susanne Eckel Univ. Karlsruhe and Fraunhofer-Institut für Informations- und Datenverarbeitung, Juergen Geisler, Fraunhofer-Institut für Informations-und Datenverarbeitung

Visualizing uncertainty for geographical information in a global terrorism database, Josh Jones, Winthrop Univ., Remco Chang, Thomas Butkiewicz, William Ribarsky, The Univ. of North Carolina at Charlotte

Human posture classification for intelligent visual surveillance systems, Haroun Rababaah, Amir Shirkhodaie, Tennessee State Univ.

Visual analysis of entity relationships in global terrorism database, Alex Godwin, Remco Chang, Robert Kosara, William Ribarsky, The Univ. of North Carolina at Charlotte

Resource Restricted Embedded and Sensor Networks

Monday 17 March · 1:30 to 5:30 pm

Chair: **Sergey Balandin,** Nokia Research Ctr. (Finland)

This year's promotional session addresses most hot research questions for resource restricted embedded and sensor networks. The session consists of a number of lectures and tutorials, which give overview of the state of art and existing solutions in the field, the current vision of the applications and use scenarios and the key open issues in the area.

PRESENTATIONS INCLUDE:

State of art and recent development of embedded networks solutions research (Tutorial), Michel Gillet, Sergey Balandin, Nokia Research Ctr. (Finland)

High-rate serial interconnections for embedded and distributed systems with power and resource constraints (Tutorial) by Yuriy Sheynin, Elena Suvorova, Felix Shutenko, and Evgenej Yablokov, SUAI (Russia)

Building of advanced simulation tools for resource restricted networks on top of SystemC, Michel Gillet, Sergey Balandin, Nokia Research Ctr. (Finland)

Security in embedded networks, Elena Reshetova, St. Petersburg State Univ. of Aerospace Instrumentation (Russia)

Applications of wireless sensor and control networks for industrial applications, work machines, and vehicles, Vesa Pentikäinen, VTT Elektroniikka (Finland)

Forensic Science: Emerging Needs

Monday 17 March · 4:00 to 6:00 pm

Moderator: **Colleen Fitzpatrick,** Yeiser and Associates

The panel has been assembled to investigate the potential synergy between the forensics and optical communities, to bring together what is needed with what is possible. Our panelists are well known experts in the forensic sciences, drawn from both the government and the private sector. Each panelist will offer a commentary on his designated subject, after which the floor will be open to questions and discussion by the audience.

PRESENTATIONS INCLUDE:

Present and future technologies, Dr. Benjamin C. Garrett, Senior Scientist, FBI Forensic Science Lab Quantico, VA

Practical aspects of forensic laboratory development, Tammy Pruett Northrup, Executive Director, Coroner Forensic Science Ctr., St. Tammany Parish, Slidell, LA

Funding sources for the forensic sciences, Dr. Amanda Sozer, President, Sozer, Niezgoda and Associates, LLC, Alexandria, VA

Successful case study in the forensic sciences, Dr. Michael Coble, Chief of Research, Armed Forces DNA Identification Lab., Rockville, MD

3D Imaging and Display

Tuesday 18 March · 1:00 to 4:30 pm

Chair: **Bahram Javidi,** Univ. of Connecticut

This Hot Topics Session is a forum for interchange on various algorithms, devices, systems, sensors, and architectures for novel applications in the field of 3D sensing, 3D display, and 3D visualization. Invited papers from internationally known scientists and engineers on these subjects reporting recent advances are presented.

INVITED PRESENTATIONS:

3D imaging with aperture coding, Saeed Bagheri, IBM Research Ctr.

3D TV and display using multi-view, Jung Young Son, Daegu Univ. (Korea)

3D TV with integral imaging, Fumio Okano, NHK (Japan)

3D optical microscopy using digital holography, Adrian Stern, Ben-Gurion Univ. of the Negev (Israel)

3D integral imaging with optical processing, Manuel Martinez Corral, Univ. of Valencia (Spain)

Holography of incoherently illuminated 3D scenes, Natan T. Shaked, Joseph Rosen, Ben-Gurion Univ. of the Negev (Israel)

Conference-Related Special Events

Requires Conference Registration to Attend.

Global Homeland Security Technical Meeting

Monday 17 March · 5:00 to 6:00 pm

Chair: **Craig S. Halvorson,** Lawrence Livermore National Lab.

Please join us to discuss the following questions in relation to the conference on Optics and Photonics in Global Homeland Security (OPGHS):

- How should the technology needs of first responders be addressed?
- Are there ways to increase international involvement?
- Does OPGHS have the optimal balance between presentations from sponsors and presentations from researchers?
- How might corporate sponsors participate in bringing university researchers to the conference?
- Are there any particular researchers or sponsors that should be invited to present at Defense & Security 2009?
- Are there suggestions for possible symposium plenary speakers for Defense & Security 2009?

This technical meeting is held in conjunction with conference 6945. Interested attendees are welcome to attend.

Vendor Presentations and Reception

Monday 17 March · 5:00 to 8:00 pm

Chairs: **Andrés E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **G. Raymond Peacock,** Temperatures.com, Inc.

What's News in Hardware and Software at the 2008 DSS Exhibition?

This Special Session was started three years ago and has been a very popular, well-attended success. Its intent is to bring together vendors and Early Arrival Thermosense and DSS exhibitors to highlight the newest products and services being shown at the Exhibition. In this way the busy technical conference attendees can better prioritize their activities when visiting the exhibits. It is also a relaxed opportunity for getting to know one another better and to have informal discussions on matters of mutual interest. A limited time for 10 to 15 minute vendor presentations starts the session, followed by a reception with snacks and soft drinks. The list of vendors presenting will be in the final program and also available onsite.

This event is organized by the Thermosense conference 6939.

Invited Panel Discussion

Issues and Challenges in Performance Assessment of Multitarget Tracking Algorithms with Applications to Real-World Problems

Monday 17 March · 7:00 to 9:45 pm

Organizer: **Ivan Kadar,** Interlink Systems Sciences, Inc.

Moderators: **Ivan Kadar,** Interlink Systems Sciences, Inc.; **William Dale Blair,** Georgia Tech Research Institute

Panelists: **William Dale Blair,** Georgia Tech Research Institute; **Erik Blasch,** Air Force Research Lab.; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Oliver Drummond,** Consulting Engineer; **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **X. Rong Li,** Univ. of New Orleans; **Ronald P. Mahler,** Lockheed Martin Tactical Systems

This panel discussion is held in conjunction with conference 6968.

Panel Discussion

Bio-inspired Computing for Homeland Security: Issues and Answers

Tuesday 18 March · 3:30 to 4:30 pm

Moderator: **Robert Bird,** Red Lamda, Inc.

This event is held in conjunction with conference 6964.

Demonstrations and Open Discussion

Tuesday 18 March · 8:00 to 10:00 pm

Chair: **Oliver Drummond,** Consulting Engineer

This event is held in conjunction with conference 6969.

Polarization Technical Meeting

Wednesday 19 March · 11:40 am to 1:40 pm

Chairs: **David B. Chenault,** Polaris Sensor Technologies, Inc.; **Dennis H. Goldstein,** Polaris Sensor Technologies, Inc.

This Technical Group is focused on research, development, engineering, and applications in fields of optics where polarization and its measurement are key issues.

This meeting is held in conjunction with conference 6972.

Panel Discussion

Performance Evaluation for Impact Assessment Systems

Wednesday 19 March · 3:30 to 5:10 pm

Moderator: **Shanchieh Jay Yang,** Rochester Institute of Technology

Panelists: **John J. Salerno, Jr.,** Air Force Research Lab.; **James Llinas,** Univ. at Buffalo; **Robert S. Lynch,** Jr., Naval Undersea Warfare Ctr.; **Jerome J. Braun,** MIT Lincoln Lab.; **Erik Blasch,** Air Force Research Lab.

Traditionally, fusion systems are evaluated via Monte-Carlo simulations against the ground truth. ROC charts and associated metrics are typically used to assess performance of object detection and tracking. In the case of Impact Assessment, a fusion system presumably aims at projecting future actions of the RED and BLUE teams and assessing the consequences of such actions. Because it involves "future actions" and "potential consequences," evaluating performance of an impact assessment system becomes a nontrivial problem. Techniques, metrics and data sets suitable for evaluating lower level fusion systems may no longer applicable. This panel will identify challenges and discuss methodologies in evaluating impact assessment systems for general and specific application domains.

This panel discussion is held in conjunction with conference 6974.

Special Events

Don't miss these two presentations FREE to all registered attendees.

Future Directions for CBRNE Sensors and Systems Development

Tuesday 18 March · 5:00 to 7:00 pm

Chairs: **Thomas George,** ViaLogy PLC;
Patrick J. Gardner, Western Carolina Univ.

Events from recent years have shown us that awareness of Chemical, Biological, Radiation, Nuclear and Explosive (CBRNE) threats are no longer the exclusive domain of the military and first responder communities, but has spread to the civilian population at large. While a diverse set of sensors and instruments have been developed for the detection and characterization of these threats, government agencies are discovering that our capabilities for early detection, threat mitigation and decontamination operations are still woefully inadequate in order to effectively counter CBRNE threats. The various DoD and Homeland Security agencies have focused on a "detect-to-warn" system-integration strategy involving sensor fusion and the development ^{3}network-centric^{2} systems. A key factor to be considered for future in-situ and standoff detection technologies is a rapid analysis capability with minimum false positives and negatives.

A distinguished panel of leading experts from academia, industry and the end-user community will identify the future opportunities for research and new product development of CBRNE sensors intended for operation in both urban and non-urban environments. The panel will examine the various deficiencies of existing state-of-the-art technologies and unmet needs with regard to CBRNE threat sensing and mitigation. Mechanisms for rapidly and cost-effectively transitioning emerging sensing technologies from the laboratory to system-level applications will be discussed.

PANELISTS:

Don Buley, Deputy Joint Program Manager Guardian

Robert W. Dean, President and CEO, ViaLogy PLC

David W. Cullin, Senior VP for Technology Transition at ICx Technologies, Inc.

John C. Carrano, VP for R&D at Luminex Corp.

Augustus W. Fountain III, U.S. Army Research, Development and Engineering Command

Greg Hebner, Sandia National Labs.

Innovation and the Wealth of Nations

Wednesday 19 March · 5:00 to 6:00 pm

Chair: **Roger Appleby,** QinetiQ Ltd. (United Kingdom)

Sir John Chisholm,
Executive Chairman of QinetiQ

The UK Government, along with many other governments, believes that innovation is the basis of our survival in the 21st Century. But for individuals and companies, innovation can also lead to costly mistakes. This session draws on experience across a number of industries to point the way as to how you can make money while avoiding losing it.

Sir John Chisholm's distinguished career bridges science, government, and industry—He is uniquely situated to discuss the role of innovation in the increasingly interconnected public-private research and development arena. Sir John is currently Chairman of QinetiQ, a firm created out of the majority privatization of the UK's Defence Evaluation and Research Agency. In 2006 the company was listed on the LSE with revenues of £1,15 bn5 and earnings of £90m. Sir John also serves as Chair of the Medical Research Council, the agency responsible for the UK's £500m biomedical research program.

Sir John is an Engineering graduate of Cambridge University. He helped to found and build CAP Group plc, a diversified computer software company, which merged with French group Sema Metra SA to become the 8000 strong Sema Group plc in 1988. Sir John served as UK Managing Director. During the nineties, Sir John was central in achieving the reorganization of the UK Defence Research Establishments into the Defence Evaluation and Research Agency.

He was Knighted by the Queen in 1999 for services to Defence Science. Sir John is a Fellow of the Royal Academy of Engineering, a Fellow of the Royal Aeronautical Society, a Fellow of the Institute of Physics, and a Fellow of the Institute of Engineering and Technology. He served as President of the Electrical Engineering Association (1989) and President of the Institution of Engineering and Technology (2005/6), as a member of the 2007 Science and Technology Policy review team, and was a founding member of the UK Government's Technology Foresight programme. In 1999 he was Knighted by the Queen for services to Defence Science. Sir John is a frequent speaker on Change Management, Innovation, and Defence Science.

Industry Workshops

The Business of Defense

Requires Workshop Registration to Attend.
For complete workshop information see p.116.

Intellectual Property Issues in the Defense and Security Industries

WS639 · Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 8:30 am to 12:30 pm

Intellectual property (IP), in the form of copyrights, trademarks, trade secrets, ideas and patents, is of great importance in the defense and security industries. Many companies and contractors are involved with developing and manufacturing specialized products or processes (read: inventions) for use by the government, often with the assistance of the government. This governmental connection creates special issues for developing, managing, protecting and leveraging IP. For many companies and government contractors, their IP is their most valuable asset, so that having a modern view of IP and the IP issues in the defense and security business is critical. The aim of this course is to provide an overview of the numerous IP issues and considerations related to doing business in the defense and security industries.

INSTRUCTORS

Joseph Gortych is a registered patent attorney and is president of Opticus IP Law PLLC.

Timothy Stanley is Intellectual Property Counsel for Lockheed Martin Corporation.

Harvey Kauget is a partner at Phelps Dunbar LLP in the firm's regional commercial litigation group.

Eric Pellenbarg is an associate at Phelps Dunbar LLP in the firm's regional commercial litigation group.

Compliance with the International Traffic in Arms Regulations (ITAR)

Course level: Introductory
CEU .35 $265 / $315 USD
Thursday 8:30 am to 12:30 pm

This course provides background on the ITAR and the importance to national security of licensing defense articles. An interactive format ensures students will gain a working knowledge of the ITAR and will be able to identify potential trouble spots.

INSTRUCTOR

Suzanne Palmer founded Export Compliance Solutions LLC (ECS).

Playing the SBIR Game to Win

WS843 · Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 1:30 to 5:30 pm

This course provides attendees with a working knowledge of the Small Business Innovation Research (SBIR) Program and presents proven strategies to win awards. The course concentrates on those elements for Phase I that will enhance the likelihood of getting a favorable review and an Agency decision to fund your research project. Many practical and useful examples that prepare you to win more funding will be included throughout. You will learn to construct and submit winning proposals.

INSTRUCTOR

Fred Patterson, is the co-founder of two of Texas' most successful SBIR companies, and a well-recognized consultant with dozens of clients nationwide.

Special Events



All Symposium Welcome Reception

Crystal Ballroom H

Monday 17 March · 6:00 to 7:00 pm

All attendees are invited to the Welcome Reception. Relax, socialize, and enjoy refreshments. Please remember to wear your conference registration badges. Dress is casual.

SPIE Women in Optics Lunch

Monday 17 March · Noon to 1:00 pm

Join us for an opportunity to network with other optics professionals, generate new contacts, and expand your resources and referrals. This SPIE hosted luncheon at Defense and Security is the perfect way to meet and develop relationships with others in your field. Register for this lunch at the SPIE Cashier onsite; location information will be provided upon sign-up.

Poster Session

Tuesday 18 March · 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

FLORIDA INNOVATION SHOWCASE 2008

University Partnership Opportunities for Your Organization

19–20 March 2008
Co-located with SPIE Defense+Security

The Florida Innovation Showcase 2008 is your opportunity to discover Florida 's hottest university technologies and research competencies for leveraging your research and development efforts. This technology development and partnership conference is presented by the Florida Research Consortium, a not-for-profit strategic partner between Florida's universities, the business community and state government to introduce you to the many exciting discoveries being generated as a result of the tremendous volume of research taking place throughout the state of Florida.

On Wednesday afternoon, 19 March, attendees will be welcomed and given a high level briefing (Governor Crist invited) on "Florida's Progression as a Technological Leader". This overview will be followed by an informative panel of experts covering ways to engage and leverage universities in the commercial enterprise. The day will end with a cocktail reception featuring tasty Florida treats and opportunities to mingle with top Florida business, economic development and academic leaders.

On Thursday, 20 March a hosted continental breakfast, followed by breakout sessions and university/institute briefings that give you the opportunity to discuss trends in technology transfer and discover new developments in hot growth areas such as:

- Physical and Chemical Sensor and Diagnostic Technologies
- Data Mining and Analysis Technologies
- Imaging System Technologies
- Biomedical Technologies with Homeland Security and Defense Applications
- Biosensors and Diagnostic Technologies
- Materials Technologies
- Agriculture and Food Source Protection Technologies
- Modeling and Simulation Technologies

Plenty of time will be allowed for networking breaks throughout the day.

For registration and more information:
www.FLinnovation.org

Florida Research

Special 2-Day Event SPIEWorks Career Fair

SPIE Works

Check final program for location information.

Tuesday 18 March. . . . . .11:00 am to 3:00 pm
Wednesday 19 March . . . . . .11:00 am to 3:00 pm

Job Seekers

Whether you are looking for a better job, re-entering the workforce or just starting your career, this career fair is a great place to start!

- Get face-to-face time with employers and interview on the spot
- Learn more about the jobs available in our industry
- Network
- Post your resume online today! Visit spieworks.com

NOTE: Many of the positions posted to this career event require an active security clearance or the ability to acquire one.

All SPIEWorks services are free to individuals seeking employment.

Employers

Don't Miss This Recruiting Opportunity—hire top talent at Defense+Security. SPIEWorks offers a customized recruitment package in conjunction with this conference. A typical Career Fair package includes:

- 2 x 6 draped table
- Job postings on the SPIEWorks website
- Resume access (includes data on who plans to attend the conference)
- A display banner on the homepage to promote your recruiting effort
- Promotion of your company on signage and in show programs.

For more information, contact Dave Baggenstos at 360.715.3705 or email sales@spieworks.com. Reserve your space today!

Student Lunch with the Experts–A Networking Event

Monday, 17 March · 12:30 to 1:30 pm

Seating is Limited.
Tickets Required.

Enjoy a casual meal with colleagues at this engaging networking opportunity. Hosted by SPIE Student Services, this event features experts willing to share their experience and wisdom on career paths in optics and photonics. Students receive one complimentary ticket with registration.

Professional Development Speaker

Monday, 17 March · 4:30 to 5:30 pm

Wondering where your career is going? Looking for new perspectives on the industry? Find answers at this professional development event.

"No Ties" Student Social

Monday, 17 March · 7:00 to 8:30 pm

Relax and hang out with new friends and peers while enjoying a casual Florida atmosphere. No ties required but please bring photo ID.

Early Career Social

Tuesday, 18 March · 5:00 to 6:00 pm

Meet distinguished SPIE contributors for a casual pre-dinner cocktail. This event promises one on one networking opportunities with some of SPIE's most influential volunteers from conferences and leadership.

The Craft of Scientific Presentations: A Workshop on Technical Presentations

WS667

Free for Students!

Course level: Introductory
CEU .35 $75 / $125 USD
Wednesday 8:30 am to 12:30 pm

You must register to attend.

This course provides attendees with an overview of what distinguishes the best scientific presentations. The course introduces a new design for presentation slides that is both more memorable and persuasive from what is typically shown at conferences.

INSTRUCTOR

Michael Alley teaches writing and speaking to engineering students at Penn State.

Course price includes the text *The Craft of Scientific Presentations* by the instructor.

The Craft of Scientific Writing: A Workshop on Technical Writing

WS668

Free for Students!

Course level: Introductory
CEU .35 $75 / $125 USD
Wednesday 1:30 to 5:30 pm

You must register to attend.

This course provides an overview on writing a scientific paper. The course focuses on the structure, language, and illustration of scientific papers.

INSTRUCTOR

Michael Alley teaches writing and speaking to engineering students at Penn State.

Essential Skills for Engineering Project Leaders

WS846

Free for Students!

Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 1:00 to 5:00 pm

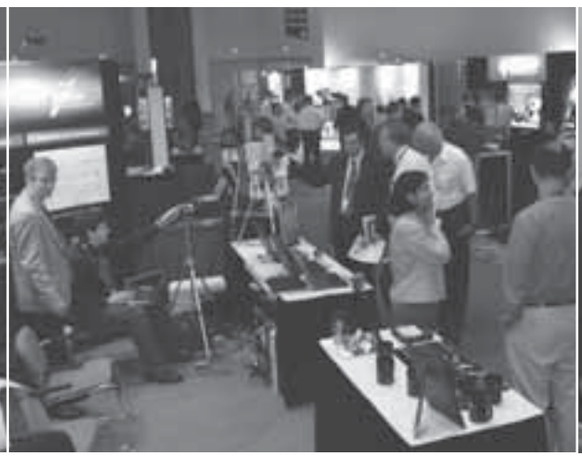
You must register to attend.

This workshop teaches skills needed to lead technical projects, drive innovation, and influence others. Attendees learn the difference between leadership and management, and how to develop specific leadership skills that are important to technical professionals who lead projects or need assistance from others to get things done. Participants engage in exercises that assess their individual leadership abilities and provide guidance for further skill development.

INSTRUCTOR

Gary Hinkle is President and founder of Auxilium, Inc.

Don’t Miss the FREE Exhibition!


Moving Technology to Market™

Exhibition: 18–20 March 2008
Orlando, Florida USA

Exhibition Hours

Tuesday 18 March. . . . . 10:00 am to 5:00 pm
Wednesday 19 March . . . . . 10:00 am to 5:00 pm
Thursday 20 March . . . . . 10:00 am to 2:00 pm

The largest showcase of unclassified defense and security equipment

Visit the number one event in the world for infrared imaging, optics, and sensor equipment—SPIE Defense+Security. See exhibitors displaying the latest advances in laser and sensor technologies and systems, forensic technologies, unmanned vehicles, and more. SPIE Defense+Security is the place to connect with the right people and discover where the industry is going.

Committed Exhibitors as of 7 December 2007

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A.J. Tuck Co.
AccuCoat, Inc.
Acktar Ltd.
Active Silicon Ltd.
Aculight Corp.
Acutronic USA, Inc.
Adimec
Aerotech, Inc.
Agilent Technologies, Inc.
AIM Infrarot-Module GmbH
Ametek HCC Industries
Ametek Precitech, Inc.
Ampex Data Systems Corp.
Analog Modules, Inc.
Analytical Business Unit
Andover Corp.
Applied Image Group
Applied Optronics
ASD Inc. (formerly Analytical Spectral Devices)
ASML Optics
asphericon GmbH
Atlantic Positioning Systems
Autonosys Inc.
Avo Photonics, Inc.
Axsys Motion Control Products
Axsys Technologies Imaging Systems
Axsys Technologies IR Systems
BAE Systems
Bandwidth Semiconductor, LLC
Barr Associates Inc.
Boston Electronics Corp.
Boulder Imaging Inc.
Boulder Nonlinear Systems, Inc.
Brijot Imaging Systems, Inc.
Brush Wellman Inc.
CALCULEX, Inc.
Cantronic Sytems, Inc.
Carl Zeiss MicroImaging, Inc.
Carl Zeiss Optronics GmbH
Carleton Life Support Systems Inc.
CBC (AMERICA) Corp.
Cedip Infrared Systems
ChemImage Corp.
CI Systems, Inc.
Cincinnati Sub-Zero Products, Inc.
Clear Align
CMPC Surface Finishes
Coastal Optical Systems, Inc.
Coherent Inc.
Cohu, Inc.
Components Express, Inc.
Computer Optics Inc.
Contour Fine Tooling
CorActive High-Tech, Inc.
Corning Inc.
CVI Melles Griot - Albuquerque
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Defense Tech Briefs
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Deposition Sciences, Inc
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Dilas Diode Laser
Directed Perception, Inc.
Dontech Inc.
DRS Technologies, Inc., Reconnaissance, Surveillance & Target Acquisition (RSTA) Segment
Drytech Inc.
Dynamics Research Corp.
Dynetics, Inc.
e2v
Edmund Optics
EGIDE USA
ELCAN Optical Technologies
Electro Optical Industries, Inc.
Electro-Optical Imaging, Inc.
Electrophysics Corp.
Eltek USA Inc.
EM Photonics
EM4 Defense
Epitaxial Technologies, LLC
Epner Technology, Inc.
Equinox Corp.
ET Precision Optics Inc.
Evaporated Coatings, Inc.
Exotic Electro-Optics
Fairfield Crystal Technology, LLC
Fast-Vision, LLC
Fiberguide Industries, Inc.
Fibertek Inc.
Firebird Technologies Inc.
FLIR Systems, Inc. - Commercial Vision Systems
FLIR Systems, Inc. - Americas Thermography Division
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Fosta-Tek Optics
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Fresnel Technologies Inc.
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IMT Masken und Teilungen AG
Infinite Optics Inc.
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Intense Ltd.
InterSense, Inc.
Intevac, Inc.
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Isuzu Glass Inc.
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ITT Corp.
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JDSU
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Judson Technologies, LLC
Kigre, Inc.
Kollsman, Inc.
Kopin Corp.
Kopp Glass, Inc.
Kugler of America LTD

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L-3 Communications - Infrared Products
L-3 InfraredVision Technology Corp.
Labsphere, Inc.
LaCroix Optical Co.
Lambda Research Optics Inc.
Laser Components IG, Inc.
Laser Diode, Inc.
Laser Focus World
Laser Optics, a PPGI company
Laser Research Optics
Lasertel, Inc.
Lattice Electro Optics, Inc.
Lattice Materials LLC
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MRC a PPGI company
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NEC Corp.
NEC San'ei Instruments, Ltd.
New Scale Technologies, Inc.
New York Photonics Industry Association
Newport Corp.
Nippon Avionics Co., Ltd.
nLight Corp.
NoblePeak Vision Corp.
NorPix, Inc.
North Dakota Department of Commerce
Northrop Grumman Cutting Edge Optronics
Novotech, Inc.
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Nufern
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Ontar Corp.
Onyx Optics Inc.
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Optronic Laboratories, Inc.
OSRAM Opto Semiconductors
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Phoenix Infrared
Photon Engineering, LLC
Photon Gear, Inc.
Photonic Cleaning Technologies
Photonic Sense GmbH
Photonics Spectra
Photonics.com/Photonics Directory
Photron USA, Inc.
Physics Today
Phytron Inc.
PI (Physik Instrumente) LP
PixonImaging LLC
Pleora Technologies
Poco Graphite, Inc.
Polaris Electronics Corp.
Polaris Sensor Technologies, Inc.
PolarOnyx, Inc.
Pollution Equipment News
Polymer Optics, LLC
Polymicro Technologies, A Subsidiary of Molex Inc.
Power Technology, Inc.
Precision Optical
Precision Photonics Corp.
Precision Solutions (MBDA UK Ltd.)
Princeton Instruments
Process Sensors Corp.
Proxitronic Industries AG
Qioptiq
QmagiQ, LLC
QPC Lasers, Inc.
Quality Thin Films, Inc.
QuickSet International
R. Mathews Optical Works, Inc.
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Raytheon Vision Systems
RedShift Systems
Research Electro-Optics, Inc.
Reynard Corp.
RICOR - Cryogenic & Vacuum Systems
Riegl USA, Inc.
Rochester Precision Optics LLC
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Rocky Mountain Instrument Co.
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RSoft Design Group
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Salvador Imaging
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Santa Barbara Infrared, Inc.
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Satisloh North America Inc.
Sawyer Technical Materials, LLC
SCD-SemiConductor Devices
Schneider Optics, Inc.
SCHOTT North America, Inc. - Defense
Scientific Solutions, Inc. (SSI)
SELEX Sensors and Airborne Systems
Sensors Unlimited, Inc., part of Goodrich Corporation
SEO Precision, Inc.
SESO
Sheaumann Inc.
Snake Creek Lasers, LLC
SOFRADIR
Solid State Scientific Corp.
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Spectrum Detector Inc.
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Stellar Industries Corp.
StellarNet, Inc.
StingRay Optics, LLC
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Sydor Optics, Inc.
Syntec Optics
tec5USA, Inc.
Technodiamant USA Inc.
Tecomet/Precision Technologies
Tecport Optics, Inc.
Teledyne Imaging Sensors
Telops Inc.
Teraxion Inc.
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Tessera, Inc.
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Thales Angenieux
Thermoteknix Systems Ltd.
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Thorlabs, Inc.
Toptica Photonics, Inc.
ULIS
Umicore Optical Materials
Univ. of Central Florida
Univ. of Massachusetts/Lowell - Submillimeter-Wave Technology Lab
Universal Photonics, Inc.
Ural Optical and Mechanical Plant
Vacuum Process Technology, Inc.
Vectronix Inc.
Vincent Associates
Vision Systems Design
Voltage Multipliers Inc.
Wafer Technology Ltd.
Wamco, Inc.
WaveFront Sciences, Inc.
Webcom Communications
Western Photonics Technology
Wideband Systems, Inc.
Wordingham Technologies
XenICs
Z&Z Optoelectronic Tech. Co., Ltd.
ZEMAX Development Corp.
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Technical Conference Index

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PROGRAM ON

IR Sensors and Systems Engineering

Chair: **Gabor F. Fulop,** Maxtech International, Inc.

PROGRAM ON

Technologies for Homeland Security and Law Enforcement

Chair: **Edward M. Carapezza,** Univ. of Connecticut and DARPA

PROGRAM ON

Tactical Sensors and Imagers

Chair: **Roger Appleby,** QinetiQ Ltd. (United Kingdom)

PROGRAM ON

Laser Sensors and Systems

Chair: **Gary W. Kamerman,** FastMetrix, Inc.

PROGRAM ON

Battlespace Technologies

Chairs: **John H. Holloway, Jr.,** Naval Surface Warfare Ctr.

Patrick J. Gardner, General Dynamics Armament and Technical Products

PROGRAM ON

Displays

Chairs: **Clarence E. Rash,** U.S. Army Aeromedical Research Lab.

Jacques G. Verly, Univ. de Liège (Belgium)

PROGRAM ON

Space Technologies and Operations

Chairs:
Thomas George, ViaLogy Corp.

Peter Tchoryk, Jr., Michigan Aerospace Corp.

PROGRAM ON

Intelligent and Unmanned Systems

Chairs: **Grant R. Gerhart,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.

Steve K. Rogers, Sensors and Information Directorate AFRL

PROGRAM ON

Modeling and Simulation

Chair: **Dawn A. Trevisani,** Air Force Research Lab.

PROGRAM ON

Sensor Data Exploitation and Target Recognition

Chair: **Ivan Kadar,** Interlink Systems Sciences, Inc.

PROGRAM ON

Information Fusion, Data Mining, and Information Networks Security Related Technologies

Chair: **Belur V. Dasarathy,** Consultant

PROGRAM ON

Signal, Image, and Neural Net Processing

Chair: **Andrew R. Pirich,** ACP Consulting

PROGRAM ON

Communications and Networking Technologies and Systems

Chair: **Raghuveer M. Rao,** Rochester Institute of Technology

Course Index

Take advantage of courses and workshops taught by leaders in the field—bring yourself up to date on the hottest technologies or get the background basics you need. To see courses on a day-by-day schedule, see pp. 97–100.

Students save 50% on Course Registration

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Foundation courses provide an introduction to and overview of the technical area they address. They are an ideal entry point for understanding core concepts and tools if you're new to a field, looking to brush up your knowledge in a specific area, or want to take a closer look at a specialization you're considering pursuing. Courses are taught by instructors with deep knowledge and years of in-the-field experience, and offer the unique opportunity to learn from some of the most accomplished optics professionals in their respective industries.

Register Today!
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Course prices go up $50 after 29 February 2008.

Technologies for Homeland Security and Law Enforcement

Sun SC891 ***NEW*** **Security of Information and Communication Networks** *(Kartalopoulos)* 1:30 to 5:30 pm, $265 / $315 110

Mon SC719 FC **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)* 1:30 to 5:30 pm, $265 / $315 101

Mon SC836 FC **Using IR Thermographic Instruments—A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, $315 / $365 104

IR Sensors and Systems Engineering

Sun SC134 FC **Optical Design Fundamentals for Infrared Systems** *(Kampe)* 8:30 am to 5:30 pm, $505 / $605 102

Sun SC900 ***NEW*** **Uncooled Thermal Imaging Detectors and Systems** *(Hanson)* 8:30 am to 5:30 pm, $505 / $605 . .101

Mon-Tues SC835 **Infrared Systems - Technology & Design** *(Daniels)* **(1.5 day course)** 8:30 am to 5:30 pm/8:30 am to 12:30 pm, $955 / $1095 103

Mon SC178 FC **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $390 / $490 114

Mon SC896 ***NEW*** **Optical Testing of Focal Plane Array Imagers - Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* 8:30 am to 5:30 pm, $470 / $570 104

Mon SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, $265 / $315 105

Mon SC892 ***NEW*** **Infrared Search and Track Systems** *(Schwering)* 1:30 to 5:30 pm, $265 / $315 102

Mon SC836 FC **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, $315 / $365 104

Tues SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* 8:30 am to 12:30 pm, $265 / $315 102

Tues SC710 **NIR and SWIR Imaging Applications** *(Richards)* 8:30 am to 12:30 pm, $305 / $355 104

Tues SC278 **Infrared Detectors** *(Dereniak)* 1:30 to 5:30 pm, $345 / $395 102

Weds SC796 **Allowable Stresses in Glass and Engineering Ceramics** *(Pepi)* 8:30 am to 12:30 pm, $265 / $315 .115

Weds SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* 8:30 am to 5:30 pm, $485 / $585 103

Thurs SC789 FC **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $470 / $570 106

Thermosense

Mon SC836 FC **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, $315 / $365 104

Tues SC710 **NIR and SWIR Imaging Applications** *(Richards)* 8:30 am to 12:30 pm, $305 / $355 .104

Tactical Sensors and Imagers

Sun SC713 FC **Engineering Approach to Imaging System Design** *(Holst)* 8:30 am to 5:30 pm, $525 / $625 106

Sun SC194 FC **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $265 / $315 106

Mon SC178 **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $390 / $490 114

Mon SC157 ***NEW*** **MTF in Optical and Electro-Optical Systems** *(Ducharme)* 8:30 am to 5:30 pm, $505 / $605 105

Mon SC896 **Optical Testing of Focal Plane Array Imagers - Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* 8:30 am to 5:30 pm, $470 / $570 104

Mon SC067 **Testing and Evaluation of E-O Imaging Systems** *(Holst)* 8:30 am to 5:30 pm, $535 / $635 104

Mon SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, $265 / $315 105

Tues SC901 **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $470 / $570 111

Thurs SC154 **Electro-Optical Imaging System Performance** *(Holst)* 8:30 am to 5:30 pm, $540 / $640 105

Thurs SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $470 / $570 106

Laser Sensors and Systems

Tues SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* 8:30 am to 12:30 pm, $265 / $315 107

Tues SC784 **Fiber Lasers for Defense Applications: Fibers, Components and System Design Considerations** *(Samson, Torruellas)* 8:30 am to 5:30 pm, $470 / $570 107

Tues SC167 FC **Introduction to Laser Radar** *(Kamerman)* 1:30 to 5:30 pm, $265 / $315 107

Weds SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, $470 / $570 107

Intelligent and Unmanned Systems

Mon SC898 ***NEW*** **Path Planning for Autonomous Vehicles** *(Flann)* 8:30 am to 12:30 pm, $265 / $315 108

Sun SC894 ***NEW*** **Introduction to INS and INS-Based Integrated Navigation** *(Soloviev)* 8:30 am to 5:30 pm, $470 / $570 . .108

Mon SC549 **Incorporating GPS Technology into Commercial and Military Applications** *(Uijt de Haag)* 8:30 am to 12:30 pm, $265 / $315 .108

Displays

Weds SC159 **Head-Mounted Displays: Design and Applications, Including Night Vision** *(Melzer, Browne)* 8:30 am to 5:30 pm, $470 / $570 108

Modeling and Simulation

Sensor Data Exploitation and Target Recognition

Information Fusion, Data Mining, and Information Networks Security Related Technologies

Signal, Image, and Neural Net Processing

Communications and Networking Technologies and Systems

Battlespace Technologies

Optical and Optomechanical Engineering

Industry Workshops

The Business of Defense

Professional Development

PROGRAM ON

IR Sensors and Systems Engineering

Chair: **Gabor F. Fulop,** Maxtech International, Inc.

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6942 **Technologies for Synthetic Environments: Hardware-in-the-Loop Testing XIII** *(Murrer)* p. 28

6940 **Infrared Technology and Applications XXXIV** *(Andresen, Fulop, Norton)* p. 21

Vendor Presentations and Reception *(Rozlosnik, Peacock)* 5:00 to 8:00 pm, p. 8
This event is organized by the Thermosense Conference 6939.

6939 **Thermosense XXX** *(Vavilov, Burleigh)* p. 19

6941 **Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XIX** *(Holst)* p. 26

Courses of Related Interest

SC900 ***NEW*** **Uncooled Thermal Imaging Detectors and Systems** *(Hanson)* 8:30 am to 5:30 pm, p. 101

SC835 **Infrared Systems - Technology & Design** *(Daniels)* Monday 8:30 am to 5:30 pm, Tuesday 8:30 am to 12:30 pm, p. 103

SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* 8:30 am to 5:30 pm, p. 103

SC134 **Optical Design Fundamentals for Infrared Systems** *(Kampe)* 8:30 am to 5:30 pm, p. 102

SC892 ***NEW*** **Infrared Search and Track Systems** *(Schwering)* 1:30 to 5:30 pm, p. 102

SC710 **NIR and SWIR Imaging Applications** *(Richards)* 8:30 am to 12:30 pm, p. 104

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, p. 107

SC896 ***NEW*** **Optical Testing of Focal Plane Array Imagers - Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* 8:30 am to 5:30 pm, p. 104

SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* 8:30 am to 12:30 pm, p. 102

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, p. 105

SC278 **Infrared Detectors** *(Dereniak)* 1:30 to 5:30 pm, p. 102

SC836 **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, p. 104

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition
10:00 am to 5:00 pm | 10:00 am to 5:00 pm | 10:00 am to 2:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

SPIE Works **Career Fair**
11:00 am to 3:00 pm | 11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

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Thermosense XXX

Conference Chairs: **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russia); **Douglas D. Burleigh,** La Jolla Cove Consulting

Program Committee: **Lee R. Allen,** Allen Applied Infrared Technology, Emeritus Member; **Nicolas P. Avdelidis,** EBETAM S.A. (Greece); **Pierre Bremond,** Cedip Infrared Systems (France); **Antonio Colantonio,** Public Works and Government Services Canada (Canada); **Fred Colbert,** Colbert Infrared Services; **K. Elliott Cramer,** NASA Langley Research Ctr.; **Ralph B. Dinwiddie,** Oak Ridge National Lab.; **Ermanno G. Grinzato,** Consiglio Nazionale delle Ricerche (Italy); **Sheng-Jen Hsieh,** Texas Agricultural & Mechanical Univ.; **Herbert Kaplan,** Honeyhill Technical Co.; **Timo T. Kauppinen,** VTT (Finland); **Dennis H. LeMieux,** Siemens Corporate Research; **Sven-Åke Ljungberg,** Univ. of Gävle, Emeritus Member (Sweden); **Robert P. Madding,** FLIR Systems, Inc.; **Xavier P. V. Maldague,** Univ. Laval (Canada); **G. Raymond Peacock,** Temperatures.com, Inc.; **Piotr Pregowski,** Pregowski Infrared Services (Poland); **Austin A. Richards,** FLIR Systems; **Andrés E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **Morteza Safai,** The Boeing Co.; **Takahide Sakagami,** Osaka Univ. (Japan); **R. James Seffrin,** Infraspection Institute; **Steven M. Shepard,** Thermal Wave Imaging, Inc.; **John R. Snell,** Snell Infrared; **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc.; **Lisa West Åkerblom,** FLIR Systems AB (Sweden)

THERMOSENSE MISSION STATEMENT

The purpose of Thermosense is to promote the exchange of information pertaining to the use of infrared sensing and imaging instruments for diagnostics and controls. Presentations should address the solutions to problems and their reduction to practice.

THERMOSENSE BACKGROUND

Thermosense is the oldest and largest international technical meeting focused on scientific, industrial and general uses of Infrared Imaging and Infrared Temperature Measurements. Its regular printed proceedings are found in most scientific and engineering libraries, providing an unequaled depth and breadth of technical information and reference data. Further information regarding Thermosense can be found at: www.thermosense.org

Monday 17 March

Vendor Presentations and Reception

Monday 17 March · 5:00 to 8:00 pm

Chairs: **Andrés E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **G. Raymond Peacock,** Temperatures.com, Inc.

Brief presentations from hardware and software vendors on what is new this year in their product lines that impact thermal imaging applications and practices.

What's News in Hardware and Software at the 2008 DSS Exhibition?

This Special Session was started three years ago and has been a very popular, well-attended success. Its intent is to bring together Vendors and Early Arrival Thermosense and DSS exhibitors to highlight the newest products and services being shown at the Exhibition. In this way the busy technical conference attendees can better prioritize their activities when visiting the exhibits. It is also a relaxed opportunity for getting to know one another better and to have informal discussions on matters of mutual interest. A limited time for 10 to 15 minute vendor presentations starts the session, followed by a reception with snacks and soft drinks. The list of vendors presenting will be in the final program and also available onsite.

Your company must be an exhibitor at DSS08 to be part of this event. If you are interested in participating, or have more questions, please contact:

G. Raymond Peacock, rpeacock@temperatures.com

or

Andrés E. Rozlosnik, aer@termografia.com

Tuesday 18 March

SESSION 1 . . . . . Tues. 8:00 to 9:00 am

Pyrometry, Temperature Measurements, and Calibration I

Session Chairs: **G. Raymond Peacock,** Temperatures.com, Inc.; **Robert P. Madding,** FLIR Systems, Inc.

Infrared micro-thermography of an actively heated preconcentrator device, Robert Furstenberg, Christopher A. Kendziora, Stanley V. Stepnowski, R. A. McGill, Naval Research Lab. . . . . [6939-01]

High-temperature IR-imager with wide dynamic range for industrial process control, Uwe Hoffmann, Günter Hofmann, Dimitar Wassilew, Norbert Hess, Manfred Zimmerhackl, DIAS Infrared GmbH (Germany) . . . . . [6939-02]

Emissivity independent low-temperature pyrometry, Ivan Dolezal, Lubos Hes, Technical Univ. of Liberec (Czech Republic) . . . . . [6939-03]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen, Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 2 . . . . . Tues. 10:30 to 11:30 am

Pyrometry, Temperature Measurements, and Calibration II

Session Chairs: **G. Raymond Peacock,** Temperatures.com, Inc.; **Robert P. Madding,** FLIR Systems, Inc.

Spectrally resolved calibration of flat-plate blackbody sources and targets in thermal IR, Sergey N. Mekhontsev, Vladimir B. Khromchenko, Leonard M. Hanssen, National Institute of Standards and Technology . . . . . [6939-04]

Infrared calibration development at Fluke Corporation Hart Scientific Division, Frank Liebmann, Fluke Corp. . . . . [6939-05]

AIRI mid-IR reference pyrometer for near-ambient radiation thermometry, Vladimir B. Khromchenko, Space Dynamics Lab. and National Institute of Standards and Technology; Sergey N. Mekhontsev, Leonard M. Hanssen, National Institute of Standards and Technology . . . . [6939-06]

SESSION 3 . . . . . Tues. 11:30 am to 12:10 pm

Professional Standards I

Session Chairs: **Lisa West Åkerblom,** FLIR Systems AB (Sweden); **Antonio Colantonio,** Public Works and Government Services Canada (Canada).

Do thermographers need a professional association?, G. Raymond Peacock, Temperatures.com, Inc. . . . . [6939-07]

ASNT-based certification for thermographers, John R. Snell, Jr., Snell Infrared . . . . . [6939-08]

Lunch/Exhibition Break . . . . . 12:10 to 1:30 pm

SESSION 4 . . . . . Tues. 1:30 to 2:50 pm

Professional Standards II

Session Chairs: **Lisa West Åkerblom,** FLIR Systems AB (Sweden); **Antonio Colantonio,** Public Works and Government Services Canada (Canada).

International standards: thermography, training, and certification, Lisa West Åkerblom, FLIR Systems AB (Sweden) . . . . . [6939-09]

International standards related to infrared thermography applications for buildings and infrastructure: defined gaps and potential work, Antonio Colantonio, Public Works and Government Services Canada (Canada) . . . . . [6939-10]

The usefulness of existing standard of qualitative building thermography, Timo T. Kauppinen, VTT (Finland) . . [6939-11]

The professional thermographer and certification, standards, and liability, Fred P. Colbert, Colbert Infrared Services . . . . . [6939-12]

SESSION 5 . . . . . Tues. 2:50 to 3:30 pm

Thermal Image Fusion

Session Chair: **Herbert Kaplan,** Honeyhill Technical Co.

Recent development of image mixing function for thermography, Yukinori Kimura, Ichikawa Akihiko, Nippon Avionics Co., Ltd. (Japan) . . . . . [6939-13]

IR and ultraviolet image fusion, Fred P. Colbert, Colbert Infrared Services . . . . . [6939-14]

SESSION 6 . . . . . Tues. 4:00 to 5:00 pm

IR Neighbors: NIR, Visible and UV I

Session Chairs: **Herbert Kaplan,** Honeyhill Technical Co.; **Jan K. Eklund,** EKLUND INFRARED, Inc.

Industrial defect discrimination applying infrared imaging spectroscopy and artificial neural networks, Pilar Beatriz Garcia-Allende, Olga M. Conde, Francisco J. Madruga, Ana M. Cubillas, Jose M. Lopez-Higuera, Univ. de Cantabria (Spain) . . . . . [6939-15]

Overview of SWIR detectors, cameras, and applications, Douglas S. Malchow, Marc Hansen, SUI, Goodrich Corp. . . . . [6939-16]

Calibration of visible and near-infrared spectrums for measuring freshness of vegetables, Faisal Abdullah, Chow Jeng Wong, Mohd Zubir Mat Jafri, Mohamad Suhaimi Jaafar, Univ. Sains Malaysia (Malaysia) . . . . . [6939-17]

Wednesday 19 March

SESSION 7 . . . . . .Wed. 8:00 to 8:40 am

IR Neighbors: NIR, Visible and UV II

Session Chairs: **Herbert Kaplan,** Honeyhill Technical Co.; **Jan K. Eklund,** EKLUND INFRARED, Inc.

High-voltage electrical survey advances using UV/IR, Dan Ninedorf, Ox Creek Energy Associates, Inc. . . . [6939-18]

Overview of expanding the longwave NDT into the shortwave spectrum below visible, Jan K. Eklund, EKLUND INFRARED, Inc. . . . . [6939-19]

SESSION 8 . . . . . .Wed. 8:40 to 10:00 am

Research Topics

Session Chairs: **Morteza Safai,** The Boeing Co.; **Gary L. Orlove,** FLIR Systems, Inc.

Thermography investigations and numerical analysis of turbulent and laminar flow at light-weight structures, Ralf W. Arndt, Bundesanstalt für Materialforschung und -prüfung (Germany); Alexander Gaulke, Mike Schlaich, Technische Univ. Berlin (Germany). . . . . [6939-20]

Electrochromic device for satellite thermal control, Hulya Demiryont, Eclipse Energy Systems, Inc. . . . . [6939-21]

Using lock-in infrared thermography for the visualization of the hand vascular tree, Nabila Bouzida, Univ. Laval (Canada) . . . . . [6939-22]

Active thermography for potato characterization, Sheng-Jen Hsieh, Chih-Chen Sun, Texas Agricultural & Mechanical Univ. . . . . [6939-23]

SESSION 9 . . . . . .Wed. 10:30 to 11:10 am

Products and Processes

Session Chairs: **Andrés E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc.

Arc welding quality monitoring by means of near-infrared imaging spectroscopy, Pilar Beatriz García-Allende, Jesus M. Mirapeix, Adolfo Cobo, Olga M. Conde, Jose M. Lopez-Higuera, Univ. de Cantabria (Spain) . . . . . [6939-24]

Infrared thermography applied for outdoor power substations, Laerte dos Santos, Furnas Centrais Elétricas S.A. (Brazil); Edson C. da Costa Bortoni, Luiz E. de Souza, Guilherme S. Bastos, Univ. Federal de Itajubá (Brazil) . . . . . [6939-25]

SESSION 10 . . . . . Wed. 11:10 am to 12:10 pm

Environmental Investigations

Session Chairs: **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc.; **Andrés E. Rozlosnik,** SI Termografía Infrarroja (Argentina)

Direct measurement of heat flux from cooling lake thermal imagery, Alfred J. Garrett, Eliel Villa-Aleman, Robert J. Kurzeja, Malcolm M. Pendergast, Savannah River National Lab.; John Saylor, Clemson Univ. . . . . [6939-26]

Aerial measurements of convection cell elements in heated lakes, Eliel Villa-Aleman, Alfred J. Garret, Malcolm M. Pendergast, Timothy B. Brown, Saleem R. Salaymeh, Savannah River National Lab. . . . . [6939-27]

Toward the development of a methodology for NDT of bridges using aerial infrared thermography, Gregory R. Stockton, Stockton Infrared Thermographic Services, Inc. . . . . [6939-28]

Lunch/Exhibition Break . . . . . 12:10 to 1:40 pm

SESSION 11 . . . . . .Wed. 1:40 to 4:30 pm

NDT of Buildings and Civil Structures

Session Chairs: **Kathryn M. Knettel,** United Space Alliance, LLC; **Nicolas P. Avdelidis,** EBETAM S.A. (Greece); **Timo T. Kauppinen,** VTT (Finland).

Thermography as a tool for building applications and diagnostics, Nicolas P. Avdelidis, EBETAM S.A. (Greece); Timo T. Kauppinen, VTT (Finland) . . . . . [6939-29]

A nondestructive method for diagnostic of insulated building walls using infrared thermography in real situation, Mohamed Larbi Youcef, Atef Mazioud, Univ. Paris 12 Val-de-Marne (France); Pierre Bremond, Cedip Infrared Systems (France); Laurent Ibos, Yves Candau, Univ. Paris 12 Val-de-Marne (France); Michel Piro, EDF (France); Alain Filloux, Alphéeis (France). . . . . [6939-30]

Crack detection and fatigue related delamination in FRP composites applied to concrete, Jeff R. Brown, Robyn Anderson, Rebecca L. Baker, Lisa Kallemeyn, Hope College . . . . . [6939-31]

Square-pulse thermography in frequency domain, Ralf W. Arndt, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [6939-32]

Building material characterization by using IR thermography for efficient heating systems, Ermanno Grinzato, Paolo G. Bison, Consiglio Nazionale delle Ricerche (Italy) . . . . . [6939-33]

Defect evaluation based on passive lock-in thermography for concrete structure, Daisuke Sato, Concrete Soft Technical Engineering Corp. (Japan); Takahide Sakagami, Osaka Univ. (Japan); Tatsuhito Komiyama, Concrete Soft Technical Engineering Corp. (Japan); Shiro Kubo, Osaka Univ. (Japan). . . . . [6939-34]

Quantitative evaluation of defect depth in concrete structures using Fourier analysis for sequential thermal data, Shiro Nakamura, Sumitomo Osaka Cement Co., Ltd. (Japan); Takahide Sakagami, Osaka Univ. (Japan); Shuusuke Harada, Sumitomo Osaka Cement Co., Ltd. (Japan); Shiro Kubo, Osaka Univ. (Japan) . . . . . [6939-35]

Thursday 20 March

SESSION 12 . . . . . Thurs. 8:00 to 10:00 am

NDT Numerical Analysis and Theory

Session Chairs: **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russia); **Douglas D. Burleigh,** La Jolla Cove Consulting; **K. Elliott Cramer,** NASA Langley Research Ctr.

Physics-based processing for static and dynamic industrial thermograms, Mohammed A. Omar, Clemson Univ.; Yi Zhou, Clemson Univ; Tomokazu Okuno, Toyota Motor Engineering & Manufacturing North America, Inc. . . . . [6939-36]

Accuracy issues in modeling thermal NDT problems, Vladimir P. Vavilov, Denis Nesteruk, Tomsk Polytechnic Univ. (Russia); Sergio Marinetti, Consiglio Nazionale delle Ricerche (Italy) . . . . . [6939-37]

IR-View: a straightforward graphical user interface for basic and advanced signal processing of thermographic infrared sequences, Matthieu T. Klein, Jean-Marc A. Piau, Clemente Ibarra-Castanedo, Xavier P. Maldague, Abdelhakim Bendada, Univ. Laval (Canada) . . . . . [6939-38]

Thermographic signal processing through correlation operators in pulsed thermography, Matthieu T. Klein, Jean-Marc Piau, Clemente Ibarra-Castanedo, Abdelhakim Bendada, Xavier Maldague, Univ. Laval (Canada) . . [6939-39]

Quantitative characterization of delaminations in thick composites using step heating thermography, Adel A. Badghaish, David C. Fleming, Florida Institute of Technology . . . . . [6939-40]

Measurement accuracy in thermographic NDT, Steven M. Shepard, YuLin Hou, Thermal Wave Imaging, Inc. . . . . [6939-41]

SESSION 13 . . . . . Thurs. 10:30 am to 12:10 pm

NDT Methods and Applications

Session Chairs: **Douglas D. Burleigh,** La Jolla Cove Consulting; **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russia); **Ermanno G. Grinzato,** Consiglio Nazionale delle Ricerche (Italy).

A study of active thermography approaches for the nondestructive testing and evaluation of aerospace structures, Nicolas P. Avdelidis, EBETAM S.A. (Greece); Clemente Ibarra-Castanedo, Jean-Marc A. Piau, Abdel Hakim Bendada, Xavier P. Maldague, Univ. Laval (Canada) [6939-42]

Fuselage inspection of Boeing 737 using lock-in thermography, Markus Tarin, MoviMED and Automation Technology (Germany) and FLIR. . . . . [6939-43]

Thermal imaging of fatigue damage to composites after low-velocity impact, Jeff R. Brown, Bradley Lininger, David Visser, Hope College . . . . . [6939-44]

Thermographic nondestructive testing using inductive thermal excitation, Morteza Safai, The Boeing Co. [6939-45]

Real-time infrared thermography testing on composite materials-through transmission one sided, Marcus R. Harty, Wyle Labs. . . . . [6939-46]

Lunch/Exhibition Break . . . . . 12:10 to 1:40 pm

SESSION 14 . . . . . Thurs. 1:30 to 3:30 pm

Materials Evaluation: Thermal and Fatigue Properties

Session Chairs: **Takahide Sakagami,** Osaka Univ. (Japan); **Pierre Bremond,** Cedip Infrared Systems (France); **Jeff R. Brown,** Hope College.

Nondestructive thermal diffusivity mapping of refractory bricks, Ralph B. Dinwiddie, James G. Hemrick, Oak Ridge National Lab. . . . . [6939-47]

Development of a self-reference lock-in thermography and its applications to nondestructive testing, Takahide Sakagami, Shiro Kubo, Osaka Univ. (Japan) . . . . . [6939-48]

Influence of ultrasonic vibration mode on sonic IR, Manyong Choi, Kisoo Kang, Jeonghak Park, Korea Research Institute of Standards and Science (South Korea); Wontae Kim, Kongju National Univ. (South Korea). . . . . [6939-49]

Thermal stress analysis of a circular-holed specimen, Wontae Kim, Kongju National Univ. (South Korea); Kisoo Kang, Manyong Choi, Jeonghak Park, Korea Research Institute of Standards and Science (South Korea); Koungsuk Kim, Chosun Univ. (South Korea) . . . . . [6939-50]

Simulating thermal NDT of bonded structures, Xingwang Guo, Fang Qie, Beihang Univ. (China). . . . . [6939-51]

Dimensionless heat transfer model to compress and analyze pulsed thermography data for NDT of composite materials, Juan-Carlos Ramirez-Granados, Marija Strojnik, Gonzalo Paez, Ctr. de Investigaciones en Óptica, A.C. (Mexico). . . . . [6939-52]

Related Courses

SC836	**Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* Monday, 1:30 to 5:30 pm
SC710	**NIR and SWIR Imaging Applications** *(Richards)* Tuesday, 8:30 am to 12:30 pm
SC892 *NEW*	**Infrared Search and Track Systems** *(Schwering)* Monday, 1:30 to 5:30 pm
SC896 *NEW*	**Optical Testing of Focal Plane Array Imagers-Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* Monday, 8:30 am to 5:30 pm
SC900 *NEW*	**Uncooled Thermal Imaging Detectors and Systems** *(Hanson)* Sunday, 8:30 am to 5:30 pm
SC134	**Optical Design Fundamentals for Infrared Systems** *(Kampe)* Sunday, 8:30 am to 5:30 pm
SC152	**Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* Tuesday, 8:30 am to 12:30 pm
SC180	**Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* Monday, 1:30 to 5:30 pm
SC278	**Infrared Detectors** *(Dereniak)* Tuesday, 1:30 to 5:30 pm
SC545	**Infrared Characterization of Sources and Backgrounds** *(Jacobs)* Wednesday, 8:30 am to 5:30 pm
SC835	**Infrared Systems - Technology & Design** *(Daniels)* Monday / Tuesday, 8:30 am to 5:30 pm / 8:30 am to 12:30 pm

See pp. 101–117 for course descriptions.

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Infrared Technology and Applications XXXIV

Conference Chairs: **Bjørn F. Andresen,** Elbit Systems Electro-Optics ElOp Ltd. (Israel); **Gabor F. Fulop,** Maxtech International, Inc.; **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate

Program Committee: **Christopher Carl Alexay,** StingRay Optics, LLC; **Raymond S. Balcerak,** Defense Advanced Research Projects Agency; **Stefan T. Baur,** Raytheon Vision Systems; **Philippe Francis Bois,** Thales Research & Technology (France); **Wolfgang A. Cabanski,** AIM Infrarot-Module GmbH (Germany); **John T. Caulfield,** Cyan Systems; **Jean-Pierre Chatard,** ULIS (France); **Peter N. J. Dennis,** QinetiQ Ltd. (United Kingdom); **John W. Devitt,** L-3 Communications Cincinnati Electronics, Inc.; **Michael T. Eismann,** Air Force Research Lab.; **Martin H. Ettenberg,** SUI, Goodrich Corp.; **Sarath D. Gunapala,** Jet Propulsion Lab.; **Masafumi Kimata,** Ritsumeikan Univ. (Japan); **Hee Chul Lee,** Korea Advanced Institute of Science and Technology (South Korea); **Paul D. LeVan,** Air Force Research Lab.; **Wei Lu,** Shanghai Institute of Technical Physics (China); **Whitney Mason,** U.S. Army Night Vision & Electronic Sensors Directorate; **Mark A. Massie,** Nova Sensors; **Paul L. McCarley,** Air Force Research Lab.; **R. Kennedy McEwen,** SELEX Sensors and Airborne Systems Ltd. (United Kingdom); **Paul F. McManamon,** Air Force Research Lab.; **John Lester Miller,** FLIR Systems, Inc.; **A. Fenner Milton,** U.S. Army Night Vision & Electronic Sensors Directorate; **Ofer Nesher,** SCD-Semi Conductor Devices (Israel); **Peter W. Norton,** BAE Systems, Inc.; **Herbert K. Pollehn,** Army Research Lab.; **Ingmar G. E. Renhorn,** Swedish Defence Research Agency (Sweden); **Antoni Rogalski,** Wojskowa Akademia Techniczna (Poland); **Myron J. Scholten,** DRS Technologies, Inc.; **Venkataraman S. Swaminathan,** U. S. Army RDECOM-ARDEC; **Meimei Z. Tidrow,** Missile Defense Agency; **Philippe M. Tribolet,** Sofradir (France); **Jay Vizgaitis,** U.S. Army Night Vision & Electronic Sensors Directorate; **Kadri Vural,** Teledyne Scientific Co.

Monday 17 March

Opening Remarks . . . . . .Mon. 8:30 to 8:40 am

Session Chair: **Gabor F. Fulop,** Maxtech International, Inc.

Sessions 1-2 run concurrently with sessions 6-7.

SESSION 1 . . . . . .Mon. 8:40 to 11:10 am

QWIP, QDIP, DWELL and QWISP FPAs with Applications

Session Chairs: **Philippe Francis Bois,** Thales Research & Technology (France); **Sarath D. Gunapala,** Jet Propulsion Lab.

Voltage mediated tuning of the detection wavelength in quantum dots-in-a-well infrared photodetectors, Linda Höglund, Acreo AB (Sweden); Per O. Holtz, Linköpings Univ. (Sweden); Carl Asplund, IRnova AB (Sweden); Qin Wang, Susanne Almqvist, Erik Petrini, Acreo AB (Sweden); Håkan Pettersson, Halmstad Univ. (Sweden); Jan Y. Andersson, Acreo AB (Sweden) . . . . . [6940-01]

Spectral characterization of two novel single-bump two-color quantum dots-in-a-well (DWELL) infrared focal plane arrays, Thomas E. Vandervelde, Michael C. Lenz II, Sanjay Krishna, The Univ. of New Mexico . . . . . [6940-02]

Comparison of the performance limit of quantum dot and other types of infrared photodetectors, Antoni Rogalski, Wojskowa Akademia Techniczna (Poland) . . . . . [6940-03]

Multiband infrared arrays for imaging spectrometers, Sumith V. Bandara, Sarath D. Gunapala, David Z. Ting, John K. Liu, Jason M. Mumolo, Jet Propulsion Lab. . . . . [6940-04]

Quantum well intrasubband photodetector (QWISP): prospects for large-format far-infrared focal plane arrays, David Z. Ting, Jet Propulsion Lab.; Yia-Chung Chang, Univ. of Illinois at Urbana-Champaign; Sumith V. Bandara, Sarath D. Gunapala, Jet Propulsion Lab. . . . . [6940-05]

A voltage-tunable multiband quantum dot infrared focal plane array with high photodetectivity, Xuejun Lu, Univ. of Massachusetts/Lowell; Mark J. Meisner, Raytheon Missile Systems. . . . . [6940-06]

SESSION 2 . . . . . .Mon. 11:10 to 11:50 am

Emerging FPAs I

Session Chairs: **Meimei Z. Tidrow,** Missile Defense Agency; **Venkataraman S. Swaminathan,** U. S. Army RDECOM

Recent advances in LWIR Type-II InAs/GaSb superlattice photodetectors and focal plane arrays at the Center for Quantum Devices *(Invited Paper)*, Manijeh Razeghi, Binh Minh Nguyen, Pierre-Yves Delaunay, Darin M. Hoffman, Northwestern Univ.; Meimei Z. Tidrow, Missile Defense Agency . . . . . [6940-07]

Antimony based superlattices for high-performance infrared imagers, Robert H. Rehm, Martin Walther, Johannes Schmitz, Frank Rutz, Joachim Fleissner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Johann Ziegler, AIM Infrarot-Module GmbH (Germany) . . . . . [6940-08]

Lunch Break . . . . . 11:50 am to 1:00 pm

SESSION 6 . . . . . .Mon. 9:00 to 10:00 am

Advanced IR Materials

Session Chairs: **Christopher Carl Alexay,** StingRay Optics, LLC; **Jay Vizgaitis,** U.S. Army Night Vision & Electronic Sensors Directorate

Optical and thermo-mechanical properties of infrared glasses, Yann M. Guimond, Umicore IR Glass (France) . . . . . [6940-22]

Amorphous materials molded IR lens progress report, Ray A. Hilton, Sr., James McCord, Ronald Timm, Amorphous Materials Inc. . . . . [6940-23]

An innovative getter coating for IR dewars and cold shields, Dina Katsir, Acktar Advanced Coatings Ltd. (Israel) . . . . . [6940-24]

SESSION 7 . . . . . .Mon. 10:30 to 11:50 am

IR Optics for 3rd Generation Systems I

Session Chairs: **Jay Vizgaitis,** U.S. Army Night Vision & Electronic Sensors Directorate; **Christopher Carl Alexay,** StingRay Optics, LLC

Third-generation infrared optics, Jay Vizgaitis, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6940-25]

Dual-band antireflection coatings for the infrared, Thomas D. Rahmlow, Jr., Jeanne E. Lazo-Wasem, Rugate Technologies, Inc. . . . . [6940-26]

Third-generation FLIR demonstrator, Jay Vizgaitis, U.S. Army Night Vision & Electronic Sensors Directorate; John M. Hall, OASYS Technology, LLC; Jason Miller, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6940-27]

Third-generation infrared system calibration using dual-band thermoelectric reference sources and thermoelectric test systems to calibrate uncooled IRFPAs, David K. Finfrock, William L. Kolander, Marlow Industries, Inc. . . . . [6940-28]

Lunch Break . . . . . 11:50 am to 1:00 pm

Sessions 3-4-5 run concurrently with sessions 8-9.

SESSION 3 . . . . . .Mon. 1:00 to 2:20 pm

Emerging FPAs II

Session Chairs: **Meimei Z. Tidrow,** Missile Defense Agency; **Venkataraman S. Swaminathan,** U. S. Army RDECOM

Design optimization of superlattice type-II IR-detection modules with coincident integration in two-spectral ranges, Rainer Breiter, R. Scheibner, Joachim C. Wendler, Johann Ziegler, AIM Infrarot-Module GmbH (Germany); Robert H. Rehm, Martin Walther, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) . . . . . [6940-09]

Infrared imaging arrays based on superlattice photodiodes, Cory J. Hill, Alexander Soibel, Sam A. Keo, Jason M. Mumolo, Sarath D. Gunapala, Jet Propulsion Lab.; David R. Rhiger, Robert E. Kvaas, Sean F. Harris, Raytheon Vision Systems . . . . . [6940-10]

GaSb/InAsSb heterostructure MWIR detector for high-temperature operation, Yaakov Sharabani, Yossi Paltiel, Ariel Sher, Arie Raizman, Avigdor Zussman, Soreq Nuclear Research Ctr. (Israel) . . . . . [6940-11]

Reduction of leakage currents in nBn-based long-wave infrared detectors using type-II InAs/GaSb superlattices, Elena A. Plis, Jean-Baptiste Rodriguez, Greg Bishop, Ha Sul Kim, Arezou Khoshakhlagh, Yagyadeva D. Sharma, Ralph L. Dawson, Sanjay Krishna, The Univ. of New Mexico . [6940-12]

SESSION 4 . . . . . .Mon. 2:20 to 4:10 pm

Advanced HgCdTe FPAs and Applications

Session Chair: **Philippe M. Tribolet,** Sofradir (France)

Realization and performances of HgCdTe LWIR arsenic-implanted planar p-on-n photodiodes, Laurent Mollard, Johan Rothman, Nicholas Baier, Philippe Ballet, Franck Henry, Sylvain Gout, Guillaume Bourgeois, Jean-Paul Chamonal, Commissariat à l'Energie Atomique (France); Christine Cassillo, Christophe Pautet, SOFRADIR (France) . . . . . [6940-13]

LW IRFPAs made from HgCdTe grown by MOVPE for use in hyperspectral imaging, Leslie G. Hipwood, Chris L. Jones, Ian M. Baker, Chris D. Maxey, Hon Wo Lau, Jonathan Fitzmaurice, Mark C. Wilson, Peter Knowles, SELEX Sensors and Airborne Systems Infrared Ltd. (United |Kingdom) . . . . . [6940-14]

IR detector design and approach for tactical applications with high reliability without maintenance, Xavier Brenière, SOFRADIR (France) . . . . . [6940-15]

State-of-the-art of mass production: challenges for low-cost and application benefits of high-performances small-pitch IR detectors, Emmanuel Bercier, Xavier Brenière, Jerome Sevenier, SOFRADIR (France) . . . . . [6940-16]

SESSION 5 . . . . . .Mon. 4:10 to 5:50 pm

Short Wave IR and Applications

Session Chair: **Martin H. Ettenberg,** Sensors Unlimited, Inc., part of Goodrich Corp.

Development of a miniature InGaAs camera for wide operating temperature range using a temperature-parameterized uniformity correction, Timothy C. Bakker, Devon Turner, Jesse Battaglia, SUI, Goodrich Corp. .[6940-17]

Performance of very low dark-current SWIR PIN arrays, Joseph C. Boisvert, Takahiro Isshiki, Rengarajan Sudharsanan, Ping Yuan, Paul A. McDonald, Spectrolab, Inc.. . . . . [6940-18]

Design and development of SiGe-based infrared imaging sensor, Ashok K. Sood, Robert A. Richwine, Yash R. Puri, Magnolia Optical Technologies, Inc.; Judy L. Hoyt, Tayo I. Akinwande, Massachusetts Institute of Technology. [6940-19]

Monolithic germanium SWIR imaging array, Conor S. Rafferty, Clifford A. King, Bryan D. Ackland, Ingvar Aberg, T. S. Sriram, Jay H. O'Neill, NoblePeak Vision . . . . . [6940-20]

Performance of high-resolution visible-InGaAs imager for day/night vision, Marlon D. Enriquez, Michael A. Blessinger, Joseph V. Groppe, Thomas M. Sudol, Jesse Battaglia, Joseph Passe, Mark Stern, Bora M. Onat, SUI, Goodrich Corp. . . . . [6940-21]

SESSION 8 . . . . . .Mon. 1:00 to 2:20 pm

IR Optics for 3rd Generation Systems II

Session Chairs: **Jay Vizgaitis,** U.S. Army Night Vision & Electronic Sensors Directorate; **Christopher Carl Alexay,** StingRay Optics, LLC

Etching of chalcogenide glass for IR optics, John G. Smith, MEMS Optical, Inc. . . . . [6940-29]

Design and fabrication of efficient miniature retroreflectors for the infrared, Bruce E. Bernacki, Norman C. Anheier, Jr., Kannan Krishnaswami, Bret D. Cannon, Pacific Northwest National Lab. . . . . [6940-30]

High-performance radiation-hard antireflective microstructures for HgCdTe focal plane arrays, Bruce D. MacLeod, Douglas S. Hobbs, TelAztec LLC. . . . . [6940-31]

Anamorphic imaging spectrometer, Rand Swanson, Casey Smith, Michael Kehoe, Thomas S. Moon, Resonon Inc.; Steven W. Brown, Keith R. Lykke, National Institute of Standards and Technology . . . . . [6940-32]

SESSION 9 . . . . . .Mon. 2:20 to 5:30 pm

Novel Uncooled Technologies

Session Chair: **Whitney Mason,** U.S. Army Night Vision & Electronic Sensors Directorate.

Amorphous Si-Ge-O thin film for uncooled infrared detection, Qi Cheng, Mahmoud F. Almasri, Univ. of Missouri/ Columbia . . . . . [6940-33]

Uncooled dual-band MWIR/LWIR optical readout imager, Matthew Erdtmann, Lei Zhang, Guanghai Jin, Agiltron, Inc.. . . . . [6940-34]

Development and optimization of microcantilever-based IR imaging arrays, Scott R. Hunter, Gregory S. Maurer, Gregory Simelgor, Shankar Radhakrishnan, John Gray, Martin L. Bauer, Multispectral Imaging, Inc.. . . . . [6940-35]

A high fill-factor uncooled infrared detector with low-noise characteristic, Il Woong Kwon, Jong Eun Kim, Chi Ho Hwang, Yong Soo Lee, Hee Chul Lee, Korea Advanced Institute of Science and Technology (South Korea) . [6940-36]

Thermal-to-visible transducer (TVT) for thermal-IR imaging, Allen M. Flusberg, Stephen D. Swartz, Science Research Lab., Inc.; Michael A. Huff, Steven J. Gross, CNRI MEMS Exchange. . . . . [6940-37]

Solid state optical thermal imaging: performance update, Matthias Wagner, RedShift Systems Corp.. . . . . [6940-38]

Carbon nanotube-based color IR detectors, Ning Xi, Michigan State Univ. . . . . [6940-39]

Thermopile infrared detector released through XeF_2 etching technique, Hengzhao Yang, Bin Xiong, Yuelin Wang, Shanghai Institute of Microsystem and Information Technology (China) . . . . . [6940-40]

Tuesday 18 March

Session 10 runs concurrently with sessions 12.

Session 11 runs concurrently with sessions 13-14.

SESSION 10 . . . . . .Tues. 8:10 to 8:50 am

Infrared Search and Track (IRST)-Related Systems and Technologies

Session Chairs: **Ingmar G. E. Renhorn,** Swedish Defence Research Agency (Sweden); **Gil A. Tidhar,** Optigo Systems, Ltd. (Israel)

Spherical sensor configurations, Ryan D. Riel, Lucid Dimensions . . . . . [6940-41]

IR panomorph lens imager and applications, Simon Thibault, ImmerVision (Canada) . . . . . [6940-42]

SESSION 12 . . . . . .Tues. 8:10 to 8:50 am

Uncooled FPAs: The French Connection

Session Chairs: **Jean-Luc Tissot,** ULIS (France); **Whitney Mason,** U.S. Army Night Vision & Electronic Sensors Directorate

Design trade-offs in ADC architectures dedicated to uncooled focal plane arrays, Benoit Dupont, Patrick Robert, ULIS (France) . . . . . [6940-59]

Uncooled amorphous silicon 1/4 VGA IRFPA with 25 µm pixel-pitch for high end applications, Jean-Luc Tissot, Michel Vilain, Olivier Legras, Sebastien Tinnes, Christophe Minassian, Bruno Fieque, Patrick Robert, ULIS (France) . . . . . [6940-60]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 10 continued . .Tues. 10:30 am to 12:00 pm

Infrared Search and Track (IRST)-Related Systems and Technologies

Session Chairs: **Ingmar G. E. Renhorn,** Swedish Defence Research Agency (Sweden); **Gil A. Tidhar,** Optigo Systems, Ltd. (Israel)

Third-generation naval IRST using the step and stare architecture, Pierre-Olivier Nougues II, Sagem Defense Securite (France) . . . . . [6940-43]

Navy staring IRST system development and testing *(Invited Paper, Presentation Only)*, James R. Waterman, Naval Research Lab. . . . . [6940-44]

Large format IR camera technology, John W. Devitt, Phillip Henry, David P. Forrai, Richard L. Rawe, Jr., Mark E. Greiner, L-3 Communications Cincinnati Electronics, Inc.; Michael T. Eismann, Kenneth Barnard, Air Force Research Lab. . . . . [6940-45]

IRST infrared background analysis of bay environments, Piet B. Schwering, TNO (Netherlands) . . . . . [6940-46]

Lunch/Exhibition Break . . . . 12:00 to 1:30 pm

SESSION 12 continued . . . . .Tues. 10:30 to 11:50 am

Uncooled FPAs: The French Connection

Session Chairs: **Jean-Luc Tissot,** ULIS (France); **Whitney Mason,** U.S. Army Night Vision & Electronic Sensors Directorate

Latest amorphous silicon microbolometer developments at LETI LIR, Jean-Jacques Yon, Eric E. M.Mottin, Commissariat à l'Energie Atomique (France) . . . . . [6940-61]

Uncooled amorphous silicon XVGA IRFPA with 17 µm pixel-pitch for high resolution applications, Jean-Luc Tissot, Michel Vilain, Olivier Legras, Patrick Robert, Christophe Minassian, Benoit Dupont, ULIS (France); Jean-Jacques Yon, Commissariat Ã l'Energie Atomique (France) . . . . . [6940-62]

Innovative on-chip packaging applied to uncooled IRFPA, Agnès Arnaud, Commissariat à l'Energie Atomique (France) . . . . . [6940-63]

Uncooled amorphous silicon TEC-less 1/4 VGA IRFPA with 25 Îµm pixel-pitch for high volume applications, Jean-Luc Tissot, Michel Vilain, Olivier Legras, Sebastien Tinnes, Christophe Minassian, Bruno Fieque, Jean-Marc Chiappa, Aurelie Touvignon, ULIS (France) . . . . . [6940-64]

Lunch/Exhibition Break . 11:50 am to 1:30 pm

SESSION 11 . . . . . .Tues. 1:30 to 6:00 pm

Target Acquisition Systems

Session Chairs: **Wolfgang A. Cabanski,** AIM Infrarot-Module GmbH (Germany); **Michael T. Eismann,** Air Force Research Lab.

Near-field observation platform, Harry H. Schlemmer, Constantin Baeurle, Holger Vogel, Carl Zeiss Optronics GmbH (Germany) . . . . . [6940-47]

Comparison between a low-light-level visible channel and an IR channel for spaceborne night imaging, Guy Raz, Meira Citroen, Michael J. Berger, Elbit Systems Electro-Optics ElOp Ltd. (Israel) . . . [6940-48]

OPUS H: a new navigational and targeting observation device, Jörg Fritze, Uwe Schwarzkopf, Matthias Spranz, Carl Zeiss Optronics GmbH (Germany); Friedel Kohlmeyer, Johan van der Merwe, Carl Zeiss Optronics (Pty) Ltd. (South Africa). . [6940-49]

IR technology for enhanced force protection by AIM, Rainer Breiter, Tobias Ihle, Karl-Heinz Mauk, Joachim C. Wendler, Johann Ziegler, AIM Infrarot-Module GmbH (Germany) . . . . . [6940-50]

Thermal weapon sights with integrated fire control computers: algorithms and experiences, Hendrik Rothe, Helmut-Schmidt Univ. (Germany); Rainer Breiter, AIM Infrarot-Module GmbH (Germany) . . . . . [6940-51]

Three-dimensional scene reconstruction from IR image sequences for image-based navigation update and target detection of an autonomous airborne system, Stefan Lang, Klaus J. Jaeger, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany)[6940-52]

SWIR imager design and building blocks for automatic detection systems, Gil A. Tidhar, Yuval Ben-Horin, Ran Manor, Optigo Systems, Ltd. (Israel). . . . . [6940-53]

Novel approach for low-cost muzzle flash detection system, Asher A. Voskoboinik, Israel Defense Forces (Israel) . . . . . [6940-54]

Fast multichannel radiometer for diagnosing munition flashes, Adam D. Devir, Michael Y. Engel, Ilan Mendelevicz, Sahar Vilan, Institute for Advanced Research and Development (Israel); Dario Cabib, Amir Gil, CI Systems (Israel) Ltd. (Israel). . . . . [6940-55]

Hyperspectral imager research and development at ARL, Neelam Gupta, Army Research Lab. . . . . [6940-56]

Comparison of QWIP to HgCd Te detectors for gas imaging, Michele Hinnrichs, Pacific Advanced Technology, Inc.; Neelam Gupta, Army Research Lab. . . . . [6940-57]

Progress on characterization of a dualband IR imaging spectrometer, Brian P. Beecken, Bethel Univ.; Paul D. LeVan, Air Force Research Lab. . . . . [6940-58]

SESSION 13 . . . . . .Tues. 1:30 to 4:40 pm

Uncooled FPAs and Applications

Session Chairs: **Stefan T. Baur,** Raytheon Vision Systems; **Charles M. Hanson,** L-3 Communications Infrared Products

New features and development directions in SCD's Î¼-bolometer technology, Avraham R. Fraenkel, Udi Mizrahi, Leonid Bikov, Avihoo Giladi, Amnon Adin, Niv Shiloah, Eyal Malkinson, Tomer Czyzewski, Asaf Amsterdam, Yehuda Sinai, SemiConductor Devices (Israel) . . . [6940-65]

Uncooled VO_x thermal imaging systems, Michael D. Joswick, BAE Systems . [6940-66]

RVS uncooled sensor development for tactical applications *(Invited Paper)*, Todd E. Sessler, Michael Ray, Jessica Wyles, Charles Hewitt, Richard Wyles, Eli E. Gordon, Kenneth Almada, Stefan T. Baur, Matthew Kuiken, Donald D. Chi, Stephen H. Black, Raytheon Vision Systems . . . . . [6940-67]

Amorphous silicon-based large-format uncooled FPA microbolometer technology, Thomas R. Schimert, John Brady, Charles Hanson, Micheal Taylor, Roland W. Gooch, William L. McCardel, Athanasios Syllaios, Thomas Fagan, Sameer Ajmera, L-3 Communications Infrared Products [6940-68]

Thermal image fusion for improving battlefield effectiveness, Michael D. Joswick, BAE Systems . . . . . [6940-69]

Enhanced performance PIR security sensors, Kevin C. Liddiard, Electro-optic Sensor Design (Australia) . . . . . [6940-70]

Uncooled thermal imaging with thin-film ferroelectric detectors, Charles M. Hanson, Howard R. Beratan, Diane L. Arbuthnot, L-3 Communications Infrared Products [6940-71]

A low-power readout circuit approach for uncooled resistive microbolometer FPAs, Tayfun Akin, Murat Tepegoz, Aysen Toprak, Middle East Technical Univ. (Turkey)[6940-72]

SESSION 14 . . . . . .Tues. 4:40 to 5:20 pm

Sensor Vibrations: Sources, Effects, and Elimination

Session Chair: **Alexander M. Veprik,** RICOR-Cryogenic & Vacuum Systems (Israel)

Finite element design of vibration protective pads for portable cryogenically cooled infrared imagers, Michel M. Azoulay, Loughborough Univ. (United Kingdom); Alexander M. Veprik, RICOR-Cryogenic & Vacuum Systems (Israel); Vladimir I. Babitsky, Loughborough Univ. (United Kingdom) . . . . . [6940-73]

Optimal design of a snubbed vibration isolator for vibration sensitive electro-optic payload, Alexander M. Veprik, RICOR-Cryogenic & Vacuum Systems (Israel); Shlomo Djerassi, RAFAEL Armament Development Authority Ltd. (Israel) . . . . . [6940-74]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster session.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

A design of high-performance IRST system using dual-band 1D sensors, Shichang Joung, Byungin Choi, Changhan Park, Samsung Thales Co., Ltd. (South Korea). . . . [6940-115]

A MEMS-based infrared array emitter, Haisheng San, Xiamen Univ. (China) . . . . . [6940-116]

Improved performance of GaSb/InGaAsSb/AlGaAsSb mid-IR photodiodes operating at 1.8-2.4 µm, Tadeusz T. Piotrowski, Anna Piotrowska, Krystyna Golaszewska, Eliana Kaminska, Ewa Papis, Renata Kruszka, Instytut Technologii Elektronowej (Poland); Jaroslaw Rutkowski, Wojskowa Akademia Techniczna (Poland); Yury P. Yakovlev, Ekaterina V. Kunitsyna, A.F. Ioffe Physico-Technical Institute (Russia) . . . . . [6940-117]

CMOS readout integrated circuit involving pixel-level ADC for microbolometer FPAs, Chi Ho Hwang, Il Woong Kwon, Yong Soo Lee, Hee Chul Lee, Korea Advanced Institute of Science and Technology (South Korea) . . . . . [6940-118]

Simulated and measured performance of small-pitched MWIR and LWIR HgCdTe photodiodes, Mikhail S. Nikitin, Galina V. Chekanova, Alpha (Russia); Albina A. Drugova, Viacheslav A. Kholodnov, Institute of Radio-engineering and Electronics (Russia) . . . . . [6940-119]

High-photosensitive nanocrystalline lead chalcogenide films for IR applications, Zinovi Dashevsky, Vladimir Kasiyan, Ben-Gurion Univ. of the Negev (Israel); Leonid Chernyak, Univ. of Central Florida; Konstantin Gartsman, Weizmann Institute of Science (Israel) . . . . . [6940-120]

Novel band-pass and long-pass filters for infrared and terahertz applications, William R. McGovern, Philip R. Swinehart, Pong Thongsavanh, Lake Shore Cryotronics, Inc.. . . . . [6940-121]

A new method to estimate the absorption coefficient for uncooled infrared detectors, Tayfun Akin, Yusuf Tanrikulu, F. Civitci, Middle East Technical Univ. (Turkey) . . . [6940-122]

An optimum reference detector design for uncooled resistive microbolometer FPAs, Tayfun Akin, Murat Tepegoz, F. Civitci, Middle East Technical Univ. (Turkey) . . . . . [6940-123]

Wednesday 19 March

SESSION 15 . . . . . .Wed. 8:00 to 11:00 am

Smart Processing for 3rd Generation Systems

Session Chairs: **Paul L. McCarley,** Air Force Research Lab.; **John T. Caulfield,** Cyan Systems

Integration of IR focal plane array with massively parallel processor, Pashang Esfandiari, Paul Koskey, Missile Defense Agency; Csaba Rekeczky, Akos Zarandy, Eutecus Inc.; Brian Krejca, Solid State Scientific Corp.; Walter R. Buchwald, Kenneth Vaccaro, Frank Clarck, Air Force Research Lab. . . . . [6940-75]

IR focal plane array with background limited performance over 120dB dynamic range using pixel-level digitization, Stefan C. Lauxtermann, Selim Eminoglu, Teledyne Imaging Sensors . . . . . [6940-76]

CMOS architectures and circuits for high speed, Angel B. Rodríguez-Vázquez, Anafocus (Spain) . . . . . [6940-77]

Single-frame image processing techniques for low-SNR infrared imagery, Richard P. Edmondson, Polaris Sensor Technologies, Inc.; Hegegerre S. Ranganath, The Univ. of Alabama in Huntsville; Michele R. Banish, Michael H. Rodgers, Polaris Sensor Technologies, Inc. . . . . [6940-78]

An information-theoretic model of target discrimination using hyperspectral and multisensor data, Niclas Wadströmer, Ingmar G. E.Renhorn, Swedish Defence Research Agency (Sweden) . . . . . [6940-79]

Customized image processing for infrared systems *(Invited Paper)*, Dean Scribner, Northrop Grumman Corp. . . . . [6940-80]

A high-speed MWIR reference source for FPA non-uniformity correction using negative luminescence, Neil T. Gordon, James W. Edwards, Jean Giess, Andrew Graham, Mary K. Haigh, Janet E. Hails, David J. Hall, Alan J. Hydes, Stuart J. Smith, QinetiQ Ltd. (United Kingdom) . . . . [6940-81]

SESSION 16 . . . . . .Wed. 11:00 to 11:20 am

Keynote Session

Session Chair: **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate.

Future army applications for IR focal plane arrays *(Invited Paper, Presentation Only)*, Donald A. Reago, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . .[6940-82]

SESSION 17 . . . . . Wed. 11:20 am to 12:00 pm

Active Imaging I

Session Chair: **R. Kennedy McEwen,** SELEX Sensors and Airborne Systems Ltd. (United Kingdom).

Advanced infrared detectors for multimode active and passive imaging applications, Ian M. Baker, Peter Thorne, Daniel Owton, Keith J. Trundle, SELEX Sensors and Airborne Systems Infrared Ltd. (United Kingdom) . . . . . [6940-83]

Advanced pixel design for infrared 3D ladar imaging, Fabrice Guellec, Michael Tchagaspanian, Pierre Castelein, Commissariat à l'Energie Atomique (France) . . . . . [6940-84]

Lunch/Exhibition Break . . . . . 12:00 to 1:30 pm

SESSION 18 . . . . . .Wed. 1:30 to 2:10 pm

Active Imaging II

Session Chair: **R. Kennedy McEwen,** SELEX Sensors and Airborne Systems Ltd. (United Kingdom).

HgCdTe APD focal plane array development at CEA LETI Minatec, Johan Rothman, Gwladys M. Perrais, Pierre Castelein, Nicholas Baier, Michael Tchagaspanian, Philippe Ballet, Laurent Mollard, Sylvain Gout, André Perez, Eric De Borniol, Jean-Paul Chamonal, Gerard Destefanis, Commissariat à l'Energie Atomique (France); Philippe M. Tribolet, SOFRADIR (France). . . . . [6940-85]

Ultra-high sensitivity APD-based 3D ladar sensors, Michael D. Jack, Steven L. Bailey, Raytheon Vision Systems. . . . . [6940-86]

SESSION 19 . . . . . .Wed. 2:10 to 4:40 pm

Advanced FPAs with Selected 3rd Generation Properties

Session Chairs: **Peter N. J. Dennis,** QinetiQ Ltd. (United Kingdom); **Joseph G. Pellegrino,** U.S. Army Night Vision & Electronic Sensors Directorate

Advanced HgCdTe technologies and dual-band developments, Philippe M. Tribolet, SOFRADIR (France); Gérard L. Destefanis, Commissariat à l'Energie Atomique (France) . . . . . [6940-87]

Dual waveband MW/LW focal plane arrays grown by MOVPE on silicon substrates, David J. Hall, James W. Edwards, Jean Giess, Neil T. Gordon, Andrew Graham, Janet E. Hails, Alan J. Hydes, David J. Lees, QinetiQ Ltd. (United Kingdom) . . . . . [6940-88]

3rd generation MW/LWIR sensor engine for advanced tactical systems, Donald F. King, J. Graham, Adam Kennedy, R. Mullins, J. Tucker, J. McQuitty, William A. Radford, Raytheon Vision Systems; Thomas Kostrzewa, Raytheon Space and Airborne Systems; Elizabeth A. Patten, Tom F. McEwan, Jim G. Vodicka, Raytheon Vision Systems; J. Wootan, Raytheon Space and Airborne Systems . [6940-89]

Two-color (MW/LW) IRFPAs made from HgCdTe grown by MOVPE, Chris L. Jones, Jim P. Price, Leslie G. Hipwood, Chris J. Shaw, Paul Abbot, Chris D. Maxey, Hon Wo Lau, Jonathan Fitzmaurice, Rose A. Catchpole, Mike Ordish, Peter Thorne, Harald J. Weller, Raman C. Mistry, Kerren Hoade, Peter Knowles, SELEX Sensors and Airborne Systems Infrared Ltd. (United Kingdom) . . . . . [6940-90]

Megapixel dual-band QWIP focal plane array, Sarath D. Gunapala, Jet Propulsion Lab. . . . . [6940-91]

Barrier photodetectors for high-sensitivity and high-operating temperature infrared sensors, Philip C. Klipstein, SemiConductor Devices (Israel) . . . . . [6940-92]

SESSION 20 . . . . . .Wed. 4:40 to 5:40 pm

ROIC Developments

Session Chair: **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate

Development of linear array ROIC for machine vision and spectroscopy using InGaAs detector arrays with wavelength response to 1.7, 2.2 and 2.6 micron wavelengths, Douglas S. Malchow, Robert M. Brubaker, Kevin J. Flynn, Hai Nguyen, SUI, Goodrich Corp.. . . [6940-93]

New readout integrated circuit using continuous time fixed-pattern noise correction, Michael Tchagaspanian, Gilles Chammings, Bertrand Dupont, Gaelle Rapellin, Benoit Dupont, Jean-Jacques Yon, Commissariat à l'Energie Atomique (France); Jean-Luc Tissot, ULIS (France) . [6940-94]

Advanced ROICs design associated with HgCdTe technology, Michel Zecri, SOFRADIR (France) . . . . [6940-95]

Thursday 20 March

SESSION 21 . . . . . Thurs. 8:30 to 10:10 am

Infrared Activities in Japan

Session Chair: **Masafumi Kimata,** Ritsumeikan Univ. (Japan)

Detection of terahertz radiation from quantum cascade laser using vanadium oxide microbolometer focal plane arrays, Naoki Oda, Hajime Yoneyama, Tokuhito Sasaki, Masahiko Sano, NEC Corp. (Japan); Iwao Hosako, Norihiko Sekine, National Institute of Information and Communications Technology (Japan); Takayuki Sudoh, Nippon Avionics Co., Ltd. (Japan); Tomoko Irie, NEC San'ei Instruments, Ltd. (Japan). . . . . [6940-96]

IR2 camera on board PLANET-C Mission, Munetaka Ueno, The Univ. of Tokyo (Japan); Takehiko Satoh, Kazunori Uemizu, Takeshi Imamura, Masato Nakamura, Japan Aerospace Exploration Agency (Japan); Naomoto Iwagami, The Univ. of Tokyo (Japan); Hirofumi Yagi, Makoto Kawai, Masashi Ueno, Munehisa Takeda, Mitsubishi Electric Corp. (Japan); Masafumi Kimata, Ritsumeikan Univ. (Japan). . . . . [6940-97]

Development of the longwave infrared imager (LIR) onboard PLANET-C, Tetsuya Fukuhara, Japan Aerospace Exploration Agency (Japan); Makoto Taguchi, National Institute for Polar Research (Japan); Takeshi Imamura, Masato Nakamura, Japan Aerospace Exploration Agency (Japan); Naomoto Iwagami, Munetaka Ueno, The Univ. of Tokyo (Japan); Makoto Suzuki, Japan Aerospace Exploration Agency (Japan); George Hashimoto, Kobe Univ. (Japan); Mitsuteru Sato, Tohoku Univ. (Japan); Atsushi Yamazaki, Kazuhide Noguchi, Ryoichi Kashikawa, NEC TOSHIBA Space Systems, Ltd. (Japan); Isamu Higashino, Japan Aerospace Exploration Agency (Japan) . . . . . [6940-98]

Infrared position sensitive detector (IRPSD), Akihiro Takahata, Yoshiharu Shimada, Fumio Yoshioka, Masashi Yoshida, Kodenshi Corp. (Japan); Masafumi Kimata, Takashi Ota, Ritsumeikan Univ. (Japan). . . . . [6940-99]

Low-cost thermo-electric infrared FPAs and their automotive application *(Invited Paper)*, Masaki Hirota, Yoshimi Ohta, Yasuhiro Fukuyama, Nissan Motor Co. (Japan). . . . . [6940-100]

SESSION 22 . . . . . Thurs. 10:40 am to 12:00 pm

Selected Application Presentations I

Session Chair: **John Lester Miller,** FLIR Systems, Inc.

Multiple human tracking using wireless distributed pyro-electric sensors, Nanxiang Li, Qi Hao, Univ. of Alabama . . . . . [6940-101]

Multiple walker recognition using wireless distributed pyro-electric sensors, Nanxiang Li, Qi Hao, Univ. of Alabama . . . . . [6940-102]

Two-channel IR vibration sensor based on dynamic gratings in semiconductors and pyro-electrics, Nickolai V. Kukhtarev, Tatiana V. Kukhtareva, Alabama A&M Univ.; H. John Caulfield, Fisk Univ.; Phillip P. Land, Alabama A&M Univ.; Yurii P. Gnatenko, Institute of Physics (Ukraine); Alexander A. Grabar, Uzhgorod National Univ. (Ukraine); Roman V. Gamernyk, Lviv National Univ. (Ukraine); Peter Bukovskij, Institute of Physics (Ukraine); Todd W. Murray, Boston Univ. . . . . [6940-103]

Low NEP pyroelectric radiometer standards, George P. Eppeldauer, Howard W. Yoon, National Institute of Standards and Technology. . . . . [6940-104]

The development of, and applications for extended response (0.7 to 1.7µm) InGaAs focal plane arrays, Devon Turner, Timothy C. Bakker, SUI, Goodrich Corp. . . . . [6940-105]

Lunch Break . . . . . 12:00 to 1:30 pm

SESSION 23 . . . . . Thurs. 1:30 to 2:10 pm

Selected Application Presentations II

Session Chair: **John Lester Miller,** FLIR Systems, Inc.

Measurement of thermal radiation using regular glass optics and short-wave infrared detectors, Howard W. Yoon, National Institute of Standards and Technology . . . . . [6940-106]

Multispectral radiometers for temporal flares intensity emission and target-background discrimination measurements, Dario Cabib, Amir Gil, CI Systems (Israel) Ltd. (Israel); Adam D. Devir, Michael Y. Engel, Ilan Mendelevicz, Sahar Vilan, Yossi Bushlin, Institute for Advanced Research and Development (Israel) . . . . [6940-107]

SESSION 24 . . . . . Thurs. 2:10 to 4:40 pm

Selected Technology Presentations

Session Chair: **Bjørn F. Andresen,** Elbit Systems Electro-Optics ELOP Ltd. (Israel)

High-speed LWIR transparent flexible electronics, Xuejun Lu, Univ. of Massachusetts/Lowell; Xuliang Han, Brewer Science, Inc. . . . . [6940-108]

Formation and characterization of rare-earth upconverting nanoparticles using laser vaporization controlled condensation, Garry P. Glaspell, John E. Anderson, James R. Wilkins, Samy S. El-Shall, Virginia Commonwealth Univ. . . . . [6940-109]

Three-dimensional multispectral imaging for incipient pressure ulcer detection, Francine J. Prokoski, Infrared Identification Inc. . . . . [6940-110]

FPA development: from InGaAs, InSb, to HgCdTe, Henry H. Yuan, Gary W. Apgar, Jongwoo Kim, Joyce G. Laquindanum, Joseph Kimchi, Ted Wong, Judson Technologies LLC . . . . . [6940-111]

High-operability VLWIR array via interdigitated pixel utilization, Arvind I. D'Souza, Maryn G. Stapelbroek, Larry C. Dawson, Dale E. Molyneux, DRS Sensors & Targeting Systems, Inc. . . . . [6940-112]

Low-frequency noise in LWIR HgCdTe staring imager, Konstantin O. Boltar, Igor D. Burlakov, Anatoly M. Filachev, Vladimir V. Poluneev, Vladimir P. Ponomarenko, Natalia Yakovleva, Orion Research and Production Association (Russia) . . . . . [6940-114]

Conference 6941

Tuesday-Wednesday 18-19 March 2008 • Proceedings of SPIE Vol. 6941

Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XIX

Conference Chair: **Gerald C. Holst,** JCD Publishing

Program Committee: **Piet Bijl,** TNO Human Factors (Netherlands); **Dieter Clement,** Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany); **Ronald G. Driggers,** U.S. Army Night Vision & Electronic Sensors Directorate; **David P. Forrai,** L-3 Communications Cincinnati Electronics, Inc.; **Alan Irwin,** Santa Barbara Infrared, Inc.; **Keith A. Krapels,** Office of Naval Research; **Terrence S. Lomheim,** The Aerospace Corp.; **Luanne P. Obert,** U.S. Army RDECOM CERDEC NVESD; **Hector M. Reyes,** Raytheon Co.; **Endre Repasi,** Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany); **Joseph P. Reynolds,** U.S. Army RDECOM CERDEC NVESD; **Ronald B. Sartain,** Army Research Lab.; **Michael A. Soel,** FLIR Systems, Inc.; **Marija Strojnik,** Ctr. de Investigaciones en Óptica, A.C.; **Curtis M. Webb,** Northrop Grumman Corp.

Tuesday 18 March

Introductory Remarks . . . . . Tues. 8:10 to 8:15 am

Session Chair: **Gerald C. Holst,** JCD Publishing

SESSION 1 . . . . . Tues. 8:15 to 9:05 am

Modeling I

Session Chairs: **Piet Bijl,** TNO Human Factors (Netherlands); **Ronald G. Driggers,** U.S. Army Night Vision & Electronic Sensors Directorate; **David P. Forrai,** L-3 Communications Cincinnati Electronics, Inc.

What causes sampling artifacts? *(Invited Paper)*, Gerald C. Holst, JCD Publishing . . . . . [6941-01]

Modeling panchromatic performance of color filter arrays, Joseph P. Reynolds, Stephen D. Burks, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-02]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 2 . . . . . Tues. 10:30 am to 12:30 pm

Modeling II

Session Chairs: **Piet Bijl,** TNO Human Factors (Netherlands); **Ronald G. Driggers,** U.S. Army Night Vision & Electronic Sensors Directorate; **David P. Forrai,** L-3 Communications Cincinnati Electronics, Inc.

Enhancing illumination for IR/CCD camera, James B. Van Anda, Christopher Douglass, ICx Imaging Systems . [6941-03]

Modeling the benefit of color in target acquisition, Richard H. Vollmerhausen, Joseph P. Reynolds, Jeffrey T. Olson, U.S. Army Night Vision & Electronic Sensors Directorate. [6941-04]

Assessment of a resolution enhancement technique applied to an uncooled microbolometer array, John Sadi, Lightnics (France); Arnaud Crastes, ULIS (France) . . [6941-05]

Effects of video compression on target acquisition performance, Richard L. Espinola, Jae H. Cha, Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6941-06]

Short-wave infrared sensor performance modeling: small craft identification discrimination criteria for maritime security, Keith A. Krapels, Office of Naval Research; Ronald G. Driggers, U.S. Army Night Vision & Electronic Sensors Directorate; Paul Larson, Office of Naval Research . [6941-07]

An image scene registration using wavelets, Eric P. Lam, ThalesRaytheonSystems. . . . . [6941-08]

Lunch/Exhibition Break . . . . . 12:30 to 1:30 pm

SESSION 3 . . . . . Tues. 1:30 to 3:10 pm

Modeling III

Session Chairs: **Keith A. Krapels,** Office of Naval Research; **Hector M. Reyes,** Raytheon Co.; **Marija Strojnik,** Ctr. de Investigaciones en Óptica, A.C.

Monotonic correlation analysis of image quality measures for image fusion, Lance M. Kaplan, Army Research Lab.; Stephen D. Burks, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6941-09]

Comparison of human visual discrimination of vehicle silhouettes and shape metrics, Srikant K. Chari, Carl E. Halford, The Univ. of Memphis . . . . . [6941-10]

Target acquisition performance: effects of target aspect angle, dynamic imaging, and signal processing, Jaap A. Beintema, Piet Bijl, Maarten A. Hogervorst, TNO Human Factors (Netherlands); Judith Dijk, TNO-FEL (Netherlands) . . . . . [6941-11]

Infrared sensor modeling for discrimination of ground-based human activity, Eric A. Flug, Dawne M. Deaver, U.S. Army Night Vision & Electronic Sensors Directorate. [6941-12]

Modular target acquisition model and visualization tool, Piet Bijl, Maarten A. Hogervorst, Wouter K. Vos, TNO Human Factors (Netherlands) . . . . . [6941-13]

SESSION 4 . . . . . Tues. 3:40 to 6:00 pm

Modeling IV

Session Chairs: **Keith A. Krapels,** Office of Naval Research; **Luanne P. Obert,** U.S. Army Night Vision & Electronic Sensors Directorate; **Ronald B. Sartain,** Army Research Lab.

Effect of image bit depth on target acquisition modeling, Brian P. Teaney, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6941-14]

Human activity discrimination for maritime applications, Evelyn J. Boettcher, DCS Corp.; Dawne M. Deaver, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-15]

Application of compressive sensing theory in infrared imaging systems, Jing Zheng, Eddie L. Jacobs, The Univ. of Memphis . . . . . [6941-16]

Optical component analysis for a sparse sensor detection system, Karl K. Klett, Jr., Ronald B. Sartain, Keith Aliberti, Army Research Lab. . . . . [6941-17]

Optical signature modeling in urban environments, J. Michael Cathcart, Brian Kocher, Ken Camann, Georgia Institute of Technology . . . . . [6941-18]

IR-system field-performance effect of local-area contrast enhancement, Todd W. Du Bosq, Jonathan D. Fanning, U.S. Army Night Vision & Electronic Sensors Directorate. [6941-19]

The impact of spatio-temporal focal plane array nonuniformity noise on target search and identification performance, Richard L. Espinola, Jason G. Zeibel, U.S. Army Night Vision & Electronic Sensors Directorate. [6941-20]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Approaching non-uniformity correction using Hough transform, Ehsan Koohestani, Ali Homaei, Rayan-Electronics (Iran). . . . . [6941-44]

Infrared imaging spectroscopic system based on a PGP spectrograph and a monochrome infrared camera, Pilar Beatriz Garcia-Allende, Francisco Anabitarte, Olga M. Conde, Francisco J. Madruga, Mauro Lomer, Jose M. Lopez-Higuera, Univ. de Cantabria (Spain). . . . . [6941-45]

Self-referenced system for IR-to-visible conversion based on EuTTA fluorescence properties, Mariana Alfaro, Marija Strojnik, Gonzalo Paez, Ctr. de Investigaciones en Óptica, A.C. (Mexico) . . . . . [6941-46]

Elimination algorithm of fixed pattern noise for infrared image system, Changhan Park, Jungsoo Han, Samsung Thales Co., Ltd. (South Korea) . . . . . [6941-47]

Suite of proposed imaging performance metrics and test methods for fire service thermal imaging cameras, Francine K. Amon, National Institute of Standards and Technology . . . . . [6941-48]

Infrared hyperspectral imager for ground and airborne use: performance testing results and examples of measurements and applications, Dario Cabib, Robert A. Buckwald, Amir Gil, CI Systems (Israel) Ltd. (Israel) . [6941-49]

Application of spatial frequency response as a criteria for evaluating thermal imaging camera performance, Andrew Lock, Francine K. Amon, Anthony Hamins, National Institute of Standards and Technology . . . . . [6941-50]

Using extended surfaces to reduce thermal signatures of military assets, Jeffrey G. Marchetta, Edward H. Perry, Matthew D. Schultz, Brian A. Butler, Mark Grizzard, The Univ. of Memphis . . . . . [6941-51]

Alignment study for a rotationally shearing interferometer employing exact ray trace, Enoch Gutierrez-Herrera, Marija Strojnik, Ctr. de Investigaciones en Óptica, A.C. (Mexico). . . . . [6941-52]

Wednesday 19 March

SESSION 5 . . . . . .Wed. 8:00 to 10:00 am

Modeling V

Session Chairs: **Ronald G. Driggers,** U.S. Army Night Vision & Electronic Sensors Directorate; **Terrence S. Lomheim,** The Aerospace Corp.; **Joseph P. Reynolds,** U.S. Army Night Vision & Electronic Sensors Directorate

Modeling diffraction MTF, Melvin Friedman, Jay Vizgaitis, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-21]

Target identification performance of superresolution versus dither, Jonathan D. Fanning, Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-22]

Applications of evolving performance models, Jeanne A. Atwell, Brent P. Canova, Ball Aerospace & Technologies Corp. . . . . [6941-23]

Modeling impact of magnification on observer performance, Brian P. Teaney, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-24]

MWIR persistent surveillance performance for human backtracking, Ronald G. Driggers, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-25]

Low- to mid-altitude tracking resolution requirements for urban vehicles, Aaron L. Robinson, The Univ. of Memphis; Brian S. Miller, Philip I. Richardson, Chun Ra, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-26]

SESSION 6 . . . . . Wed. 10:30 am to 12:10 pm

Atmospheric Effects

Session Chairs: **Dieter Clement,** Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany); **Endre Repasi,** Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany); **Marija Strojnik,** Ctr. de Investigaciones en Óptica, A.C. (Mexico)

Analysis of image distortions by atmospheric turbulence and computer simulation of turbulence effects, Endre Repasi, Robert Weiss, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany) . . [6941-27]

Perception range prediction for IR pilot sight, Robert Weiss, Wolfgang Wittenstein, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany) . . [6941-28]

Dust and dew affecting infrared signatures, Yossi Bushlin, Alexander B. Lessin, Arcady Reinov, Dieter Clement, Institute for Advanced Research and Development (Israel) . . [6941-29]

CACAMO: computer-aided camouflage assessment of moving objects, Markus Müller, Thomas Mueller, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany) . . . . . [6941-30]

Adapting speckle imaging for field use in real-time IR-video applications, Fernando E. Ortiz, EM Photonics, Inc.; Carmen J. Carrano, Lawrence Livermore National Lab.; Petersen F. Curt, Michael R. Bodnar, EM Photonics, Inc.. . . . . [6941-31]

Lunch/Exhibition Break . . . . . 12:10 to 1:30 pm

SESSION 7 . . . . . .Wed. 1:30 to 3:10 pm

Systems and Testing I

Session Chairs: **Alan Irwin,** Santa Barbara Infrared, Inc.; **Michael A. Soel,** FLIR Systems, Inc.; **Curtis M. Webb,** Northrop Grumman Corp.

Modulation transfer function measurement on QWIP focal plane array, Sir Don B. Rafol, Eric Cho, Diversified Electronics Corp.. . . . . [6941-32]

Comparison of Fourier transform methods for calculating MTF, Joseph D. LaVeigne, Santa Barbara Infrared, Inc.; Stephen D. Burks, U.S. Army Night Vision & Electronic Sensors Directorate; Brian Nehring, Santa Barbara Infrared, Inc.. . . . . [6941-33]

Edge response revisited, Shimshon N. Lashansky, Elbit Systems Electro-Optics ELOP Ltd. (Israel) . . . . . [6941-34]

Infrared lens characterization using common undersampled systems, Colin A. Nichols, StingRay Optics, LLC . . . . . [6941-35]

A means for calculating the optics MTF of an under-sampled IR imaging system, Stephen D. Burks, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6941-36]

SESSION 8 . . . . . .Wed. 3:40 to 5:40 pm

Systems and Testing II

Session Chairs: **Alan Irwin,** Santa Barbara Infrared, Inc.; **Michael A. Soel,** FLIR Systems, Inc.; **Curtis M. Webb,** Northrop Grumman Corp.

Model-based Tec-Less FPN correction with bolometric resistance prediction, Benoit Dupont, Aurelie Touvignon, ULIS (France); Antoine Dupret, Univ. Paris-Sud-XI (France); Patrick Villard, Commissariat à l'Energie Atomique (France) . . . . . [6941-37]

Measurement of effective temperature range of fire service thermal imaging cameras, Francine K. Amon, Nelson P. Bryner, National Institute of Standards and Technology . . . . . [6941-38]

Practical measurement and analysis of the nonuniformity of thermal imaging cameras for first responders, Andrew Lock, Francine K. Amon, Anthony Hamins, National Institute of Standards and Technology . . . . . [6941-39]

New automatic testing system for today's airborne laser sensors, Dario Cabib, CI Systems (Israel) Ltd. (Israel) . . . . . [6941-40]

Relative color delineation testing of visible camera systems, Jason A. Mazzetta, Stephen D. Scopatz, Fred Ennerson, Electro Optical Industries, Inc.. . . . . [6941-41]

Clutter and signatures from near infrared testbed sensor, Richard B. Sanderson, Air Force Research Lab.; Joel B. Montgomery, M & M Aviation; John F. McCalmont, Air Force Research Lab. . . . . [6941-42]

Related Courses

SC892 **Infrared Search and Track Systems** *(Schwering)*
NEW Monday, 1:30 to 5:30 pm

SC896 **Optical Testing of Focal Plane Array Imagers- Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* Monday, 8:30 am to 5:30 pm
NEW

SC900 **Uncooled Thermal Imaging Detectors and Systems** (Hanson) Sunday, 8:30 am to 5:30 pm

SC134 **Optical Design Fundamentals for Infrared Systems** *(Kampe)* Sunday, 8:30 am to 5:30 pm

SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* Tuesday, 8:30 am to 12:30 pm

SC278 **Infrared Detectors** *(Dereniak)* Tuesday, 1:30 to 5:30 pm

SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* Wednesday, 8:30 am to 5:30 pm

SC835 **Infrared Systems - Technology & Design** *(Daniels)* Monday / Tuesday, 8:30 am to 5:30 pm / 8:30 am to 12:30 pm

See pp. 101–117 for course descriptions.

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Technologies for Synthetic Environments: Hardware-in-the-Loop Testing XIII

Conference Chair: **Robert Lee Murrer,** Millennium Engineering and Integration Co.

Conference Co-Chair: **James A. Buford,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.

Program Committee: **Mary A. Amick,** U.S. Air Force; **David Brett Beasley,** Optical Sciences Corp.; **Paul Tristan Bryant,** Left Coast Consulting; **Charles F. Coker,** Air Force Research Lab.; **David S. Cosby,** U.S. Army Research, Development and Engineering Command; **Naresh C. Das,** Army Research Lab.; **George C. Goldsmith,** U.S. Air Force; **Alexander G. Hayes,** MIT Lincoln Lab.; **Jay B. James,** Santa Barbara Infrared, Inc.; **John M. Lannon,** RTI International; **Heard S. Lowry,** Aerospace Testing Alliance; **Scott B. Mobley,** U.S. Army Aviation and Missile Command; **Randy A. Nicholson,** Aerospace Testing Alliance; **Robert M. Patchan,** The Johns Hopkins Univ. Applied Physics Lab.; **Donald R. Snyder,** Air Force Research Lab.; **Steven Lawrence Solomon,** Acumen Scientific; **Rhoe A. Thompson,** Air Force Research Lab.; **Owen M. Williams,** Defence Science and Technology Organisation (Australia)

Monday 17 March

SESSION 1 . . . . . .Mon. 8:30 to 10:10 am

Flight Motion Simulators, Facilities, and LADAR

Session Chairs: **James A. Buford,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Donald R. Snyder,** Air Force Research Lab.; **Mary A. Amick,** U.S. Air Force

Major specification discriminators affecting advanced motion simulator configurations, Robert W. Mitchell, Ideal Aerosmith, Inc. . . . . [6942-01]

Keeping up with dynamics of next generation missiles, Michael Warden, Robin Hauser, Peter Hofstetter, Martin Kägi, ACUTRONIC Schweiz AG (Switzerland) . . . . . [6942-02]

An object-oriented simulation architecture for utilizing hardware-in-the-loop simulation within a many-on-many engagement scenario, Ryan N. Brindley, Jeffrey P. Gareri, Simulation Technologies, Inc.; Scott B. Mobley, U.S. Army Aviation and Missile Command. . . . . [6942-03]

Geographical-distributed stimulation architecture for system of system HWIL sensor and weapon facilities, James A. Buford, Jr., Bernard W. Vatz II, M. Joshua Williams, Thomas C. Barnett, Cliff Burson, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.[6942-04]

Ladar projector calibration sensor for the HWIL simulation development, Hajin J. Kim, U.S. Army Aviation and Missile Command . . . . . [6942-05]

SESSION 2 . . . . . Mon. 10:40 am to 12:20 pm

Scene Projector Systems I

Session Chairs: **Robert Lee Murrer,** Millennium Engineering and Integration Co.; **George C. Goldsmith,** U.S. Air Force; **Rhoe A. Thompson,** Air Force Research Lab.

NIST traceable infrared test chamber calibration using the BXR and MDXR, Adriaan C. Carter, Raju Datla, National Institute of Standards and Technology; Timothy M. Jung, Allan W. Smith, James A. Fedchak, Solomon I. Woods, Jung Research and Development Corp. . . . . [6942-27]

Development of infrared scene projectors for fire-fighter cameras, Jorge E. Neira, Joseph P. Rice, Francine K. Amon, National Institute of Standards and Technology. . . . [6942-06]

Two-band DMD-based infrared scene simulator, Julia R. Dupuis, David J. Mansur, Robert M. Vaillancourt, OPTRA, Inc.. . . . . [6942-07]

Design of NIR and LWIR projector systems to support the AMRDEC multispectral simulation HWIL facility, Daniel A. Saylor, Optical Sciences Corp. . . . . [6942-08]

High-temperature resistor pixels, Steven L. Solomon, Robert P. Ginn, Acumen Scientific; Stephen A. Campbell, Maryam Jalali, Univ. of Minnesota . . . . . [6942-09]

Lunch Break . . . . . 12:20 to 1:30 pm

SESSION 3 . . . . . .Mon. 1:30 to 2:30 pm

Scene Projector Systems II

Session Chairs: **Robert M. Patchan,** The Johns Hopkins Univ. Applied Physics Lab.; **George C. Goldsmith,** U.S. Air Force; **Rhoe A. Thompson,** Air Force Research Lab.

Plasma TVs for bugs, Steven L. Solomon, Robert P. Ginn, Acumen Scientific . . . . . [6942-10]

Development of photonic crystal-based scene projection technology, John T. Caulfield, Cyan Systems . . . . . [6942-11]

Testing and results of an infrared polarized scene generator concept demonstrator, Peter S. Erbach, Larry Pezzaniti, David B. Chenault, Polaris Sensor Technologies, Inc.. . . . . [6942-12]

SESSION 4 . . . . . .Mon. 2:30 to 4:50 pm

Diode-Based Scene Projector Systems

Session Chairs: **Heard S. Lowry,** Aerospace Testing Alliance; **David Brett Beasley,** Optical Sciences Corp.; **Paul T. Bryant,** Left Coast Consulting

Thermal simulations of packaged IR LED arrays, John Lawler, Joseph Currano, Advanced Thermal and Environmental Concepts, Inc.. . . . . [6942-13]

Room temperature operated GaSb-based type-I quantum well light-emitting diodes, Sergey Suchalkin, Power Photonic Corp.; Gela Kipshidze, Leon Shterengas, Takashi Hosoda, Stony Brook Univ.; David Westerfeld, Power Photonic Corp.; Gregory L. Belenky, Stony Brook Univ. . . . . [6942-14]

Development of a mid-infrared interband cascade LED array, John L. Bradshaw, John D. Bruno, Frederick J. Towner, Christi A. Shiner, John T. Pham, Maxion Technologies, Inc.; Sergey D. Suchalkin, Gregory L. Belenky, Stony Brook Univ. . . . . [6942-15]

Design and fabrication of 2XD long wave (8µm) light emitting device arrays for IR scene projection, Naresh C. Das, Army Research Lab.; John L. Bradshaw, Frederick J. Towner, Maxion Technologies, Inc. . . . . [6942-16]

Performance of 64x64 MWIR superlattice light-emitting diode (SLED) array for IR scene generation, Naresh C. Das, Army Research Lab.; Fouad Kimilev, Univ. of Delaware; Thomas F. Boggess, The Univ. of Iowa . . . . . [6942-17]

Hybrid infrared scene projector (HIRSP): a high dynamic range infrared scene projector, Thomas M. Cantey, David B. Beasley, Optical Sciences Corp.; Gary H. Ballard, U.S. Army Aviation and Missile Command; David S. Cosby, U.S. Army Research, Development and Engineering Command . . . . . [6942-18]

SESSION 5 . . . . . .Mon. 4:50 to 5:30 pm

Scene Generation Technologies

Session Chairs: **David S. Crosby,** QSS Group, Inc.; **Charles F. Coker,** Air Force Research Lab.

Real-time dynamic PC image generation techniques for high performance and high dynamic range fidelity, Dennis H. Bunfield, AMRDEC; Joesph W. Morris, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; Gary H. Ballard, U.S. Army Aviation and Missile Command; Darian E. Trimble, Thomas K. Fronckowiak, AMRDEC . . . . . [6942-19]

Improvement of global illumination methods, Nicolas Douchin, Jean Latger, Antoine Boudet, OKTAL Synthetic Environment (France); Alain Y. Le Goff, DGA/DCE/CELAR (France) . . . . . [6942-20]

Tuesday 18 March

SESSION 6 . . . . . Tues. 8:00 to 9:00 am

Scene Projector Calibration and Characterization I

Session Chairs: **Owen M. Williams,** Defence Science and Technology Organisation (Australia); **Naresh C. Das,** Army Research Lab.; **Scott B. Mobley,** U.S. Army Aviation and Missile Command.

Technical issues in the development of scene-projection systems for sensor calibration, characterization, and HWIL testing at AEDC, Heard S. Lowry, Dustin H. Crider, Mary F. Breeden, Randy A. Nicholson, Aerospace Testing Alliance . . . . . [6942-21]

Resistor array infrared projector nonuniformity correction: search for performance improvement III, Robert A. Joyce, Leszek Swierkowski, Owen M. Williams, Defence Science and Technology Organisation (Australia) . . . . . [6942-22]

Calibration and characterization of the seeker experimental system's cryogenic scene-projection system, Matthew G. Brown, Fino J. Caraco, Anthony Gabrielson, David C. Harrison, Jonathan M. Swenson, MIT Lincoln Lab.. . . . . [6942-23]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 7 . . . . . Tues. 10:30 to 11:30 am

Scene Projector Calibration and Characterization II

Session Chairs: **Owen M. Williams,** Defence Science and Technology Organisation (Australia); **Naresh C. Das,** Army Research Lab.; **Scott B. Mobley,** U.S. Army Aviation and Missile Command

The LADAR scene projector (LRSP) characterization sensor, Mike Cornell, Optical Sciences Corp. . . . . [6942-24]

LWIR AutoNUC performance issues for resistor arrays, Jack R. Lippert, Dynetics, Inc. . . . . [6942-25]

AMRDEC FMS projector gradient reduction, Mark Bowden, Optical Sciences Corp. . . . . [6942-26]

Related Courses

SC892 **Infrared Search and Track Systems** *(Schwering)*
NEW Monday, 1:30 to 5:30 pm

SC896 **Optical Testing of Focal Plane Array Imagers-**
NEW **Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* Monday, 8:30 am to 5:30 pm

SC900 **Uncooled Thermal Imaging Detectors and Systems**
NEW *(Hanson)* Sunday, 8:30 am to 5:30 pm

SC134 **Optical Design Fundamentals for Infrared Systems** *(Kampe)* Sunday, 8:30 am to 5:30 pm

SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* Tuesday, 8:30 am to 12:30 pm

SC278 **Infrared Detectors** *(Dereniak)* Tuesday, 1:30 to 5:30 pm

SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* Wednesday, 8:30 am to 5:30 pm

SC835 **Infrared Systems - Technology & Design** *(Daniels)* Monday / Tuesday, 8:30 am to 5:30 pm / 8:30 am to 12:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Technologies for Homeland Security and Law Enforcement

Chair: **Edward M. Carapezza,** Univ. of Connecticut and DARPA

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6943 **Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense VII** *(Carapezza)* p. 30

6945 **Optics and Photonics in Global Homeland Security IV** *(Halvorson, Lehrfeld, Saito)* p. 33

Global Homeland Security Technical Meeting *(Halvorson)* 5:00 to 6:00 pm, p. 8
This events is organized by Conference 6945. Interested attendees are welcome to attend.

6944 **Biometric Technology for Human Identification V** *(Kumar, Prabhakar, Ross)* p. 32

Courses of Related Interest

SC891 ***NEW*** **Security of Information and Communication** Networks *(Kartalopoulos)* 1:30 to 5:30 pm, p. 110

SC836 **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, p. 104

SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)* 1:30 to 5:30 pm, p. 101

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works

11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair

11:00 am to 3:00 pm

FREE Exhibition

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense VII

Conference Chair: **Edward M. Carapezza,** Univ. of Connecticut and DARPA

Program Committee: **John G. Blitch,** ARACAR: Alliance for Robot Assisted Crisis Assessment and Response; **George V. Cybenko,** Dartmouth College; **Mildred A. Donlon,** Defense Advanced Research Projects Agency; **John S. Eicke,** Army Research Lab.; **Jeffrey R. Heberley,** U.S. Army Armament Research, Development and Engineering Ctr.; **Kurt A. Henry,** U.S. Navy Medical Corps.; **Todd M. Hintz,** Space & Naval Warfare Systems Command, San Diego; **Myron E. Hohil,** U.S. Army Research, Development and Engineering Command; **Bahram Javidi,** Univ. of Connecticut; **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Pradeep K. Khosla,** Carnegie Mellon Univ.; **David Knowles,** U.S. Secret Service; **Michael A. Kolodny,** Army Research Lab.; **Parsa Mirhaji,** The Univ. of Texas Health Science Ctr. at Houston; **Paul F. Morgan,** U.S. Special Operations Command; **Tien Pham,** Army Research Lab.; **Dennis J. Reimer,** National Memorial Institute for the Prevention of Terrorism; **Nino Srour,** Army Research Lab.; **Glenn T. Shwaery,** Univ. of New Hampshire

Monday 17 March

SESSION 1 . . . . . .Mon. 8:00 to 8:40 am

Keynote Session

Session Chair: **Edward M. Carapezza,** Univ. of Connecticut

Enhanced cyber security with CyLab Technologies (Keynote Presentation), Pradeep K. Khosla, Carnegie Mellon Univ. . . . . [6943-01]

SESSION 2 . . . . . .Mon. 8:40 to 9:40 am

Cybercrimes and Cyberterrorism Technologies and Systems

Session Chairs: **Edward M. Carapezza,** Univ. of Connecticut; **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

Behavioral biometrics for verification and recognition of malicious software agents, Roman V. Yampolskiy, Venu Govindaraju, Univ. at Buffalo. . . . . [6943-02]

Development of network attack characterization modeling and simulation testbed, Alexander P. Barzilov, Phillip C. Womble, Bruce Kessler, Uta Ziegler, Ivan Novikov, Jonathon Paschal, Ronald Hopper, Western Kentucky Univ.. . [6943-03]

Recognition of coordinated adversarial behaviors from multi-source information, Georgiy M. Levchuk, Aptima, Inc.; Djuana Lea, Air Force Research Lab.; Krishna R. Pattipati, Univ. of Connecticut . . . . . [6943-04]

SESSION 3 . . . . . Mon. 10:20 am to 12:20 pm

Robotic amd Mobile Sensor Technologies and Systems

Session Chairs: **Edward M. Carapezza,** Univ. of Connecticut; **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

SMARBot: a modular miniature mobile robot platform, Yan Meng, Kerry Johnson, Brian Simms, Matthew Conforth, Stevens Institute of Technology . . . . . [6943-05]

Inexpensive semi-autonomous ground vehicles for defusing IED's, Christopher Davenport, Phillip C. Womble, James Lodmell, Kyle Moss, Alexander P. Barzilov, Jonathon Paschal, Robert Hernandez, Western Kentucky Univ. . . . . [6943-06]

Mobility control in mobile wireless ad hoc-based unmanned ground vehicles, Pedro M. Wightman, Daladier Jabba Molinares, Miguel A. Labrador, Univ. of South Florida . . . . . [6943-07]

Performance of sensors mounted on a robotic platform for personnel detection, Thyagaraju R. Damarla, Army Research Lab. . . . . [6943-08]

Stress-resolved and cockroach-friendly piezoelectric sensors, Rodrigo A. Cooper, Hyungoo Lee, Stephanie J. Butler, Bartek Mika, David Clayton, Ke Wang, Texas A&M Univ.; Jingang Yi, San Diego State Univ.; Hong Liang, Texas A&M Univ. . . . . [6943-09]

Three-dimensional modeling of environments contaminated with chemical, biological, radiological and nuclear (CBRN) agents, Piotr Jasiobedzki, Ho-Kong Ng, Michel Bondy, MacDonald, Dettwiler and Associates Ltd. (Canada); Carl McDiarmid, Royal Canadian Mounted Police (Canada) . . . . . [6943-10]

Lunch Break . . . . . 12:20 to 1:30 pm

SESSION 4 . . . . . .Mon. 1:30 to 4:50 pm

Biological and Chemical Agent Sensor Technologies and Systems

Session Chairs: **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN; **Stanley A. Erickson,** National Institute of Justice

National Institute of Justice (NIJ): current R&D in biometrics *(Invited Paper)*, Stanley A. Erickson, National Institute of Justice. . . . . [6943-11]

Localization to potential chemical/biological event using acoustics on a moving platform, Sachi V. Desai, U.S. Army Research, Development and Engineering Command [6943-12]

Further studies on the detection of chemical agents using an alkaline energy cell, John Shewchun, Wayne State Univ. . . . . [6943-13]

Distributed intrinsic chemical sensors for terrorist countermeasures, Robert A. Lieberman, Steven R. Cordero, Jeff Iida, Intelligent Optical Systems, Inc.. . . . . [6943-14]

Noise phenomena in porous silicon gas sensors, Vladimir M. Aroutiounian, Zara O. Mkhitaryan, Arkadi A. Shatveryan, Yerevan State Univ. (Armenia). . . . . [6943-15]

Porous silicon room temperature nanosensor covered by TiO_2 or ZnO thin films, Vladimir M. Aroutiounian, Valery M. Arakelyan, Vardan Galstyan, Khachatur Martirosuan, Yerevan State Univ. (Armenia). . . . . [6943-16]

Design and build a compact Raman sensor for identification of chemical composition, Christopher S. Garcia, Old Dominion Univ.; M. Nurul Abedin, Syed Ismail, NASA Langley Research Ctr.; Shiv K. Sharma, Anupam K. Misra, Univ. of Hawai'i at Manoa; Stephen P. Sandford, NASA Langley Research Ctr.; Hani E. Elsayed-Ali, Old Dominion Univ. . . . . [6943-17]

Tin dioxide thin film hydrogen nanosensor, Vladimir M. Aroutiounian, Arsen Adamyan, Zaven N. Adamyan, Artsrun H. Arakelyan, Yerevan State Univ. (Armenia). . . . . [6943-18]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 5 . . . . . Tues. 10:30 to 11:50 am

Keynote Session

Session Chair: **Edward M. Carapezza,** Univ. of Connecticut; **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

Joint session with conference 6963.

Models of processing in the visual cortex (Keynote Presentation) *(Invited Paper)*, James S. Albus, National Institute of Standards and Technology . . . . . [6943-19]

Photon counting 3D passive sensing and processing for target recognition (Keynote Presentation) *(Invited Paper)*, S. Yeom, Daegu Univ. (South Korea); Bahram Javidi, Univ. of Connecticut; Edward A. Watson, Air Force Research Lab. . . . . [6963-21]

Lunch/Exhibition Break . . . . . 11:50 am to 1:10 pm

SESSION 6 . . . . . Tues. 1:10 to 1:50 pm

Keynote Session

Session Chair: **Edward M. Carapezza,** Univ. of Connecticut

Integrative bio-surveillance for bio-terrorism and disaster preparedness: a semantic web approach (Keynote Presentation), Parsa Mirhaji, The Univ. of Texas Health Science Ctr. at Houston . . . . . [6943-20]

SESSION 7 . . . . . Tues. 1:50 to 3:10 pm

Command, Control, Communications, and Intelligence (C3I)

Session Chairs: **Parsa Mirhaji,** The Univ. of Texas Health Science Ctr. at Houston; **Edward M. Carapezza,** Univ. of Connecticut

Information integration for public safety officers, Scott A. Valcourt, Pushpa Datla, Kent Chamberlin, Benjamin McMahon, Univ. of New Hampshire . . . . . [6943-21]

Cognitive feedback and adaptation in multi-agent systems for disaster situation management, Gabriel Jakobson, Altusys Corp.; John F. Buford, Avaya Inc.; Lundy M. Lewis, Southern New Hampshire Univ. . . . . [6943-22]

Traffic data production: high-density attraction point-based approaches for path planning in complex urban environments, Alexandre Bergeron Guyard, Defence Research and Development Canada (Canada); René Proulx, Thales Canada (Canada); Luc Pigeaon, Defence Research and Development Canada (Canada) . . . . . [6943-23]

Bayesian performance metrics of binary sensors in homeland security applications, Tomasz P. Jannson, Thomas C. Forrester, Physical Optics Corp.. . . . . [6943-24]

SESSION 8 . . . . . Tues. 3:40 to 5:20 pm

Radar and Through-the-Wall Sensor Systems

Session Chair: **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

Holographic radar imaging privacy techniques utilizing dual-frequency implementation, Douglas L. McMakin, Thomas E. Hall, David M. Sheen, Pacific Northwest National Lab. . . . . [6943-25]

Benefits of wide-area intrusion detection systems using FMCW radar, Pierre Poitevin, ICx Technologies, Inc. (Canada); Walker Butler, John Bjornholt, ICx Technologies, Inc.. . . . . [6943-26]

Distance range of human detection by active Doppler and passive ultrasonic methods, Alexander E. Ekimov, James M. Sabatier, The Univ. of Mississippi . . . . . [6943-27]

Waveform design for through-the-wall radar imaging applications, Habib Estephan, Moeness G. Amin, Konstantin M. Yemelyanov, Villanova Univ. . . . . [6943-28]

Interpretation of through-the-wall radar imagery by probabilistic volume model building, Bijan G. Mobasseri, Villanova Univ.. . . . . [6943-29]

Wednesday 19 March

SESSION 9 . . . . . .Wed. 8:00 to 9:20 am

Keynote Session

Session Chair: **Edward M. Carapezza,** Univ. of Connecticut

Joint session with conference 6963.

Design of trustworthy fielded sensor networks (Keynote Presentation), Gregory J. Pottie, Univ. of California/Los Angeles . . . . . [6943-30]

MEMS and NEMS technologies for sensor applications (Keynote Presentation), Panos G. Datskos, Oak Ridge National Lab. . . . . [6943-31]

SESSION 10 . . . . . Wed. 9:20 am to 12:00 pm

Security and Surveillance Systems I

Session Chair: **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

WaterWATCH program overview, Gerald W. Driggers, Miltec Systems Co. and U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; Mark Umansky, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; Tammy Cleveland, Lisa M. Araujo, Robert Spohr, Miltec Systems Co. . . . . [6943-32]

Submarine imaging systems: developing improved capabilities and technologies, David M. Duryea, Naval Sea Systems Command; Carl E. Lindstrom, Naval Undersea Warfare Ctr.; Riad Sayegh, Naval Sea Systems Command . . . . . [6943-33]

Results of optical detection trials in harbor environment, Rob A. W.Kemp, TNO (Netherlands). . . . . [6943-34]

Maritime acoustic detection of aircrafts to increase flight safety and homeland security: an experimental study, Leng Sim, Latasha Solomon, Steve Tenney, Army Research Lab. . . . . [6943-35]

Real-time processing of a distributed phase-sensitive fiber optic sensor, Christi K. Madsen, Tim Snider, Texas Agricultural & Mechanical Univ.. . . . . [6943-36]

Systems and technologies for enhanced coastal maritime security, Edward M. Carapezza, Univ. of Connecticut . . . . . [6943-37]

Lunch/Exhibition Break . . . . . 12:00 to 1:30 pm

SESSION 11 . . . . . .Wed. 1:30 to 3:10 pm

Security and Surveillance Systems II

Session Chairs: **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN; **Edward M. Carapezza,** Univ. of Connecticut

A Compton telescope for locating radioactive material, James M. Ryan, John R. Macri, Justin R. Baker, Mark L. McConnell, Univ. of New Hampshire; Richard Carnade, Neva Ridge Technologies, Inc.. . . . . [6943-38]

Fusion-based multi-target tracking and localization for intelligent surveillance systems, Haroun Rababaah, Amir H. Shirkhodaie, Tennessee State Univ. . . . . [6943-39]

Advanced border monitoring sensor system, Ronald A. Knobler, Mark A. Winston, McQ, Inc. . . . . [6943-40]

A wireless electronic monitoring system for securing milk from farm to processor, Phillip C. Womble, Western Kentucky Univ.; Fred A. Payne, Univ. of Kentucky; Suraj Alexander, Univ. of Louisville; Chris Thompson, Univ. of Kentucky; Ryan Moore, Western Kentucky Univ.; Brian Luck, Univ. of Kentucky; Jonathon Paschal, Western Kentucky Univ.; Timothy S. Stombaugh, William Crist, Univ. of Kentucky . . . . . [6943-41]

A demonstrator for an integrated subway protection system, Edoardo Detoma, SEPA (Italy) . . . . . [6943-42]

SESSION 12 . . . . . .Wed. 3:40 to 4:40 pm

Counter-sniper Systems

Session Chairs: **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN; **Myron E. Hohil,** U.S. Army Research, Development and Engineering Command

Acoustic gunshot location in complex environments: concepts and results, Robert L. Showen, Robert B. Calhoun, Wai C. Chu, ShotSpotter, Inc.. . . . . [6943-43]

Unattended acoustic sensors for mortar classification, Sachi V. Desai, U.S. Army Research, Development and Engineering Command . . . . . [6943-44]

Identification of localized mortar events as either launch/impact, Sachi V. Desai, U.S. Army Research, Development and Engineering Command. . . . . [6943-45]

Thursday 20 March

SESSION 13 . . . . . Thurs. 8:40 to 11:10 am

Intelligence Exploitation Systems and Technolgies

Session Chair: **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

JPEG 2000: fast access to large grayscale images, Margaret A. Lepley, The MITRE Corp. . . . . [6943-46]

Massive-scale video anti-piracy monitoring, Paul S. Cadaret, UNICON Inc.. . . . . [6943-47]

Parallel implementation of high-speed, phase diverse atmospheric turbulence compensation method on a neural network-based architecture, William W. Arrasmith, Sean Sullivan, Florida Institute of Technology . . . . . [6943-48]

Dynamic building visualization for first responders, Nathan T. Denny, 21st Century Systems, Inc.. . . . . [6943-49]

Computational acceleration using neural networks, Paul S. Cadaret, UNICON Inc. . . . . [6943-50]

Reactive-transmitter, Akbar Rahmani Nejad, Civil Aviation Organization (Iran) . . . . . [6943-51]

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Biometric Technology for Human Identification V

Conference Chairs: **B. V. K. Vijaya Kumar,** Carnegie Mellon Univ.; **Salil Prabhakar,** Digital Persona Inc.; **Arun A. Ross,** West Virginia Univ.

Program Committee: **Besma R. Abidi,** The Univ. of Tennessee; **Andy Adler,** Carleton Univ. (Canada); **George N. Bebis,** Univ. of Nevada/Reno; **Reza Derakhshani,** Univ. of Missouri/Kansas City; **Jean-Luc E. Dugelay,** Institut Eurécom (France); **Julian Fierrez-Aguilar,** Univ. Autónoma de Madrid (Spain); **Patrick J. Flynn,** Univ. of Notre Dame; **Vincent Hsu,** Identix Inc.; **Anil K. Jain,** Michigan State Univ.; **Jaihie Kim,** Yonsei Univ. (South Korea); **Javier Ortega-Garcia,** Univ. Autónoma de Madrid (Spain); **Josef Kittler,** Univ. of Surrey (United Kingdom); **Ajay Kumar,** Indian Institute of Technology Delhi (India); **Stan Z. Li,** Chinese Academy of Sciences (China); **David Maltoni,** Univ. degli Studi di Bologna (Italy); **D. M. Monro,** Univ. of Bath (United Kingdom); **Lisa Ann Osadciw,** Syracuse Univ.; **Sharath Pankanti,** IBM Thomas J. Watson Research Ctr.; **Jonathan Phillips,** National Institute of Standards and Technology; **Norman Poh,** Univ. of Surrey (United Kingdom); **Douglas A. Reynolds,** MIT Lincoln Lab.; **Sudeep Sarkar,** Univ. of South Florida; **Marios Savvides,** Carnegie Mellon Univ.; **Michael E. Schuckers,** St. Lawrence Univ.; **Diego A. Socolinsky,** Equinox Corp.; **Colin Soutar,** Bioscrypt Inc. (Canada); **Nicole A. Spaun,** Federal Bureau of Investigation; **Zhenan Sun,** Institute of Automation (China); **Elham Tabassi,** National Institute of Standards and Technology; **Umut Uludag,** Lumidigm, Inc.; **Damon Woodard,** Clemson Univ.

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 1 . . . . . Tues. 10:30 to 11:50 am

Face I

SESSION 2 . . . . . Tues. 1:10 to 2:10 pm

Iris and Signature

SESSION 3 . . . . . Tues. 2:10 to 3:30 pm

Face II

SESSION 4 . . . . . Tues. 4:00 to 5:00 pm

Hand and Palmprint.

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Wednesday 19 March

SESSION 5 . . . . . Wed. 9:00 to 10:00 am

Privacy and Forensics

SESSION 6 . . . . . Wed. 10:30 to 11:30 am

Fusion

SESSION 7 . . . . . Wed. 1:00 to 2:00 pm

Fingerprints

SESSION 8 . . . . . Wed. 2:00 to 3:00 pm

Statistical Analysis

Related Courses

SC891 **Security of Information and Communication** *NEW* **Networks** *(Kartalopoulos)* Sunday, 1:30 to 5:30 pm

SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)* Monday, 1:30 to 5:30 pm

SC836 **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* Sunday, 1:30 to 5:30 pm

See pp. 101–117 for course descriptions.

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Optics and Photonics in Global Homeland Security IV

Conference Chairs: **Craig S. Halvorson,** Lawrence Livermore National Lab.; **Daniel Lehrfeld,** Photonic Products Group, Inc.; **Theodore T. Saito,** Lawrence Livermore National Lab.

Program Committee: **Michael J. DeWeert,** BAE Systems; **Refael Gatt,** Global Security Devices (Israel); **Jeffrey S. Gordon,** GE Global Research; **Susan F. Hallowell,** Transportation Security Lab.; **Dan J. Kroll,** Hach Co., Inc.; **Han Q. Le,** Univ. of Houston; **Ashok K. Sood,** Magnolia Optical Technologies, Inc.; **Sarka O. Southern,** GAIA Medical Institute

Monday 17 March

Chair Overview . . . . . .Mon. 1:00 to 1:30 pm

Session Chair: **Craig S. Halvorson,** Lawrence Livermore National Lab.; **Jeffrey S. Gordon,** GE Global Research

SESSION 1 . . . . . .Mon. 1:30 to 4:50 pm

Radiation Detection

Session Chair: **Jeffrey S. Gordon,** GE Global Research

Strategic technology roadmap for radiation detection *(Invited Paper)*, Anu P. Bowman, U.S. Dept. of Homeland Security . . . . . [6945-01]

Iodine based compound semiconductors for room temperature gamma-ray spectroscopy, Azaree T. Lintereur, Wei Qiu, Juan Nino, James E. Baciak, Jr., Univ. of Florida . . . . . [6945-02]

An equivalent n-source for WGPu derived from a spectrum-shifted PuBe source, Gabriel M. Ghita, Glenn E. Sjoden, James E. Baciak, Jr., Scottie Walker, V. S. Cornelison, Univ. of Florida. . . . . [6945-03]

Detection of illicit substances through neutron interrogation and Compton imaging, Reynold J. Cooper, Andrew J. Boston, Helen C. Boston, Matthew R. Dimmock, Paul J. Nolan, The Univ. of Liverpool (United Kingdom); Malcolm Joyce, Robert Mackin, Bob D'Mellow, Michael Aspinall, Lancaster Univ. (United Kingdom); Anthony J. Peyton, Roelof G. van Silfhout, The Univ. of Manchester (United Kingdom). . . . . [6945-04]

A new integrated neutron/gamma radio isotope identification device evaluated under mixed radiation fields, Adrian Ivan, Brent A. Clothier, Daniel B. McDevitt, GE Global Research; James Williams, GE Energy . . . . . [6945-05]

Improved plutonium identification and characterization results with NaI(Tl) detector using ASEDRA, Rebecca S. Detwiler, Glenn E. Sjoden, Eric Lavigne, James E. Baciak, Jr., Univ. of Florida . . . . . [6945-06]

3He neutron detector design for active interrogation of cargo containers, Daniel B. McDevitt, Jeffrey W. Eberhard, Scott Zelakiewicz, Aaron Maschinot, GE Global Research . . . . . [6945-07]

Development and performance of the Fast Neutron Imaging Telescope for SNM detection, James M. Ryan, Ulisse M. Bravar, John R. Macri, Mark L. McConnell, Richard L. Woolf, Univ. of New Hampshire . . . . . [6945-08]

Global Homeland Security Technical Meeting

Monday 17 March · 5:00 to 6:00 pm

Chair: **Craig S. Halvorson,** Lawrence Livermore National Lab.

Please join us to discuss the following questions in relation to the conference on Optics and Photonics in Global Homeland Security (OPGHS):

- How should the technology needs of first responders be addressed?
- Are there ways to increase international involvement?
- Does OPGHS have the optimal balance between presentations from sponsors and presentations from researchers?
- How might corporate sponsors participate in bringing university researchers to the conference?
- Are there any particular researchers or sponsors that should be invited to present at Defense & Security 2009?
- Are there suggestions for possible symposium plenary speakers for Defense & Security 2009?

Interested attendees are welcome to attend.

Tuesday 18 March

SESSION 2 . . . . . Tues. 8:00 to 9:10 am

Bio-chem Countermeasures I

Session Chair: **Sarka O. Southern,** GAIA Medical Institute

Integrated nano-bio-chip sensor systems: from bio-terrorism to humanitarian applications *(Invited Paper)*, John T. McDevitt, The Univ. of Texas at Austin . . . . [6945-09]

Point-of-care detection of bacterial and viral pathogens using oral samples, Daniel Malamud, New York Univ. . . . . [6945-10]

Utility of POC test devices for infectious disease testing of blood and oral fluid and application to rapid testing in the field, Stephen R. Lee, Keith Kardos, Graham Yearwood, Geraldine Guillon, Lisa Kurtz, Mark Fischl, Vijaya Mokkapati, OraSure Technologies, Inc. . . . . [6945-11]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 3 . . . . . Tues. 10:30 am to 12:10 pm

Bio-chem Countermeasures II

Session Chair: **Sarka O. Southern,** GAIA Medical Institute

Integrated microfluidic platform for oral diagnostics (IMPOD), Anup K. Singh, Sandia National Labs. . . . [6945-12]

Stress response profiling: a new tool for early detection of high-consequence health threats, Sarka O. Southern, GAIA Medical Institute . . . . . [6945-13]

Pushing rapid point-of-need testing technologies to the limits: emerging technologies that facilitate highly sensitive, quantitative, field use rapid tests for the detection of biological threats, Brendan O'Farrell, Diagnostic Consulting Network. . . . . [6945-14]

Handheld and portable test systems for immunodiagnostics and nucleic acid detection, Konrad Faulstich, Klaus Haberstroh, Roman Gruler, Michael Eberhard, Thomas Wiest, Dirk Lentzsch, Embedded System Engineering GmbH (Germany). . . . . [6945-15]

Metrics for design and evaluation of chemical and biological detection systems and architectures, Susanna P. Gordon, Sandia National Labs. . . . . [6945-16]

Lunch/Exhibition Break . . . . . 12:10 to 1:10 pm

SESSION 4 . . . . . Tues. 1:10 to 5:00 pm

Bio-chem Countermeasures III

Session Chair: **Sarka O. Southern,** GAIA Medical Institute

Biodetection technologies to meet defense and security needs, Cynthia J. Bruckner-Lea, Pacific Northwest National Lab. . . . . [6945-17]

Qualification metrics for chemical and biological sensors, Leora Peltz, The Boeing Co. . . . . [6945-18]

Organic thin film field effect transistors for vapor and aqueous sensing applications, Zhenan Bao, Stanford Univ. . . . . [6945-19]

Bioluminescent bioreporter assays for targeted detection of chemical and biological agents, Steven A. Ripp, Patricia Jegier, Scott Moser, Courtney Johnson, Syed Islam, Gary S. Sayler, The Univ. of Tennessee. . . . . [6945-20]

Considerations in detecting CDC select agents under field conditions, Charles B. Spinelli, The Boeing Co.; Scott Soelberg, Univ. of Washington; Nathaneal Swanson, Seattle Sensor Systems, Inc.; Clement E. Furlong, Univ. of Washington; Paul Baker, Seattle Sensor Systems, Inc.. . . . . [6945-21]

A simple nucleic acid dipstick for rapid influenza detection: towards the development of a real time diagnostic assay at point-of-care (POC), Hong Cai, Xiaoyun Lu, David T. Fox, Los Alamos National Lab. . . . . [6945-22]

Class identification of pathogens based on native fluorescence spectroscopy on-a-chip, Peter Kiesel, Markus Beck, Michael Bassler, Oliver Schmidt, Noble M. Johnson, Tobias Buergel, Palo Alto Research Ctr., Inc. . . . . [6945-23]

Biosensing with semiconductor quantum dot conjugates, Igor L. Medintz, Hedi Mattoussi, Naval Research Lab. . . . . [6945-24]

Analysis of flow-cytometer scattering and fluorescence data to identify particle mixtures, Thomas A. Reichardt, Scott E. Bisson, Robert W. Crocker, Thomas J. Kulp, Sandia National Labs. . . . . [6945-25]

Confirmatory measurement channels for LIF-based bioaerosol instrumentation, Scott E. Bisson, Robert W. Crocker, Thomas J. Kulp, Thomas A. Reichardt, Sandia National Labs.; Peter T.Reilly, William B. Whitten, Oak Ridge National Lab. . . . . [6945-26]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Detection of residual traces of explosives by surface enhanced Raman scattering using gold coated substrates produced by nanospheres imprint technique, Fernando A. Calzzani, Jr., R. Silesh, Aschalew S. Kassu, Jean Michel Taguenang, A. Chowdhury, Anup Sharma, Alabama A&M Univ.; Paul B. Ruffin, Christina L. Brantley, Eugene Edwards, U.S. Army Research, Development and Engineering Command . . . . . [6945-55]

Two step signal processing of optical fiber mesh for intruder detection, Il-Bum Kwon, Dae-Cheol Seo, Chi-Yeop Kim, Dong-Jin Yoon, Korea Research Institute of Standards and Science (South Korea) . . . . . [6945-56]

Nuclear material detection technologies, James F. Christian, Purushottam Dokhale, Irina Shestakova, Vivek V. Nagarkar, Kanai S. Shah, Michael R. Squillante, Radia Sia, Radiation Monitoring Devices, Inc.; James M. Ryan, John R. Macri, Ulisse M. Bravar, Univ. of New Hampshire; Ka-Ngo Leung, Lawrence Berkeley National Lab. . . . . [6945-57]

Carbosilane polymers with hydrogen bond acidic functionalization for chemical preconcentrator applications, Duane L. Simonson, Robert A. McGill, Bernadette A. Higgins, Naval Research Lab. . . . . [6945-58]

Rotationally resolved spectral signatures for RDX-based explosives in the 3 micron region, Sindhu Kaimal, William A. Burns, Alan R. Ford, Scott W. Reeve, Arkansas State Univ. . . . . [6945-59]

Wednesday 19 March

SESSION 5 . . . . . Wed. 8:00 am to 12:10 pm

Maritime Security

Session Chair: **Michael J. DeWeert,** BAE Systems

Small maritime target detection through false color fusion, Alexander Toet, TNO Human Factors (Netherlands); Tirui Wu II, Jiangsu Univ. of Science and Technology (China) . . . . . [6945-27]

Anomaly detection in the maritime domain, Jean Roy, Defence Research and Development Canada (Canada) . . . . . [6945-28]

A comparison of MWIR and LWIR polarimetric imaging for surface swimmer detection, John S. Harchanko, Larry Pezzaniti, David B. Chenault, Graham Eades, Polaris Sensor Technologies, Inc. . . . . [6945-29]

Ocean color remote sensing: approaches for the waters' edge, Patty D. Pratt, Northrop Grumman Space Technology . . . . . [6945-30]

Flight test capabilities for real time multiple target detection and tracking for airborne surveillance and maritime domain awareness, Brian A. Gorin, BAE Systems North America; Allen M. Waxman, BAE Systems Advanced Information Technologies . . . . . [6945-31]

Information visualization for enhanced maritime domain awareness, Alain Bouchard, Defence R&D Canada/Valcartier (Canada); Anna-Liesa S. Lapinski, Defence R&D Canada/ Atlantic (Canada) . . . . . [6945-32]

Automatic sensor management: challenges and possible solutions, Tanja Y. C.van Valkenburg-Haarst, Wilbert van Norden, Fok Bolderheij, Royal Netherlands Navy (Netherlands) . . . . . [6945-33]

SeaSpider: automated information gathering on vessel movements in support of marine intelligence, surveillance, and reconnaissance, Serhan Tatar, David Chapman, Defence Research and Development Canada (Canada) . . . . . [6945-34]

Passive acoustic threat detection in estuarine environments, Brian S. Borowski, Alexander M. Sutin, Heui-Seol Roh, Barry J. Bunin II, Stevens Institute of Technology . . . . . [6945-35]

Combination of acoustic measurements with video surveillance for estuarine threat detection, Barry J. Bunin, Heui-Seol Roh, Alexander M. Sutin, George Kamberov, Stevens Institute of Technology . . . . . [6945-36]

Variability of SCUBA diver acoustic emission, Dimitri M. Donskoy, Nikolay Sedunov, Alexander Sedunov, Michael Tsionskiy, Stevens Institute of Technology . . . . . [6945-37]

Lunch/Exhibition Break . . . . . 12:10 to 1:10 pm

SESSION 6 . . . . . Wed. 1:10 to 3:10 pm

Explosives Detection

Session Chair: **Refael Gatt,** Global Security Devices (Israel)

X-ray backscatter imaging, Joseph Callerame, American Science and Engineering, Inc. . . . . [6945-38]

Differential spectroscopic imaging of particulate explosives residue, Bruce E. Bernacki, Nicolas Ho, Pacific Northwest National Lab. . . . . [6945-39]

Megavolt CT for air cargo container inspection, Joseph Bendahan, GE Homeland Protection, Inc. . . . . [6945-40]

High efficiency angular selective detection of thermal and cold neutrons, Anton S. Tremsin, Jason B. McPhate, John V. Vallerga, Oswald H. W.Siegmund, Univ. of California/Berkeley; Bruce Feller, Nova Scientific, Inc.; Lowell Crow, Ron Cooper, Oak Ridge National Lab. . . . . [6945-41]

Rotationally resolved spectral signatures for volatile impurities in TNT-based explosives, Tabetha Osborn, Scott W. Reeve, Alan R. Ford, Arkansas State Univ. . . . . [6945-42]

Employee screening at U.S. airports, Charles Chambers, Airport Council International-North America; Charlotte Bryan, Global Security Devices Inc. . . . . [6945-43]

SESSION 7 . . . . . Wed. 3:40 to 5:20 pm

Transportation Security

Session Chair: **Daniel Lehrfeld,** Photonic Products Group, Inc.

DHS Counter-MANPADS Program update *(Presentation Only)*, Kerry D. Wilson, U.S. Dept. of Homeland Security . . . . . [6945-44]

JETEYE ™: commercial airliner IR missile protection system *(Presentation Only)*, Ernest Keirstead, BAE Systems North America . . . . . [6945-45]

Northrop Grumman Guardian ™ System Counter-MANPADS Program: protecting commercial aircraft for the Department of Homeland Security *(Presentation Only)*, Leo Danielides, Northrop Grumman Corp. . . . . [6945-46]

Ground based laser for defense against MANPADS, Josef Shwartz, Northrop Grumman Corp. . . . . [6945-47]

Detection of security relevant substances within the cooperative project SAFE XUV, Elisabeth Schramm, GSF-Forschungszentrum für Umwelt und Gesundheit, GmbH (Germany); Andreas J. Görtler, Coherent GmbH (Germany); Thomas Heindl, Technische Univ. München (Germany); Alexander McNeish, Smiths Heimann GmbH (Germany); Stefan Mitschke, GSF-Forschungszentrum für Umwelt und Gesundheit, GmbH (Germany); Andrei Morozov, Technische Univ. München (Germany); Fabian Mühlberger, GSF-Forschungszentrum für Umwelt und Gesundheit, GmbH (Germany); Michael Pütz, Federal Criminal Police Office (Germany); Gerd Reichardt, BESSY GmbH (Germany); Hermann Ries, Patricia Schall, Smiths Heimann GmbH (Germany); Rasmus Schulte-Ladbeck, Federal Criminal Police Office (BKA) (Germany); Rainer H. Schultze, Optimare GmbH (Germany); Martin Sklorz, GSF-Forschungszentrum für Umwelt und Gesundheit, GmbH (Germany); Roman Trebbe, Federal Office of Civil Protection and Disaster Assistance (Germany); Andreas Ulrich, Technische Univ. München (Germany); Jochen Wieser, Coherent GmbH (Germany); Ralf Zimmermann, GSF-Forschungszentrum für Umwelt und Gesundheit, GmbH (Germany) . . . . . [6945-48]

Thursday 20 March

SESSION 8 . . . . . Thurs. 9:00 to 10:00 am

Water Security

Session Chair: **Dan J. Kroll,** Hach Co., Inc.

Requirements of biological detection technologies by municipal water laboratories: pathogens of interest and hardware requirements, Tammy Spain, The Pinellas County Utilities Lab. . . . . [6945-49]

Microorganism identification utilizing image-based software algorithms, Kent A. Peterson, Fluid Imaging Technologies . . . . . [6945-50]

A true real-time, on-line security system for waterborne pathogen surveillance, John A. Adams, JMAR Technologies, Inc. . . . . [6945-51]

SESSION 9 . . . . . Thurs. 10:30 to 11:30 am

Border Security

Session Chair: **Ashok K. Sood,** Magnolia Optical Technologies, Inc.

Diffraction-based optical sensor detection system for capture-restricted environments, Rahul M. Khandekar, Vladimir V. Nikulin, Binghamton Univ. . . . . [6945-52]

Rapid 3D measurement of human faces for biometric application, Gottfried J. Frankowski, Christian Benderoth, GFMesstechnik GmbH (Germany) . . . . . [6945-53]

Development of UV image intensifier tube with GaN photocathode, Itaru Mizuno, Tokuaki Nihashi, Toshimitsu Nagai, Minoru Niigaki, Yusuke Shimizu, Kenshi Shimano, Kazumasa Kato, Tsuneo Ihara, Kazuyoshi Okano, Masayuki Matsumoto, Masumi Tachino, Hamamatsu Photonics K.K. (Japan) . . . . . [6945-54]

Panel Discussion

Border Security

Thurs. 11:30 am to 12:30 pm

Panel Moderator: **Ashok K. Sood,** Magnolia Optical Technologies, Inc.

PROGRAM ON

Tactical Sensors and Imagers

Chair: **Roger Appleby,** QinetiQ Ltd. (United Kingdom)

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

Monday, 17 March

6946 **Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications V** *(Henry)* p. 36

Tuesday, 18 March

6949 **Terahertz for Military and Security Applications VI** *(Jensen, Cui)* p. 39

6948 **Passive Millimeter-Wave Imaging Technology XI** *(Appleby, Wikner)* p. 38

6947 **Radar Sensor Technology XII** *(Tan)* p. 37

Courses of Related Interest

Sunday, 16 March

SC162 **SAR Signal Processing** *(Soumekh)* 8:30 am to 5:30 pm, p. 111

Tuesday, 18 March

SC893 ***NEW*** **SAR Signal Processing Laboratory** *(Soumekh)* 8:30 am to 5:30 pm, p. 111

Wednesday, 19 March

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, p. 107

Special Events

Sunday, 16 March

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

Monday, 17 March

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works **Career Fair**
11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

Tuesday, 18 March

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

11:00 am to 3:00 pm

Wednesday, 19 March

FREE Exhibition
10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications V

Conference Chair: **Daniel J. Henry,** Recon/Optical, Inc.

Monday 17 March

SESSION 1 . . . . . Mon. 8:30 am to 12:20 pm

Multispectral ISR Sensors

Session Chair: **Daniel J. Henry,** Recon/Optical, Inc.

Operational hyperspectral in Recce, Serge Larroque, Thales Optronique (France). . . . . [6946-01]

Compact low-cost multispectral imaging for target detection on UAVs, Michael F. Crowley, Joseph J. Dirbas, Tim Schoenmackers, Elisa Berver, Adam Davies, PAR Government Systems Corp.; Jon S. Schoonmaker, Advanced Coherent Technologies LLC; Denise Runnels, Radiance Technologies, Inc.; Raymond S. Kwok, Innovative Intuitive Technology, Inc.; Michael Klausen, PAR Government Systems Corp. . . . . [6946-02]

Real-time multispectral data collection, processing downlink and display: test and demonstration, Denise Runnels, Chad Leflore, Radiance Technologies, Inc.; Paula Henderson, PAR Government Systems Corp.; Jonathan Powell, Addison Martin, Radiance Technologies, Inc.; Jon S. Schoonmaker, Advanced Coherent Technologies LLC; Adam Davies, Joseph Dirbas, Michael F. Crowley, PAR Government Systems Corp.; Scott Peterman, Radiance Technologies, Inc. . . . . [6946-03]

Overcoming adverse weather conditions with a common optical path, multiple sensor, and intelligent image fusion system, Joseph Ng, Panavision Federal Systems; Michael Piacentino, Sarnoff Corp.; Brian Caldwell, Panavision Federal Systems. . . . . [6946-04]

Spectral detection and monitoring of marine mammals, Jon S. Schoonmaker, Yuliya Podobna, Irina M. Petrosyuk, Gary D. Gilbert, Joseph J. Dirbas, Advanced Coherent Technologies LLC . . . . . [6946-05]

DUSTER: an integrated LWIR and L-band SAR imaging system, Michael L. Wilson, Dale C. Linne von Berg, Melvin R. Kruer, Naval Research Lab.; Niel S. Holt, Scott A. Anderson, Space Dynamics Lab.; David G. Long, Brigham Young Univ.; Yuly Margulis, ARTEMIS, Inc. . . . . [6946-06]

Near infrared missile warning testbed, Joel B. Montgomery, M & M Aviation; John F. McCalmont, Richard B. Sanderson, Air Force Research Lab.; Randy Johnson, MacAulay-Brown, Inc.. . . . . [6946-07]

Performance analysis of a multispectral framing camera for detecting mines in the littoral zone and beach zone, Eric Louchard, BAE Systems Advanced Information Technologies . . . . . [6946-08]

Color in perceptual tracking using low frame rate motion imagery, Tariq Bakir, Harris Corp.; Michelle Brennan, Moriarty and Associates, Inc. . . . . [6946-09]

The importance of balance in a gimbaled sensor platform, Dan Otlowski, Kurt Wiener, Paul Kennedy, Brandon Rathbun, Space Electronics LLC . . . . . [6946-10]

Lunch Break . . . . . 12:20 to 1:40 pm

SESSION 2 . . . . . Mon. 1:40 to 2:20 pm

3D ISR Sensors

Session Chair: **Daniel J. Henry,** Recon/Optical, Inc.

A high definition 3D laser scanner for autonomous vehicle applications, Bruce Hall, Michael Dunbar, Velodyne Acoustics, Inc. . . . . [6946-11]

3D rapid mapping, Folke Isaksson, Johan Borg, Leif Haglund, Saab Bofors Dynamics AB (Sweden) . . . . [6946-12]

SESSION 3 . . . . . Mon. 2:20 to 4:50 pm

ISR Processing

Session Chair: **Daniel J. Henry,** Recon/Optical, Inc.

A complete passive or imaging-based sensor system for unmanned air vehicle taking off and landing operations, Steven X. Yi, Technest Holdings, Inc. . . . . [6946-13]

SmartCapture: a highly compact video capture technology for UAVs, Pankaj Topiwala, FastVDO LLC . . . . . [6946-14]

Automatic image exploitation system for small UAVs, Norbert F. Heinze, Martin Esswein, Wolfgang Krüger, Günter M. Saur, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany) . . . . . [6946-15]

VideoQuest: managing large-scale aerial video database through automated content extraction, Hui Cheng, Sarnoff Corp. . . . . [6946-16]

A content-based retrieval system for UAV-like video and associated metadata, Noel E. O'Connor, Paul Ferguson, Cathal Gurrin, Gareth Jones, Hyowon Lee, Alan F. Smeaton, Ke Zhang, Dublin City Univ. (Ireland) . . . . . [6946-17]

Real-time aerial video exploitation station for small unmanned aerial vehicles, Jason B. Gregga, Art Pope, Kathy Kielmeyer, Yang Ran, SET Corp. . . . . [6946-18]

Related Course

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* Wednesday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Radar Sensor Technology XII

Conference Chair: **Robert J. Tan,** Army Research Lab.

Program Committee: **Olga Boric-Lubecke,** Univ. of Hawaii at Manoa; **Armin W. Doerry,** Sandia National Labs.; **John E. Gray,** Naval Surface Warfare Ctr.; **Ryan K. Hersey,** Georgia Institute of Technology; **Todd A. Kastle,** Air Force Research Lab.; **James L. Kurtz,** Univ. of Florida; **Jenshan Lin,** Univ. of Florida; **Victor M. Lubecke,** Univ. of Hawaii at Manoa; **Kenneth I. Ranney,** Army Research Lab.; **Jeffrey P. Sichina,** Army Research Lab.; **Jerry Silvious,** Army Research Lab.; **Lars M. Wells,** Sandia National Labs.

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 1 . . . . . Tues. 10:30 to 11:50 am

Phenomenology

Session Chair: **Kenneth I. Ranney,** Army Research Lab.

The results of snow and bare soil, waved water surface and soil vegetation microwave reflective and emissive characteristics spatio-temporally combined measurements at 37GHz, Artashes K. Arakelyan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia) . . . . . [6947-01]

Measurements of bare and vegetated soil, snow and waved water surface microwave reflective and emissive characteristics at 5.6GHz, Astghik K. Hambaryan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia) . . . . . [6947-02]

Ka-band clutter measurements of urban environments, Robert J. Tan, Thomas J. Pizzillo, Army Research Lab. . . . . [6947-03]

Ultra-wideband signal propagation experiments in liquid media, Rastko Selmic, Louisiana Tech Univ.; Atindra K. Mitra, Air Force Research Lab. . . . . [6947-04]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 2 . . . . . Tues. 1:20 to 3:00 pm

Radar Signal and Image Processing

Session Chair: **Armin W. Doerry,** Sandia National Labs.

SAR data collection and processing requirements for high quality coherent change detection, Armin W. Doerry, Sandia National Labs. . . . . [6947-05]

Recovering shape from shadows in synthetic aperture radar imagery, Fred M. Dickey, Armin W. Doerry, Sandia National Labs. . . . . [6947-06]

Recent MTI experiments using ARL's synchronous impulse reconstruction (SIRE) radar, Kenneth I. Ranney, Lam H. Nguyen, Brian Stanton, Marc A. Ressler, David C. Wong, Francois Koenig, Chi N. Tran, Gregory D. Smith, Karl A. Kappra, Getachew A. Kirose, Jeffrey P. Sichina, Army Research Lab. . . . . [6947-07]

Moving target localization using dual-frequency radar arrays, Yimin Zhang, Fauzia Ahmad, Moeness G. Amin, Villanova Univ. . . . . [6947-08]

Change detection using the synchronous impulse reconstruction (SIRE) radar, Kenneth I. Ranney, Lam H. Nguyen, Marc A. Ressler, Brian Stanton, David C. Wong, Francois Koenig, Chi N. Tran, Getachew A. Kirose, Gregory D. Smith, Jeffrey P. Sichina, Army Research Lab. . . . . [6947-09]

SESSION 3 . . . . . Tues. 3:30 to 5:10 pm

Sensing Through-the-Wall (STTW)

Session Chair: **Robert J. Tan,** Army Research Lab.

Sensing through-the-wall imaging using the Army Research Lab Ultra-Wideband Synchronous Impulse Reconstruction (UWB SIRE) radar, Lam H. Nguyen, Army Research Lab. . . . . [6947-10]

High resolution through-the-wall radar image based on beamspace eigenstructure subspace methods, Yeo-Sun Yoon, Moeness G. Amin, Villanova Univ. . . . . [6947-11]

Concrete wall characterization for through-the-wall radar applications, Eugene F. Greneker III, Georgia Tech Research Institute . . . . . [6947-12]

Urban structures imaging with sparse arrays, Roberto Innocenti, Army Research Lab. . . . . [6947-13]

Xaver: through wall imager, Amir Beeri, Camero Tech Ltd. (Israel) . . . . . [6947-14]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

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The interaction of RF energy with wall materials and objects of interest, Douglas Cohen, Mark J. Farwell, U.S. Army Communications-Electronics Command; David Sheby, Michael Brennan, CACI Tecnologies. . . . . [6947-19]

Wednesday 19 March

SESSION 4 . . . . . Wed. 9:10 to 10:30 am

Radar Systems and Biometric Sensing

Session Chair: **Robert J. Tan,** Army Research Lab.

A survey of antennas for ultra-wideband applications, Maysam Sarfaraz, Amir H. Shirkhodaie, Tennessee State Univ. . . . . [6947-15]

Low sidelobe nonlinear stepped-frequency waveforms, Dmitry Chebanov, City College/CUNY . . . . . [6947-16]

Range and azimuth resolution enhancement for 94 GHz real-beam radar, Guoqing Liu, Ken Yang, Brian Sykora, Imad Salha, BAE Systems . . . . . [6947-17]

Battlefield triage life signs detection techniques, Olga Boric-Lubecke, Anders Host-Madsen, Victor M. Lubecke, Univ. of Hawai'i at Manoa; Jenshan Lin, Univ. of Florida; Byung-Kwon Park, Univ. of Hawai'i at Manoa . . . . . [6947-18]

Tactical Sensors and Imagers Track Plenary Presentation

Wed. 11:00 to 11:45 am

Radar Horizons *(Invited Paper, Presentation Only)*, **Joseph R. Guerci,** Consultant

See page 5 for details.

Related Courses

SC893 **SAR Signal Processing Laboratory** *(Soumekh)*
NEW Tuesday, 8:30 am to 5:30 pm

SC162 **SAR Signal Processing** *(Soumekh)* Sunday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Passive Millimeter-Wave Imaging Technology XI

Conference Chairs: **Roger Appleby,** QinetiQ Ltd. (United Kingdom); **David A. Wikner,** Army Research Lab

Program Committee: **Dennis W. Prather,** Univ. of Delaware; **Christopher A. Schuetz,** Univ. of Delaware

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 1 . . . . . Tues. 10:30 am to 12:10 pm

Systems

Session Chair: **Christopher A. Martin,** Trex Enterprises Corp.

Millimeter wave case study of operational deployments: retail, airport, military, courthouse, and customs, Gary V. Tryon, Brijot Imaging Systems, Inc. . . . . [6948-01]

Multispectral mm-wave imaging: materials and images, Naomi E. Alexander, Carlos Callejero Andrés, Alfa Imaging (Spain); Ramón Gonzalo, Univ. Pública de Navarra (Spain) . . . . . [6948-02]

Far field millimeter-wave imaging via optical upconversion, Jesse P. Samluk, Christopher A. Schuetz, Edwin L. Stein, Jr., Andrew Robbins, Richard D. Martin, Caihua Chen, Dennis W. Prather, Univ. of Delaware [6948-03]

Two-dimensional snapshot distributed aperture millimeter-mave imaging using optical upconversion, Richard D. Martin, Christopher A. Schuetz, Caihua Chen, Indraneil Biswas, Jesse P. Samluk, Edwin L. Stein, Jr., Univ. of Delaware; Mark S. Mirotznik, The Catholic Univ. of America; Dennis W. Prather, Univ. of Delaware . . . . [6948-04]

Imaging with modular linear arrays of cryogenic Nb microbolometers, Erich N. Grossman, National Institute of Standards and Technology; Charles R. Dietlein, National Institute of Standards and Technology and Univ. of Colorado at Boulder; Mabel D. Ramirez, Univ. of Colorado at Boulder; Arttu R. M.Luukanen, Mikko Leivo, Panu Helisto, VTT Technical Research Ctr. of Finland (Finland); Jari Pentilla, Aivon Oy (Finland) . . . . . [6948-05]

Lunch/Exhibition Break . . . . . 12:10 to 1:10 pm

SESSION 2 . . . . . Tues. 1:10 to 4:20 pm

Enabling Technology

Session Chair: **David A. Wikner,** Army Research Lab.

A wideband and scalable radiometer module for an unamplified direct detection W-band imaging array, James H. Schaffner, Jonathan J. Lynch, Keith V. Guinn, Joel N. Schulman, Harris P. Moyer, HRL Labs., LLC . . . . . [6948-06]

Design, fabrication and characterization of $LiNbO_3$ optical modulator for high-sensitivity mmW imaging system, Peng Yao, Christopher A. Schuetz, Rownak Shireen, Julien Macario, Shouyuan Shi, Dennis W. Prather, Univ. of Delaware . . . . . [6948-07]

Development of a low cost 94GHz imaging receiver using multi-layer liquid crystal polymer technology, Paul Rice, Mark Black, MMIC Solutions Ltd. (United Kingdom); Paul D. Munday, Katherine L. Adamson, Lee Smethurst, QinetiQ Ltd. (United Kingdom). . . . . [6948-08]

The reflectivity of skin from 35GHz to 1THz, Roger Appleby, QinetiQ Ltd. (United Kingdom). . . . . [6948-09]

Wideband fractal antennas for holographic imaging and rectenna applications, Kyle J. Bunch, Douglas L. McMakin, David M. Sheen, Pacific Northwest National Lab. . . [6948-10]

Extended depth of field imaging at 94-GHz, Joseph N. Mait, David A. Wikner, Army Research Lab.; Mark S. Mirotznik, The Catholic Univ. of America; Joseph van der Gracht, Holospex, Inc.; Greg P. Behrmann, Brandon L. Good, Scott A. Mathews, The Catholic Univ. of America. . . . . [6948-11]

Ultra wide band antenna coupled direct detectors for millimeter wave imaging, Hooman Kazemi, Teledyne Scientific Co. . . . . [6948-12]

Balance of absorption, scattering, transmission, and reflection for clothing and expanded polystyrene in the millimeter-wave and terahertz frequency range, Charles R. Dietlein, Univ. of Colorado at Boulder and National Institute of Standards and Technology; Zoya Popovic, Univ. of Colorado at Boulder; Erich N. Grossman, National Institute of Standards and Technology. . . . . [6948-13]

SESSION 3 . . . . . Tues. 4:20 to 5:20 pm

Image Processing

Session Chair: **Dennis W. Prather,** Univ. of Delaware

A novel approach to automatic threat detection in MMW imagery of people scanned in portals, Nitin M. Vaidya, Thomas D. Williams, Millivision Technologies. . . . . [6948-14]

Overview of techniques for improving millimeter wave imaging through advanced signal processing and their implementation in practical defense systems, Fernando E. Ortiz, Petersen F. Curt, Eric J. Kelmelis, EM Photonics, Inc.. . . . . [6948-15]

Resolving R and B functions in ultra-resolution problem, Evgeni N. Terentiev, M.V. Lomonosov Moscow State Univ. (Russia); Nikolai E. Terentiev, Quest Software (Russia) . . . . . [6948-16]

Wednesday 19 March

SESSION 4 . . . . . Wed. 8:00 to 10:20 am

Security

Session Chair: **Roger Appleby,** QinetiQ Ltd. (United Kingdom)

Millimetre-wave, sub-millimetre-wave and terahertz technology for the detection of concealed objects: a review, Michael C. Kemp, Iconal Technology Ltd. (United Kingdom) . . . . . [6948-17]

Rapid passive MMW security screening portal, Christopher A. Martin, John A. Lovberg, Trex Enterprises Corp.; Carlos E. García González, Univ. Complutense de Madrid (Spain) . . . . . [6948-18]

The monitoring of critical infrastructures using microwave radiometers, Markus Peichl, Stephan Dill, Matthias Jirousek, Helmut Suess, DLR Standort Oberpfaffenhofen (Germany) . . . . . [6948-19]

Standoff detection of concealed handguns and knives, Nicholas J. Bowring, Nacer Rezgui, Manchester Metropolitan Univ. (United Kingdom); Stuart W. Harmer, Queen Mary Univ. of London (United Kingdom); David A. Andrews, Matthew Southgate, Manchester Metropolitan Univ. (United Kingdom) . . . . . [6948-20]

Active imaging at 350 GHz for security applications, David M. Sheen, Douglas L. McMakin, Thomas E. Hall, Ronald H. Severtsen, Pacific Northwest National Lab. . . . . [6948-21]

mmWave imaging for concealed weapon detection and surveillance at up to 220GHz, Stephan Stanko, Denis Nötel, Johann Huck, Stefan Wirtz, Frank Klöppel, Helmut Essen, FGAN-FHR (Germany). . . . . [6948-22]

Passive THz imaging system for stand-off identification of concealed objects: results from a turn-key 16 pixel imager, Arttu R. Luukanen, Millimetre Waver Lab. of Finland (Finland) and VTT Technical Research Ctr. of Finland (Finland); Panu Helistö, Mikko M. Leivo, VTT Technical Research Ctr. of Finland (Finland); Jari S. Penttilä, Aivon Oy (Finland); Charles D. Dietlein, Univ. of Colorado at Boulder and National Institute of Standards and Technology; Mabel E. Ramirez, Univ. of Colorado at Boulder; Erich N. Grossman, National Institute of Standards and Technology . . . . . [6948-23]

Tactical Sensors and Imagers Track Plenary Presentation

Wed. 11:00 to 11:45 am

Radar Horizons *(Invited Paper, Presentation Only)*, **Joseph R. Guerci,** Consultant

See page 5 for details.

Terahertz for Military and Security Applications VI

Conference Chairs: **James O. Jensen,** U.S. Army Edgewood Chemical Biological Ctr.; **Hong-Liang Cui,** Stevens Institute of Technology

Conference Co-Chairs: **Dwight L. Woolard,** U.S. Army Research Office; **R. Jennifer Hwu,** INNOSYS Inc.

Program Committee: **Torsten Löffler,** Johann-Wolfgang-Goethe-Univ. (Germany); **Daniel J. Radack,** Institute for Defense Analyses

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Super-resolution reconstruction of terahertz images, Yue Li, Li Li, Andrew D. Hellicar, Jay Guo, Commonwealth Scientific and Industrial Research Organisation (Australia). . . . . [6949-17]

Wednesday 19 March

SESSION 1 . . . . . .Wed. 8:00 to 10:30 am

THz Sensing and Phenomenology

Session Chair: **Hong-Liang Cui,**
Stevens Institute of Technology

Imaging terahertz radar for security applications *(Invited Paper)*, Alexei D. Semenov, Huebers Heinz-Wilhelm, Richter Heiko, Boettger Ute, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [6949-01]

Fingerprinting malathion vapor: a simulant for VX nerve agent, Renbo Song, Yujie J. Ding, Lehigh Univ.; Yuliya B. Zotova, ArkLight, Inc. . . . . [6949-02]

Manufacturing process effects on the terahertz spectra of RDX, John Wilkinson, Stanley M. Caulder, Naval Surface Warfare Ctr.; Alessia Portieri, TeraView Ltd. (United Kingdom) . . . . . [6949-03]

Terahertz imaging of concealed objects by acoustic phase detection, Federico F. Buersgens, Guillermo Acuna, Roland Kersting, Ludwig-Maximilians-Univ. München (Germany) . . . . . [6949-04]

Terahertz target illumination fluctuation estimates derived from field measurements of atmospheric water vapor, Sean G. O'Brien, David H. Tofsted, Army Research Lab. . . . . [6949-05]

Scattering effects in terahertz reflection spectroscopy, Lisa M. Zurk, Scott Schecklman, Garth Sundberg, Portland State Univ.; Zhen Zhou, Antao Chen, Eric I. Thorsos, Dale P. Winebrenner, Univ. of Washington . . . . . [6949-06]

A quantitative study of the practical sensitivity limit of a THz absorption spectrometer, Jon E. Bjarnason, National Institute of Standards and Technology; Charles R. Dietlein, National Institute of Standards and Technology and Univ. of Colorado at Boulder; Erich N. Grossman, National Institute of Standards and Technology . . . . . [6949-07]

Tactical Sensors and Imagers Plenary Presentation

Wed. 11:00 to 11:45 am

Radar Horizons *(Invited Paper, Presentation Only)*, **Joseph R. Guerci,** Consultant

See page 5 for details.

Lunch/Exhibition Break . . . . . 11:45 am to 1:15 pm

SESSION 2 . . . . . .Wed. 1:15 to 3:05 pm

THz Technology and Methodology

Session Chair: **James O. Jensen,** U.S. Army Edgewood Chemical Biological Ctr.

A coherent frequency-domain THz spectrometer with a signal-to-noise ratio of 60dB at 1 THz *(Invited Paper)*, Joseph R. Demers, Ronald T. Logan, Jr., EMCORE Corp. . . . . [6949-08]

Analysis of a device for single pixel terahertz imaging, Eddie L. Jacobs, Orges Furxhi, The Univ. of Memphis . . . . . [6949-09]

Quantitative measurement of laminar material properties and structure using time domain reflection imaging, David A. Zimdars, Jeffrey S. White, Greg Fichter, Artur Chernovsky, Picometrix, LLC. . . . . [6949-10]

Passive stand-off terahertz imaging with 1 hertz frame rate, Torsten May, Solveig Anders, Viatcheslav Zakosarenko, Hans-Georg Meyer, IPHT Jena (Germany); Michael Starkloff, Supracon AG (Germany); Günter Thorwirth, Jena-Optronik GmbH (Germany); Ernst Kreysa, Max-Planck-Institut für Radioastronomie (Germany) . . . . . [6949-11]

THz imaging based on water-concentration contrast, Zach D. Taylor, R. S. Singh, J. Suen, Elliott R. Brown, Univ. of California/Santa Barbara . . . . . [6949-12]

SESSION 3 . . . . . .Wed. 3:35 to 4:55 pm

THz Devices and Components

Session Chair: **R. Jennifer Hwu,** INNOSYS Inc.

An HTS detector for terahertz imaging, Andrew D. Hellicar, Jia Du, Stephen Hanham, Commonwealth Scientific and Industrial Research Organisation (Australia) . . . . . [6949-13]

Quantum 1/f noise in all-epitaxial metal-semiconductor diodes, Peter H. Handel, Univ. of Missouri/St. Louis [6949-14]

Correcting the secondary focus of Fresnel zone plate antennas, James C. Wiltse, Georgia Institute of Technology . . . . . [6949-15]

1/f noise and phase noise in AlGaSb/InAs/AlGaSb double-barrier RTD oscillators, Peter H. Handel, Univ. of Missouri/St. Louis . . . . . [6949-16]

PROGRAM ON

Laser Sensors and Systems

Chair: **Gary W. Kamerman,** FastMetrix, Inc.

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6952 **Laser Source Technology for Defense and Security IV** *(Dubinskii, Wood)* p. 43

6951 **Atmospheric Propagation V** *(Gilbreath, Wasiczko)* p. 42

6950 **Laser Radar Technology and Applications XIII** *(Turner, Kamerman)* p. 41

Courses of Related Interest

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, p. 105

SC167 **Introduction to Laser Radar** *(Kamerman)* 1:30 to 5:30 pm, p. 107

SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* 8:30 am to 12:30 pm, p. 107

SC784 **Fiber Lasers for Defense Applications: Fibers, Components and System Design Considerations** *(Samson, Torruellas)* 8:30 am to 5:30 pm, p. 107

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, p. 107

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works
11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair
11:00 am to 3:00 pm

FREE Exhibition
10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

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Laser Radar Technology and Applications XIII

Conference Chairs: **Monte D. Turner,** Defense Advanced Research Projects Agency; **Gary W. Kamerman,** FastMetrix, Inc.

Program Committee: **Ravil R. Agishev,** Kazan State Univ. (Russia); **Phillip Gatt,** Lockheed Martin Coherent Technologies; **Jeffrey W. Grantham,** Northrop Grumman Corp.; **Clarke E. Harris,** FastMetrix, Inc.; **Robert O. Hauge,** National Reconnaissance Office; **Richard M. Heinrichs,** MIT Lincoln Lab.; **James C. Lamoreux,** NASA Johnson Space Ctr.; **Vasyl Molebny,** National Taras Shevchenko Univ. of Kyiv (Ukraine); **William A. Neuman,** Lawrence Livermore National Lab.; **Vladimir L. Pavlovitch,** Polyus Research and Development Institute (Russia); **C. Russell Philbrick,** The Pennsylvania State Univ.; **Michael W. Roth,** Johns Hopkins Univ.; **Jean-Robert Simard,** Defence Research and Development Canada (Canada); **Upendra N. Singh,** NASA Langley Research Ctr.; **Bevan D. Staple,** Ball Aerospace & Technologies Corp.; **Ove K. Steinvall,** Swedish Defence Research Agency (Sweden); **David M. Tratt,** The Aerospace Corp.

Wednesday 19 March

SESSION 1 . . . . . Wed. 8:30 to 10:30 am

3D Imaging Lidar Systems

Session Chair: **Monte D. Turner,** Defense Advanced Research Projects Agency

High resolution laser radar using time correlated photon counting, Ove K. Steinvall, Markus Henriksson, Per Jonsson, Lars J. Sjöqvist, Swedish Defence Research Agency (Sweden) . . . . . [6950-01]

Real-time 3D color imaging of scenes using the Eyesafe ladar test-bed, Robert T. Pack, Rollin R. Fullmer, Scott E. Budge, Paul Israelsen, Brad Petersen, Utah State Univ.; Thomas D. Cook, Naval Air Warfare Ctr.. . . . . [6950-02]

Three dimensional imaging laser radar system for short-range target detection and identification, Ping Li, Kun Li, Huimin Chen, Beijing Institute of Technology (China) [6950-03]

Lidar surface elevation and digital elevation map (DEM) of the CALIPSO lidar data over Penang, Malaysia, Azrul N. Alias, Mohd Zubir Mat Jafri, Hwee-San Lim, Nasirun Mohd. Saleh, Univ. Sains Malaysia (Malaysia) . . . . . [6950-04]

Ball laser spot tracking and 3D imaging sensor (LST-3D), Rex M. Craig, Ball Aerospace & Technologies Corp. [6950-05]

Inflight performance of a second-generation, photon-counting, 3D IMAGING lidar, John J. Degnan, Sigma Space Corp. . . . . [6950-06]

SESSION 2 . . . . . Wed. 11:00 am to 12:20 pm

Coherent Lidar Applications I

Session Chair: **Phillip Gatt,** Lockheed Martin Coherent Technologies

Ultra-fast coherent optical system for active remote sensing applications, Shubhashish Datta, Abhay M. Joshi, Donald A. Becker, Roy L. Howard, Discovery Semiconductors, Inc. . . . . [6950-07]

Coherent ladar imaging of dust clouds: four waveform comparison, Douglas G. Youmans, SPARTA, Inc. . [6950-08]

Resonance Raman measurements utilizing a tunable deep UV source, Adam H. Willitsford, The Pennsylvania State Univ.; C. Todd Chadwick, Hans D. Hallen, North Carolina State Univ.; C. Russell Philbrick, The Pennsylvania State Univ. . . . . [6950-09]

Supercontinuum lidar applications for measurements of atmospheric constituents, David M. Brown, Zhiwen Liu, C. Russell Philbrick, The Pennsylvania State Univ. . . . . [6950-10]

Lunch/Exhibition Break . . . . . 12:20 to 1:50 pm

SESSION 3 . . . . . Wed. 1:50 to 3:10 pm

Coherent Lidar Applications II

Session Chair: **Phillip Gatt,** Lockheed Martin Coherent Technologies

Integrating real-time airborne Doppler lidar wind measurements with operational mesoscale models and decision aides, George D. Emmitt, Sidney A. Wood, Jr., Steven Greco, Simpson Weather Associates, Inc.; Yansen Wang, Army Research Lab.. . . . . [6950-11]

Imaging backscattering detection of explosives by using mid-infrared quantum cascade lasers, Frank Fuchs, Christoph Wild, Quankui Yang, Wolfgang Bronner, Klaus Köhler, Hans-Joachim Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) . . . . . [6950-12]

Compensating for volume and vector averaging biases in lidar wind speed measurements, Peter J. M. Clive, SgurrEnergy Ltd. (United Kingdom) . . . . . [6950-13]

Lidar and resource assessment for wind power applications: the state of the art, Peter J. M. Clive, SgurrEnergy Ltd. (United Kingdom) . . . . . [6950-14]

SESSION 4 . . . . . Wed. 3:40 to 5:40 pm

Ladar System Modeling and Calibration

Session Chair: **Ove K. Steinvall,** Swedish Defence Research Agency (Sweden)

Modeling the detection of optical sights using retroreflection, Arjan L. Mieremet, Ric H. Schleijpen, TNO Defence, Security and Safety (Netherlands); Pierre-Nicolas Pouchelle, ENSIETA (France) . . . . . [6950-15]

Multiscale target manifold characterization for 3D imaging ladar, Estille Whittenberger, Donald E. Waagen, Nitesh N. Shah, Donald R. Hulsey, Raytheon Missile Systems [6950-16]

Design and validation of the Eyesafe ladar test-bed (ELT) using the LadarSIM System Simulator, Scott E. Budge, Robert T. Pack, Rollin R. Fullmer, Utah State Univ. . [6950-17]

A new development for laser rangefinder testing, Kenn S. Bates, Raytheon Co. . . . . [6950-18]

Calibration of full-waveform airborne laser scanning data for object classification, Andreas Ullrich, RIEGL Laser Measurement Systems GmbH (Austria); Andreas Roncat, Wolfgang Wagner, Christian Briese, Technische Univ. Wien (Austria) . . . . . [6950-19]

Simulation of a new 3D imaging sensor for identifying difficult military targets, Christophe R. J.Harvey, Jonathon J. Wood, Peter N. Randall, Gilbert W. Smith, QinetiQ Ltd. (United Kingdom). . . . . [6950-20]

Thursday 20 March

SESSION 5 . . . . . Thurs. 8:30 to 10:10 am

Emerging Technologies for Lidar

Session Chair: **Gary W. Kamerman,** FastMetrix, Inc.

Application of holographic optical elements for detection and imaging tasks, Olha Asmolova, Kiev Polytechnic Univ. . . . . [6950-21]

Single photon counting Geiger mode InGaAs/InP avalanche photodiode arrays for 3D imaging, Rengarajan Sudharsanan, Ping Yuan, Joseph Boisvert, Paul A. McDonald, Takahiro Isshiki, Shoghig Mesropian, Eduardo Labios, Spectrolab, Inc.; Michael Salisbury, Boeing SVS, Inc.. . . . . [6950-22]

Large-area high-speed InGaAs photodetectors, Henry H. Yuan, Jongwoo Kim, Gary W. Apgar, Joyce G. Laquindanum, Joseph Kimchi, Ted Wong, Judson Technologies LLC . . . . . [6950-23]

Low-cost ladar imagers, Stefan A. Vasile, Jerold Lipson, aPeak, Inc.. . . . . [6950-24]

Single photon sensitive linear mode APD ladar receiver developments, George M. Williams, Jr., Voxtel, Inc. [6950-25]

SESSION 6 . . . . . Thurs. 10:40 am to 12:20 pm

Imaging Through Obscurants

Session Chair: **Gary W. Kamerman,** FastMetrix, Inc.

An approach to target detection and recognition in forested scenes, Christina A. Grönwall, Gustav Tolt, Tomas R. Chevalier, Swedish Defence Research Agency (Sweden); Pierre Andersson, Saab Bofors Dynamics AB (Sweden) . . . . . [6950-26]

Lidar for obstacle detection during helicopter landing, Xiang Zhu, Philip M. Church, Martin Labrie, Neptec Design Group Ltd. (Canada) . . . . . [6950-27]

Three-dimensional laser scanners with echo digitization, Andreas Ullrich, RIEGL Laser Measurement Systems GmbH (Austria) . . . . . [6950-28]

Experimental validation of ship identification with a laser range profiler, Johan C. van den Heuvel, Herman Bekman, Frank J. M.van Putten, Ric H. Schleijpen, TNO (Netherlands) . . . . . [6950-29]

Search-lidar demonstrator for detection of small sea-surface targets, Johan C. van den Heuvel, Herman Bekman, Frank J. M.van Putten, Leo H. Cohen, Ric H. Schleijpen, TNO (Netherlands) . . . . . [6950-30]

Related Courses

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* Wednesday, 8:30 am to 5:30 pm

SC167 **Introduction to Laser Radar** *(Kamerman)* Tuesday, 1:30 to 5:30 pm

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* Monday, 1:30 to 5:30 pm

SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* Tuesday, 8:30 am to 12:30 pm

SC784 **Fiber Lasers for Defense Applications: Fibers, Components and System Design Considerations** *(Samson, Torruellas)* Tuesday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Atmospheric Propagation V

Conference Chairs: **G. Charmaine Gilbreath,** Naval Research Lab.; **Linda M. Wasiczko,** Naval Research Lab

Program Committee: **Larry C. Andrews,** Univ. of Central Florida; **Gary J. Baker,** Lockheed Martin Advanced Technology Ctr.; **Harris Rayvon Burris,** Naval Research Lab.; **Frank D. Eaton,** Air Force Research Lab.; **Gary G. Gimmestad,** Georgia Tech Research Institute; **Kenneth J. Grant,** Defence Science and Technology Organisation (Australia); **Chadwick Todd Hawley,** Signatures Program Management Office; **Norman S. Kopeika,** Ben-Gurion Univ. of the Negev (Israel); **Martin Kruger,** Office of Naval Research; **Christopher I. Moore,** Naval Research Lab.; **Sergio Raffaele Restaino,** Naval Research Lab.; **Jennifer C. Ricklin,** Defense Advanced Research Projects Agency; **Jonathan M. Saint Clair,** The Boeing Co.; **Ove K. Steinvall,** Swedish Defence Research Agency (Sweden); **Cynthia Y. Young,** Univ. of Central Florida

Wednesday 19 March

Opening Remarks . . . . . Wed. 8:30 to 8:50 am

Session Chairs: **G. Charmaine Gilbreath,** Naval Research Lab.; **Linda M. Wasiczko,** Naval Research Lab.

SESSION 1 . . . . . Wed. 8:50 to 11:30 am

Theoretical Studies

Session Chair: **Jonathan M. Saint Clair,** The Boeing Co

FSO communications: atmospheric effects for an airborne backbone *(Invited Paper)*, Ronald L. Phillips, Larry C. Andrews, Univ. of Central Florida . . . . . [6951-01]

An analysis of the spatio-temporal evolution of the far field irradiance distribution from a Gaussian beam due to atmospheric turbulence in the boundary layer, Ray J. Oermann, Defence Science and Technology Organisation (Australia). . . . . [6951-02]

Turbulent thermal blooming, Kyle Petrowski, Johns Hopkins Univ.; Curtis Menyuk, Univ. of Maryland/Baltimore County; Richard Joseph, Michael E. Thomas, William E. Torruellas, The Johns Hopkins Univ. Applied Physics Lab. . . . . [6951-03]

Branch point detection and correction using the branch point potential method, Kevin Murphy, Ruth Mackey, Christopher Dainty, National Univ. of Ireland/Galway (Ireland) . . . . . [6951-04]

Simulated impact of aero-optical effects on a 200 km air-to-air lasercomm link, Gary J. Baker, Kevin R. Bock, Lockheed Martin Advanced Technology Ctr. . . . . [6951-05]

A study of retrieving aerosol optical depth from day-exposed horizontal surface broadband direct solar radiation, Xiaofeng Xu, Nanjing Univ. of Information Science & Technology (China) and Institute of Atmospheric Physics (China); Jinhuan Qiu, Institute of Atmospheric Physics (China); Shengjie Niu, Nanjing Univ. of Information Science & Technology (China) . . . . . [6951-06]

Lunch/Exhibition Break . . . . . 11:30 am to 1:10 pm

SESSION 2 . . . . . Wed. 1:10 to 3:00 pm

Theory and Experiment I

Session Chair: **Harris Rayvon Burris,** Naval Research Lab.

To be announced *(Invited Paper)*, Don M. Boroson, MIT Lincoln Lab.. . . . . [6951-07]

High power laser system figure of merit improvement with adaptive compensation, William E. Torruellas, The Johns Hopkins Univ. Applied Physics Lab.; Curtis Menyuk, Univ. of Maryland/Baltimore County . . . . . [6951-08]

Phase trajectories for parameters: laser beam propagation problems for turbulent medium, Evgeni N. Terentiev, Fedor V. Shugaev, Ludmila S. Shtemenko, M.V. Lomonosov Moscow State Univ. (Russia). . . . . [6951-09]

Angle of arrival fluctuations: theory vs. experiment, Cynthia Y. Young, Todd Smith, Univ. of Central Florida . . . . . [6951-10]

Algorithm for haze determination using digital camera images, Chow Jeng Wong, Mohd Zubir Mat Jafri, Khiruddin Abdullah, Hwee San Lim, Univ. Sains Malaysia (Malaysia). . . . . [6951-11]

SESSION 3 . . . . . Wed. 3:30 to 5:40 pm

Theory and Experiment II

Session Chair: **Cynthia Y. Young,** Univ. of Central Florida

To be announced *(Invited Paper)*, Michael G. Lovern, Space and Naval Warfare Systems Ctr., San Diego . . . . . [6951-12]

An initial assessment of the CALIPSO Lidar data on stratospheric aerosol backscatter profiles over Penang, Malaysia, Azrul Nizam Alias, Mohd Zubir Mat Jafri, Hwee-San Lim, Nasirun Mohd. Saleh, Univ. Sains Malaysia (Malaysia). . . . . [6951-13]

Propagation variability assessments of ship defense HEL and HPM performance in worldwide maritime boundary layer environments at wavelengths of 1.0642µm, 2.141µm, 3.16mm and 2.3cm, Steven Fiorino, Richard Bartell, Matthew J. Krizo, Salvatore J. Cusumano, Air Force Institute of Technology . . . . . [6951-14]

Real-time scintillation noise mitigation for free space optical transmission of analogue and digital signals, Kenneth J. Grant, Bradley A. Clare, Kerry Mudge, Ben M. Sprey, Raymond J. Oermann, Defence Science and Technology Organisation (Australia) . . . . . [6951-15]

Development of the polarization tracking scheme for free-space quantum cryptography, Morio Toyoshima, Yoshihisa Takayama, Hiroo Kunimori, Masahiro Takeoka, Mikio Fujiwara, Masahide Sasaki, National Institute of Information and Communications Technology (Japan) . . . . . [6951-16]

Enhanced performance for ultrafast lasers in heavy scattering medium, experimental evidence for theoretical predictions, John Cabaniss, Georgia Institute of Technology; Thomas M. Chaffee, Attochron, LLC. . . . . [6951-17]

Thursday 20 March

SESSION 4 . . . . . Thurs. 8:30 to 10:30 am

Experimental Studies I

Session Chair: **Gary J. Baker,** Lockheed Martin Advanced Technology Ctr.

A history of free-space laser communications *(Invited Paper)*, David L. Begley, Ball Aerospace & Technologies Corp. . . . . [6951-18]

A tabletop turbulence generator, Jonathan M. Saint Clair, The Boeing Co.; David Soreide, Optimal Aerospace [6951-19]

Optical communications receiver array, Jonathan M. Saint Clair, The Boeing Co.; David C. Soreide, Optimal Aerospace; Eric Y. Chan, Dennis G. Koshinz, Stephen K. Wilcken, The Boeing Co.; Atul Joshi, Hakan Durmus, Teledyne Imaging Sensors . . . . . [6951-20]

Maximizing receiver misalignment tolerance in a hybrid wireless network, Peter G. LoPresti, Casey Kiister, Univ. of Tulsa; Hazem Refai, Univ. of Oklahoma . . . . . [6951-21]

Atmospheric propagation of novel MWIR lasers for emerging free-space applications *(Invited Paper)*, Anna M. Tabirian, Northrop Grumman Laser System . . . . . [6951-22]

SESSION 5 . . . . . Thurs. 11:00 am to 12:30 pm

Experimental Studies II

Session Chair: **Gary G. Gimmestad,** Georgia Tech Research Institute

A comparative study of 3.6µm and 1.55µm atmospheric transmission, Rita Mahon, L-3 Communications Titan Group; Harris R. Burris, Jr., Mike S. Ferraro, Christopher I. Moore, William S. Rabinovich, Michelle R. Suite, Naval Research Lab. . . . . [6951-23]

Characterization of 1550nm laser propagation in the maritime atmosphere, Linda M. Wasiczko, Christopher I. Moore, Harris R. Burris, Jr., Michele R. Suite, Naval Research Lab. . . . . [6951-24]

Measurement of optical refraction across the Chesapeake Bay *(Invited Paper)*, William P. Hooper, Naval Research Lab. . . . . [6951-25]

Analog frequency modulation of 20 mile free space optical links at the NRL lasercomm test facility, Christopher I. Moore, Harris R. Burris, Jr., Michele R. Suite, Linda M. Wasiczko, Frank Bucholtz, William S. Rabinovich, Naval Research Lab.; Rita Mahon, L-3 Communications Titan Group; James L. Murphy, Mike S. Ferraro, Naval Research Lab.; Kenneth J. Grant, Defence Science and Technology Organisation (Australia); G. Charmaine Gilbreath, Naval Research Lab. . . . . [6951-26]

Lunch/Exhibition Break . . . . . 12:30 to 2:00 pm

SESSION 6 . . . . . Thurs. 2:00 to 3:10 pm

Experimental Studies III

Session Chair: **Linda M. Wasiczko,** Naval Research Lab.

Results from long term studies of packet testing at the U.S. Naval Research Laboratory free-space lasercomm test facility *(Invited Paper)*, Michele R. Suite, Christopher I. Moore, Harris R. Burris, Jr., Linda M. Wasiczko, Naval Research Lab.; Rita Mahon, L-3 Communications Titan Group; William S. Rabinovich, Naval Research Lab. [6951-27]

High speed lasercomm data transfer in the Seahawk 2007 exercise, Harris R. Burris, Jr., Christopher I. Moore, Michele R. Suite, Linda M. Wasiczko, James R. Waterman, Naval Research Lab.; Kenneth M. Vilardebo, V Systems, Inc.; William S. Rabinovich, Naval Research Lab.; Rita Mahon, L-3 Communications Titan Group; Mike S. Ferraro, Naval Research Lab.; Eric Saint Georges, Stan Uecke, NOVASOL . . . . . [6951-28]

Laser propagation through the atmosphere, as derived from near earth space missions, applied to laser communications, David L. Begley, Robert G. Marshalek, Paul A. Lightsey, Carl S. Weimer, David M. Giltner, Ball Aerospace & Technologies Corp. . . . . [6951-29]

SESSION 7 . . . . . Thurs. 3:40 to 5:10 pm

Freespace Lasercomm Systems

Session Chair: **G. Charmaine Gilbreath,** Naval Research Lab.

Lasercomm (Keynote Presentation), Larry B. Stotts, Defense Advanced Research Projects Agency . . [6951-30]

Panel Discussion

Freespace Lasercomm: Today's Readiness and Challenges Ahead

Michele R. Suite, Naval Research Lab.; **David L. Begley,** Ball Aerospace & Technologies Corp.; **Don M. Boroson,** MIT Lincoln Lab.; **Ronald L. Phillips, Larry C. Andrews,** Univ. of Central Florida; **Michael G. Lovern,** Space and Naval Warfare Systems Ctr., San Diego

Related Course

SC167 **Introduction to Laser Radar** *(Kamerman)* Tuesday, 1:30 to 5:30 pm

See pp. 101–117 for course descriptions.

Monday-Tuesday 17-18 March 2008 • Proceedings of SPIE Vol. 6952

Laser Source Technology for Defense and Security IV

Conference Chairs: **Mark Dubinskii,** Army Research Lab.; **Gary L. Wood,** Army Research Lab.

Program Committee: **Steven R. Bowman,** Naval Research Lab.; **Andrew J. W. Brown,** Aculight Corp.; **Joseph Mangano,** Defense Advanced Research Projects Agency; **Mark W. Neice,** High Energy Laser Joint Technology Office; **Stephen G. Post,** Missile Defense Agency

Monday 17 March

SESSION 1 . . . . . .Mon. 1:00 to 3:10 pm

Fiber Lasers

Session Chair: **Andrew J. W. Brown,** Aculight Corp.

Overview of Sandia's fiber laser program *(Invited Paper)*, Dahv A. V.Kliner, Sandia National Labs. . . . . [6952-01]

Single-frequency cw and pulsed master-oscillator fiber power amplifiers, Clifford Headley III, Marc D. Mermelstein, David J. DiGiovanni, OFS Labs.; Igor E. Trofimov, PTAC, Inc.; Robert F. Sellers, Applied Optronics. . . . . [6952-02]

Compact, high-power, eye safe fiber laser for LADAR, Mark S. Bowers, Andrew J. W.Brown, Jason Henrie, Aculight Corp. . . . . [6952-03]

Resonantly cladding-pumped, low-quantum-defect operation of Er-doped LMA fiber amplifier: 1480-nm versus 1530-nm diode pumping case, Mark Dubinskii, Jun Zhang, Army Research Lab.; Igor Kudryashov, Princeton Lightwave Corp. . . . . [6952-04]

Parametric generation in optical fibers in the 900-950nm spectral band, William E. Torruellas, Michael L. Dennis, Jeffery W. Warren, The Johns Hopkins Univ. Applied Physics Lab. . . . . [6952-05]

Comparison of spectral beam combining approaches for high power fiber laser systems, Pratheepan Madasamy, Alison M. Thomas, Pat Jones, Eric C. Honea, Aculight Corp. . . . . [6952-06]

SESSION 2 . . . . . .Mon. 3:40 to 5:40 pm

Diode Lasers

Session Chair: **Steven R. Bowman,** Naval Research Lab.

High brightness semiconductor lasers from 780-1800nm, Paul T. Rudy, Jeffrey E. Ungar, Mark L. Osowski, Robert M. Lammert, Thomas S. Stakelon, Wentao Hu, QPC Lasers, Inc.. . . . . [6952-07]

Diode laser pumping sources for cryogenically-cooled solid-state lasers, Mikhail A. Maiorov, Igor E. Trofimov, PTAC, Inc.; Robert F. Sellers, Applied Optronics . . . [6952-08]

High-brightness laser diode modules for Yb and Er fiber lasers, Igor E. Trofimov, Mikhail A. Maiorov, PTAC, Inc.; Robert F. Sellers, Applied Optronics. . . . . [6952-09]

High-power, very high brightness fiber-coupled diode laser arrays, Daniel M. Grasso, S. David Roh, Coherent Direct Diode Systems . . . . . [6952-10]

Mode control for high performance laser diode sources, Paul O. Leisher, Raymond K. Price, Shabbir A. Bashar, Steve Patterson, Ling Bao, Hua Huang, Jun Wang, Damian Wise, Mark DeFranza, Aaron L. Hodges, Utsu Trifan, Shiguo Zhang, Suhit Das, Weimin Dong, Mike Grimshaw, Mark A. DeVito, Jake Bell, Robert J. Martinsen, Jason Farmer, nLight Corp. . . . . [6952-11]

High power volume Bragg laser bar with 10 GHz spectral bandwidth, George B. Venus, Alex Gourevitch, College of Optics & Photonics/Univ. of Central Florida; Vadim I. Smirnov, OptiGrate; Leonid B. Glebov, College of Optics & Photonics/ Univ. of Central Florida . . . . . [6952-12]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 3 . . . . . Tues. 10:30 am to 12:20 pm

Advanced Laser Concepts

Session Chair: **Gary L. Wood,** Army Research Lab.

Thermal conductivity model of optical materials *(Invited Paper)*, Takunori Taira, Yoichi Sato, Institute for Molecular Science (Japan). . . . . [6952-13]

Synthesis and properties of novel eye-safe and mid-IR single crystal, ceramic, and optical fiber sources, Joseph W. Kolis, John M. Ballato, Colin D. McMillen, Baris Kokuoz, Basak Kokuoz, Karn Serivalsatit, Paul R. Foy, Thomas W. Hawkins, Exley McCormick, Clemson Univ. . . . . [6952-14]

Single-frequency-mode Q-switched Nd:YAG laser controlled by volume Bragg gratings, Nikolai S. Vorobiev, College of Optics & Photonics/Univ. of Central Florida; Vadim I. Smirnov, OptiGrate; Leon Glebov, College of Optics & Photonics/Univ. of Central Florida . . . . . [6952-15]

Design and fabrication for efficient collimation and focusing optics for mid-IR quantum cascade lasers, Bruce E. Bernacki, Kannan Krishnaswami, Norman C. Anheier, Jr., Bret D. Cannon, Pacific Northwest National Lab. . . . [6952-16]

Cohering of multiple polariton lasers for sensing applications, Richard L. Fork, Luke A. Burgess, The Univ. of Alabama in Huntsville . . . . . [6952-17]

Lunch/Exhibition Break . . . . . 12:20 to 1:30 pm

SESSION 4 . . . . . Tues. 1:30 to 3:10 pm

High Power SSL

Session Chair: **Mark W. Neice,** High Energy Laser Joint Technology Office

Strategic illuminator laser (SILL): provides state-of-the-art power and beam quality at 5kHz, Glenn P. Brossus, Northrop Grumman Space Technology . . . . . [6952-18]

Kilowatt class high-power CW Yb:YAG cryogenic laser, David C. Brown, Joseph M. Singley, Evan D. Yager, Katie A. Kowalewski, Brett J. Lotito, James W. Guelzow, Jerry W. Kuper, Snake Creek Lasers, LLC . . . . . [6952-19]

High power silicon carbide face-cooled ceramic Nd:YAG laser, George A. Newburgh, Mark Dubinskii, Army Research Lab. . . . . [6952-20]

Tensile strength and elastic moduli of composite solid state laser media, Huai-Chuan Lee, Helmuth E. Meissner, Onyx Optics Inc. . . . . [6952-21]

Results for a phosphate athermal glass (PA-GLASS), William A. Goodman, Schafer Corp. . . . . [6952-22]

SESSION 5 . . . . . Tues. 3:40 to 5:50 pm

Visible, Eye-Safe and Mid-IR Lasers

Session Chair: **Stephen G. Post,** Missile Defense Agency

First laser performance of Er^{3+}-doped scandia (Sc2O3) ceramic *(Invited Paper)*, Mark Dubinskii, Nikolay Ter-Gabrielyan, Larry D. Merkle, George A. Newburgh, Army Research Lab.; Akio Ikesue, World Lab Co., Ltd. . . . [6952-23]

Thermo-optical model for Er^{3+}:YAG gain media, Marc Eichhorn, French-German Research Institute of Saint-Louis (France) . . . . . [6952-24]

Design of walk-off corrected biaxial crystal composites, Huai-Chuan Lee, Helmuth E. Meissner, Onyx Optics Inc.. . . . . [6952-25]

Miniature solid-state lasers for pointing, illumination, and warning devices, David C. Brown, Snake Creek Lasers, LLC . . . . . [6952-26]

Investigation of generating 473nm by doubling of a 946nm, Nd:YAG laser, Mark E. Kushina, Steven T. Horstmann, Northrop Grumman Corp. . . . . [6952-27]

Thulium fiber laser-pumped mid-IR OPO, Daniel Creeden, BAE Systems; Min Jiang, Spectrode, LLC; Peter A. Budni, Peter A. Ketteridge, Scott D. Setzler, York E. Young, John C. McCarthy, Peter G. Schunemann, Thomas M. Pollak, BAE Systems; Parviz Tayebati, Spectrode, LLC; Evan P. Chicklis, BAE Systems. . . . . [6952-28]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Experimental demonstration of beam cleanup system based on stochastic parallel gradient descent method, Sanhong Wang, Yonghui Liang, XiaoJun Xu, Xuejun Long, Qifeng Yu, National Univ. of Defense Technology (China) . . . . . [6952-29]

Nonlinear optical device for middle infrared generation, Navin B. Patel, Univ. of Campinas (Brazil) . . . . . [6952-30]

300kW, eye-safe intracavity OPO transmitter, Waldemar Zendzian, Wojskowa Akademia Tehcniczna (Poland); Jan K. Jabczynski, Jacek Kwiatkowski, Krzysztof Kopczyski, Wojskowa Akademia Techniczna (Poland) . . . . . [6952-31]

Passively Q-switched epitaxially grown Cr^{4+}:YAG/Yb^{3+}:YAG and cw Yb:doped YAG, KGW, KYW, KYbW microchip lasers, Krzysztof Kopczyski, Jaroslaw Mlynczak, Zygmunt Mierczyk, Wojskowa Akademia Techniczna (Poland); Jerzy Sarnecki, Jerzy Skwarcz, Instytut Technologii Materialów Elektronicznych (Poland); Andrzej Majchrowski, Wojskowa Akademia Techniczna (Poland) . . . . . [6952-32]

Ultra fast gated Raman for explosives identification, Lev Nagli, Tel Aviv Univ. (Israel) . . . . . [6952-34]

Related Courses

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* Wednesday, 8:30 am to 5:30 pm

SC167 **Introduction to Laser Radar** *(Kamerman)* Tuesday, 1:30 to 5:30 pm

SC784 **Fiber Lasers for Defense Applications: Fibers, Components and System Design Considerations** *(Samson, Torruellas)* Tuesday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Battlespace Technologies

Chairs: **John H. Holloway, Jr.,** Naval Surface Warfare Ctr.

Patrick J. Gardner, General Dynamics Armament and Technical Products

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6953 **Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XIII** *(Harmon, Broach, Holloway)* p. 45

6954 **Chemical Biological Radiological Nuclear and Explosives (CBRNE) Sensing IX** *(Fountain, Gardner)* p. 47

Courses of Related Interest

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, p. 105

SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)* 1:30 to 5:30 pm, p. 101

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works

11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair

11:00 am to 3:00 pm

FREE Exhibition

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

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Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XIII

Conference Chairs: **Russell S. Harmon,** U.S. Army Research Office; **J. Thomas Broach,** U.S. Army Night Vision & Electronic Sensors Directorate; **John H. Holloway,** Naval Surface Warfare Ctr., Panama City

Program Committee: **Leslie M. Collins,** Duke Univ.; **Yogadhish Das,** Defence Research and Development Canada (Canada); **Gerald J. Dobeck,** Naval Surface Warfare Ctr., Panama City; **Paul D. Gader,** Univ. of Florida; **John E. McFee,** Defence Research and Development Canada (Canada); **Nicola A. Playle,** Defence Science and Technology Lab. (United Kingdom); **James M. Sabatier,** The Univ. of Mississippi; **Motoyuki Sato,** Tohoku Univ. (Japan); **Miranda A. Schatten,** U.S. Army Night RDECOM CERDEC NVESD; **Waymond R. Scott,** Georgia Institute of Technology; **Richard C. Weaver,** U.S. Army RDECOM CERDEC NVESD

Monday 17 March

Opening Remarks . . . . . Mon. 10:30 to 10:40 am

Session Chairs: **Russell S. Harmon,** U.S. Army Research Office; **J. Thomas Broach,** U.S. Army Night Vision & Electronic Sensors Directorate; **John H. Holloway,** Naval Surface Warfare Ctr.

SESSION 1 . . . . . Mon. 10:40 am to 12:00 pm

Electromagnetic Induction Sensing and Detection I

Session Chairs: **Al Wexler,** Quantic EMC Inc. (Canada); **Francis Navish,** U.S. Army Night Vision & Electronic Sensors Directorate

Study of the influence of the plastic casing on the electromagnetic induction response of a buried landmine, Yogadhish Das, Defence Research and Development Canada (Canada) . . . . . [6953-01]

Application of the NSMC model to the multi-axis time domain EMI data, Fridon Shubitidze, Dartmouth College and Sky Research, Inc.; Ben E. Barrowes, U.S. Army Engineer Research and Development Ctr.; Irma Shamatava, Sky Research, Inc. and Dartmouth College; Kevin A. O'Neill, U.S. Army Engineer Research and Development Ctr.. . . . [6953-02]

Performance comparison of frequency domain quadrapole and dipole electromagnetic induction sensors in a landmine detection application, Eric Fails, Peter A. Torrione, Leslie M. Collins, Duke Univ. . . . . [6953-03]

Combining dipole and mixed models approaches for UXO discrimination, Fridon Shubitidze, Dartmouth College and Sky Research, Inc.; Alex Bijamov, Eugene Demidenko, Dartmouth College; Irma Shamatava, Sky Research, Inc. and Dartmouth College . . . . . [6953-04]

Lunch Break . . . . . 12:00 to 2:00 pm

SESSION 2 . . . . . Mon. 2:00 to 3:00 pm

Electromagnetic Induction Sensing and Detection II

Session Chairs: **Yogadhish Das,** Defence Research and Development Canada (Canada); **Fridon Shubitidze,** Dartmouth College.

High definition impedance imaging: of mines and tunnels, Al Wexler, Patrick A. O'Connor, Quantic Electroscan Inc. (Canada); John E. McFee, Defence Research and Development Canada (Canada) . . . . . [6953-05]

Improvements based on ground penetration radar field evaluations in Angola, Francis Navish III, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6953-06]

Detection of buried objects using ultra-wideband radar: newly launched mine detection project in South Korea, Kyungryul Kam, Kangwook Kim, Gwangju Institute of Science and Technology (South Korea) . . . . . [6953-07]

SESSION 3 . . . . . Mon. 3:30 to 5:50 pm

Sensing and Detection Potpourri

Session Chairs: **James B. Spicer,** Johns Hopkins Univ.; **Hernan Moreno,** New Mexico Institute of Mining and Technology

Differential remote photo-acoustic spectroscopy for stand off detection of explosive residues on external surfaces, Pamela M. Aker, Pacific Northwest National Lab. . . [6953-08]

Substrate-related effects on molecular and atomic emission in LIBS of explosives, James B. Spicer, Caroline McEnnis, Johns Hopkins Univ. . . . . [6953-09]

Mathematical modeling of the transport of explosive related compunds, Maik Irrazábal-Aguilera, Samuel P. Hernandez-Rivera, Julio G. Briano, Univ. de Puerto Rico Mayagüez . . . . . [6953-10]

Electron-beam injected into ground generates subsoil x-rays that may deactivate concealed electronics used to trigger explosive devices, Michael W. Retsky, Electron Optics Development Co., LLC . . . . . [6953-11]

Humanitarian IED clearance in Colombia, Hernan Moreno, New Mexico Institute of Mining and Technology; Ruben D. Hernandez, Escuela de Ingenieria de Antioquia (Colombia); Alejandro Molina, Univ. Nacional de Colombia (Colombia); Jan M. H.Hendrickx, New Mexico Institute of Mining and Technology; Mark Grasmueck, Univ. of Miami . . . . . [6953-12]

Preliminary experimental validation of a landmine detection system based on localized heating and sensing, Marco Balsi, Massimo Corcione, Pierpaolo Dell'Omo, Salvatore Esposito, Lorenzo Magliocchetti, Univ. degli Studi di Roma/La Sapienza (Italy). . . . . [6953-56]

Achievements and bottlenecks in humanitarian demining EU-dunfed research: final results from the EC DELVE project, Hichem Sahli, Vrije Univ. Brussel (Belgium); Claudio Bruschini, CBR Scientific Consulting (Switzerland); Luc M. van Kempen, Vrije Univ. Brussel (Belgium); Ric H. Schleijpen, Eric den Breejen, TNO (Netherlands) . . . . . [6953-57]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 4 . . . . . Tues. 10:30 am to 12:10 pm

Littoral Sensing and Detection I

Session Chairs: **John H. Holloway,** Naval Surface Warfare Ctr.; **James Tory Cobb,** Naval Surface Warfare Ctr.

Automated sea mine detection, classification, and fusion in sonar data, Gerald J. Dobeck, Naval Surface Warfare Ctr.. . . . . [6953-13]

Through-the-sensor environmental adaptation for computer-aided detection/computer-aided classification (CAD/CAC) algorithms, Charles M. Ciany, William C. Zurawski, Raytheon Co. . . . . [6953-14]

Enhanced ATR algorithm for high-resolution multi-band sonar imagery, Tom Aridgides, Manuel F. Fernández, Lockheed Martin Corp. . . . . [6953-15]

Multi task semi-supervised underwater mine detection, Lawrence Carin, Duke Univ.; Jason R. Stack, Naval Surface Warfare Ctr.. . . . . [6953-16]

Buried underwater target classification using frequency subband coherent analysis, Neil S. Wachowski, Mahmood R. Azimi-Sadjadi, Colorado State Univ. . . . . [6953-17]

Lunch/Exhibition Break . . . . . 12:10 to 1:40 pm

SESSION 5 . . . . . Tues. 1:40 to 3:40 pm

Littoral Sensing and Detection II

Session Chairs: **Gerald J. Dobeck,** Naval Surface Warfare Ctr.; **Tom Aridgides,** Lockheed Martin Corp.

Target detection and classification from multiple side-scan sonar platforms using canonical correlations, James D. Tucker, Mahmood Azimi-Sadjdadi, Colorado State Univ.; Gerald J. Dobeck, Naval Surface Warfare Ctr. . . . . [6953-18]

Statistical properties of synthetic aperture sonar image textures, James T. Cobb, Naval Surface Warfare Ctr.. . . . . [6953-19]

Gaussian Markov random field modeling of textures in high-frequency synthetic aperture sonar, Simon Y. Foo, Florida State Univ.; James T. Cobb, Jason R. Stack, Naval Surface Warfare Ctr. . . . . [6953-20]

Underwater UXO detection and discrimination: understanding EMI scattering phenomena in a conducting environment, Fridon Shubitidze, Dartmouth College and Sky Research, Inc.; Irma Shamatava, Sky Research, Inc. and Dartmouth College; Ben E. Barrowes, Kevin A. O'Neill, U.S. Army Engineer Research and Development Ctr.. . . . [6953-21]

TacMSI: a novel multi-look multispectral imager for maritime mine detection, Carrie L. Leonard, Chong Wai Chan, Tamara Cottis, Michael J. DeWeert, Brian P. Farm, Daniel Kokubun, Reid Noguchi, Dugan Yoon, Eric Louchard, BAE Systems. . . . . [6953-22]

Electrical impedance tomography for underwater mine detection, Gail Bouchette, Stephane Gagnon, Philip M. Church, Tim Luu, Neptec Design Group Ltd. (Canada); John E. McFee, Defense Research and Development Canada (Canada) . . . . . [6953-23]

Wednesday 19 March

SESSION 6 . . . . . Wed. 9:00 to 11:50 am

Optical Sensing and Detection

Session Chairs: **J. Michael Cathcart,** Georgia Institute of Technology; **Miranda A. Schatten,** U.S. Army Night Vision & Electronic Sensors Directorate

UXO detection and characterization using vision-based robotic systems, Saed Amer, Amir H. Shirkhodaie, Haroun Rababaah, Tennessee State Univ. . . . . [6953-24]

Phenomenology of thermal signatures of disturbed and undisturbed soils, George G. Keonig, U.S. Army Engineer Research and Development Ctr.. . . . . [6953-25]

Spectral methods to detect surface mines, Edwin M. Winter, Technical Research Associates, Inc.; Miranda A. Schatten, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6953-26]

Exposure effects on optical properties of building materials, J. Michael Cathcart, Sarah Lane, J. Timothy Harrell, Georgia Institute of Technology . . . . . [6953-27]

Adaptive spatial sampling schemes for the detection of mine fields in hyperspectral imagery, Alan Thomas, J. Michael Cathcart, Georgia Institute of Technology. . [6953-28]

Comparative performance between compressed and uncompressed airborne imagery, Chung D. Phan, Ronald R. Rupp, Anh H. Trang, U.S. Army Night Vision & Electronic Sensors Directorate; Sanjeev Agarwal, Univ. of Missouri/ Rolla . . . . . [6953-29]

Automated determination of scale and orientation of mine field grid, Alan Thomas, J. Michael Cathcart, Georgia Institute of Technology . . . . . [6953-30]

Lunch/Exhibition Break . . . . . 11:50 am to 1:30 pm

SESSION 7 . . . . . Wed. 1:30 to 3:10 pm

Environmental Effects on Sensing and Detection

Session Chairs: **Yogadhish Das,** Defence Research and Development Canada (Canada); **Russell S. Harmon,** U.S. Army Research Office

Investigation of soil processes on radar signature of landmines, Deborah T. Abrams, Univ. de Puerto Rico Mayagüez and U.S. Army Engineer Research and Development Ctr.; Gary Koh, U.S. Army Engineer Research and Development Ctr. . . . . [6953-31]

Radar attenuation in desert soil, Gary Koh, U.S. Army Engineer Research and Development Ctr. . . . . [6953-32]

Global prediction of thermal regimes in bare soils, Hernan Moreno, Jan M. H.Hendrickx, New Mexico Institute of Mining and Technology; Hongjie Xie, The Univ. of Texas at San Antonio; Jirka Simunek, Univ. of California/Riverside [6953-33]

Toward a model for predicting magnetic susceptibility of bedrock regolith and soils, Remke L. Van Dam, Michigan State Univ.; Jan M. H.Hendrickx, Bruce J. Harrison, New Mexico Institute of Mining and Technology; Russell S. Harmon, U.S. Army Research Office; Samer Hariri, Michigan State Univ. . . . . [6953-34]

Improving detection and discrimination of buried metallic objects in magnetic geologic settings by modeling the background soil response, Leonard R. Pasion, The Univ. of British Columbia (Canada) and Sky Research, Inc. (Canada); Douglas W. Oldenburg, The Univ. of British Columbia (Canada); Nicolas Lhomme, Stephen D. Billings, Sky Research, Inc. (Canada) . . . . . [6953-35]

SESSION 8 . . . . . .Wed. 3:40 to 5:40 pm

Multi System Sensing

Session Chairs: **Motoyuki Sato,** Tohoku Univ. (Japan); **Mehmet Sezgin,** TÜBITAK Marmara Research Ctr. (Turkey)

Hand-held dual-sensor ALIS and its evaluation tests, Motoyuki Sato IV, Tohoku Univ. (Japan); Kazunori Takahashi, Bundesanstalt für Materialforschung und -prüfung (Germany) . . . . . [6953-36]

HSTAMIDS operational field evaluation, Cambodia, Roger Cresci, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6953-37]

Buried object depth estimation, Mehmet Sezgin, TÜBITAK Marmara Research Ctr. (Turkey) . . . . . [6953-38]

Determining object depth using radar, metal detectors, and magnetometers, Jay A. Marble, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6953-39]

On the registration of FLGPR and IR data for the forward-looking landmine detection system and its use in eliminating FLGPR false alarms, Kevin Stone, James M. Keller, Mark A. Busch, Dominic K. C.Ho, Univ. of Missouri/Columbia; Paul D. Gader, Univ. of Florida . . . . . [6953-40]

Sensor management for landmine detection using correlated sensor observations, Mark P. Kolba, Leslie M. Collins, Duke Univ. . . . . [6953-41]

Thursday 20 March

SESSION 9 . . . . . Thurs. 8:40 to 10:00 am

EOIR Signal Processing

Session Chairs: **George G. Keonig,** U.S. Army Engineer Research and Development Ctr.; **Edwin M. Winter,** Technical Research Associates, Inc.

FastKRX: a fast approximation for kernel RX anomaly detection, Spandan Tiwari, Sanjeev Agarwal, Univ. of Missouri/Rolla; Anh H. Trang, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6953-42]

Exploiting mineness for scatterable minefield detection, Anh H. Trang, U.S. Army Night Vision & Electronic Sensors Directorate; Sanjeev Agarwal, Univ. of Missouri/Rolla; Thomas Broach, Thomas E. Smith, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6953-43]

HAMD: a software system for surface and buried mine detections, Bo Ling, Migma Systems, Inc.; Anh H. Trang, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6953-44]

Application of context-based classifier to remotely sensed imagery for mine detection, Jeremy Bolton, Paul D. Gader, Univ. of Florida . . . . . [6953-45]

SESSION 10 . . . . . Thurs. 10:30 to 11:50 am

GPR for Detection and Algorithm Fusion I

Session Chairs: **Paul D. Gader,** Univ. of Florida; **Lawrence Carin,** Duke Univ.

Data fusion of vehicle-mounted countermine sensors, Robert M. Deas, Nigel G. Davidson, Nicola A. Playle, Defence Science and Technology Lab. (United Kingdom); Tom Riley, Mark Bernhardt, Moira I. Smith, Waterfall Solutions Ltd. (United Kingdom). . . . . [6953-46]

Application of Markov random fields to landmine detection in ground-penetrating radar data, Peter A. Torrione, Leslie M. Collins, Duke Univ. . . . . [6953-47]

Landmine detection with ground penetrating radar using discrete hidden Markov models with symbol dependent features, Hichem Frigui, Oualid Missaoui, Univ. of Louisville; Paul D. Gader, Univ. of Florida . . . . . [6953-48]

Subspace processing of GPR signals for vehicle-based landmine detection system, Dominic K. C.Ho, Univ. of Missouri/Columbia; Paul D. Gader, Joseph N. Wilson, Univ. of Florida; Hichem Frigui, Univ. of Louisville . . . . . [6953-49]

Lunch/Exhibition Break . . . . . 11:50 pm to 1:30 am

SESSION 11 . . . . . Thurs. 1:30 to 3:30 pm

GPR for Detection and Algorithm Fusion II

Session Chairs: **Peter A. Torrione,** Duke Univ.; **Anh H. Trang,** U.S. Army Night Vision & Electronic Sensors Directorate

Use of rank-based decision level fusion in landmine discrimination, Joseph N. Wilson, Univ. of Florida . [6953-50]

A generic framework for context-dependent fusion with application to landmine detection, Hichem Frigui, Univ. of Louisville; Paul D. Gader, Univ. of Florida; Ahmed Chamseddine, Univ. of Louisville . . . . . [6953-51]

Decision- and feature-level fusion processing for multi-sensor landmine detection: practical applications and real-time implementation, Joe Keranen, Applied Research Associates, Inc. and Duke Univ.; Gregory M. Schultz, Applied Research Associates, Inc.; Peter A. Torrione, Leslie M. Collins, Duke Univ. . . . . [6953-52]

The model-based generalized SEA and a statistical signal processing approach for UXO discrimination, Irma Shamatava, Fridon Shubitidze, Dartmouth College and Sky Research, Inc.; Eugene Demidenko, Dartmouth College; Ben Barrowes, Kevin A. O'Neill, U.S. Army Engineer Research and Development Ctr. . . . . [6953-53]

A data-derived time-domain SEA for UXO identification using the MPV sensor, Juan P. Fernández, Dartmouth College; Benjamin E. Barrowes, Kevin A. O'Neill, U.S. Army Engineer Research and Development Ctr.; Irma Shamatava, Fridon Shubitidze, Dartmouth College . . . . . [6953-54]

Inversion of frequency domain data collected in a magnetic setting for the detection of UXO, Nicolas Lhomme, Leonard R. Pasion, Sky Research, Inc. (Canada) and The Univ. of British Columbia (Canada); Stephen D. Billings, Sky Research, Inc. (Canada); Douglas W. Oldenburg, The Univ. of British Columbia (Canada) . . . . . [6953-55]

Related Course

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)*
Monday, 1:30 to 5:30 pm

See pp. 101–117 for course descriptions.

Chemical Biological Radiological Nuclear and Explosives (CBRNE) Sensing IX

Conference Chairs: **Augustus Way Fountain,** U.S. Army Research, Development and Engineering Command; **Patrick J. Gardner,** Western Carolina Univ.

Program Committee: **Jerome J. Braun,** MIT Lincoln Lab.; **John C. Carrano,** Luminex Corp.; **Christopher C. Carter,** The Johns Hopkins Univ. Applied Physics Lab.; **Vernon Davis,** National Nuclear Security Administration; **Matthew Todd Griffin,** General Dynamics Armament and Technical Products; **Harry Ing,** Bubble Technology Industries, Inc. (Canada); **Harold R. McHugh,** U.S. Dept. of Energy; **Brian E. Moretti,** U.S. Military Academy; **Paul M. Pellegrino,** Army Research Lab.; **Michael Peters,** Intelagard; **Michael W. P. Petryk,** Defence Research and Development Canada (Canada); **Michael A. Strauss,** General Dynamics Armament and Technical Products; **Cynthia R. Swim,** U.S. Army Edgewood Chemical Biological Ctr.

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 1 . . . . . Tues. 1:40 to 4:50 pm

Explosives Sensing

Session Chair: **Augustus Way Fountain,** U.S. Army Edgewood Chemical Biological Ctr.

Explosives signatures and analysis, Augustus W. Fountain III, U.S. Army Edgewood Chemical Biological Ctr. . . [6954-01]

LIBS plasma enhancement for standoff detection applications, Dennis K. Killinger, Univ. of South Florida; Susan D. Allen, Arkansas State Univ.; Robert D. Waterbury, Chris Stefano, Edwin L. Dottery, Alaka'i Consulting & Engineering, Inc. . . . . [6954-02]

Gamma-ray imaging for explosives detection, Georgia A. DeNolfo, Stanley D. Hunter, Seunghee Son, Jason T. Link, NASA Goddard Space Flight Ctr. . . . . [6954-03]

Combining hyperspectral imaging and Raman spectroscopy for remote chemical sensing, John Ingram, U.S. Military Academy . . . . . [6954-04]

Standoff explosive detection using broadly tunable mid-infrared external cavity quantum cascade lasers, Tim Rayner, Timothy Day, Michael B. Pushkarsky, Miles J. Weida, Eric Takeuchi, Daylight Solutions, Inc. . . . . [6954-05]

Experimental demonstration of remote optical detection of trace explosives, Charles M. Wynn, Roderick R. Kunz, Mordechai Rothschild, John J. Zayhowski, Stephen T. Palmacci, MIT Lincoln Lab. . . . . [6954-06]

Characterization of near-infrared low-energy ultra-short laser pulses for portable applications of laser-induced breakdown spectroscopy, Paul M. Pellegrino, Alexander W. Schill IV, Dimitra N. Stratis-Cullum, Army Research Lab. . . . . [6954-07]

Standoff LIBS and Raman measurements of energetic materials using a single UV excitation laser, Robert D. Waterbury, Alaka'i Consulting & Engineering, Inc.; Dennis K. Killinger, Univ. of South Florida; Jeremy D. Rose, Edwin L. Dottery, Guy P. Ontai, Alaka'i Consulting & Engineering, Inc.. . . . . [6954-08]

Wednesday 19 March

SESSION 2 . . . . . Wed. 8:00 am to 12:30 pm

Chemical Sensing I

Session Chair: **Paul M. Pellegrino,** Army Research Lab.

"Light Flight": a new approach for chemical sensing using optic fibers sensorial system, design validation and calibration of an original device, Antonio M. Calabro, Ctr. Italiano Ricerche Aerospaziali (Italy); Luca Mazzola, Univ. degli Studi di Roma Tre (Italy) . . . . . [6954-09]

Evaluating performance enhancements for a Raman hyperspectral imaging sensor, Patrick J. Treado, Jason H. Neiss, Matthew P. Nelson, ChemImage Corp. . . . . [6954-10]

Extending lifetime of plasmonic silver structures designed for high-resolution chemical imaging or chemical and biological sensing, Carlos A. Barrios, Andrey V. Malkovskiy, Ryan D. Hartschuh, Scott R. Hamilton, Alexander M. Kisliuk, Alexei P. Sokolov, Mark D. Foster, The Univ. of Akron . . . . . [6954-11]

Multidimensional molecular identification by laser control mass spectrometry, Marcos M. Dantus, Michigan State Univ. . . . . [6954-12]

Large-area cold plasma applicator for decontamination, Gregory A. Konesky, K-Plasma Ltd. . . . . [6954-13]

Recent advances toward a fiber optic sensor for nerve agent, Steven R. Cordero, Robert A. Lieberman, Intelligent Optical Systems, Inc. . . . . [6954-14]

Remote identification of liquid surface contamination by imaging Fourier transform spectrometry, Roland Harig, Technische Univ. Hamburg-Harburg (Germany) . . . . [6954-15]

DMS-IMS2, GC-DMS, DMS-MS: DMS hybrid devices combining orthogonal principles of separation for challenging applications, Andrew Anderson, Kenneth Markoski, Quan Shi, Stephen Coy, Evgeny Krylov, Erkinjon Nazarov, Sionex Corp. . . . . [6954-16]

A new miniature, hand-held, solar-blind, reagentless standoff chemical, biological and explosives (CBE) sensor, William F. Hug, Ray D. Reid, Photon Systems, Inc.; Rohit Bhartia, Arthur L. Lane, Jet Propulsion Lab. . . [6954-17]

Fingerprinting CBRNE materials, Jane F. Bertone, Kevin M. Spencer, EIC Labs., Inc. . . . . [6954-18]

Sensing characteristics of carbon nanotubes for chlorine, Ahalapitiya H. Jayatissa, Univ. of Toledo . . . . . [6954-19]

Active hyperspectral imaging system for the detection of liquids, Chris R. Howle, Defence Science and Technology Lab. (United Kingdom); David J. Stothard, Cameron F. Rae, Mark Ross, Univ. of St. Andrews (United Kingdom); Benjamin Truscott, Defence Science and Technology Lab. (United Kingdom); Malcolm H. Dunn, Univ. of St. Andrews (United Kingdom) . . . . . [6954-46]

Lunch/Exhibition Break . . . . . 12:30 to 1:40 pm

SESSION 3 . . . . . Wed. 1:40 to 4:30 pm

Chemical Sensing II

Session Chair: **Michael W. P. Petryk,** Defence Research and Development Canada (Canada)

Airborne measurements in the longwave infrared using a FIRST imaging hyperspectral sensor, Alexandre Vallières, Jean-Pierre Allard, Martin Chamberland, Vincent Farley, André Villemaire, Telops, Inc. (Canada) . . . . . [6954-20]

Computational models and spectroscopic studies in the near-infrared and visible regions, Michael W. P.Petryk, Defence Research and Development Canada (Canada) . . . . . [6954-21]

Imaging open-path Fourier transform infrared spectrometer for 3D cloud profiling, Julia R. Dupuis, David J. Mansur, James R. Engel, Robert M. Vaillancourt, OPTRA, Inc.; Lori A. Todd, Kathleen Mottus, The Univ. of North Carolina at Chapel Hill. . . . . [6954-22]

Identification and localization of potential chemical/biological events on the move, Sachi V. Desai, Myron E. Hohil, U.S. Army Research, Development and Engineering Command . . . . . [6954-23]

Detection of chemicals at a standoff >10 m distance based on single-beam coherent anti-Stokes Raman scattering, Marcos M. Dantus, Michigan State Univ.[6954-24]

CATSI EDM: recent advances on the development and validation of a ruggedized passive standoff CWAs sensor, Hugo Lavoie, Jean-Marc Theriault, Francois Bouffard, Eldon Puckrin, Caroline S. Turcotte, Defence Research and Development Canada (Canada); Paul Lacasse, AEREX Avionics Inc. (Canada). . . . . [6954-25]

Detection of gas plumes in cluttered environments using long-wave infrared hyperspectral sensors, Joshua Broadwater, Thomas S. Spisz, The Johns Hopkins Univ. Applied Physics Lab.. . . . . [6954-26]

SESSION 4 . . . . . Wed. 4:30 to 5:30 pm

Venture Capital Considerations for CBRNE

Session Chair: **Patrick J. Gardner,** Western Carolina Univ.

Chart venture investment considerations for CBRNE products and opportunities, Patrick J. Gardner, Western Carolina Univ.; Cole Van Nice, Chart Venture Partners . . . . . [6954-27]

In-Q-Tel investment considerations for CBRNE products and opportunities, Patrick J. Gardner, Western Carolina Univ. . . . . [6954-28]

Arch Venture Partners investment considerations for CBRNE products and opportunities, Patrick J. Gardner, Western Carolina Univ. . . . . [6954-29]

Thursday 20 March

SESSION 5 . . . . . Thurs. 8:20 to 10:00 am

Biological Sensing I

Session Chair: **Christopher C. Carter,** The Johns Hopkins Univ. Applied Physics Lab.

Development of a standardized differential-reflective bioassay for microbial pathogens, Jay Wilhelm, J. R. X.Auld, James E. Smith, West Virginia Univ.. . . . . [6954-30]

Shape characteristics of biological spores, Richard I. Joseph, Alison K. Lazarevich, The Johns Hopkins Univ. Applied Physics Lab.. . . . . [6954-31]

Refractive index measurement of biological particles in visible region, Diane Limsui, Marc B. Airola, The Johns Hopkins Univ. Applied Physics Lab. . . . . [6954-32]

Extinction and backscatter cross sections of biological materials, Michael E. Thomas, Diane Limsui, The Johns Hopkins Univ. Applied Physics Lab. . . . . [6954-33]

Surface imaging microscope, Eric W. Rogala, Isaac N. Bankman, The Johns Hopkins Univ. Applied Physics Lab. . . . . [6954-34]

SESSION 6 . . . . . Thurs. 10:30 am to 12:10 pm

Biological Sensing II

Session Chair: **Jerome J. Braun,** MIT Lincoln Lab.

Short non-coding RNAs as biowarfare agent identifiers detected by surface plasmon resonance enhanced common path interferometry, Charles Greef, Viatcheslav Petropavlovskikh, Oyvind Nilsen, Bilge Hacioglu, AlphaSniffer LLC; John Hall, Hall Stable Lasers, LLC; Patrick J. Gardner, Western Carolina Univ. . . . . [6954-35]

DMS-prefiltered mass spectrometry for the detection of biomarkers, Stephen Coy, Evgeny Krylov, Erkinjon Nazarov, Sionex Corp. . . . . [6954-36]

Measurement and characterization of optical diffraction patterns for bacterial spores, Patrick J. Gardner, Western Carolina Univ.; Michael A. Fiddy, The Univ. of North Carolina at Charlotte . . . . . [6954-37]

Classification of category A pathogenic bacteria, A. Peter Snyder, U.S. Army Edgewood Chemical Biological Ctr.; Ashish Tripathi, Science Applications International Corp.; Diane St. Amant, U.S. Army Edgewood Chemical Biological Ctr.; Mark Campbell, U.S. Dept. of Agriculture; Jennifer Minter, Science and Technology Corp.; Darren K. Emge, Alan C. Samuels, U.S. Army Edgewood Chemical Biological Ctr.. . . . . [6954-38]

Growth and characterization of bismuth iodide crystals grown by the Bridgman method, Wei Qiu, Juan C. Nino, Azaree T. Lintereur, James E. Baciak, Univ. of Florida . . . . . [6954-39]

Lunch/Exhibition Break . . . . . 12:10 to 1:40 pm

SESSION 7 . . . . . Thurs. 1:40 to 3:40 pm

Radiological and Nuclear Sensing

Session Chair: **Vernon Davis,**
National Nuclear Security Administration

Neutron imaging camera, Stanley D. Hunter, Georgia A. DeNolfo, Seunghee Son, Jason T. Link, NASA Goddard Space Flight Ctr.; Noel A. Guardala, Naval Surface Warfare Ctr.. . . . . [6954-40]

Extraordinary improvement in scintillation detectors via post-processing with ASEDRA: solution to a 50-year-old problem, Eric LaVigne, Glenn E. Sjoden, James E. Baciak, Jr., Rebecca S. Detwiler, Univ. of Florida . . . . . [6954-41]

Polymer composites for gamma photon detection, Qibing Pei, Univ. of California/Los Angeles . . . . . [6954-42]

Research and application of digital image processing technique in cobalt 60-based container inspection system, Bo Sun, Beijing Normal Univ. (China); Yun Liu, Beijing Energy Detection Technology Inc. (China); Jun He, Beijing Normal Univ. (China) . . . . . [6954-43]

A new electronic neutron dosimeter (END) for reliable personal dosimetry, Harry Ing, Hugh R. Andrews, Rachid Machrafi, Alexey Voevodskiy, Kevin Zhang, Bubble Technology Industries, Inc. (Canada); Thomas Cousins, Carey Larsson, Roger Hugron, Jason Brown, Defence Research and Development Canada (Canada) . . . . . [6954-44]

Unattended sensors for nuclear threat detection, Robert C. Runkle, Lindsay Todd, Scott J. Morris, Scott Kiff, John S. Rohrer, Michael T. Batdorf, Brion J. Burghard, Kenneth Jarman, Pacific Northwest National Lab. . . . . [6954-45]

Related Course

SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)*
Monday, 1:30 to 5:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Displays

Chairs: **Clarence E. Rash,** U.S. Army Aeromedical Research Lab.

Jacques G. Verly, Univ. de Liège (Belgium)

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6955 **Head- and Helmet-Mounted Displays XIII: Design and Applications** *(Brown, Marasco)* p. 50

6957 **Enhanced and Synthetic Vision 2008** *(Güell, Uijt de Haag)* p. 52

6956 **Display Technologies & Applications for Defense, Security, and Avionics II** *(Thomas, Malloy)* p. 51

Courses of Related Interest

SC159 **Head-Mounted Displays: Design and Applications, Including Night Vision** *(Melzer, Browne)* 8:30 am to 5:30 pm, p. 108

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works

11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair

11:00 am to 3:00 pm

FREE Exhibition

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Head- and Helmet-Mounted Displays XIII: Design and Applications

Conference Chairs: **Randall W. Brown,** Air Force Research Lab.; **Peter L. Marasco,** Air Force Research Lab.

Conference Co-Chairs: **Thomas H. Harding,** U.S. Army Aeromedical Research Lab.; **Sion A. Jennings,** National Research Council Canada (Canada)

Program Committee: **Randall E. Bailey,** NASA Langley Research Ctr.; **Laurence Durnell,** QinetiQ Ltd. (United Kingdom); **Paul R. Havig,** Air Force Research Lab.

Monday 17 March

Welcome & Introductions . Mon. 8:30 to 8:40 am

Session Chair: **Randall W. Brown,**
Air Force Research Lab.

SESSION 1 . . . . . .Mon. 8:40 to 10:00 am

Systems

Session Chair: **Thomas H. Harding,** U.S. Army Aeromedical Research Lab.

The development of the HMD with wide FOV and high-resolution using shuttle optical system, Kazutaka Inoguchi, Motomi Matsunaga, Shoichi Yamazaki, Canon Inc. (Japan). . . . . [6955-01]

Head-mounted display upgrade for the US Army's AVCATT simulation program, James E. Melzer, James Porter, Rockwell Collins Optronics . . . . . [6955-02]

The Cobra HMD system for Gripen, Jorgen Larsson, Tommy Blomqvist, SAAB AB (Sweden) . . . . . [6955-03]

TopOwl night vision improvements, Olivier Lemoine, Manuel Kabache, Frédéric Saviot, Marie Charbonneau, Bruno Coumert, Thales Avionics S.A. (France) . . . . . [6955-04]

Display Track Plenary Presentation

Mon. 10:30 to 11:30 am

Display content in advanced NVG and HMD systems: a pilot/flight surgeon's concerns *(Invited Paper)*
Joseph C. Antonio, Naval Air Warfare Ctr. [6955-05]

See page 5 for details.

Lunch Break . . . . . 11:30 am to 1:00 pm

SESSION 2 . . . . . .Mon. 1:00 to 3:00 pm

HMD Components

Session Chair: **Sion A. Jennings,**
National Research Council Canada (Canada)

All solid-state electrochromic device for helmet-mounted displays, Hulya Demiryont, Kenneth C. Shannon III, Eclipse Energy Systems, Inc.; Sharon Dixon, Alan Pinkus, Air Force Research Lab. . . . . [6955-06]

Active matrix organic light emitting diode (OLED)-XL life test results, David A. Fellowes, Michael V. Wood, U.S. Army Night Vision & Electronic Sensors Directorate; Amalkumar P. Ghosh, Olivier Prache, eMagin Corp. . . . . [6955-07]

Accurate eye-tracking in a high-G environment, Richard A. Hutchin, Optical Physics Co.. . . . . [6955-08]

The use of head-mounted displays in HUD applications, Andrei Cernasov, Honeywell Defense and Space Electronic Systems. . . . . [6955-09]

A new optical HMT system based on image processing, Kazuho Tawada, Ken Hirooka, Shimadzu Corp. (Japan). . . . . [6955-10]

A full color, SXGA AMLCD for military head mounted displays (HMDs) and other viewer applications, Ollie C. Woodard, Jason Lo, Murshed Khandaker, Frederick Herrmann, Hiap L. Ong, Kopin Corp.; Colin Reese, U.S. Army Night Vision & Electronic Sensors Directorate . . . . . [6955-11]

SESSION 3 . . . . . .Mon. 3:30 to 5:10 pm

Design Issues

Session Chair: **Peter L. Marasco,**
Air Force Research Lab.

Visual issues associated with the use of the integrated helmet and display sighting system (IHADSS) in the Apache helicopter: three decades in review, Keith L. Hiatt M.D., U.S. Army Research Institute of Environmental Medicine; Clarence E. Rash, U.S. Army Aeromedical Research Lab.; Kevin Heinecke, U.S. Army-2nd Aviation Flight Detachment . . . . . [6955-12]

Visual perceptual issues of the integrated helmet and display sighting system (IHADSS): four expert perspectives, Clarence E. Rash, U.S. Army Aeromedical Research Lab.; Kevin Heinecke, U.S. Army-2nd Aviation Flight Detachment; Gregory Francis, Purdue Univ.; Keith L. Hiatt, U.S. Army Research Institute of Environmental Medicine . . . . . [6955-13]

Determining good contrast requirements for HMD see-through imagery, Thomas H. Harding, John S. Martin, Clarence E. Rash, U.S. Army Aeromedical Research Lab. . . . . [6955-14]

Perceptual design tradeoff considerations for viewing, Melvyn E. Kalich, Thomas H. Harding, Clarence E. Rash, U.S. Army Aeromedical Research Lab.. . . . . [6955-15]

Spatial constraints for 3D perception in virtual displays, Anne-Emmanuelle Priot, Institut de Médecine Aérospatiale du Service de Santé des Armées (France); Marie Charbonneau, Thales Avionics S. A. (France); D. Paille, Essilor International (France) . . . . . [6955-28]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 4 . . . . . Tues. 10:30 am to 12:10 pm

Human Factors

Session Chair: **Paul R. Havig,**
Air Force Research Lab.

Effects of field of view on human locomotion, Alexander Toet, Marieke van der Hoeven, Nico J. Delleman, TNO Human Factors (Netherlands) . . . . . [6955-16]

Aurally-aided visual search performance in a dynamic environment, John McIntire, Consortium Research Fellows Program; Paul R. Havig, Air Force Research Lab.; Scott Watamaniuk, Robert Gilkey, Wright State Univ. . . . . [6955-17]

Comparative effects of vergence/accommodation conflicts with different interocular separation and viewing distance, Marie Charbonneau, Thales Avionics S.A. (France); Anne-Emmanuelle Priot, Institut de Médecine Aérospatiale du Service de Santé des Armées (France); Alain Leger, Thales Avionics S.A. (France) . . . . . [6955-18]

The yaw, pitch and roll of the head when straight ahead, Leonard A. Temme, David L. Still, Adrianus J. Houtsma, U.S. Army Aeromedical Research Lab.. . . . . [6955-19]

Toward the HMD as a cognitive prosthesis, James E. Melzer, Rockwell Collins Optronics. . . . . [6955-20]

Lunch/Exhibition Break . . . . . 12:10 to 1:10 pm

SESSION 5 . . . . . Tues. 1:10 to 2:10 pm

Testing

Session Chair: **Randall W. Brown,**
Air Force Research Lab.

Civilian rotorcraft NVG contrast testing, Sion A. Jennings, Greg Craig, National Research Council Canada (Canada) . . . . . [6955-21]

Development of NVG test maneuvers for civilian aircraft, Sion A. Jennings, National Research Council Canada (Canada) . . . . . [6955-22]

Safety qualification and operational assessment of a night vision cueing and display system, James M. Barnaba, Cary W. Wilson, Melina Baez-Vazquez, U.S. Air Force . . . [6955-23]

SESSION 6 . . . . . Tues. 2:10 to 3:30 pm

Augmented/Virtual Reality

Session Chair: **Randall E. Bailey,**
NASA Langley Research Ctr.

Stereoscopic helmet mounted system for real time 3D environment reconstruction and indoor ego-motion estimation, Giuseppe Donato, Joint Research Ctr. (Italy) and Brunel Univ. (United Kingdom); Vitor Sequeira, Joint Research Ctr. (Italy); Abdul Sadka, Brunel Univ. (United Kingdom) . . . . . [6955-24]

Virtual reality: a reality for future military pilotage?, Gary L. Martinsen, Peter L. Marasco, Mathew W. Swinney, Jonathon S. Hosket, Air Force Research Lab. . . . . [6955-25]

Evaluation of tangible user interfaces for command and control in virtual environments, Paul R. Havig, George Reis, Eric Heft, Air Force Research Lab.; John McIntire, Lisa Douglas, Consortium Research Fellows Program . . [6955-26]

A survey of robot application based on augmented reality, Yahui Liu, Qingxuan Jia, Beijing Univ. of Posts and Telecommunications (China); Jie Su, Harbin Univ. of Science and Technology (China). . . . . [6955-27]

Related Course

SC159 **Head-Mounted Displays: Design and Applications, Including Night Vision** *(Melze, Browne)* Wednesday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Thursday 20 March 2008 • Proceedings of SPIE Vol. 6956

Display Technologies & Applications for Defense, Security, and Avionics II

Conference Chair: **John Tudor Thomas,** General Dynamics Canada Ltd. (Canada); **Andrew Malloy,** Naval Research Lab.

Program Committee: **Daniel D. Desjardins,** Consultant; **Eric W. Forsythe,** Army Research Lab.; **Greg Grabski,** Korry Electronics Co.; **David C. Huffman,** L-3 Communications Display Systems; **Kalluri R. Sarma,** Honeywell International, Inc.; **Murray Trakalo,** General Dynamics Canada Ltd. (Canada)

Monday 17 March

Display Track Plenary Presentation

Mon. 10:30 to 11:30 am

Display content in advanced NVG and HMD systems: a pilot/flight surgeon's concerns *(Invited Paper)*
Joseph C. Antonio, Naval Air Warfare Ctr. [6955-05]

See page 5 for details.

Tuesday 18 March

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

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Analysis of reconstructed hologram image resolution which consists of different hologram pattern numbers generated using a picked-up image by integral imaging technique, Sang-Hyun Lee, Seung-Cheol Kim, Eun Soo Kim, Kwangwoon Univ. (South Korea) . . . . . [6956-25]

Efficient generation of computer generated holographic video using novel look-up table, Jung-Hoon Yoon, Seung-Cheol Kim, Eun Soo Kim, Kwangwoon Univ. (South Korea) . . . . . [6956-26]

Thursday 20 March

SESSION 1 . . . . . Thurs. 8:00 am

Surveillance & Information Extraction

Session Chair: **Andrew Malloy,** Naval Research Lab.

Displays for future intermediate unmanned aerial vehicle, Daniel D. Desjardins, James Metzler, Courtney Rister, David Blakesley, Abdul-Razak Nuhu, Air Force Research Lab. . . . . [6956-01]

Visualization of the operational environment for understanding and response, Denise Aleva, Air Force Research Lab. . . . . [6956-02]

The advanced linked extended reconnaissance & targeting technology demonstration project, Mark J. Edwards, General Dynamics Canada Ltd. (Canada). [6956-03]

Content-based image exploitation for situational awareness, David Gains, General Dynamics Canada Ltd. (Canada) . . . . . [6956-04]

SESSION 2 . . . . . Thurs. 9:20 to 10:20 am

Human/Display Interaction

Session Chair: **Daniel D. Desjardins,** Consultant

Tactile target discrimination, Alexander Toet, Eric L. Groen, Marjolaine Oosterbeek, TNO Human Factors (Netherlands) . . . . . [6956-05]

Fused quad audio/visual and tracking data collection to enhance mobile robot and operator performance analyses, Brian A. Weiss, Brian Antonishek, Richard Norcross, National Institute of Standards and Technology . . . . . [6956-06]

Hover training display, rationale and implementation, David L. Still, Leonard A. Temme, U.S. Army Aeromedical Research Lab. . . . . [6956-07]

SESSION 3 . . . . . Thurs. 10:40 am to 12:00 pm

NVG Compatibility

Session Chair: **Kalluri R. Sarma,** Honeywell International, Inc.

Short-wave infrared imager cockpit lighting radiance limits, Peter L. Marasco, Air Force Research Lab. . . [6956-08]

OLED displays in a ground mibile application, John Tudor Thomas, Sean Lorimer, General Dynamics Canada Ltd. (Canada) . . . . . [6956-27]

Automated image intensifier tube measuring system, Jonathan Partee, Carl Paul, The Pennsylvania State Univ.; Mark Sartor, RDIS; James West, Nicholas Wichowski, Brian McIntyre, The Pennsylvania State Univ. . . . . [6956-10]

Adapting deployed touch screen displays for NVG Compatibility, Claude Gaudette, Wamco, Inc. . . . . [6956-11]

Lunch Break . . . . . 12:00 to 1:00 pm

SESSION 4 . . . . . Thurs. 1:00 to 2:20 pm

3D System-Level Perspectives

Session Chair: **David C. Huffman,** L-3 Communications Display Systems

3D displays and applications *(Invited Paper)*, Patrick J. Green, Scott D. Robinson, Planar Systems, Inc. . . . [6956-12]

Investigations into optimal color and shape primitives using the Perspecta 3D volumetric display, George A. Reis, Paul Havig, Eric Heft, Air Force Research Lab.; John McIntire, Consortium Research Fellows Program . . . . . [6956-13]

Comparison of 3D displays using objective metrics, Paul R. Havig, George Reis, Jason Moore, Air Force Research Lab.; John McIntire, Consortium Research Fellows Program. . . . . [6956-14]

SESSION 5 . . . . . Thurs. 2:20 to 3:00 pm

3D Display Hardware

Session Chair: **David C. Huffman,** L-3 Communications Display Systems

3D vision system for manned and unmanned vehicles, David B. Chenault, Richard P. Edmondson, J. Larry Pezzaniti, Polaris Sensor Technologies, Inc. . . . . [6956-15]

Autostereoscopic multiperspective display using temporal multiplexing, Vladimir B. Markov, Stephen A. Kupiec, MetroLaser, Inc.; Darrel G. Hopper, Gurdial B. Saini, Air Force Research Lab. . . . . [6956-16]

SESSION 6 . . . . . Thurs. 3:20 to 4:20 pm

Display Design

Session Chair: **Greg J. Grabski,** Korry Electronics Corp.

Ruggedized flat panel displays using COTS components, Robert Smith-Gillespie, E3 Displays . . . . . [6956-17]

15.1-inch touch tactical avionics display, Tracy J. Barnidge, Bruce D. Hufnagel, Joseph Tchon, Rockwell Collins, Inc.. . . . . [6956-18]

Designing display enhancement windows for commercial and military applications, Michael J. Dent, Optical Filters USA LLC . . . . . [6956-19]

SESSION 7 . . . . . Thurs. 4:20 to 5:20 pm

LCD Backlighting

Session Chair: **Murray Trakalo,** General Dynamics Canada Ltd. (Canada)

High-performance RGB LED backlight in high-temperature environment, Grzegorz J. Grabski, Walter L. Gurr, John R. Green, Korry Electronics Co. . . . . [6956-20]

Advanced flat panel display backlighting techniques, Robert D. Smith-Gillespie, E3 Displays. . . . . [6956-21]

High-performance display backlighting, Richard P. Webster, LCD Lighting Inc. . . . . [6956-22]

SESSION 8 . . . . . Thurs. 5:20 to 6:00 pm

OLED Display Applications

Session Chair: **John Tudor Thomas,** General Dynamics Canada Ltd. (Canada)

Updated integrated diver display device (ID3) for diver applications, David Tremper, Naval Research Lab.; Andy Brosky, Cardinal Scientific, Inc. . . . . [6956-23]

The use of OLED display technology in military applications, Murray Trakalo, Sean Lorimer, General Dynamics Canada Ltd. (Canada). . . . . [6956-24]

Related Course

SC159 **Head-Mounted Displays: Design and Applications, Including Night Vision** *(Melze, Browne)* Wednesday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Enhanced and Synthetic Vision 2008

Conference Chair: **Jeff J. Güell,** The Boeing Co.; **Maarten Uijt de Haag,** Ohio Univ.

Program Committee: **Guy A. French,** Air Force Research Lab.; **Bernd R. Korn,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Michael C. Lightfoot,** NASA Langley Research Ctr.; **Jens Schiefele,** Jeppesen GmbH (Germany); **Jacques G. Verly,** Univ. de Liège (Belgium); **Kenneth L. Bernier,** The Boeing Co.

Monday 17 March

Display Track Plenary Presentation

Mon. 10:30 to 11:30 am

Display content in advanced NVG and HMD systems: a pilot/flight surgeon's concerns *(Invited Paper)*
Joseph C. Antonio, Naval Air Warfare Ctr. [6955-05]

See page 5 for details.

Tuesday 18 March

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An approach to instrument qualified visual range and the percieved-flicker problem, Benoit Courtade, Ecole Supérieure d'Ingénieurs en Electronique et Electrotechnique (France); David A. Schimon, Harvey Mudd College . [6957-24]

Wednesday 19 March

SESSION 1 . . . . . .Wed. 8:30 to 10:10 am

Session Chairs: **Jeff J. Güell,** The Boeing Co.; **Kenneth L. Bernier,** The Boeing Co.; **Michael C. Lightfoot,** NASA Langley Research Ctr.

Runway infrared range concept for EVS, James R. Kerr, Max-Viz, Inc. . . . . [6957-01]

Enhanced detection of LED runway/approach lights for EVS, James R. Kerr, Max-Viz, Inc. . . . . [6957-02]

"Stereo radar": reconstructing 3D data from 2D radar, Sven Schmerwitz, Hans-Ullrich Doehler, Bernd R. Korn, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [6957-03]

Next generation enhanced vision systems processing, Tom Riley, Catherine Cowell, Mark Bernhardt, Waterfall Solutions Ltd. (United Kingdom); Paul K. Kimber, SELEX Sensors and Airborne Systems Ltd. (United Kingdom); Karen M. Brosseaud, Waterfall Solutions Ltd. (United Kingdom) . . . . . [6957-04]

Synthetic vision for lunar landing vehicles, Steven P. Williams, Jarvis J. Arthur, Kevin J. Shelton, NASA Langley Research Ctr.; Robert M. Norman, The Boeing Co.; Lawrence J. Prinzel III, NASA Langley Research Ctr. . . . . [6957-05]

SESSION 2 . . . . . Wed. 10:40 am to 12:20 pm

Session Chairs: **Jacques G. Verly,** Univ. de Liège (Belgium); **Michael C. Lightfoot,** NASA Langley Research Ctr.; **Guy A. French,** Air Force Research Lab.

Operational landing credit with EVS head down display: crew procedure and human factors evaluation, Bernd R. Korn, Marcus Biella, Helge Lenz, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [6957-06]

Synthetic vision primary flight displays for helicopters, Gang He, Thea Feyereisen, Blake Wilson, Honeywell International, Inc.. . . . . [6957-07]

An efficient real time superresolution ASIC system, Dikpal Reddy, Zhanfeng Yue, Pankaj Topiwala, FastVDO LLC. . . . . [6957-08]

Dynamic region of interest computer vision, Tracy D. McSheery, PhaseSpace, Inc. . . . . [6957-09]

Design of a synthetic vision overlay for UAV autoland monitoring, Jochum Tadema, Netherlands Defence Academy (Netherlands); Eric Theunissen, Technische Univ. Delft (Netherlands) . . . . . [6957-10]

Lunch/Exhibition Break . . . . . 12:20 to 1:50 pm

SESSION 3 . . . . . .Wed. 1:50 to 3:30 pm

Session Chairs: **Maarten Uijt de Haag,** Ohio Univ.; **Guy A. French,** Air Force Research Lab.; **Bernd R. Korn,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany).

Three-dimensional display and vision system for enhanced situational awareness, David B. Chenault, Richard P. Edmondson, J. Larry Pezzaniti, Polaris Sensor Technologies, Inc.. . . . . [6957-11]

Hazard detection on runways using image processing techniques, Girish S. Rajput, Zia-Ur Rahman, Old Dominion Univ. . . . . [6957-12]

Ultra-violet sensor as integrity monitor for enhanced flight vision system approaches to CAT II RVR conditions, John B. McKinley, Roger B. Pierson, Mehmet C. Ertem, Norris J. Krone, Jr., Univ. Research Foundation . . . . . [6957-13]

Sensor classification and obstacle detection for aircraft external hazard monitoring, Mark A. Smearcheck, Ananth Vadlamani, Maarten Uijt de Haag, Ohio Univ.. . . . . [6957-14]

Concept for an onboard runway incursion alerting system based on emerging advanced traffic surveillance technologies, Christoph Vernaleken, Carole Urvoy, Uwe Klingauf, Technische Univ. Darmstadt (Germany). . . [6957-15]

SESSION 4 . . . . . .Wed. 4:00 to 5:20 pm

Session Chairs: **Jens Schiefele,** Jeppesen GmbH (Germany); **Jeff J. Güell,** The Boeing Co.; **Jacques G. Verly,** Univ. de Liège (Belgium)

Real-time panoramic of multiple sensors, Jason R. Beauvais, Octec Ltd. (United Kingdom) . . . . . [6957-16]

Enhanced and synthetic vision system (ESVS) flight demonstration, Jack N. Sanders-Reed, Boeing SVS, Inc.; Kenneth L. Bernier, Jeff J. Guell, The Boeing Co.. . . [6957-17]

Down-to-the-runway enhanced flight vision system approach test results, John B. McKinley, Eric Heidhausen, James A. Cramer, Norris J. Krone, Jr., Univ. Research Foundation . . . . . [6957-18]

Simulation evaluation of synthetic vision as an enabling technology for equivalent visual operations, Lynda J. Kramer, Steven P. Williams, Randall E. Bailey, NASA Langley Research Ctr. . . . . [6957-19]

Thursday 20 March

SESSION 5 . . . . . Thurs. 8:30 to 9:50 am

Session Chairs: **Kenneth L. Bernier,** The Boeing Co.; **Maarten Uijt de Haag,** Ohio Univ.; **Bernd R. Korn,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

Simulation of imaging radar using graphics hardware acceleration, Niklas Peinecke, Bernd Korn, Hans-Ullrich Döhler, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [6957-20]

Cybersickness determines the affective appraisal of a virtual environment, Alexander Toet, TNO Human Factors (Netherlands); Joske Houtkamp, Univ. Utrecht (Netherlands); Erik van der Spek, TNO Human Factors (Netherlands) . . . . . [6957-21]

Considerations on symbology, data requirements, and operational concept for integral NOTAM visualization on airport moving map displays, Christoph Vernaleken, Carole Urvoy, Katja Koch, Uwe Klingauf, Technische Univ. Darmstadt (Germany) . . . . . [6957-22]

Embedded formats for airport mapping databases, Christian Pschierer, Jens Schiefele, Jeppesen GmbH (Germany) . . . . . [6957-23]

Related Course

SC159 **Head-Mounted Displays: Design and Applications, Including Night Vision** *(Melze, Browne)* Wednesday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Space Technologies and Operations

Chairs:
Thomas George, ViaLogy Corp.

Peter Tchoryk, Jr., Michigan Aerospace Corp.

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6958 **Sensors and Systems for Space Applications II** *(Howard, Motaghedi)* p. 54

6960 **Space Exploration Technologies** *(Fink)* p. 56

6959 **Micro (MEMS) and Nanotechnologies for Space, Defense, and Security III** *(George, Cheng)* p. 55

Courses of Related Interest

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, p. 107

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works **Career Fair**

11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

11:00 am to 3:00 pm

FREE Exhibition

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Conference 6958

Monday-Tuesday 17-18 March 2008 • Proceedings of SPIE Vol. 6958

Sensors and Systems for Space Applications II

Conference Chairs: **Richard T. Howard,** NASA Marshall Space Flight Ctr.; **Pejmun Motaghedi,** The Boeing Co.

Program Committee: **Edmund C. Baroth,** Jet Propulsion Lab.; **Brian Buckley,** Consultant; **Richard Cohn,** Air Force Research Lab.; **Michael D. Cornelius,** ATK Thiokol; **N. Glenn Creamer,** Naval Research Lab.; **Michael E. Dobbs,** ITT Industries, Inc.; **Charles J. Finley,** Air Force Research Lab.; **Sivaram P. Gogineni,** Innovative Scientific Solutions, Inc.; **Stephen R. Granade,** Advanced Optical Systems, Inc.; **Shahid Habib,** NASA Goddard Space Flight Ctr.; **Scott Hyde,** ATK Mission Research; **Jeffrey L. Janicik,** Innoflight Inc.; **Valentin Korman,** Madison Research Corp.; **Daniel Leo Lau,** Univ. of Kentucky; **Eric M. Miller,** General Dynamics Advanced Information Systems; **Simon Nolet,** Massachusetts Institute of Technology; **Robert D. Richards,** Optech, Inc. (Canada); **Timothy E. Rumford,** Orbital Sciences Corp.; **Sam Sims,** SMC Det 12 Space Test Program; **Robert H. Smith,** General Dynamics C4 Systems; **Lon M. Stevens,** ATK Thiokol; **Stanley D. Straight,** Air Force Research Lab.; **Amanda Vaughn,** Air Force SMC/SYZ; **Michael D. Watson,** NASA Marshall Space Flight Ctr.; **John T. Wiley,** NASA Marshall Space Flight Ctr.

Monday 17 March

Space Technologies and Operations Track Plenary Presentation

Monday 17 March · 8:00 to 9:00 am

Deep Space Flight of Hayabusa Asteroid Explorer
Hitoshi Kuninaka, Junichiro Kawaguchi,
Japan Aerospace Exploration Agency

See page 5 for details.

SESSION 1 . . . . . Mon. 9:00 am to 12:20 pm

Orbital Express I

Keynote Presentation, Fred Kennedy, Defense Advanced Research Projects Agency . . . . . [6958-01]

Orbital Express program summary and mission overview *(Invited Paper)*, Bob Friend, The Boeing Co. . . . . [6958-02]

Orbital Express mission operations: flight director's perspective, Randy J. Rubens, Tracey Espero, The Boeing Co. . . . . [6958-03]

Scripted variant autonomy for experimental spacecraft, Ray Barrington, Rick Brunet, The Charles Stark Draper Lab., Inc.; Pejmun Motaghedi, The Boeing Co. . . . . [6958-04]

The Orbital Express flight software and simulation solution, Joseph M. Hansen, Richard J. Gerardi, The Boeing Co. . . . . [6958-05]

Orbital Express mission operations planning and resource management using ASPEN, Caroline Chouinard, Russell Knight, Grailing Jones, Daniel Tran, Jet Propulsion Lab. . . . . [6958-06]

Lunch Break . . . . . 12:20 to 1:30 pm

SESSION 2 . . . . . Mon. 1:30 to 4:40 pm

Orbital Express II

Orbital Express NextSat mission operations experiences, Christopher Randall, Kenny Epstein, Brad Porter, David Kaufman, Ball Aerospace & Technologies Corp. . . . [6958-07]

Orbital Express fluid transfer demonstration system, Scott J. Rotenberger, David SooHoo, Gabriel Abraham, Northrop Grumman Space Technology . . . . . [6958-08]

Autonomous robotic operations for on-orbit satellite servicing, Andrew Ogilvie, Justin Allport, Michael Hannah, John Lymer, MacDonald, Dettwiler and Associates Ltd. (Canada) . . . . . [6958-09]

Orbital Express autonomous rendezvous and capture sensor system (ARCSS): flight test results overview, Manny R. Leinz, The Boeing Co. . . . . [6958-10]

Ground processing of Orbital Express autonomous rendezvous capture sensor system telemetry, Clyde C. Helms, The Boeing Co. . . . . [6958-11]

Modeling, simulation, testing, and verification of the Orbital Express autonomous rendezvous and capture sensor system (ARCSS), Manny R. Leinz, The Boeing Co. . . . . [6958-12]

Comparison of navigation solutions for autonomous spacecraft from multiple sensor systems, Richard T. Howard, NASA Marshall Space Flight Ctr.; Jerry E. LeCroy, Dean S. Hallmark, Peter Scott, The Boeing Co. . . . . [6958-13]

On-orbit performance of the Orbital Express capture system, Pejmun Motaghedi, The Boeing Co. . . . . [6958-14]

SESSION 3 . . . . . Mon. 4:40 to 5:20 pm

Sensor Development I

A fully packaged thermal electrically cooled quantum dot infrared photodetector, Xuejun Lu, Univ. of Massachusetts/ Lowell . . . . . [6958-15]

A tunneling quantum dot infrared photodetector with monolithically integrated avalanche amplifier for ultra-sensitivity LWIR sensing, Xuejun Lu, Univ. of Massachusetts/Lowell. . . . . [6958-16]

Tuesday 18 March

Space Technologies and Operations Track Plenary Presentation

Tuesday 18 March · 8:00 to 9:00 am

Protecting the Moon's Environment
Jeffrey Maclure, International Academy of Astronautics and International Institute of Space Law

See page 5 for details.

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 4 . . . . . Tues. 10:30 am to 12:10 pm

Video and Space Data Processing

Three-dimensional position and velocity vector computations of objects jettisoned from the International Space Station using close-range photogrammetry approach, Valer O. Papanyan, Edward Oshel, Jacobs Technology; Daniel Adamo, United Space Alliance, LLC . . . . . [6958-17]

ULTOR® passive pose and position engine (P3E) for space craft relative navigation, Joel S. Hannah, Michael K. Balch, Advanced Optical Systems, Inc. . . . . [6958-18]

Optical SAR processor for space applications, Pascal Bourqui, Institut National d'Optique (Canada); Bernd Harnisch, European Space Agency (Netherlands); Linda E. Marchese, Alain Bergeron, Institut National d'Optique (Canada) . . . . . [6958-19]

Phase retrieval in sparse aperture systems with phase diversity: an image quality study, Brian Daniel, Rochester Institute of Technology; Matthew R. Bolcar, Univ. of Rochester . . . . . [6958-20]

Aerosol retrieval at South China Sea by AVHRR image, Hou Guan Ng, Chow Jeng Wong, Mohd Zubir Mat Jafri, Khiruddin Abdullah, Hwee San Lim, Univ. Sains Malaysia (Malaysia). . . . . [6958-21]

Lunch/Exhibition Break . . . . . 12:10 to 1:40 pm

SESSION 5 . . . . . Tues. 1:40 to 3:00 pm

Sensor Development II

Fiber optic sensor technologies for detection of hydrogen in space application, Alex A. Kazemi, The Boeing Co. . . . . [6958-22]

Optical detection of formaldehyde, Kira D. Patty, Don A. Gregory, The Univ. of Alabama in Huntsville. . . . . [6958-23]

A radiation-hardened high-resolution optical encoder for use in aerospace applications, Scott Sandruck, MicroE Systems. . . . . [6958-24]

Uncooled detector development for space application, Wilfried Rabaud, Commissariat à l'Energie Atomique (France); Olivier Legras, ULIS (France); Gordon R. Hopkinson, Surrey Satellite Technology Ltd. (United Kingdom); Mark Bentley, Stefan Kraft, cosine Research B.V. (Netherlands); Jérome Meilhan, Commissariat à l'Energie Atomique (France) . . . . . [6958-25]

SESSION 6 . . . . . Tues. 3:30 to 5:30 pm

Spacecraft: Sensors, Testing, and Control

Design and characterization of uniform spectral radiance source for test and calibration of radiometers used for KOMPSAT-3, Vikrant Mahajan, Labsphere, Inc.; Dae-Jun Jung, Korea Aerospace Research Institute (South Korea) . . . . . [6958-26]

Ground testing the Hydra AR&D sensor system, Stephen R. Granade, Joel D. Burcham, Fred Roe, Advanced Optical Systems, Inc. . . . . [6958-27]

Rendezvous lidar sensor system for terminal rendezvous, capture, and berthing to the International Space Station, Andrew C. M.Allen, Raja Mukherji, Christopher Langley, Manickam Umasuthan, MacDonald, Dettwiler and Associates Ltd. (Canada). . . . . [6958-28]

Results of SPHERES microgravity autonomous docking experiments in the presence of anomalies, Amer Fejzic, Simon Nolet, David W. Miller, Massachusetts Institute of Technology . . . . . [6958-29]

Space telemetric panomorph imaging system for micro/ nano satellite applications, Simon Thibault, ImmerVision (Canada) . . . . . [6958-30]

A cognitive neuroscience approach for enhancing robotic error detection and recovery, Kevin R. Dixon, James D. Morrow, Fredrick Rothganger, Ann E. Speed, Patrick G. Xavier, Sandia National Labs. . . . . [6958-31]

Related Course

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* Wednesday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Tuesday-Thursday 18-20 March 2008 • Proceedings of SPIE Vol. 6959

Micro (MEMS) and Nanotechnologies for Space, Defense, and Security III

Conference Chair: **Thomas George,** ViaLogy Corp.; **Zhongyang Cheng,** Auburn Univ.

Program Committee: **Debjyoti Banerjee,** Texas A&M Univ.; **Steve Blair,** The Univ. of Utah; **Richard W. Cernosek,** Sandia National Labs.; **Xuyuan Chen,** Vestfold Univ. College (Norway); **Scott D. Collins,** Univ. of Maine; **Xudong Fan,** Univ. of Missouri/Columbia; **Ernest J. Garcia,** Sandia National Labs.; **Stephanie A. Getty,** NASA Goddard Space Flight Ctr.; **Edward A. Johnson,** Ion Optics Inc.; **Mary J. Li,** NASA Goddard Space Flight Ctr.; **Cheng Luo,** Louisiana Tech Univ.; **Dan Luo,** Cornell Univ.; **Harish M. Manohara,** Jet Propulsion Lab.; **Nosang V. Myung,** ; **Gregory P. Nordin,** Brigham Young Univ.; **Ashok K. Sood,** Magnolia Optical Technologies, Inc.; **Kyung-ah Son,** Jet Propulsion Lab.; **Thomas G. Thundat,** Oak Ridge National Lab.; **David V. Wick,** Sandia National Labs.; **Eui-Hyeok Yang,** Stevens Institute of Technology

Monday 17 March

Space Technologies and Operations Track Plenary Presentation

Monday 17 March · 8:00 to 9:00 am

Deep Space Flight of Hayabusa Asteroid Explorer
Hitoshi Kuninaka, Junichiro Kawaguchi,
Japan Aerospace Exploration Agency

See page 5 for details.

Tuesday 18 March

Space Technologies and Operations Track Plenary Presentation

Tuesday 18 March · 8:00 to 9:00 am

Protecting the Moon's Environment
Jeffrey Maclure, International Academy of Astronautics and International Institute of Space Law

See page 5 for details.

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

Keynote Session I . . . . . Tues. 1:00 to 2:00 pm

Nano-enabled defense opportunities (Keynote Presentation), Dennis L. Polla, Defense Advanced Research Projects Agency . . . . . [6959-01]

SESSION 2 . . . . . Tues. 2:00 to 5:30 pm

Nanowires and Nanotubes

Wide-bandgap nanowire sensors *(Invited Paper)*, Stephen J. Pearton, Fan Ren, Jenshan Lin, David P. Norton, Univ. of Florida . . . . . [6959-02]

Cadmium zinc telluride (CZT) nanowire sensors for detection of low-energy gamma-ray detection, Thulasidharan Gandhi, Krishnan S. Raja, Manoranjan Misra, Univ. of Nevada/Reno . . . . . [6959-03]

Controlled growth of ZnO nanorod arrays and their PL properties, Minqiang Wang, Zhou Xu, Zhiguang Wang, Jiefei Zhu, Xi'an Jiaotong Univ. (China) . . . . . [6959-04]

Application specific electrode-integrated nanotube cathodes (ASINCs) for miniature analytical instruments for space exploration *(Invited Paper)*, Harish M. Manohara, Michael J. Bronikowski, Risaku Toda, Eduardo R. Urgiles, Jet Propulsion Lab. . . . . [6959-05]

Life testing of patterned CNT field emitters for the electron impact ionization source of a time-of-flight mass spectrometer, Stephanie A. Getty, NASA Goddard Space Flight Ctr.; Rachael Bis, Univ. of Michigan; Stacy E. Snyder, Lehigh Univ.; Todd T. King, Patrick A. Roman, Paul R. Mahaffy, NASA Goddard Space Flight Ctr.. . . . . [6959-06]

Carbon nanotube (CNT) growth and substrate adhesion for CNT-based materials, Michael J. Bronikowski, Harish M. Manohara, Eric W. Wong, Edward M. Luong, Jet Propulsion Lab. . . . . [6959-07]

Carbon nanotube NEM switches for extreme environment space applications, Anupama B. Kaul, Eric W. Wong, Larry W. Epp, Jet Propulsion Lab. . . . . [6959-08]

Fabrication of amorphous magnetostrictive nanowires and nanotubes, Kewei Zhang, Auburn Univ. . . . . [6959-46]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Domain wall resistance in AlFe nanocontact, Peng Xu, Haisheng San, Xiamen Univ. (China); Xuyuan Chen, Vestfold Univ. College (Norway) . . . . . [6959-42]

Internationalization of gold and nickel nanowires of different lengths by living cells, Hui Yu, Eui-Hyeok Yang, Stevens Institute of Technology . . . . . [6959-43]

Theory of nanoelectromechanical quantum tunneling frequency multipliers, Hector J. De Los Santos, NanoMEMS Research, LLC. . . . . [6959-44]

ZnO nanostructures for optoelectronic applications, Ashok K. Sood, Magnolia Optical Technologies, Inc.; Zhong L. Wang, Georgia Institute of Technology; Dennis L. Polla, Defense Advanced Research Projects Agency; Martin B. Soprano, U.S. Army. . . . . [6959-45]

Wednesday 19 March

Keynote Session II . . . . . Wed. 8:00 to 9:00 am

Emerging sensors and electron devices for army applications (Keynote Presentation), John M. Pellegrino, Army Research Lab. . . . . [6959-09]

SESSION 4 . . . . . Wed. 9:00 am to 12:00 pm

Complex MEMS

Development and operation of the microshutter array system *(Invited Paper)*, Murzy D. Jhabvala, David E. Franz, Todd T. King, NASA Goddard Space Flight Ctr.; Gunther Kletetschka, The Catholic Univ. of America; Alexander S. Kutyrev, Univ. of Maryland/College Park; Mary J. Li, Stephen E. Meyer, Samual Moseley, Scott Schwinger, NASA Goddard Space Flight Ctr. . . . . [6959-10]

Packaging the microshutter array for the James Webb Space Telescope, David E. Franz, Murzy D. Jhabvala, Larry A. Hess, Steve J. Snodgrass, Christian A. Zincke, Audrey J. Ewin, Mary J. Li, D. Scott Schwinger, Chris Ray, NASA Goddard Space Flight Ctr. . . . . [6959-11]

Texas Instruments' DLP® products massively paralleled MOEMS arrays for display applications: a distant second to Mother Nature *(Invited Paper)*, Patrick I. Oden, Texas Instruments Inc.. . . . . [6959-12]

Simulation and testing of a miniature low-power time-of-flight mass spectrometer for in situ analysis of planetary atmospheres *(Invited Paper)*, Todd T. King, Stephanie A. Getty, Rachael A. Bis, NASA Goddard Space Flight Ctr.; Stacy E. Snyder, Lehigh Univ.; Bernard A. Lynch, Patrick A. Roman, Paul R. Mahaffy, NASA Goddard Space Flight Ctr.. . . . . [6959-13]

Carbon nanotube vacuum gauges, Anupama B. Kaul, Harish M. Manohara, Jet Propulsion Lab.. . . . . [6959-14]

A miniature MEMS/NEMS enabled time-of-flight mass spectrometer for investigations in planetary science, Patrick A. Roman, Stephanie A. Getty, Federico Herrero, Ron Hu, Hollis H. Jones, Duncan M. Kahle, Todd T. King, Paul R. Mahaffy, NASA Goddard Space Flight Ctr.. . . . . [6959-15]

Lunch/Exhibition Break . . . . . 12:00 to 1:30 pm

SESSION 5 . . . . . Wed. 1:30 to 3:20 pm

Dip Pen Nanolithography

Overview of nanoscience and technology at the Air Force Research Laboratory *(Invited Paper)*, Gail J. Brown, Air Force Research Lab. . . . . [6959-16]

Commercially available high-throughput Dip Pen Nanolithography®, Jason R. Haaheim, Emma Tevaarwerk, Joeseph Fragala, Roger Shile, NanoInk, Inc. . . . . [6959-17]

Application of solid-phase direct-write (SPDW) via scanning force microscopy for electrical devices and sensors, Patrick S. Spinney, Scott D. Collins, Rosemary Smith, Univ. of Maine . . . . . [6959-18]

Room-temperature synthesis of carbon nanotubes using Dip Pen Nanolithography (DPN), Rohit Gargate, Debjyoti Banerjee, Texas A&M Univ.. . . . . [6959-19]

Dip Pen Nanolithography® of silver nanoparticle inks for printed electronics, Mohammed Parpia, Emma Tevaarwerk, Nabil A. Amro, Jason R. Haaheim, Sergey Rozhok, Terry Renner, Mike Nelson, Tom Levesque, NanoInk, Inc. [6959-20]

SESSION 6 . . . . . Wed. 3:50 to 5:40 pm

Advanced MEMS Devices and Fabrication

Science and technology of piezoelectric/diamond heterostructures for monolithically integrated high-performance MEMS/NEMS/CMOS devices *(Invited Paper)*, Orlando Auciello, Anirudha V. Sumant, Jon C. Hiller, Bernd Kabius, Derrick C. Mancini, Argonne National Lab.; Zhenqiang Ma, Univ. of Wisconsin/Madison; Gianluca Piazza, Robert W. Carpick, Univ. of Pennsylvania; Sudarsan Srinivasan, Intel Corp. . . . . [6959-21]

Micromechanical sensors based on conformational change of proteins, Haifeng Ji, Louisiana Tech Univ. . . . . [6959-22]

An integrated multisensor for three-axis accelerometer, absolute pressure, and temperature in MIMU, Yulong Zhao, Zhuangde Jiang, Xi'an Jiaotong Univ. (China) [6959-23]

Control of MEMS disc resonance gyroscope (DRG) using an FPGA platform, Didier Keymeulen, Jet Propulsion Lab. . . . . [6959-24]

Fabrication of an electrostatically levitated rotating gyro, Charles Ellis, Bogdan Wilamowski, Auburn Univ. . . . [6959-25]

Conference 6959

Thursday 20 March

SESSION 7 . . . . . Thurs. 8:00 to 10:10 am

Nano-bio-info Technologies

Organic nano-, bio-, and info-technologies and systems in medicine *(Invited Paper)*, Vijay K. Varadan, Univ. of Arkansas . . . . . [6959-26]

Experimental results of chemical recording using thermally sensitive liposomes, Maria E. Tanner, Duke Univ.; Elizabeth Vasievich, The Univ. of North Carolina at Chapel Hill; Jonathan Protz, Duke Univ.. . . . . [6959-27]

X-ray luminescence of nanophosphors and their applications for radiation detection, Wei Chen, The Univ. of Texas at Arlington . . . . . [6959-28]

ZnO-based nanogenerators and nanopiezotronics *(Invited Paper)*, Zhong L. Wang, Georgia Institute of Technology . . . . . [6959-29]

CNT-based sensors and applications *(Invited Paper)*, Tayo I. Akinwande, Massachusetts Institute of Technology . . . . . [6959-30]

SESSION 8 . . . . . Thurs. 10:40 am to 12:20 pm

Biosensors

A versatile biomolecular sensor using oxide-gated carbon nanotube transistor arrays *(Invited Paper)*, Romel D. Gomez, Herman Pandana, Konrad Aschenbach, Jookyung Lee, Daniel Lenski, Michael Fuhrer, Univ. of Maryland/College Park; Javed Khan, National Institutes of Health . . . . . [6959-31]

Using cellular and molecular approaches with micro- and nanotechnology for chemical and biological sensors, Philip R. LeDuc, Carnegie Mellon Univ. . . . . [6959-32]

Development and characterization of a microheater array device for real-time DNA mutation detection, Layne D. Williams, The Univ. of Utah; Murat Okandan, Sandia National Labs.; Alex Chagovetz, Steve Blair, The Univ. of Utah. . . . . [6959-33]

Recent developments in sensors and microsystems for bacterial detection *(Invited Paper)*, Mohammed M. Zourob, Biophage Pharma Inc. (Canada) . . . . . [6959-34]

Lunch Break . . . . . 12:20 to 1:50 pm

SESSION 9 . . . . . Thurs. 1:50 to 3:30 pm

Photonic Sensors

Photonic crystal biosensors *(Invited Paper)*, Brian T. Cunningham, Univ. of Illinois at Urbana-Champaign [6959-35]

Fine tune localized surface plasmon resonance for chemical and biological sensors, Junxue Fu, Yiping Zhao, The Univ. of Georgia . . . . . [6959-36]

Passivation of aluminum for micromachining silicon sensors, Ani Duan, Vestfold Univ. College (Norway); Xuyuan Chen, Vestfold Univ. College (Norway) and Xiamen Univ. (China) . . . . . [6959-37]

Plasmonic sensors based on nano-holes: technology and integration *(Invited Paper)*, Reuven Gordon, Univ. of Victoria (Canada) . . . . . [6959-38]

SESSION 10 . . . . . Thurs. 4:00 to 5:20 pm

Adaptive Optics

MEMS deformable mirrors for space and defense applications *(Invited Paper)*, Thomas G. Bifano, Boston Univ.; Steven A. Cornelissen, Boston Micromachines Corp.[6959-39]

Wiregrid micro-polarizers for mid-infrared applications, Andrew M. Sarangan, Aziz F. Mahfoud, Zhi Wu, Qiwen Zhan, Univ. of Dayton; David P. Forrai, Darrel W. Endres, John W. Devitt, L-3 Communications Cincinnati Electronics, Inc.; Robert T. Mack, James S. Harris, Air Force Research Lab. . . . . [6959-40]

Progress in MEMS for adaptive optics *(Invited Paper)*, Scot S. Olivier, Lawrence Livermore National Lab. . . . . [6959-41]

Conference 6960

Monday-Tuesday 17-18 March 2008 • Proceedings of SPIE Vol. 6960

Space Exploration Technologies

Conference Chair: **Wolfgang Fink,** California Institute of Technology

Program Committee: **Danilo Bassi,** Univ. de Santiago de Chile (Chile); **Bernard Foing,** International Lunar Exploration Working Group (ILEWG) (Netherlands); **Roberto Furfaro,** The Univ. of Arizona; **Jeff Kargel,** The Univ. of Arizona

Monday 17 March

Space Technologies and Operations Track Plenary Presentation

Monday 17 March · 8:00 to 9:00 am

Deep Space Flight of Hayabusa Asteroid Explorer
Hitoshi Kuninaka, Junichiro Kawaguchi,
Japan Aerospace Exploration Agency

See page 5 for details.

SESSION 1 . . . . . Mon. 9:20 am to 12:00 pm

Lunar and Planetary Exploration Technologies

Session Chairs: **Bernard Foing,** European Space Research and Technology Ctr. (Netherlands); **Wolfgang Fink,** California Institute of Technology

Full-scale testing and platform stabilization of a scanning lidar system for planetary landing, Manny Nimelman, Andrew C. M.Allen, Christopher Langley, MDA Space Missions (Canada); Jeffrey W. Tripp, Optech Inc. (Canada); Jean de Lafontaine, NGC Aerospace Ltd. (Canada) . [6960-01]

Pico-satellite capabilities for telecommunication and Earth observation, Klaus-Juergen Schilling, Marco Schmidt, Univ. Würzburg (Germany) . . . . . [6960-02]

Extreme environment technologies for space and terrestrial applications, Tibor S. Balint, James A. Cutts, Elizabeth A. Kolawa, Craig E. Peterson, Jet Propulsion Lab. . . . . [6960-03]

SMART-1 results and future lunar exploration, Bernard Foing, ILEWG (Netherlands) . . . . . [6960-04]

ILEWG technology roadmap for Moon exploration *(Invited Paper)*, Bernard Foing, ILEWG (Netherlands) . . . . . [6960-05]

Lunar landers and sample return: science and technologies, Bernard Foing, ILEWG (Netherlands) [6960-06]

Tuesday 18 March

Space Technologies and Operations Track Plenary Presentation

Tuesday 18 March · 8:00 to 9:00 am

Protecting the Moon's Environment
Jeffrey Maclure, International Academy of Astronautics and International Institute of Space Law

See page 5 for details.

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 2 . . . . . Tues. 10:20 am to 12:20 pm

Airborne Platforms and Autonomous Navigation

Session Chairs: **Danilo F. Bassi,** Univ. de Santiago de Chile (Chile); **Wolfgang Fink,** California Institute of Technology

Intelligent systems for the autonomous exploration of Titan and Enceladus *(Invited Paper)*, Roberto Furfaro, Jonathan I. Lunine, Jeffrey S. Kargel, The Univ. of Arizona; Wolfgang Fink, California Institute of Technology. . . [6960-07]

Multilevel control structure for autonomous robotic aircraft operation *(Invited Paper)*, Danilo F. Bassi, Univ. de Santiago de Chile (Chile) . . . . . [6960-08]

Wind-based navigation of a hot-air balloon on Titan: a feasibility study, Roberto Furfaro, Jonathan I. Lunine, The Univ. of Arizona; Alberto Elfes, Kim Reh, Jet Propulsion Lab. . . . . [6960-09]

Rule-based navigation control design for autonomous flight, Hugo Contreras, Danilo F. Bassi, Univ. de Santiago de Chile (Chile) . . . . . [6960-10]

Aerodynamic and control design for efficient low-altitude autonomous flights, Marcelo Martinez, Nostromo Defensa S.A (Argentina); Danilo F. Bassi, Univ. de Santiago de Chile (Chile). . . . . [6960-11]

Lunch/Exhibition Break . . . . . 12:20 to 1:30 pm

SESSION 3 . . . . . Tues. 1:30 to 3:30 pm

Robotic Resource Exploration and Low-Gravity Environments

Session Chairs: **Jeffrey S. Kargel,** The Univ. of Arizona; **Wolfgang Fink,** California Institute of Technology

Robotic resource exploration is a key to human expansion through the cosmos *(Invited Paper)*, Jeffrey S. Kargel, The Univ. of Arizona; Wolfgang Fink, California Institute of Technology; Roberto Furfaro, The Univ. of Arizona . [6960-12]

Uniqueness of Martian geochemistry and the opportunity presented by its mineral resources, Jeffrey S. Kargel, The Univ. of Arizona . . . . . [6960-13]

Steerable hopping six-legged robot, Paulo J. Younse, Jet Propulsion Lab. . . . . [6960-14]

Granular processes on Itokawa, a small near-Earth asteroid: implications for resource utilization *(Invited Paper)*, Hideaki Miyamoto, The Univ. of Tokyo (Japan); Jeffrey S. Kargel, The Univ. of Arizona . . . . . [6960-15]

Launchable and retrievable tetherbot, Paulo J. Younse, Jet Propulsion Lab. . . . . [6960-16]

SESSION 4 . . . . . Tues. 3:50 to 6:20 pm

Intelligent Sensors and Knowledge Discovery

Session Chairs: **Roberto Furfaro,** The Univ. of Arizona; **Wolfgang Fink,** California Institute of Technology

Reconfigurable imaging spectroscopy and prioritizing data acquisition, William R. Johnson, Jet Propulsion Lab. . . . . [6960-17]

Evaluating the realism of synthetic hyperspectral imagery for space-based sensor development and surface classification algorithm exploration, Michael J. Mendenhall, Air Force Institute of Technology; Erzsebet Merenyi, Rice Univ.; John P. Kerekes, Rochester Institute of Technology . . . . . [6960-18]

Intelligent information extraction to aid science decision making in autonomous space exploration *(Invited Paper)*, Erzsebet Merenyi, Kadim Tasdemir, Rice Univ.; William H. Farrand, Space Science Institute . . . . . [6960-19]

Stochastic optimization framework (SOF) for computer-optimized design, engineering, and performance of multidimensional systems and processes *(Invited Paper)*, Wolfgang Fink, California Institute of Technology. . . [6960-20]

Forward and inverse models for photon transport in soil-ice mixtures and their application to the problem of retrieving optical properties of planetary surfaces, Paolo Picca, Roberto Furfaro, Jeffrey Kargel, Barry D. Ganapol, The Univ. of Arizona . . . . . [6960-21]

Spectral unmixing using non-negative basis learning *(Invited Paper)*, Mario Parente, Stanford Univ. . . . . [6960-22]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

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A hexapod robot to demonstrate mesh walking in a microgravity environment, Alberto Behar, Jet Propulsion Lab. . . . . [6960-23]

ICA-based multitemporal multispectral remote sensing images change detection, Juan Gu, Cold and Arid Regions Environmental and Engineering Research Institute (China) . . . . . [6960-24]

Micro-cameras for space applications, Stephane Beauvivre, Micro-cameras & Space Exploration (Switzerland) . . . . . [6960-25]

Path following control strategies for aerial robotic vehicles, Arturo C. Alvarez, Hugo F. Contreras, Univ. de Santiago de Chile (Chile) . . . . . [6960-26]

Technical Program Plenary Presentation

Space Technologies and Operations

Deep Space Flight of Hayabusa Asteroid Explorer

Monday 17 March · 8:00 to 9:00 am

Hitoshi Kuninaka, Junichiro Kawaguchi,
Japan Aerospace Exploration Agency

ISAS/JAXA has developed the microwave discharge ion engine myu10, which eliminates all the electrodes for plasma generation so as to realize long life and high reliability. Four myu10 propelled Hayabusa asteroid explorer, launched in 2003, and succeeded in rendezvousing with the asteroid in 2005 after a 2-year flight. Hayabusa caused serious troubles in the proximity operation and postponed the Earth return. The new software to control the attitude by means of a momentum wheel and the thrust vector control by a two-axis gimbal enabled the powered flight toward Earth again since April 2007. It will come back Earth in 2010.

Hitoshi Kuninaka received the B.S. degree from Department of Aeronautics, Kyoto University, in 1983, and the M.S. and Ph.D degrees from Department of Aeronautics, University of Tokyo, Japan in 1985 and 1988, respectively. He was promoted to Full Professor in ISAS/JAXA, in 2005. He holds concurrently the post of Professor in Department of Aeronautics and Astronautics, University of Tokyo. He researches the plasma interaction of satellites and develops electric propulsion. He invented the microwave discharge ion engines for the asteroid explorer HAYABUSA.

Protecting the Moon's Environment

Tuesday 18 March · 8:00 to 9:00 am

Jeffrey Maclure, International Academy of Astronautics and International Institute of Space Law

Following a summary of international treaties, agreements, and the plans of governments and private concerns who soon will voyage to the Moon, essential Earthly tenets related to the Moon are reviewed, including sovereignty, territorial appropriation, and the use of Res Communis. Future human Lunar activities-and their pros and cons for the maintenance of the Moon's environment - are speculated upon, including the Moon as a Body for international scientific and technical research; as a way-station in the exploration of Mars and the rest of the Universe; and as a New World for commercial natural resource exploitation.

Mr. Jeffrey Maughan Maclure is a career US Government Officer experienced in US Government international policy formulation and cooperation in satellite remote sensing programs and other S&T initiatives. He is a skilled negotiator, having represented the US in the UN Committee on the Peaceful Uses of Outer Space, a number of additional UN fora, and in other varied bilateral scientific and technical consultations. Mr. Maclure has served as a Department of State Foreign Affairs Officer since 1990 and, earlier, seven years assisting in the international management of the US Landsat and other satellite programs of the Satellite Service, NOAA. He graduated in 1983 from the Fletcher School, Tufts University, with a Master of Arts in Law and Diplomacy.

[Jeffrey Maughan Maclure, Foreign Affairs Officer, United States Department of State, Washington, D.C., 20520. The views expressed in this article are those of the author, and do not necessarily reflect those of the U.S. Department of State or the Government of the United States of America.]

PROGRAM ON

Intelligent and Unmanned Systems

Chairs: **Grant R. Gerhart,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.

Steve K. Rogers, Sensors and Information Directorate AFRL

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6963 **Unattended Ground, Sea, and Air Sensor Technologies and Applications X** *(Carapezza)* p. 62

6961 **Intelligent Computing: Theory and Applications VI** *(Priddy, Ertin)* p. 59

6962 **Unmanned Systems Technology X** *(Gerhart, Gage, Shoemaker)* p. 60

Panel Discussion: **UGS Users** *(Kolodny, Carapezza, Heberley)*, 9:00 to 11:00 am. *This event is held in conjunction with Conference 6963* p. 63

Courses of Related Interest

SC894 ***NEW*** **Introduction to INS and INS-Based Integrated Navigation** *(Soloviev)* 8:30 am to 5:30 pm, p. 108

SC898 ***NEW*** **Path Planning for Autonomous Vehicles** (Flann) 8:30 am to 12:30 pm, p. 108

SC549 **Incorporating GPS Technology into Commercial and Military Applications** (Uijt de Haag) 8:30 am to 12:30 pm, p. 108

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works **Career Fair**
11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair
11:00 am to 3:00 pm

FREE Exhibition
10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Intelligent Computing: Theory and Applications VI

Conference Chair: **Kevin L. Priddy,** Air Force Research Lab.; **Emre Ertin,** The Ohio State Univ.

Program Committee: **Eugene Santos,** Dartmouth College; **Gianfranco Basti,** Pontificia Univ. Lateranense (Italy); **William S. Hortos,** Associates in Communication Engineering Research and Technology; **Anke Meyer-Bäse,** Florida State Univ.; **Mark E. Oxley,** Air Force Institute of Technology; **Todd V. Rovito,** Air Force Research Lab.; **Robert L. Williams,** Air Force Research Lab.

Monday 17 March

SESSION 1 . . . . . .Mon. 8:30 to 9:50 am

Intelligent Sensor Networks

Session Chair: **Kevin L. Priddy,** Air Force Research Lab.

Unsupervised learning in persistent sensing for target recognition by wireless ad hoc networks of ground-based sensors, William S. Hortos, Associates in Communication Engineering Research and Technology. . . . . [6961-01]

Computation and the design of autonomous intelligent systems, Robert L. Fry, System Engineering Group, Inc.. . . . . [6961-02]

Localized construction of aggregation trees in sensor networks, Raj K. Bhatnagar, Andra Kalyan, Univ. of Cincinnati. . . . . [6961-03]

Dynamic landscape maps for path planning and target assignment, Michael L. Larsen, Nikolai F. Rulkov, Information Systems Labs., Inc.. . . . . [6961-04]

SESSION 2 . . . . . Mon. 10:20 am to 12:00 pm

Sensor Applications

Session Chair: **William S. Hortos,** Associates in Communication Engineering Research and Technology

Position-adaptive explosive detection concepts for swarming micro-UAVs, Rastko Selmic, Louisiana Tech Univ.; Atindra K. Mitra, Air Force Research Lab. . . . [6961-05]

Combining and displaying results from aeronautical smart nodes, Alex Tarter, Ultra Electronics Ltd. (United Kingdom) and Lancaster Univ. (United Kingdom); Rainer Koeller, European Organisation for the Safety of Air Navigation (Belgium) and Lancaster Univ. (United Kingdom) . . . [6961-06]

Human activity recognition in video using two methods for matching shape contexts of silhouettes, Natasha Kholgade, Andreas E. Savakis, Rochester Institute of Technology . . . . . [6961-07]

Onboard system for synchronizing video and telemetry on a small UAV, Andres F. Rodriguez, Brigham Young Univ.; Yohannes Aregawi, Ronald Dennis, Todd Jenkins, Air Force Research Lab. . . . . [6961-08]

Analytical approach to cross-layer protocol optimization in wireless sensor networks, William S. Hortos, Associates in Communication Engineering Research and Technology . . . . . [6961-09]

Lunch Break . . . . . 12:00 to 1:30 pm

SESSION 3 . . . . . .Mon. 1:30 to 5:00 pm

Theory

Session Chair: **Emre Ertin,** The Ohio State Univ.

Internalizing intelligent activity, Jim E. Brander, Interactive Engineering Pty Ltd. (Australia) . . . . . [6961-10]

From sensor networks to sensor organizations, Eric T. Matson, Wright State Univ. . . . . [6961-11]

Learning spatial models for indoor tracking of wireless nodes, Emre Ertin, The Ohio State Univ. . . . . [6961-12]

Distributed caching strategy, Keum J. Kim, Dartmouth College; Eunice E. Santos, Virginia Polytechnic Institute and State Univ.; Eugene Santos, Jr., Dartmouth College [6961-13]

Multi-threat containment with wireless dynamic neighborhood networks, Nathan A. Ransom, Harris Corp.; Shanchieh J. Yang, Rochester Institute of Technology . . . . . [6961-14]

A self-adapting heuristic for automatically constructing terrain appreciation exercises, Sanjeeb Nanda, SDS International, Inc.; Carl Lickteig, Peter Schaefer, U.S. Army Research Institute . . . . . [6961-15]

A heuristic for deriving the optimal number and placement of reconnaissance sensors, Sanjeeb Nanda, SDS International, Inc.. . . . . [6961-16]

Multi-level data registration for persistent sensing, Sangil Jwa, Umit Ozguner, The Ohio State Univ.. . . . . [6961-17]

Exploring approaches to layered image registration, Leslie G. Watkins, North Carolina State Univ. and Air Force Research Lab.; Hamid Krim, North Carolina State Univ.; Olga L. Mendoza, Air Force Research Lab.. . . . . [6961-18]

Tuesday 18 March

SESSION 4 . . . . . Tues. 8:00 to 9:00 am

Applications I

Session Chair: **Anke Meyer-Baese,** Florida State Univ.

Intelligent computer-aided diagnosis system for breast MRI combining kinetic and morphological aspects, Anke Meyer-Bäse, Florida State Univ. . . . . [6961-19]

Unsupervised learning for intrusion detection and identification in wireless ad hoc sensor networks, William S. Hortos, Associates in Communication Engineering Research and Technology. . . . . [6961-20]

Neural network internal model process control, Lifford McLauchlan, Mehrube Mehrubeoglu, Texas A&M Univ. . . . . [6961-21]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 5 . . . . . Tues. 10:30 to 11:10 am

Applications II

Session Chair: **Anke Meyer-Baese,** Florida State Univ.

Developing a cost effective cluster from high-performance personal desktop computers, Jay Wilhelm, James E. Smith, West Virginia Univ. . . . . [6961-22]

Static versus dynamic infrared digital imaging for breast cancer automatic detection by dynamic perceptron algorithm, Gianfranco Basti, Antonio L. Perrone, Pontificia Univ. Lateranense (Italy) . . . . . [6961-23]

Panel Discussion . . . . . Tues. 11:10 am to 12:10 pm

Panel Moderators: **Kevin L. Priddy,** Air Force Research Lab.; **Emre Ertin,** The Ohio State Univ.

Conference 6962

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Unmanned Systems Technology X

Conference Chairs: **Grant R. Gerhart,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.; **Douglas W. Gage,** XPM Technologies; **Charles M. Shoemaker,** General Dynamics Robotic Systems

Program Committee: **James S. Albus,** National Institute of Standards and Technology; **John G. Blitch,** ARACAR: Alliance for Robot Assisted Crisis Assessment and Response; **Johann Borenstein,** Univ. of Michigan; **Jonathan A. Bornstein,** Army Research Lab.; **Bruce E. Brendle,** U.S. Army TARDEC RDECOM; **Bruce Leonard Digney,** Defence Research and Development Canada (Canada); **Rajiv V. Dubey,** Univ. of South Florida; **Hobart Ray Everett,** Space and Naval Warfare Systems Ctr., San Diego; **Scott Fish,** The Univ. of Texas at Austin; **David J. Gorsich,** U.S. Army TARDEC RDECOM; **Helen Greiner,** iRobot Corp.; **Karl D. Iagnemma,** Massachusetts Institute of Technology; **Lawrence D. Jackel,** Defense Advanced Research Projects Agency; **Clinton W. Kelly,** Science Applications International Corp.; **Gene A. Klager,** U.S. Army Night Vision & Electronic Sensors Directorate; **Andreas F. Koschan,** The Univ. of Tennessee; **James H. Lever,** U.S. Army Corps of Engineers; **Larry Henry Matthies,** Jet Propulsion Lab.; **Elena R. Messina,** National Institute of Standards and Technology; **Kevin L. Moore,** Colorado School of Mines; **Robin R. Murphy,** Univ. of South Florida; **James L. Overholt,** U.S. Army TARDEC RDECOM; **Michael R. Perschbacher,** Rovno Tech; **Marc Raibert,** Boston Dynamics; **Elias J. Rigas,** Army Research Lab.; **Klaus-Juergen Schilling,** Univ. Würzburg (Germany); **Christian Schleippmann,** Bundesamt für Wehrtechnik und Beschaffung (Germany); **Nahid N. Sidki,** Science Applications International Corp.; **Harpreet Singh,** Wayne State Univ.; **Magnús S. Snorrason,** Charles River Analytics, Inc.; **Anthony Stentz,** Carnegie Mellon Univ.; **David L. Stone,** Mechatron Consulting; **Morley O. Stone,** Air Force Research Lab.; **Venkataraman Sundareswaran,** Teledyne Scientific Co.; **David J. Thomas,** U.S. Army Tank-automotive and Armaments Command; **Mel W. Torrie,** Autonomous Solutions, Inc.; **Richard M. Voyles,** Univ. of Minnesota; **Brian H. Wilcox,** Jet Propulsion Lab.; **Robert M. Wilcox,** The Tolliver Group; **Gary Witus,** Turing Associates, Inc.; **Brian M. Yamauchi,** iRobot Corp.

Monday 17 March

SESSION 1 . . . . . .Mon. 1:30 to 5:30 pm

Perception

Session Chairs: **Magnús S. Snorrason,** Charles River Analytics, Inc.; **Larry Henry Matthies,** Jet Propulsion Lab.

Detecting personnel around UGVs using stereo vision *(Invited Paper)*, Larry H. Matthies, Andrew B. Howard, Andres Huertas, Arturo L. Rankin, Max Bajracharya, Jet Propulsion Lab. . . . . [6962-01]

All-weather perception for small autonomous UGVs, Brian M. Yamauchi, iRobot Corp.. . . . . [6962-02]

Monocular vision-only 3D localization and mapping, Gary Witus, Shawn T. Hunt, Turing Associates, Inc. . . . . [6962-03]

A robust real-time structure from motion for situational awareness and moving target recognition, Minbo Shim, General Dynamics Robotic Systems. . . . . [6962-04]

Correspondence analysis for stable mobile robot navigation solutions, Christopher Scrapper, Jr., Raj Madhavan, Stephen B. Balakirsky, National Institute of Standards and Technology . . . . . [6962-05]

Detecting and tracking moving humans from a moving vehicle, Barry A. Bodt, Army Research Lab. . . . . [6962-06]

Analysis of laser-ranging technology for sense and avoid operation of unmanned aircraft systems: the tradeoff between resolution and power, Gary W. Euliss, Alan D. Christiansen, Ravindra A. Athale, The MITRE Corp.. [6962-07]

Track history development by combining watermarking and target tracking, Bijan G. Mobasseri, Preethi Krishnamurthy, Villanova Univ. . . . . [6962-08]

Automatic improvement of x-ray object recognition, Samuel Itzikowitz, Semion Sheraizin, College of Management (Israel) . . . . . [6962-09]

Three-dimensional vision solutions for consumer and commercial robotics systems, Ron Buck, Tyzx, Inc.. . . . . [6962-10]

Related Courses

SC894 **Introduction to INS and INS-Based Integrated** ***NEW*** **Navigation** *(Soloviev)* Sunday, 8:30 am to 5:30 pm

SC898 **Path Planning for Autonomous Vehicles** *(Flann)* ***NEW*** Monday, 8:30 am to 12:30 pm

SC549 **Incorporating GPS Technology into Commercial and Military Applications** *(Uijt de Haag)* Monday, 8:30 am to 12:30 pm

See pp. 101–117 for course descriptions.

Tuesday 18 March

SESSION 2 . . . . . Tues. 8:00 to 9:00 am

Intelligent and Autonomous Behaviors I

Session Chairs: **Robert E. Karlsen,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.; **Brian M. Yamauchi,** iRobot Corp.

Distributed pheromone-based swarming control of unmanned air and ground vehicles for RSTA, John A. Sauter, Robert S. Matthews, NewVectors LLC; Joshua S. Robinson, John E. Moody, Augusta Systems, Inc.; Stephanie P. Riddle, Naval Air Systems Command. . . . . [6962-11]

Small robot autonomy in an integrated environment, Barry J. O'Brien, Stuart H. Young, Army Research Lab. . . . . [6962-12]

UGV evolution: the human influence/factor, Kevin L. Conrad, Peter Drewes, Lockheed Martin Corp. . . . . [6962-13]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 3 . . . . . Tues. 10:30 am to 12:10 pm

Intelligent and Autonomous Behaviors II

Session Chairs: **Robert E. Karlsen,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.; **Brian M. Yamauchi,** iRobot Corp.

Learned trafficability for unmanned ground vehicles, Gregory S. Broten, Defence Research and Development Canada (Canada). . . . . [6962-14]

PointCom: semi-autonomous UGV control with intuitive interface, Mitchell M. Rohde, Victor E. Perlin, Quantum Signal LLC; Karl D. Iagnemma, Massachusetts Institute of Technology; Robert M. Lupa, Steven M. Rohde, Quantum Signal LLC; Graham Fiorani, James L. Overholt, U.S. Army Tank-Automotive Research, Development and Engineering Ctr.. . . . . [6962-15]

Adaptive learning applied to terrain recognition, Robert E. Karlsen, U.S. Army Tank-Automotive Research, Development and Engineering Ctr.; Gary Witus, Turing Associates, Inc.. . . . . [6962-16]

SCOUTS: supervisory controlled operations of UAVs for tracking and surveillance of vehicle targets, Amber D. Fischer, 21st Century Systems, Inc. . . . . [6962-17]

Performance of gunner's and robotics operator's tasks in a military multi-tasking environment, Jessie Y. C.Chen, Army Research Lab. . . . . [6962-18]

Lunch Break . . . . . 12:10 to 1:30 pm

SESSION 4 . . . . . Tues. 1:30 to 2:10 pm

Intelligent and Autonomous Behaviors III

Session Chairs: **Robert E. Karlsen,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.; **Brian M. Yamauchi,** iRobot Corp.

Practical problems in sliding scale autonomy: a case study, Scott R. Lenser, Chris Jones, iRobot Corp.. . [6962-19]

A tele-operator assistance system for agile small rovers, Klaus-Juergen Schilling, Daniel Eck, Univ. Würzburg (Germany) . . . . . [6962-20]

SESSION 5 . . . . . Tues. 2:10 to 6:00 pm

Mobile Manipulators

Session Chairs: **Kevin L. Moore,** Colorado School of Mines; **Gary Witus,** Turing Associates, Inc.

Mobile manipulation: a challenge in integration, Cressel Anderson, Ben Axelrod, Philip Case, Jaeil Choi, Martin Engel, Gaurav Gupta, Florian Hecht, John Hutchinson, Niyant Krishnamurthi, Jin Han Lee, Hai Dai Nguyen, Richard Roberts, John Rogers, Alexander J. B.Trevor, Henrik I. Christensen, Charles Kemp, Georgia Institute of Technology . . . . [6962-21]

Low-cost semi-autonomous manipulation technique for explosive ordnance disposal robots, Andrew P. Czop, Michael J. Del Signore, Naval Explosive Ordnance Disposal Technology Div.. . . . . [6962-22]

Intelligent modular manipulation for mobile robots, Jorgen Pedersen, RE2, Inc.. . . . . [6962-23]

Computer assisted robotic examination swab sampling (CARESS), Shawn T. Hunt, Gary Witus, Turing Associates, Inc.. . . . . [6962-24]

Development and enhancement of mobile robot arms for EOD applications, Matthew D. Berkemeier, Autonomous Solutions, Inc. . . . . [6962-25]

Operator control interface configuration for line-of-sight mobile manipulation, Ian Lynn, Colorado School of Mines; Jeffrey D. Will, Valparaiso Univ.; Kevin L. Moore, Colorado School of Mines. . . . . [6962-26]

Software control of a video and sensor equipped smart robotic arm for checkpoint vehicle inspection, Joseph H. Bosworth, Smart Robots, Inc.. . . . . [6962-27]

Door breaching robotic manipulator, Erik E. Schoenfeld, iRobot Corp.; Stephan von Muehlen, Lawrence Parrington, Honeybee Robotics. . . . . [6962-28]

Remote CBE detection using a robot-based Raman detector, Charles W. Gardner, ChemImage Corp.; Parag Batavia, Applied Perception, Inc.; Gary R. Gilbert, U.S. Army Medical Research and Material Command. . . . . [6962-29]

Visual interfaces for operation of non-line-of-sight mobile manipulation, Jeffrey D. Will, Valparaiso Univ.; Ian Lynn, Kevin L. Moore, Colorado School of Mines . . . . . [6962-30]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

An optical measurement-based assistant landing system of UAVs, Qifeng Yu, Xiaohu Zhang, National Univ. of Defense Technology (China) . . . . . [6962-68]

Development of an extendable arm and software architecture for autonomous and tele-operated control for mobile platforms, Yung-Sen Li, Wayne State Univ.; Shawn T. Hunt, Turing Associates, Inc.; Steven T. Walter, Wayne State Univ.; Gary Witus, Turing Associates, Inc.; R. Darin Ellis, Greg Auner, Abhilash K. Pandya, Wayne State Univ. . . . . [6962-69]

Weighted singularity robust inverse with criterion function optimization of redundant mobile manipulators in 3D space with defense applications, Redwan Alqasemi, Rajiv V. Dubey, Univ. of South Florida . . . . . [6962-70]

Pushing and steering wheelchairs and mobile platforms with non-holonomic constraints using a holonomic mobile robot equipped with a single arm, Nandagopal S. Methil, Ranjan Mukherjee, Michigan State Univ. . . . . [6962-71]

Incorporating ray tracing to compute high-fidelity cost maps for grid-based mapping and path planning, Aditya K. Nawab, Douglas C. MacKenzie, Mobile Intelligence Corp. . . . . [6962-72]

Adaptive intelligent path planning, Lifford McLauchlan, Mehrube Mehrubeoglu, Texas A&M Univ. . . . . [6962-73]

Behavior generation strategy of artificial behavioral system by self-learning paradigm for autonomous robot tasks, Hakan Temeltas, Evren Daglarli, Istanbul Teknik Üniv. (Turkey) . . . . . [6962-74]

Integrated RF modules for cooperative UGV/UAV tandems, Atindra K. Mitra, Air Force Research Lab. [6962-75]

Dexterous manipulation of NLOS manipulators, Paul L. Muench, Gregory R. Hudas, U.S. Army Research, Development and Engineering Command . . . . . [6962-76]

Wednesday 19 March

SESSION 3 . . . . . .Wed. 8:00 to 10:10 am

Self-organizing, Collaborative Unmanned ISR Robotic Teams I

Session Chairs: **George Vachtsevanos,** Georgia Institute of Technology; **Venkataraman Sundareswaran,** Teledyne Scientific Co.

Joint Session with Conference 6981

Sensors as robots *(Invited Paper)*, Michael C. Wicks, Air Force Research Lab. . . . . [6981-11]

Bringing UAVs to the fight: recent army autonomy research and a vision for the future *(Invited Paper)*, Jayashree Moorthy, Keith Arthur, Raymond Higgins, U.S. Army Aviation Applied Technology Directorate. . . . . [6981-12]

Tactical service-oriented architecture *(Invited Paper)*, Brent Rickenbach, General Dynamics Advanced Information Systems. . . . . [6981-13]

Fault tolerant and lifetime control architecture for autonomous vehicles, Alexander Bogdanov, Yi-Liang Chen, Venkataraman Sundareswaran, Thomas Altshuler, Teledyne Scientific Co. . . . . [6981-14]

Global image registration using shape space tracking, Liangyin Yu, Jose Molineros, Venkataraman Sundareswaran, Teledyne Scientific Co. . . . . [6981-15]

SESSION 6 . . . . . Wed. 10:40 am to 12:10 pm

Special Topics Session I

Session Chairs: **Scott Fish,** The Univ. of Texas at Austin; **Douglas W. Gage,** XPM Technologies

Joint session with Conference 6981

Perspectives on the DARPA Urban Challenge *(Invited Paper),* Douglas W. Gage, XPM Technologies . . . . . [6962-31]

FCS-UGV safe operations, Scott Fish, The Univ. of Texas at Austin; Joshua Ruedin, Science Applications International Corp.; Michael R. Perschbacher, RovnoTech; John E. Bares, Carnegie Mellon Univ. . . . . [6962-32]

Near-Nash targeting strategies for heterogeneous teams of unmanned combat air vehicles, David G. Galati, Carnegie Mellon Univ.; Marwan A. Simaan, Univ. of Pittsburgh[6962-33]

Adaptive collaborative control of highly redundant robots, David A. Handelman, American Android Corp. . . . . [6962-34]

Lunch/Exhibition Break . . . . . 12:10 to 1:30 pm

SESSION 7 . . . . . .Wed. 1:30 to 2:50 pm

Special Topics Session II

Session Chairs: **Scott Fish,** The Univ. of Texas at Austin; **Douglas W. Gage,** XPM Technologies

Joint Session with Conferences 6981

Skid steer fuel cell-powered unmanned ground vehicle (Burro), Jay S. Meldrum, Michigan Technological Univ. . . . . [6962-35]

Hands-free device control using sound picked up in the ear canal, Siddharth Chhatpar, Lester Ngia, Chris Vlach, Dong Lin, Craig Birkhimer, Amit Juneja, Tarun Pruthi, Think-A-Move, Ltd. . . . . [6962-36]

Argumentation-based negotiation for automated sensor tasking, Daniel Gutchess, Christopher Mow, Magnús Snorrason, Stephen Ho, Charles River Analytics, Inc.[6962-37]

Low-cost robotic arm control, John R. Rogers, United States Military Academy . . . . . [6962-38]

SESSION 8 . . . . . .Wed. 3:20 to 5:40 pm

Self-organizing, Collaborative Unmanned ISR Robotic Teams II

Session Chairs: **Nahid N. Sidki,** Science Applications International Corp.; **Venkataraman Sundareswaran,** Teledyne Scientific Co.; **George Vachtsevanos,** Georgia Institute of Technology

Joint Session with Conference 6981

Sagittarius: UAV/UGV cooperation for shared situational awareness in urban environments, Brian M. Yamauchi, iRobot Corp.; Christopher Geyer, Carnegie Mellon Univ. . . . . [6962-44]

Coordination of UAVs with resource constraints using market-based approach, Bandi B. K.Reddy, Abdollah M. Homaifar, Albert C. Esterlin, Eisa M. Osman, North Carolina A&T State Univ. . . . . [6962-39]

Multi-objective optimization to support mission planning for constellations of unmanned aerial systems, Daniel W. Stouch, Sofya Tenenbaum, Ted Fichtl, Charles River Analytics, Inc. . . . . [6962-40]

UAV-UGV collaboration with a PackBot UGV and Raven SUAV for pursuit and tracking of a dynamic target, Carol Cheung, iRobot Corp.; Ben Grocholsky, Carnegie Mellon Univ. . . . . [6962-41]

A novel real-time impact monitoring system for unmanned vehicles, David C. Zhang, Peter Qing, Shawn J. Beard, Amrita Kumar, Irene Li, Acellent Technologies, Inc.; Fukuo Chang, Stanford Univ. . . . . [6962-42]

Autonomous and intelligent diagnosis, prognosis and health management of a team of unmanned systems, Khashayar Khorasani, Concordia Univ. (Canada); Liying Ma, Tokyo Polytechnic Univ. (Japan) . . . . . [6962-43]

Modeling and simulation of reliability of unmanned intelligent vehicles, Harpreet Singh, Arati M. Dixit, Wayne State Univ. . . . . [6962-45]

Thursday 20 March

SESSION 9 . . . . . Thurs. 8:00 to 11:50 am

Mobility and Navigation

Session Chairs: **Karl D. Iagnemma,** Massachusetts Institute of Technology; **Mel W. Torrie,** Autonomous Solutions, Inc.

Path finding in perforated space-time, Marc W. Hansen, 21st Century Systems, Inc. . . . . [6962-46]

Design and control of an omnidirectional unmanned ground vehicle in rough terrain, Martin R. Udengaard, Karl D. Iagnemma, Massachusetts Institute of Technology . . . . . [6962-47]

Remote operation of the Black Knight unmanned combat vehicle, Jean-Sebastien Valois, Carnegie Mellon Univ.; Timothy J. Pasko, BAE Systems; Herman Herman, John Bares, David P. Rice, Carnegie Mellon Univ. . . . . [6962-48]

Modeling, validation and analysis of a Whegs™ robot in the USARSim environment, Brian K. Taylor, Case Western Reserve Univ.; Stephen B. Balakirsky, Elena R. Messina, National Institute of Standards and Technology; Roger D. Quinn, Case Western Reserve Univ. . . . . [6962-49]

Path planning for robotic vehicles using Generalized Field D*, Leonid Sapronov, Alberto Lacaze, Robotic Research LLC . . . . . [6962-50]

Cognitive integration of aerial and ground views in remote vehicle operations, Roger A. Chadwick, New Mexico State Univ. . . . . [6962-51]

Autonomous robot in unknown environments, Ali T. Alouani, Aravind M. Sri, Tennessee Technological Univ. . . . . [6962-52]

Design and capture point control of a bipedal walking robot, Jerry E. Pratt, Institute for Human and Machine Cognition; Benjamin T. Krupp, Yobotics, Inc. . . . . [6962-53]

Efficient statistical mobility prediction for unmanned ground vehicles, Gaurav Kewlani, Karl D. Iagnemma, Massachusetts Institute of Technology. . . . . [6962-54]

Autonomous terrain parameter estimation for wheeled vehicles, Laura E. Ray, Dartmouth College . . . . . [6962-55]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 10 . . . . . Thurs. 1:20 to 3:30 pm

Government Session

Session Chairs: **Jonathan A. Bornstein,** Army Research Lab.; **Charles M. Shoemaker,** General Dynamics; **Jeffrey J. Jaczkowski,** U.S. Army Tank-automotive and Armaments Command

Robotics technology development at GDRS *(Invited Paper)*, Charles M. Shoemaker, General Dynamics . . . . . [6962-56]

Cooperative robotics: bringing autonomy to EOD robots, Michael J. Del Signore, Andrew P. Czop, Naval Explosive Ordnance Disposal Technology Div. . . . . [6962-57]

Army Research Laboratory robotics collaborative technology alliance, Jonathan A. Bornstein, Army Research Lab. . . . . [6962-58]

UGV and UAV autonomy in Defence R&D Canada, Bruce L. Digney, Defence Research and Development Canada (Canada) . . . . . [6962-59]

Providing tactical behaviors for Army robots, David G. Knichel, MANSCEN; David J. Bruemmer, Idaho National Lab. . . . . [6962-60]

Convoy Active Safety Warfighter experiment I, Edward W. Schoenherr, U.S. Army Tank-automotive and Armaments Command; Christopher Day, U.S. Army Combined Arms Support Command; Asisat Animashaun, James Davis, Jr., Army Research Lab.; Bernard L. Theisen, U.S. Army Tank-automotive and Armaments Command . . . . . [6962-61]

SESSION 11 . . . . . Thurs. 4:00 to 6:00 pm

Standards and Metrics

Session Chairs: **Elena R. Messina,** National Institute of Standards and Technology; **Stuart H. Young,** Army Research Lab.

Performance metrics for a virtual manufacturing competition, Stephen B. Balakirsky, Christopher Scrapper, Jr., Raj Madhavan, National Institute of Standards and Technology . . . . . [6962-62]

Soldier universal robot controller, Jeffrey A. Hyams, Elizabeth Liao, Andrew Somerville, Parag Batavia, Applied Perception, Inc. . . . . [6962-63]

Performance evaluation of cost-based versus fuzzy logic-based prediction approaches in PRIDE, Craig I. Schlenoff, Zeid Kootbally, Raj Madhavan, National Institute of Standards and Technology; Sebti Foufou, Univ. de Bourgogne (France) . . . . . [6962-64]

Spatial ontologies for tactical behaviors, Chafic BouSaba, Albert C. Esterline, Jr., North Carolina A&T State Univ. . . . . [6962-65]

An ontology for tactical behaviors derived from verb frames, Albert C. Esterline, Jr., Chafic BouSaba, North Carolina A&T State Univ. . . . . [6962-66]

libdrdc: Software Standards Library, David R. Erickson, Defence Research and Development Canada (Canada) . . . . . [6962-67]

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Unattended Ground, Sea, and Air Sensor Technologies and Applications X

Conference Chair: **Edward M. Carapezza,** Univ. of Connecticut and DARPA

Program Committee: **Jacques Bédard,** Defence R&D Canada/Valcartier (Canada); **John G. Blitch,** ARACAR: Alliance for Robot Assisted Crisis Assessment and Response; **John C. Carrano,** Luminex Corp.; **Christina J. Deckard,** Space and Naval Warfare Systems Ctr., San Diego; **Douglas S. Deadrick,** BAE Systems; **John S. Eicke,** Army Research Lab.; **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom); **Jeffrey R. Heberley,** U.S. Army Armament Research, Development and Engineering Ctr.; **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN; **Myron E. Hohil,** U.S. Army Research, Development and Engineering Command; **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Michael A. Kolodny,** Army Research Lab.; **Frank Patton,** Defense Advanced Research Projects Agency; **Tien Pham,** Army Research Lab.; **Nino Srour,** Army Research Lab.; **Huub A.J.M. van Hoof,** TNO (Netherlands); **Graeme van Voorthuijsen,** TNO-FEL (Netherlands)

Monday 17 March

SESSION 1 . . . . . .Mon. 8:20 to 9:00 am

Keynote Presentation

Session Chairs: **Edward M. Carapezza,** Univ. of Connecticut; **Michael A. Kolodny,** Army Research Lab.

A vision of network-centric ISTAR and the resulting challenges (Keynote Presentation) *(Invited Paper)*, Gavin Pearson, Defence Science and Technology Lab. (United Kingdom) . . . . . [6963-01]

SESSION 2 . . . . . Mon. 9:00 am to 12:30 pm

Sensor Networking and Communications

Session Chairs: **Tien Pham,** Army Research Lab.; **Jeffrey R. Heberley,** U.S. Army Armament Research, Development and Engineering Ctr.

A family of UGS demonstration, Jeff Houser, Army Research Lab. . . . . [6963-02]

Integration of unattended ground sensors into the tactical radio communications architecture, Michael T. Cahill, Hironori Sasaki, Harris Corp.. . . . . [6963-03]

OmniSense unattended ground sensor system, John McQuiddy, McQ, Inc. . . . . [6963-04]

SCORPION persistent surveillance system with universal gateway, Michael A. Coster, Jonathan L. Chambers, Michael Winters, Joseph Belesi, Northrop Grumman Corp. . [6963-05]

USMC UGS technology advancements, David C. Hartup, L-3 Communications Nova Engineering . . . . . [6963-06]

Sustainable unattended coastal sensor networks: technologies and challenges, Edward M. Carapezza, Univ. of Connecticut . . . . . [6963-07]

Near Earth radio frequency propagation: a detailed study, Robert Wert, Andreas Goroch, Evan Worthington, Vincent Wong, Naval Research Lab. . . . . [6963-08]

Improved methods for adaptive antenna elements, Evan Worthington, SFA Corp.; Robert Wert, Naval Research Lab. . . . . [6963-09]

Achievable data rate for ultraviolet communications through the atmosphere, Zhengyuan Xu, Gang Chen, Feras Abou-Galala, Univ. of California/Riverside . . . . . [6963-10]

Lunch Break . . . . . 12:30 to 1:30 pm

SESSION 3 . . . . . .Mon. 1:30 to 3:10 pm

Transients Detection

Session Chairs: **Jacques Bédard,** Defence R&D Canada/Valcartier (Canada); **Myron E. Hohil,** U.S. Army Research, Development and Engineering Command

Helmet-mounted acoustic array for hostile fire detection and localization in an urban environment, Michael V. Scanlon, Army Research Lab.. . . . . [6963-11]

Acoustic detection and localization of small arms, influence of urban conditions, Pierre Naz, French-German Research Institute of Saint-Louis (France); Christophe R. Marty, La Délégation Générale pour l'Armement (France); Sébastien Hengy, Pascal Hamery, French-German Research Institute of Saint-Louis (France) . . . . . [6963-12]

Utilizing unattended acoustic sensors for mortar classification, Sachi V. Desai, U.S. Army Research, Development and Engineering Command . . . . . [6963-13]

Acoustic analysis of explosions in high noise environment, Hong Man, Stevens Institute of Technology; Sachi V. Desai, David Grasing, Benjamin Ellwood, U.S. Army Research, Development and Engineering Command . . . . . [6963-14]

Three layers of battlefield gunfire protection: building, vehicle and soldier sensors, Robert Showen, Robert B. Calhoun, Wai C. Chu, Jason Dunham, ShotSpotter, Inc.. . . . . [6963-15]

SESSION 4 . . . . . .Mon. 3:30 to 5:10 pm

Modeling, Simulation, and Experimentation I

Session Chairs: **Graeme van Voorthuijsen,** TNO-FEL (Netherlands); **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom)

Implementing statistical acoustic characterization of urban terrain into a decision support tool, Harley H. Cudney, D. K. Wilson, U.S. Army Engineer Research and Development Ctr.; Stephen A. Ketcham, U.S. Army Cold Regions Research and Engineering Lab. . . . . [6963-16]

A fast acoustic transmission loss predictor for tactical decision aid in different environmental and atmospheric conditions, Michael McCarron, Mahmood R. Azimi-Sadjadi, Colorado State Univ.. . . . . [6963-17]

Non-line-of-sight atmospheric channel modeling and validation in the solar blind ultraviolet regime, Zhengyuan Xu, Feras Abou-Galala, Gang Chen, Univ. of California/ Riverside . . . . . [6963-18]

Signal fading curves from computed urban acoustic wave fields, Stephen A. Ketcham, D. K. Wilson, Michael W. Parker, Harley H. Cudney, U.S. Army Engineer Research and Development Ctr. . . . . [6963-19]

Sparse detector sensor model, A. L. Robinson, C. E. Halford, E. H. Perry, T. E. Wyatt, The Univ. of Memphis . . . . . [6963-20]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 5 . . . . . Tues. 10:30 to 11:50 am

Keynote Session

Session Chairs: **Edward M. Carapezza,** Univ. of Connecticut; **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

Joint session with conference 6943

Models of processing in the visual cortex (Keynote Presentation) *(Invited Paper)*, James S. Albus, National Institute of Standards and Technology . . . . . [6943-19]

Photon counting 3D passive sensing and processing for target recognition (Keynote Presentation) *(Invited Paper)*, S. Yeom, Daegu Univ. (South Korea); Bahram Javidi, Univ. of Connecticut; Edward A. Watson, Air Force Research Lab. . . . . [6963-21]

Lunch/Exhibition Break . . . . . 11:50 am to 1:00 pm

SESSION 6 . . . . . Tues. 1:00 to 2:20 pm

Signal Processing I

Session Chairs: **Jeffrey R. Heberley,** U.S. Army Armament Research, Development and Engineering Ctr.; **Michael A. Kolodny,** Army Research Lab.

Sparse detector sensor: profiling experiments for broad-scale classification, David J. Russomanno, Matthew E. Smith, The Univ. of Memphis . . . . . [6963-22]

Qualitative performance of a local track repair algorithm for video tracking on small UAVs, Stephen P. DelMarco, BAE Systems Advanced Information Technologies; Todd Jenkins, Air Force Research Lab. . . . . [6963-23]

Combining advanced imaging processing and low cost remote imaging capabilities, Matthew J. Rohrer, McQ, Inc.. . . . . [6963-24]

Efficient sensor network vehicle classification using peak harmonics of acoustic emissions, Peter E. William, Michael W. Hoffman, Univ. of Nebraska/Lincoln . . . . . [6963-25]

SESSION 7 . . . . . Tues. 2:20 to 4:30 pm

Signal Processing II

Session Chairs: **Myron E. Hohil,** U.S. Army Research, Development and Engineering Command; **Tien Pham,** Army Research Lab.

Multi-objects recognition for distributed intelligent sensor networks, Haibo He, Stevens Institute of Technology; Sachi V. Desai, Myron E. Hohil, U.S. Army Research, Development and Engineering Command. . . . . [6963-26]

Measuring anomaly, Wanda M. Solano, NASA Stennis Space Ctr.; Jing Peng, Montclair State Univ. . . . . [6963-27]

Improving temporal coherence to enhance gain and improve detection performance, Ronald A. Wagstaff, The Univ. of Mississippi . . . . . [6963-28]

Coherence and Rayleigh wave analysis of air- and mechanically coupled ground vibrations, Richard D. Burgett, Planning Systems Inc.; James M. Sabatier, The Univ. of Mississippi. . . . . [6963-29]

Range limitation for seismic footstep detection, J. M. Sabatier, A. E. Ekimov, The Univ. of Mississippi. . . . . [6963-30]

Wednesday 19 March

SESSION 8 . . . . . .Wed. 8:00 to 9:20 am

Keynote Session

Session Chair: **Edward M. Carapezza,** Univ. of Connecticut

Joint Session with Conference 6943

Design of trustworthy fielded sensor networks (Keynote Presentation), Gregory J. Pottie, Univ. of California/Los Angeles . . . . . [6943-30]

MEMS and NEMS technologies for sensor applications (Keynote Presentation), Panos G. Datskos, Oak Ridge National Lab. . . . . [6943-31]

SESSION 9 . . . . . .Wed. 9:20 to 11:30 am

Unattended Ground Sensors (UGS)

Session Chairs: **Michael A. Kolodny,** Army Research Lab.; **Jacques Bédard,** Defence R&D Canada/ Valcartier (Canada)

Helicopter detection using harmonics and seismic-acoustic coupling, Thyagaraju R. Damarla, David Ufford, Army Research Lab. . . . . [6963-31]

Segregation of tracked and wheeled ground vehicle mobility mechanisms through in-situ adaptation of seismic features, James Fitzgerald, Christopher Park, Dennis Power, Textron Systems Corp. . . . . [6963-32]

Tactical sensor network test bed (TASTE), Rody D. J.Sandbrink, Herman H. P. T.Bekman, Philip van Dorp, TNO-FEL (Netherlands) . . . . . [6963-33]

iScout® low cost UGS system: overview of enhancements and performance characterization, Mark A. Winston, Ronald A. Knobler, Barry Jones, McQ, Inc. . . . . [6963-34]

Target activated frame capture, George M. Roberts, James Fitzgerald, Michael T. McCormack, Robert L. Steadman, Textron Systems Corp. . . . . [6963-35]

Lunch/Exhibition Break . . . . . 11:40 am to 1:00 pm

SESSION 10 . . . . . .Wed. 1:00 to 2:00 pm

Enabling Technologies (Sensing, Power, Fusion, etc.)

Session Chairs: **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom); **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

Stochastic analysis of unattended sensor battery life-time, Rajarathnam Chandramouli, Stevens Institute of Technology; Venkataraman S. Swaminathan, U. S. Army RDECOM; Sachi V. Desai, U.S. Army Research, Development and Engineering Command . . . . . [6963-36]

Miniaturization of electronics for a biomimetic acoustic direction finding system, Allyn E. Hubbard, Howard I. Cohen, Socrates Deligeorges, David Freedman, Tyler Gore, Christian Karl, Marianne Nourzad Karl, Yirong Pu, Shuwan Xue, Boston Univ. . . . . [6963-37]

Warning equipment for UGS utilizing human body for data transmission and feeding, Jaroslav Cechak, Univ. Obrany (Czech Republic) . . . . . [6963-38]

SESSION 11 . . . . . .Wed. 2:00 to 3:40 pm

Acoustic, Magnetic, and Multi-modal Sensing

Session Chairs: **Graeme van Voorthuijsen,** TNO-FEL (Netherlands); **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom)

The development of a biomimetic acoustic direction finding system for use on multiple platforms, Allyn Hubbard, The Photonics Ctr. at Boston Univ.. . . . . [6963-39]

A real-time biomimetic acoustic localizing system using time-shared architecture, Marianne Nourzad Karl, Christian Karl, Allyn E. Hubbard, Boston Univ. . . . . [6963-40]

Advances in magnetometry through miniaturization, Alan Edelstein, Army Research Lab. . . . . [6963-41]

Advanced dynamic magnetometer for UGS/MDA applications, Adi R. Bulsara, Space and Naval Warfare Systems Command. . . . . [6963-42]

Progress with UGS based on MEMs, Slobodan Rajic, Oak Ridge National Lab. and Univ. of Tennessee . . . . . [6963-43]

SESSION 12 . . . . . .Wed. 4:10 to 6:30 pm

Modeling, Simulation, and Experimentation II

Session Chairs: **Jeffrey R. Heberley,** U.S. Army Armament Research, Development and Engineering Ctr.; **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN

Development, integration, testing and evaluation of the U.S. Army Buckeye System to the NAVAIR Arrow UAV, Rob Fischer, Science Applications International Corp.; Brian G. Kennedy, Ted Gilliland, Neany, Inc.; Mitchell B. Jones, Jeffrey C. Walker, David D. Muresan, Gregory L. Baxter, Mark Flood, Brian D. Follmer, Science Applications International Corp.; Xiuhong Sun, William Chen, Flight Landata, Inc.; Jeffrey G. Ruby, U.S. Army Engineer Research and Development Ctr. . . . . [6963-44]

Automated ship image acquisition, Tim R. Hammond, Sean Webb, Defence Research and Development Canada (Canada) . . . . . [6963-45]

ARL multi-modal signatures database, Kelly Bennett, Army Research Lab.; James Robertson, Clearhaven Technologies LLC . . . . . [6963-46]

Miniature, ruggedized data collector, Wade Calcutt, Scott Jackson, McQ, Inc. . . . . [6963-47]

Study on meteorological elements of the atmospheric surface layer structure over desert area in spring, Muning Cheng, Shengjie Niu, Nanjing Univ. of Information Science & Technology (China) . . . . . [6963-48]

Spatial and temporal characteristics of cloud to ground lightning in Guizhou Province, Na Wei, Yanwei Li, Shengjie Niu, Nanjing Univ. of Information Science & Technology (China); Ning Luo, Jifen Wen, Haojuan Huang, Weather Modification Office of GuiZhou Province (China) . . . [6963-49]

Observational researches on winter boundary layer structures and fog formation and dissipation processes in Nanjing, Chunsong Lu, Shengjie Niu, Nanjing Univ. of Information Science & Technology (China) . . . . . [6963-50]

Thursday 20 March

SESSION 13 . . . . . Thurs. 8:30 to 9:00 am

UGS Users

Sensing: the road ahead, Michael A. Kolodny, Army Research Lab. . . . . [6963-51]

Panel Discussion

UGS Users

Thurs. 9:00 to 11:00 am

Panel Moderators: **Michael A. Kolodny,** Army Research Lab.; **Edward M. Carapezza,** Univ. of Connecticut; **Jeffrey R. Heberley,** U.S. Army Armament Research, Development and Engineering Ctr.

Related Courses

SC894 **Introduction to INS and INS-Based Integrated** ***NEW*** **Navigation** *(Soloviev)* Sunday, 8:30 am to 5:30 pm

SC898 **Path Planning for Autonomous Vehicles** *(Flann)* ***NEW*** Monday, 8:30 am to 12:30 pm

SC549 **Incorporating GPS Technology into Commercial and Military Applications** *(Uijt de Haag)* Monday, 8:30 am to 12:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Modeling and Simulation

Chair: **Dawn A. Trevisani,** Air Force Research Lab.

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6964 **Evolutionary and Bio-Inspired Computation: Theory and Applications II** *(Blowers, Sisti)* p. 65

6965 **Modeling and Simulation for Military Operations III** *(Trevisani)* p. 66

Panel Discussion: **Bio-inspired Computing for Homeland Security: Issues and Answers** *(Bird)* 3:30 to 4:30 pm, p. 8
This event is held in conjunction with Conference 6964.

Courses of Related Interest

SC783 **How to Validate Your Models and Simulations** *(Law)* 8:30 am to 5:30 pm, p. 109

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works

11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair

11:00 am to 3:00 pm

FREE Exhibition

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Monday-Tuesday 17-18 March 2008 • Proceedings of SPIE Vol. 6964

Evolutionary and Bio-Inspired Computation: Theory and Applications II

Conference Chairs: **Misty Blowers,** Air Force Research Lab.; **Alex F. Sisti,** Air Force Research Lab.

Program Committee: **Robert W. Bird,** Red Lambda, Inc.; **Peter LaMonica,** Air Force Research Lab.; **Sushil J. Louis,** Univ. of Nevada/Reno; **Teresa H. O'Donnell,** Air Force Research Lab.; **John C. Sciortino,** Naval Research Lab.

Monday 17 March

Welcome . . . . . Mon. 1:10 to 1:20 pm

Session Chair: **Misty Blowers,** Air Force Research Lab.

SESSION 1 . . . . . Mon. 1:20 to 3:00 pm

Cognitive/Human Behavior Modeling

Session Chair: **Misty Blowers,** Air Force Research Lab.

To be announced *(Invited Paper)*, Leonid I. Perlovsky, Air Force Research Lab. . . . . [6964-01]

BioInspiration not BioImitation, Jim E. Brander, Interactive Engineering Pty Ltd. (Australia) . . . . . [6964-02]

Grid-Group Cm-Alpha: performance prediction using environmental and cultural factors, Robert Woodley, Warren Noll, 21st Century Systems, Inc.; Katie Grantham Lough, Dan Krus, Univ. of Missouri/Rolla . . . . . [6964-03]

SESSION 2 . . . . . Mon. 3:30 to 4:10 pm

Evolvable Multiagent Systems

Session Chair: **Barry R. Secrest,** Air Force Institute of Technology

A biologically inspired approach to modeling unmanned vehicle teams, Roger S. Cortesi, Kevin S. Galloway, Eric W. Justh, Naval Research Lab. . . . . [6964-04]

A bio-inspired swarm robot coordination algorithm for multiple target searching, Yan Meng, Jing Gan, Stevens Institute of Technology; Sachi Desai, U.S. Army Research, Development and Engineering Command . . . . . [6964-05]

Tuesday 18 March

SESSION 3 . . . . . Tues. 8:00 to 9:00 am

Planning and Resource Allocation

Session Chair: **John C. Sciortino,** Naval Research Lab.

An evolutionary algorithm technique for intelligence, surveillance and reconnaissance plan optimization, John T. Langton, Charles River Analytics, Inc.; Joseph A. Caroli, Air Force Research Lab. . . . . [6964-06]

Using a multi-objective genetic algorithm for developing aerial sensor team search strategies, Jeffrey P. Ridder, Innovating Systems, Inc.; John C. Sciortino, Jr., Naval Research Lab.; Christopher R. Rehm, Air Force Research Lab. . . . . [6964-07]

Team-based resource allocation using a decentralized social decision making paradigm, A. Wu, Joshua Hecker, Univ. of Central Florida; Christopher R. Rehm, Air Force Research Lab.; John C. Sciortino, Jr., Naval Research Lab. . . . . [6964-08]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 4 . . . . . Tues. 10:30 am to 12:10 pm

Knowledge Discovery and Exploitation

Session Chair: **Robert Bird,** Red Lambda, Inc.

Data modeling enabled dynamical analysis for blogger state-of-mind modeling and prediction, Holger M. Jaenisch, Alabama A&M Univ.; Michael Coombs, Diplomacy Media Research; James Handley, AXIOM Corp.; Jeffrey Faucheaux, SPARTA, Inc.; Matthew Edwards, Alabama A&M Univ. . . . . [6964-09]

Developing an intelligence analysis process through social network analysis, Peter M. LaMonica, Todd Waskiewicz, Air Force Research Lab. . . . . [6964-10]

Toward a qualia representation of cyberspace, Timothy H. Lacey, Robert F. Mills, Richard A. Raines, Steven K. Rogers, Air Force Institute of Technology . . . . . [6964-11]

Feature selection for anomaly intrusion detection: a multi-objective evolutionary approach, Hamid Eskandari, Robert Bird, Red Lambda, Inc. . . . . [6964-12]

Bio-inspired computational technique for the fusion data from multiple sources, Misty Blowers, Air Force Research Lab.; Jae C. Oh, Syracuse Univ. . . . . [6964-13]

Lunch/Exhibition Break . . . . . 12:10 to 1:40 pm

SESSION 5 . . . . . Tues. 1:40 to 3:00 pm

System/Component Design and Optimization

Session Chair: **Teresa H. O'Donnell,** Air Force Research Lab.

Fitness landscape analysis of evolved image transforms for defense applications, Michael R. Peterson, Wright State Univ.; Gary Lamont, Air Force Institute of Technology . . . . . [6964-14]

A genetic algorithm approach to hyperspectral feature subset selection, Barry R. Secrest, Air Force Institute of Technology . . . . . [6964-15]

Efficient global optimization (EGO) of a limited parameter antenna design, Teresa H. O'Donnell, Hugh Southall, Edward Altshuler, Bryan Kaanta, Air Force Research Lab. . . [6964-16]

IR wireless cluster synapses of HYDRA very large neural networks, Tomasz P. Jannson, Thomas C. Forrester, Physical Optics Corp. . . . . [6964-17]

Panel Discussion

Bio-Inspiried Computing for Homeland Security: Issues and Answers

Tues. 3:30 to 4:30 pm

Panel Moderator: **Robert Bird,** Red Lambda, Inc.

To be announced *(Invited Paper)*, , ... [6964-18]

Closing Remarks/Wrap-up . . . . . Tues. 4:30 to 4:40 pm

Session Chair: **Misty Blowers,** Air Force Research Lab.

Related Course

SC783 **How to Validate Your Models and Simulations** *(Law)*
Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Modeling and Simulation for Military Operations III

Conference Chair: **Dawn A. Trevisani,** Air Force Research Lab.

Program Committee: **Victoria R. Hahn,** Raytheon Missile Systems; **Michael D. Letherwood,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.; **Judson McCarty,** Air Force Research Lab.; **Alex F. Sisti,** Air Force Research Lab.

Wednesday 19 March

Introductory Remarks . . . . . Wed. 8:10 to 8:20 am

SESSION 1 . . . . . Wed. 8:20 to 10:00 am

Behavior Modeling

Session Chair: **Robert Woodley,** 21st Century Systems, Inc.

A framework for deception detection in adversary intent modeling, Xiuqing Yuan, Eugene Santos, Jr., Dartmouth College . . . . . [6965-01]

Modeling adversarial intent for interactive simulation and gaming: the fused intent system, Eugene Santos, Jr., Dartmouth College; Bruce R. McQueary, Lee S. Krause, Securboration . . . . . [6965-02]

CHAOS: an architecture for human performance modeling, Emiel Ubink, Frank Aldershoff, TNO Defence, Security and Safety (Netherlands). . . . . [6965-03]

Enhancing emotional-based target prediction, Michael Gosnell, Robert Woodley, 21st Century Systems, Inc.. . . . . [6965-04]

Self-organizing modeling and simulation structures, Jim E. Brander, Interactive Engineering Pty Ltd. (Australia). . . . . [6965-05]

SESSION 2 . . . . . Wed. 10:30 am to 12:10 pm

Sensor Modeling

Session Chair: **Brian Sjoberg,** Naval Research Lab.

Using stochastic process algebras to estimate the quality of information in military sensor networks, Duncan F. Gillies, Imperial College London (United Kingdom); Chatschik Bisdikian, IBM Thomas J. Watson Research Ctr. . . . [6965-06]

A simulation program for the Firefinder radar, Eric P. Lam, Boris Abramov, H. Walker Birrell, Thales Raytheon Systems. . . . . [6965-07]

Optimized autonomous search pattern evaluation using the Cerberus framework, Christopher R. Angell, Mark Bernhardt, Waterfall Solutions Ltd. (United Kingdom); Paul K. Kimber, SELEX Sensors and Airborne Systems Ltd. (United Kingdom); Karen M. Brosseaud, Waterfall Solutions Ltd. (United Kingdom). . . . . [6965-08]

Irma 5.2 multi-sensor signature prediction model, James C. Savage, Air Force Research Lab. . . . . [6965-09]

Hyperspectral extensions in the MuSES signature code, Wellesley E. Pereira, David M. Less, Leonard J. Rodriguez, ThermoAnalytics, Inc.; Uri Bernstein, Yit-Tsi Kwan, Technology Service Corp. . . . . [6965-10]

Lunch/Exhibition Break . . . . . 12:10 to 1:40 pm

SESSION 3 . . . . . Wed. 1:40 to 3:20 pm

Modeling for Operational Effectiveness

Session Chair: **Eric J. Kelmelis,** EM Photonics, Inc.

Methodologies for aggregating large hierarchical simulation models, June F. D.Rodriguez, John O. Miller, Kenneth W. Bauer, Jr., Robert E. Neher, Jr., Air Force Institute of Technology . . . . . [6965-11]

Formal analytical modeling of blog content as personal narrative, Michael J. Coombs, Diplomacy Media Research; Holger M. Jaenisch, Alabama A&M Univ.; James Handley, AXIOM Corp.; Jeffrey Faucheaux, SPARTA, Inc.; Matthew E. Edwards, Alabama A&M Univ. . . . . [6965-12]

Designing an evaluation system for operational capacity and effectiveness based on computer simulation, Jun He, Beijing Normal Univ. (China) . . . . . [6965-13]

Accelerated determination of UAV flight envelopes, Michael R. Bodnar, EM Photonics, Inc.; Lyle N. Long, The Pennsylvania State Univ.; Eric J. Kelmelis, EM Photonics, Inc.. . . . . [6965-14]

Modeling, simulation, and evaluation of HE ammunition for counter-RAM systems, Markus Graswald, Hendrik Rothe, Helmut-Schmidt Univ. (Germany) . . . . . [6965-15]

SESSION 4 . . . . . Wed. 3:50 to 5:30 pm

Feature Modeling and Visualization

Session Chair: **Andrew Malloy,** Naval Research Lab.

Three-dimensional visualization of electronic warfare payloads, Patricia J. Kirsch, David Tremper, Naval Research Lab. . . . . [6965-16]

Interactive scenario builder, Andrew Malloy, Brian Sjoberg, Adam Szymanski, Naval Research Lab. . . . . [6965-17]

Rapid reconstruction of buildings with arbitrary roof topology, Michael C. Tarnowski, Donald R. Tolley, Applied Research Associates, Inc.. . . . . [6965-18]

A Kalman-filter based multi-sensor terrain profile measurement system: principles, implementation and validation, FeiLong Liu, Nicholas Dembski, Ahmed Soliman, Giorgio Rizzoni, The Ohio State Univ.; Brian Thompson, Bowie Vaughn, U.S. Army Yuma Proving Ground . . [6965-19]

Modeling terrain for geo-paring and casualty assessment in OneTESS, Wolfgang Baer, Naval Postgraduate School; Todd R. Campbell, William T. Powell, U.S. Army Operational Test Command; Jesse Campos, Applied Research Associates, Inc. . . . . [6965-20]

Related Course

SC783 **How to Validate Your Models and Simulations** *(Law)*
Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Sensor Data Exploitation and Target Recognition

Chair: **Ivan Kadar,** Interlink Systems Sciences, Inc.

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6968 **Signal Processing, Sensor Fusion, and Target Recognition XVII** *(Kadar)* p. 72

6966 **Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIV** *(Shen, Lewis)* p. 68

6970 **Algorithms for Synthetic Aperture Radar Imagery XV** *(Zelnio, Garber)* p. 76

Invited Panel Discussion: **Issues and Challenges in Performance Assessment of Multitarget Tracking Algorithms with Applications to Real-World Problems** *(Kadar)* 7:00 to 9:45 pm, p. 8
This event is held in conjunction with Conference 6968.

6972 **Polarization: Measurement, Analysis, and Remote Sensing VIII** *(Chenault, Goldstein)* p. 78

6969 **Signal and Data Processing of Small Targets 2008** *(Drummond)* p. 74

Demonstrations and Open Discussion *(Drummond)* 8:00 to 10:00 pm, p. 8
This event is held in conjunction with Conference 6969.

6967 **Automatic Target Recognition XVIII** *(Sadjadi, Mahalanobis)* p. 70

Polarization Technical Meeting *(Chenault, Goldstein)* 11:40 am to 1:40 pm, p. 8
This event is held in conjunction with Conference 6972.

6971 **Acquisition, Tracking, Pointing, and Laser Systems Technologies XXII** *(Chodos, Thompson)* p. 77

Courses of Related Interest

SC174 **Multispectral Image Processing** *(Schowengerdt)* 8:30 am to 5:30 pm, p. 110

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, p. 105

SC893 ***NEW*** **SAR Signal Processing Laboratory** *(Soumekh)* 8:30 am to 5:30 pm, p. 111

SC158 **Fundamentals of Automatic Target Recognition** *(Nasr)* 8:30 am to 5:30 pm, p. 109

SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, p. 106

SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, p. 106

SC892 ***NEW*** **Infrared Search and Track Systems** *(Schwering)* 1:30 to 5:30 pm, 102

SC167 **Introduction to Laser Radar** *(Kamerman)* 1:30 to 5:30 pm, p. 107

SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* 8:30 am to 5:30 pm, p. 103

SC162 **SAR Signal Processing** *(Soumekh)* 8:30 am to 5:30 pm, p. 111

SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* 8:30 am to 5:30 pm, p. 110

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, p. 107

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* 8:30 am to 5:30 pm, p. 110

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition
10:00 am to 5:00 pm | 10:00 am to 5:00 pm | 10:00 am to 2:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

SPIE Works **Career Fair**
11:00 am to 3:00 pm | 11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

Conference 6966

Monday-Wednesday 17-19 March 2008 • Proceedings of SPIE Vol. 6966

Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIV

Conference Chair: **Sylvia S. Shen,** The Aerospace Corp.; **Paul E. Lewis,** National Geospatial-Intelligence Agency

Program Committee: **Gail P. Anderson,** Air Force Research Lab.; **Hsiao-hua K. Burke,** MIT Lincoln Lab.; **Chein-I Chang,** Univ. of Maryland/Baltimore County; **Eustace L. Dereniak,** College of Optical Sciences/The Univ. of Arizona; **Michael T. Eismann,** Air Force Research Lab.; **Glenn E. Healey,** Univ. of California/Irvine; **Robert T. Kroutil,** Los Alamos National Lab.; **Fred A. Kruse,** Horizon GeoImaging, LLC; **Alan P. Schaum,** Naval Research Lab.; **Joel Susskind,** NASA Goddard Space Flight Ctr.; **Grady H. Tuell,** Optech International, Inc.; **Miguel Vélez-Reyes,** Univ. de Puerto Rico Mayagüez

Monday 17 March

SESSION 1 . . . . . .Mon. 8:30 to 10:10 am

Detection and Identification I

Session Chair: **Sylvia S. Shen,** The Aerospace Corp.

Constrained basis set expansions for target subspaces in hyperspectral detection and identification, Steven M. Adler-Golden, John H. Gruninger, Robert L. Sundberg, Spectral Sciences, Inc.; Joao M. Romano, U.S. Army Armament Research, Development and Engineering Ctr.. . . . . [6966-01]

Hyperspectral anomaly detection based on minimum generalized variance method, Edisanter Lo, Susquehanna Univ.; John M. Ingram, U.S. Military Academy . . . . . [6966-02]

Regularization for spectral matched filter and RX anomaly detector, Nasser M. Nasrabadi, Army Research Lab. . . . . [6966-03]

An adaptive CFAR algorithm for real-time hyperspectral target detection, Eskandar Ensafi, Alan D. Stocker, Space Computer Corp. . . . . [6966-04]

Band selection for hyperspectral target detection based on a multinormal mixture anomaly detection algorithm, Ingebjørg Kåsen, Torbjørn Skauli, Norwegian Defense Research Establishment (Norway) . . . . . [6966-05]

SESSION 2 . . . . . Mon. 10:30 am to 12:30 pm

Sensor Design, Performance, and Data Analysis Methodologies

Session Chair: **Eustace L. Dereniak,** College of Optical Sciences/The Univ. of Arizona

High-performance hyperspectral imager using novel acousto-optic tuneable filter, Elliot S. Wachman, ChromoDynamics Inc.; Chris N. Pannell, Optronic Labs., Inc.. . . . . [6966-06]

Color-augmented target tracking using a liquid crystal tunable filter camera, Michael Gran, Space Computer Corp. . . . . [6966-07]

Design and performance of the VNIR HyperSensor camera system, David B. Cavanaugh, Mark S. Dombrowski, Surface Optics Corp.; Brian E. Catanzaro, CFE Services . . . [6966-08]

Hyperspectral image compressive projection algorithm, Joseph P. Rice, David W. Allen, Jorge E. Neira, National Institute of Standards and Technology . . . . . [6966-09]

Solvability and speed improvement in iterative processing with deterministic pseudo-inversions, Harvey C. Schau, Meridian Systems LLC . . . . . [6966-10]

A novel method for illumination suppression in hyperspectral images, Edward A. Ashton, Brian Wemett, VirtualScopics, Inc.; Robert A. Leathers, Trijntje V. Downes, Naval Research Lab. . . . . [6966-11]

Lunch Break . . . . . 12:30 to 1:30 pm

SESSION 3 . . . . . .Mon. 1:30 to 3:10 pm

Clustering and Classification

Session Chair: **Miguel Velez-Reyes,** Univ. de Puerto Rico Mayagüez

A dynamic systems algorithm for unsupervised classification, William F. Basener, David W. Messinger, Rochester Institute of Technology . . . . . [6966-12]

Using three-dimensional spectral/spatial Gabor filters for hyperspectral region classification, Glenn E. Healey, Tien Bau, Subhadip Sarkar, Univ. of California/Irvine. . . . [6966-13]

Unsupervised spectral-spatial classification of hyperspectral imagery using real and complex features and generalized histograms, Julio M. Duarte-Carvajalino, Univ. de Puerto Rico Mayagüez; Guillermo Sapiro, Univ. of Minnesota; Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez . . . . . [6966-14]

Hyperspectral image classification using spectral histograms and semi-supervised learning, Sol M. Cruz, Vidya B. Manian, Univ. de Puerto Rico Mayagüez . . [6966-15]

Hyperspectral data-processing algorithm combining principal component analysis (PCA) and K nearest neighbours (KNN), Pilar Beatriz Garcia-Allende, Olga M. Conde, Marta Amado, Antonio Quintela, Jose M. Lopez-Higuera, Univ. de Cantabria (Spain) . . . . . [6966-16]

SESSION 4 . . . . . .Mon. 3:30 to 5:50 pm

Spectral Methodologies and Applications

Session Chair: **Paul E. Lewis,** National Geospatial-Intelligence Agency

Evaluating the use of hyperspectral data to detect and map biologiocal indicators for metal and man-made objects in the littoral environment, Daria Siciliano, Richard C. Olsen, James R. Blankenship, Naval Postgraduate School . . . . . [6966-17]

Using remotely sensed thermal infrared multispectral data and thermal modeling to estimate lava tube roof thickness at Kilauea Volcano, Hawaii, Ronald G. Resmini, National Geospatial-Intelligence Agency. . . . . [6966-18]

Linear spectral unmixing approaches to magnetic resonance image analysis, Eng-Ling Wong, Chein-I Chang, Univ. of Maryland/Baltimore County . . . . . [6966-19]

Spatial and temporal variability of hyperspectral signatures of terrain, Donald K. Perovich, Kathleen F. Jones, George G. Koenig, U.S. Army Corps of Engineers . . [6966-20]

Integration of multitechniques on reducing sea surface temperature bias, Hou Guan Ng, Chow Jeng Wong, Mohd Zubir Mat Jafri, Khiruddin Abdullah, Hwee San Lim, Univ. Sains Malaysia (Malaysia) . . . . . [6966-21]

Temporal and spatial air quality monitoring using internet surveillance camera and ALOS satellite image, Chow Jeng Wong, Mohd Zubir Mat Jafri, Khiruddin Abdullah, Hwee San Lim, Choay-Ee J. Tan, Univ. Sains Malaysia (Malaysia). . . . . [6966-22]

Spatio-spectral bilateral filters for hyperspectral imaging, Honghong Peng, Raghuveer M. Rao, David W. Messinger, Rochester Institute of Technology . . . . . [6966-23]

Tuesday 18 March

SESSION 5 . . . . . Tues. 8:00 to 9:00 am

Spectral Data Analysis Methodologies I

Session Chair: **Fred A. Kruse,** Horizon GeoImaging, LLC

Denoising of hyperspectral imagery using nonlinear filters and its application to image classification, Enid M. Alvira-Concepcion, Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez . . . . . [6966-24]

Expert system analysis of hyperspectral data, Fred A. Kruse, Horizon GeoImaging, LLC . . . . . [6966-25]

Transforming hyperspectral data via the median-spectral-spatial transformation, Amber D. Fischer, 21st Century Systems, Inc.. . . . . [6966-26]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 6 . . . . . Tues. 10:20 to 11:00 am

Spectral Data Analysis Methodologies II

Session Chair: **Fred A. Kruse,** Horizon GeoImaging, LLC

Bayesian spatial-temporal algorithms for analysis of hyper-spectral signatures, Lawrence K. Chilton, Pacific Northwest National Lab. . . . . [6966-27]

Parametric mapping singularity based infrared image fusion algorithm, Igor V. Ternovskiy, Intelligent Optical Systems, Inc.. . . . . [6966-28]

SESSION 7 . . . . . Tues. 11:00 am to 12:40 pm

Image Registration and Change Detection I

Session Chair: **Paul E. Lewis,** National Geospatial-Intelligence Agency

Registration of multisensor remote sensing imagery by gradient-based optimization of cross-cumulative residual entropy, Mark R. Pickering, Xiuping Jia, Australian Defence Force Academy (Australia) . . . . . [6966-29]

Vision inspired spatial engine (VISE): a new approach to automated registration, Derek R. Lewis, Science Applications International Corp. . . . . [6966-30]

Automated vector-to-raster image registration, Boris Kovalerchuk, Central Washington Univ.; Peter J. Doucette, ITT Corp.; Robert Brigantic, Pacific Northwest National Lab.; Gamal Seedahmed, Univ. of Florida . . . . . [6966-31]

Sensitivity of anomalous change detection to small misregistration errors, James Theiler, Los Alamos National Lab. . . . . [6966-32]

Image misregistration effects upon hyperspectral change detection, Joseph Meola, Michael T. Eismann, Air Force Research Lab. . . . . [6966-33]

Lunch/Exhibition Break . . . . . 12:40 to 1:40 pm

SESSION 8 . . . . . Tues. 1:40 to 4:40 pm

Atmospheric Instrumentation, Measurements, and Forecasting

Session Chair: **Joel Susskind,** NASA Goddard Space Flight Ctr.

Sounding improvements expected from the advanced remote-sensing imaging emission spectrometer (ARIES), Thomas S. Pagano, Edward T. Olsen, Hartmut H. Aumann, Moustafa T. Chahine, Eric J. Fetzer, Denis A. Elliott, Steven E. Broberg, Fredrick W. Irion, Jet Propulsion Lab. . . . . [6966-34]

Improved AIRS retrievals over land, Joel Susskind, John M. Blaisdell, NASA Goddard Space Flight Ctr. . . . . [6966-35]

Improving forecast skill by assimilation of quality controlled AIRS temperatures retrieved under partial cloud cover, Joel Susskind, Oreste Reale, NASA Goddard Space Flight Ctr. . . . . [6966-36]

Atmospheric parameter climatologies from AIRS: monitoring short- and longer-term climate variabilities and "trends", Gyula I. Molnar, Joel Susskind, NASA Goddard Space Flight Ctr. . . . . [6966-37]

Retrieval of mid-tropospheric CO_2 directly from AIRS measurements, Edward T. Olsen, Moustafa T. Chahine, Luke L. Chen, Thomas S. Pagano, Jet Propulsion Lab. . . [6966-38]

Recent progress in neural network estimation of atmospheric profiles using microwave and hyperspectral infrared sounding data in the presence of clouds, William J. Blackwell, MIT Lincoln Lab.. . . . . [6966-39]

Local, regional, and global views of tropospheric carbon monoxide from the InfraRed Sounder (AIRS) onboard NASA's Aqua satellite, W. Wallace McMillan, Leonid Yurganov, Univ. of Maryland/Baltimore County . . . . [6966-40]

Application of spaceborne infrared atmospheric sounder for geosynchronous Earth orbit (SIRAS-G) technology to future Earth science missions, Thomas U. Kampe, Ball Aerospace & Technologies Corp. . . . . [6966-41]

SESSION 9 . . . . . Tues. 4:40 to 6:00 pm

Atmospheric Characterization and Correction

Session Chair: **Gail P. Anderson,** Air Force Research Lab.

Radiative impact of aerosol smoke using MODTRAN™5, Robert S. Stone, National Oceanic and Atmospheric Administration; Gail P. Anderson, Air Force Research Lab.; Eric P. Shettle, Naval Research Lab.; Konstantin Loukachine, NASA Langley Research Ctr.; Elizabeth Andrews, Ellsworth G. Dutton, National Oceanic and Atmospheric Administration . . . . . [6966-42]

Apparent temperature dependence on localized atmospheric water vapor, Matthew Montanaro, Carl Salvaggio, David W. Messinger, Scott D. Brown, Rochester Institute of Technology; Alfred J. Garrett, Savannah River National Lab. . . . . [6966-43]

A worldwide physics-based high-spectral resolution atmospheric characterization, Steven T. Fiorino, Richard J. Bartell, Matthew J. Krizo, Michael A. Marciniak, Salvatore J. Cusumano, Air Force Institute of Technology. . . . . [6966-44]

Atmospheric invariants for hyperspectral image correction, Mark Bernhardt, William J. Oxford, Christopher A. Steer, Karen M. Brosseaud, Waterfall Solutions Ltd. (United Kingdom) . . . . . [6966-45]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Informational properties of the masking atmospheric-optical channel over remotely sensed onground objects, Galib A. Huseynov, Azerbaijan National Aerospace Agency (Azerbaijan) . . . . . [6966-68]

The multispectral device for a filtration of optical images, Anatoly N. Sviridov, Anatoly M. Filachev, Vladimir P. Ponomarenko, Andrey S. Kononov, Orion Research and Production Association (Russia) . . . . . [6966-69]

Weighted color composite image algorithm for hyperspectral data, Christopher Neylan, The College of New Jersey; Lawrence T. Rush, Susquehanna Univ.; Angel Gutierrez, Stefan A. Robila, Montclair State Univ. . . [6966-70]

Wednesday 19 March

SESSION 10 . . . . . .Wed. 8:30 to 10:10 am

Spectral Unmixing

Session Chair: **Miguel Velez-Reyes,** Univ. de Puerto Rico Mayagüez

A generalized linear mixing model for hyperspectral imagery, David B. Gillis, Jeffrey H. Bowles, Naval Research Lab.; Emmett J. Ientilucci, David W. Messinger, Rochester Institute of Technology . . . . . [6966-46]

A revised algorithm to compute the constrained positive matrix factorization and its application in unsupervised unmixing of hyperspectral imagery, Yahya M. Masalmah, Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez[6966-47]

Ground truth data collection for unmixing algorithm evaluation, Shawn D. Hunt, Univ. de Puerto Rico Mayagüez . . . . . [6966-48]

Abundance estimation algorithms on the NVIDIA CUDA technology, David Gonzalez, Christian Sanchez, Ricardo Veguilla, Nayda G. Santiago, Univ. de Puerto Rico Mayagüez . . . . . [6966-49]

High-order statistics-based approaches to endmember extraction for hyperspectral imagery, Chushih Yu, Univ. of Maryland/Baltimore County; Hsuan Ren, National Central Univ. (Taiwan); Chein-I Chang, Univ. of Maryland/Baltimore County . . . . . [6966-50]

SESSION 11 . . . . . Wed. 10:30 am to 12:30 pm

Spectral Data Analysis Methodologies III

Session Chair: **Fred A. Kruse,** Horizon GeoImaging, LLC

Geometric estimation of the inherent dimensionality of a single material cluster in multi- and hyperspectral imagery, Ariel A. Schlamm, David W. Messinger, William F. Basener, Rochester Institute of Technology . . . . . [6966-51]

Projection pursuit-based dimensionality reduction, Haleh Safavi, Chein-I Chang, Univ. of Maryland/Baltimore County . . . . . [6966-52]

Improving the performance of PCA and JPEG2000 for hypespectral image compression, Qian Du, Mississippi State Univ.. . . . . [6966-53]

An FPGA-based demonstration hyperspectral image compression system, Tom L. Woolston, Gail E. Bingham, Niel S. Holt, Glen Wada, Utah State Univ. . . . . [6966-54]

Exploration of component analysis in multi/hyperspectral image processing, Keng-Hao Liu, Chein-I Chang, Univ. of Maryland/Baltimore County . . . . . [6966-55]

A 2DPCA-based method for automatic selection of hyperspectral image bands for color visualization, Jason Kaufman, Jacobs Engineering and Ohio Univ.; Mehmet Celenk, Ohio Univ.; Karmon Vongsy, Jacobs Engineering . . . . . [6966-56]

Lunch/Exhibition Break. . . . . 12:30 to 1:30 pm

SESSION 12 . . . . . .Wed. 1:30 to 3:10 pm

Modeling and Simulation

Session Chair: **Glenn E. Healey,** Univ. of California/Irvine

Maximum Gaussianity models for hyperspectral images, Peter Bajorski, Rochester Institute of Technology . . [6966-57]

A simulation tool for hyperspectral thermal IR imaging sensors, Yit-Tsi Kwan, Technology Service Corp.; Steven C. Sawtelle, Air Force Research Lab.; Uri Bernstein, Technology Service Corp.; Wellesley E. Pereira, David M. Less, ThermoAnalytics, Inc. . . . . [6966-58]

Atmospheric sampling for hyperspectral signature modeling, Glenn E. Healey, Univ. of California/Irvine; Anthony J. Ratkowski, Air Force Research Lab. . . . . [6966-59]

How to design synthetic images to validate and evaluate hyperspectral imaging algorithms, Yu-Chenrg C. Chang, Univ. of Maryland/Baltimore County; Hsuan Ren, National Central Univ. (Taiwan); Chein-I Chang, Univ. of Maryland/Baltimore County; Robert S. Rand, National Geospatial-Intelligence Agency . . . . . [6966-60]

Analysis of an autonomous clutter background characterization method for hyperspectral imagery, Joao M. Romano, U.S. Army Armament Research, Development and Engineering Ctr.; Dalton S. Rosario, Army Research Lab. . . . . [6966-61]

SESSION 13 . . . . . .Wed. 3:30 to 5:10 pm

Detection and Identification II

Session Chair: **Sylvia S. Shen,** The Aerospace Corp.

Statistical methods for analysis of hyperspectral anomaly detection, Dalton S. Rosario, Army Research Lab. . [6966-62]

Kernel-based constrained energy minimization (KCEM), Xiaoli Jiao, Chein-I Chang, Univ. of Maryland/Baltimore County . . . . . [6966-63]

Hyperspectral remote sensing of chemical warfare agents for homeland security applications, Dimitris G. Manolakis, David M. Weitz, MIT Lincoln Lab. . . . . [6966-65]

Hyperspectral target detection from space using the CHRIS/PROBA satellite, Torbjorn Skauli, Trym Vegard Haavardsholm, Ingebjørg Kåsen, Øystein Farsund, Norwegian Defense Research Establishment (Norway) . . . . . [6966-66]

Support vector machines in hyperspectral imaging spectroscopy with application to material identification, Pilar Beatriz Garcia-Allende, Francisco Anabitarte, Olga M. Conde, Jesus M. Mirapeix, Francisco J. Madruga, Jose M. Lopez-Higuera, Univ. de Cantabria (Spain). . . . . [6966-67]

Related Courses

SC174 **Multispectral Image Processing** *(Schowengerdt)* Sunday, 8:30 am to 5:30 pm

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* Monday, 1:30 to 5:30 pm

SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* Sunday, 1:30 to 5:30 pm

See pp. 101–117 for course descriptions.

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Automatic Target Recognition XVIII

Conference Chairs: **Firooz A. Sadjadi,** Lockheed Martin Corp.; **Abhijit Mahalanobis,** Lockheed Martin Missiles and Fire Control

Program Committee: **Mohammad S. Alam,** Univ. of South Alabama; **Farid Amoozegar,** Jet Propulsion Lab.; **Mahmood R. Azimi-Sadjadi,** Colorado State Univ.; **David P. Casasent,** Carnegie Mellon Univ.; **Leon Cohen,** Hunter College/CUNY; **Belur V. Dasarathy,** Consultant; **Frederick D. Garber,** Wright State Univ.; **Guillermo C. Gaunaurd,** Army Research Lab.; **Izidor Gertner,** City College/CUNY; **Patti S. Gillespie,** Army Research Lab.; **Riad I. Hammoud,** Delphi Corp.; **Bahram Javidi,** Univ. of Connecticut; **Ismail I. Jouny,** Lafayette College; **Behrooz Kamgar-Parsi,** Naval Research Lab.; **Timothy J. Klausutis,** Air Force Research Lab.; **Wolfgang Kober,** Data Fusion Corp.; **Aaron D. Lanterman,** Georgia Institute of Technology; **Randolph L. Moses,** The Ohio State Univ.; **Robert R. Muise,** Lockheed Martin Missiles and Fire Control; **Nasser M. Nasrabadi,** Army Research Lab.; **Leslie M. Novak,** BAE Systems Advanced Information Technologies; **Joseph A. O'Sullivan,** Washington Univ. in St. Louis; **Mubarak Shah,** Univ. of Central Florida; **S. Richard F. Sims,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Alan J. Van Nevel,** Naval Air Warfare Ctr.; **Bradley C. Wallet,** Automated Decisions LLC; **Edmund G. Zelnio,** Air Force Research Lab.

Wednesday 19 March

SESSION 1 . . . . . .Wed. 8:00 to 9:30 am

Performance Evaluation Methods in ATR I

Session Chair: **S. Richard F. Sims,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.

The life and death of ATR/sensor fusion and the hope for resurrection *(Invited Paper)*, Steven K. Rogers, Air Force Research Lab. . . . . [6967-01]

Automated registration evaluation system, Derek R. Lewis, Nelson Fredes, Jeremy A. Weiss, Science Applications International Corp.. . . . . [6967-02]

Advancement in ATD performance prediction, Ross S. Eaton, Scott K. Ralph, Magnus S. Snorrason, Charles River Analytics, Inc.; John M. Irvine, Science Applications International Corp.; Steven D. Vanstone, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.. . . . . [6967-03]

Clutter performance and confuser rejection using distortion-invariant filters for ATR, Rohit Patnaik, David P. Casasent, Carnegie Mellon Univ. . . . . [6967-04]

SESSION 2 . . . . . .Wed. 9:20 to 10:40 am

Performance Evaluation Methods in ATR II

Session Chair: **S. Richard F. Sims,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.

Dynamic range compression deconvolution for enhancement of automatic target recognition system performance, Bahareh Haji-Saeed, Solid State Scientific Corp.; Jed Khoury, Air Force Research Lab.; William D. Goodhue, Univ. of Massachusetts/Lowell; Charles L. Woods, Air Force Research Lab.; John Kierstead, Solid State Scientific Corp. . . . . [6967-05]

ROBIN: a platform for evaluating automatic target recognition algorithms, Part 1: overview of the project and presentation of the SAGEM DS competition, Daniel Duclos, Quentin Guillerm, Sagem SA (France); Jacques Lonnoy, Sagem Defense Securite (France); Frederic Jurie, Ctr. National de la Recherche Scientifique (France); Stephane Herbin, ONERA (France) . . . . . [6967-06]

ROBIN: a platform for evaluating automatic target recognition algorithms, Part 2: protocols used for evaluating algorithms and results obtained on the SAGEM DS database, Daniel Duclos, Quentin Guillerm, Sagem SA (France); Jacques Lonnoy, Sagem Defense Securite (France); Frederic Jurie, Ctr. National de la Recherche Scientifique (France); Stephane Herbin, ONERA (France) . . . . . [6967-07]

Statistical methods to aid in performance understanding of SAR ATR systems, Brian A. Geier, Michael B. Hensel, John Gardner, Andrew Morrison, Jacobs Sverdrup Technology, Inc.; Thomas J. Wild, Air Force Research Lab. . . . . [6967-08]

SESSION 3 . . . . . Wed. 11:00 am to 12:30 pm

Hyper- and Multispectral Methods in ATR

Session Chair: **Patti S. Gillespie,** Army Research Lab.

Rapid high-performance hyperspectral anomaly detection via global SVDD *(Invited Paper)*, Reuven Meth, SET Corp.; Amit Banerjee, Philippe Burlina, The Johns Hopkins Univ. Applied Physics Lab.; Thomas M. Strat, SET Corp. . [6967-09]

Deterministic hyperspectral target detection using the DWT and spectral fringe-adjusted joint transform correlation, Wesam A. Sakla, Texas A&M Univ.; Adel Sakla, Mohammad S. Alam, Univ. of South Alabama . . . . . [6967-10]

A variational level-set method for automatic target detection in hyperspectral images, Andres Alarcon, Vidya B. Manian, Univ. de Puerto Rico Mayagüez . . . . . [6967-11]

Mine detection in multispectral imagery using PCA and matched filtering, Mohammad S. Alam, Univ. of South Alabama . . . . . [6967-12]

Lunch/Exhibition Break . . . . . 12:30 to 1:30 pm

SESSION 4 . . . . . .Wed. 1:30 to 3:00 pm

Target Detection and Classification using Active Sensors I

Session Chair: **Alan J. Van Nevel,** Naval Air Warfare Ctr.

Active and passive 3D image sensing and visualization (Keynote Presentation), Bahram Javidi, Univ. of Connecticut; Edward A. Watson, Paul F. McManamon, Air Force Research Lab. . . . . [6967-13]

Target recognition using HRR profile-based incoherent SAR (IN-SAR) image formation, Nicholas A. O'Donoughue, Walter Kuklinski, Constantine Arabadjis, The MITRE Corp. . . . . [6967-14]

Shape-based recognition of targets in synthetic aperture radar images using elliptical Fourier descriptors, Louis P. Nicoli, Georgios C. Anagnostopoulos, Florida Institute of Technology . . . . . [6967-15]

Analysis of spatially mismatched imagery for synthetic aperture rader ATR classification, Chad T. Rupp, Shawn D. Halversen, Lee J. Montagnino, Christina Hebert, Matthew Young, Mary L. Cassabaum, Raytheon Missile Systems. . . . . [6967-16]

SESSION 5 . . . . . .Wed. 3:20 to 4:40 pm

Target Detection and Classification using Active Sensors II

Session Chair: **Guillermo C. Gaunaurd,** Army Research Lab.

Dimensionality reduction and information-theoretic divergence between sets of ladar images, David Gray, Air Force Research Lab. . . . . [6967-17]

Detection of buried objects using GPR change detection in polarimetric Huynen spaces, Firooz A. Sadjadi, Lockheed Martin Corp.; Guillermo C. Gaunaurd, Anders Sullivan, Army Research Lab. . . . . [6967-18]

Particle swarm optimization for radar target recognition and modeling, Ismail I. Jouny, Lafayette College . . [6967-19]

Utilization of volume correlation filters for underwater mine identification in LIDAR imagery, Bradley Walls, Arete Assoicates . . . . . [6967-20]

SESSION 6 . . . . . .Wed. 4:40 to 6:00 pm

Correlation-based Methods in ATR

Session Chair: **Robert K. Muise,** Lockheed Martin Missiles and Fire Control

Single distortion-invariant log-polar wavelet-modified maximum average correlation height filter for recognition of infrared and visible targets, Amit Aran, Soumika Munshi, Vinod K. Beri, Arun K. Gupta, Instruments Research and Development Establishment (India). . . . . [6967-21]

Using radial basis functions to set thresholds for segmentation of targets from backgrounds on matched filter correlation surfaces, Richard P. Edmondson, Michael H. Rodgers, Polaris Sensor Technologies, Inc.. . . . . [6967-22]

Multi-frame adaptive object recognition, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control. . . . . [6967-23]

A performance comparison of the transform domain Rayleigh quotient quadratic correlation filter (TDRQQCF) approach to the regularized RQQCF, Pradeep Ragothaman, Univ. of Central Florida; Abhijit Mahalanobis, Robert R. Muise, Lockheed Martin Missiles and Fire Control; Wasfy B. Mikhael, Univ. of Central Florida . . . . . [6967-24]

Thursday 20 March

SESSION 7 . . . . . Thurs. 8:00 to 9:30 am

Advanced Methods in ATR I

Session Chair: **Timothy J. Klausutis,** Air Force Research Lab.

Fingerprinting vehicles for tracking and verification across non-overlapping views *(Invited Paper)*, Aswin C. Sankaranarayanan, Rama Chellappa, Univ. of Maryland/ College Park . . . . . [6967-25]

Tactical imagery and geospatial data support options for automatic target acquisition, Nicola K. Broderick, Michael Podlesak, Defence Science and Technology Organisation (Australia); Paul M. Dare, Spatial Scientific Technologies Pty. Ltd. (Australia); Simon D. Jones, Royal Melbourne Institute of Technology (Australia) . . . . . [6967-26]

Bayesian multi-target tracking and sequential object recognition, Walter Armbruster, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany) . . [6967-27]

A fast 2D/3D algorithm for georegistration and targeting, Scott A. Merritt, Alan J. Van Nevel, Naval Air Warfare Ctr.. . . . . [6967-28]

SESSION 8 . . . . . Thurs. 9:30 to 11:20 am

Advanced Methods in ATR II

Session Chair: **Timothy J. Klausutis,** Air Force Research Lab.

Automatic target recognition for generalized sensor networks *(Invited Paper)*, Lawrence Carin, Duke Univ. . . . . [6967-29]

Automatic detection in a maritime environment: gradient filter versus intensity background estimation, Tanja Y.van Valkenburg-Haarst, Koninklijke Marine (Netherlands) and Univ. van Amsterdam (Netherlands); Fok Bolderheij, Koninklijke Marine (Netherlands); Frans C.Groen, Univ. van Amsterdam (Netherlands) . . . . . [6967-30]

Edge feature extraction for ATR using the Helmholtz principle and level set methods, Arjuna Flenner, NAVAIR . . . . . [6967-31]

Automatic target recognition from surveillance images using phase mutual information, Mark R. Pickering, Scott Elmes, Xiuping Jia, Australian Defence Force Academy (Australia). . . . . [6967-32]

SESSION 9 . . . . . Thurs. 11:20 to 11:50 am

Advanced Methods in ATR III

Session Chair: **Abhijit Mahalanobis,** Lockheed Martin Missiles and Fire Control

Biological models for automatic target detection *(Invited Paper)*, Bruce J. Schachter, Northrop Grumman Corp. . . . . [6967-33]

Lunch/Exhibition Break . . . . . 11:50 am to 1:00 pm

SESSION 10 . . . . . Thurs. 1:00 to 2:20 pm

Advanced Methods in ATR IV

Session Chair: **Abhijit Mahalanobis,** Lockheed Martin Missiles and Fire Control

A semantic approach to the efficient integration of interactive and automatic target recognition systems for the analysis of complex infrastructure from aerial imagery, Alexander Bauer, Elisabeth Peinsipp-Byma, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany) . . . . . [6967-34]

Using non-negative matrix factorization to find informative basis in spin image data, Andrew J. Patterson, Donald E. Waagen, Nitesh N. Shah, Raytheon Missile Systems [6967-35]

Object tracking and classification in aerial videos, Jiangjian Xiao, Hui Cheng, Feng Han, Changjiang Yang, Sarnoff Corp. . . . . [6967-36]

Automatic target detection using vector quantization error, Brian Wemett, VirtualScopics, Inc. . . . . [6967-37]

SESSION 11 . . . . . Thurs. 2:20 to 4:10 pm

Advanced Methods in ATR V

Session Chair: **Izidor Gertner,** City College/CUNY

Target detection and tracking using FKT, DCCF and PDCCF and comparing these methods *(Invited Paper)*, Mohammad S. Alam, Melih S. Aslan, Univ. of South Alabama . . . . . [6967-38]

Radar echo characteristics of convective and stratiform mixed clouds during formation period in mountainous region, Yanwei Li, Shengjie Niu, Ning Luo, Jifen Wen, Haojuan Huang, Nanjing Univ. of Science & Technology (China) . . . . . [6967-39]

Multi-source feature extraction and target recognition in wireless sensor networks based on adaptive, distributed wavelet compression algorithms, William S. Hortos, Associates in Communication Engineering Research and Technology . . . . . [6967-40]

Combined classification systems for automatic target recognition, Michael Turnbaugh, Kenneth W. Bauer, Jr., Air Force Institute of Technology . . . . . [6967-41]

SESSION 12 . . . . . Thurs. 4:10 to 5:30 pm

Advanced Methods in ATR VI

Small unmanned aerial vehicle (UAV) real-time intelligence, surveillance and reconnaissance (ISR) using onboard preprocessing, Firooz A. Sadjadi, Rick Stevens, Jacob Braegelmann, Alexander Stephens, Ryan Nelson, Aaron Cordes, Lockheed Martin Corp. . . . . [6967-42]

Generalized characteristic functions and moments, Leon Cohen, Hunter College/CUNY. . . . . [6967-44]

Assessment of model-based automatic target recognition on real and simulated infrared imagery, Heiko Seidel, Christoph Stahl, Wolfgang Ensinger, EADS Deutschland GmbH (Germany); Per-Inge Jensen, Paal Skaaren-Fystro, Kirsten Rosseland, Kongsberg Defence & Aerospace AS (Norway); Frode Bjerkeli, Kongsberg Defense & Aerospace AS (Norway) . . . . . [6967-43]

Prediction and flexible modeling for automatic target recognition, Andre U. Sokolnikov, Visual Solutions and Applications. . . . . [6967-45]

Related Courses

SC892 **Infrared Search and Track Systems** *(Schwering)* ***NEW*** Monday, 1:30 to 5:30 pm

SC158 **Fundamentals of Automatic Target Recognition** *(Nasr)* Wednesday, 8:30 am to 5:30 pm

SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* Monday, 8:30 am to 5:30 pm

SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* Wednesday, 8:30 am to 5:30 pm

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Monday-Wednesday 17-19 March 2008 • Proceedings of SPIE Vol. 6968

Signal Processing, Sensor Fusion, and Target Recognition XVII

Conference Chair: **Ivan Kadar,** Interlink Systems Sciences, Inc.

Program Committee: **Mark G. Alford,** Air Force Research Lab.; **William Dale Blair,** Georgia Tech Research Institute; **Erik Blasch,** Air Force Research Lab.; **Mark J. Carlotto,** General Dynamics Corp.; **Kuo Chu Chang,** George Mason Univ.; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Marvin N. Cohen,** Georgia Tech Research Institute; **Mohammad Farooq,** Royal Military College of Canada (Canada); **Charles W. Glover,** Oak Ridge National Lab.; **I. R. Goodman,** Space and Naval Warfare Systems Ctr., San Diego; **Lynne L. Grewe,** California State Univ./East Bay; **Michael L. Hinman,** Air Force Research Lab.; **Kenneth J. Hintz,** George Mason Univ.; **Jon S. Jones,** Air Force Research Lab.; **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **Martin E. Liggins,** MITRE Corp.; **Perry C. Lindberg,** Teledyne Brown Engineering; **James Llinas,** Univ. at Buffalo; **Ronald P. Mahler,** Lockheed Martin Co./Tactical Systems; **Raj P. Malhotra,** Air Force Research Lab.; **Alastair D. McAulay,** Lehigh Univ.; **Raman K. Mehra,** Scientific Systems Co., Inc.; **Harley R. Myler,** Lamar Univ.; **David Nicholson,** BAE Systems plc (United Kingdom); **Leslie M. Novak,** BAE Systems Advanced Information Technologies; **Andrew G. Tescher,** AGT Associates; **Stelios C. A. Thomopoulos,** National Ctr. for Scientific Research (Greece); **Wiley E. Thompson,** New Mexico State Univ.

Monday 17 March

SESSION 1 . . . . . .Mon. 8:00 to 10:20 am

Multisensor Fusion, Multitarget Tracking, and Resource Management I

Session Chairs: **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **Mohammad Farooq,** Royal Military College of Canada (Canada)

Unscented Kalman filter versus extended Kalman filter, Arjang A. Noushin, Frederick E. Daum, Raytheon Co.. . . . . [6968-01]

Stochastic differential equations in micro-Doppler for classifying ground targets and dismounted combatants, Kumaradevan Punithakumar, Nadarajah Nandakumaran, McMaster Univ. (Canada); Mike McDonald, Defence Research and Development Canada (Canada); Thia Kirubarajan, McMaster Univ. (Canada) . . . . . [6968-02]

A particle filtering approach for convoy tracking in the midst of civilian traffic, Evangeline Pollard, Benjamin Pannetier, ONERA (France) . . . . . [6968-03]

Long-term ground movement prediction by Monte Carlo simulation, Mark J. Carlotto, General Dynamics Corp. . . . . [6968-04]

Monostatic and multistatic sonar fusion for reverberation rejection, Nadarajah Nandakumaran, Ratnasingham Tharmarasa, McMaster Univ. (Canada); Tom Lang, General Dynamics Canada Ltd. (Canada); Thiafalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6968-05]

Estimating target range-Doppler image slope for maneuver indication, Chun Yang, Sigtem Technology, Inc.; Erik Blasch, Air Force Research Lab. . . . . [6968-06]

Effect of sensor bias on space-based bearing-only tracker using unscented Kalman filter, Thomas M. Clemons III, Kuo-Chu Chang, George Mason Univ. . . . . [6968-07]

SESSION 2 . . . . . Mon. 10:50 am to 12:30 pm

Multisensor Fusion, Multitarget Tracking, and Resource Management II

Session Chairs: **Kenneth J. Hintz,** George Mason Univ.; **Ivan Kadar,** Interlink Systems Sciences, Inc.

Co-evolutionary data mining fuzzy decision trees for automatic cooperation between UAVs, James F. Smith III, Naval Research Lab. . . . . [6968-08]

Sensor management fusion using operating conditions, Erik Blasch, Air Force Research Lab.; Bart Kahler, General Dynamics Advanced Information Systems . . . . . [6968-09]

Task benefit calculation using information gain in sensor management, Peter J. Shea, Joe Kirk, Dave Welchons, Black River Systems Company, Inc.. . . . . [6968-10]

Evaluation of an information-based sensor management system, Jonathan P. Malachowski, Kenneth J. Hintz, George Mason Univ. . . . . [6968-11]

Collaborative distributed sensor management and information exchange flow control for multitarget tracking using Markov decision processes, Dimitry Akselrod, Abhijit Sinha, Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6968-12]

Lunch Break . . . . . 12:30 to 1:30 pm

SESSION 3 . . . . . .Mon. 1:30 to 2:50 pm

Assisted Target Recognition (ATR) I

Session Chairs: **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Kenneth J. Hintz,** George Mason Univ.

Experimental ATR performance evaluation under different operational conditions, Yin Chen, Intelligent Automation, Inc.; Erik Blasch, Air Force Research Lab.; Huimin Chen, Univ. of New Orleans; Tao Qian, Genshe Chen, Intelligent Automation, Inc. . . . . [6968-13]

Moving target detection and recognition from EO images, Xiaokun Li, Genshe Chen, Intelligent Automation, Inc.; Khanh Pham, Erik Blasch, Air Force Research Lab. . . . . [6968-14]

Generation of realistic 3D object models from multisensor data for target recognition, Carmen Witte, Walter Armbruster, Klaus M. Jäger, Marcus Hebel, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany). . . . . [6968-15]

Evaluating automated image analysis technology, Peter J. Doucette, National Geospatial-Intelligency Agency and ITT Corp.; John M. Irvine, National Geospatial-Intelligence Agency; James D. Leonard, Jr., Air Force Research Lab.; Ann Martin, National Geospatial-Intelligency Agency . . . [6968-16]

SESSION 4 . . . . . .Mon. 3:20 to 4:40 pm

Assisted Target Recognition (ATR) II

Session Chairs: **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Kenneth J. Hintz,** George Mason Univ.

On the limits of target recognition in the presence of atmospheric effects, Xiaohan Chen, Natalia A. Schmid, West Virginia Univ. . . . . [6968-17]

A distributed automatic target recognition system using multiple low resolution sensors, Zhanfeng Yue, Pankaj Topiwala, FastVDO LLC . . . . . [6968-18]

Multi-viewpoint image fusion for urban sensing applications, Fauzia Ahmad, Moeness G. Amin, Villanova Univ. . . . . [6968-19]

Virtual simulation tools for artillery, Patrick Gozard, Emmanuel Bret, DGA/DSP/Tour DGA (France). . . . . [6968-20]

Invited Panel Discussion

Issues and Challenges in Performance Assessment of Multitarget Tracking Algorithms with Applications to Real-World Problems.

Mon. 7:00 to 9:45 pm

Organizer: **Ivan Kadar,** Interlink Systems Sciences, Inc.

Panel Moderators: **Ivan Kadar,** Interlink Systems Sciences, Inc., **William Dale Blair,** Georgia Tech Research Insitute

Panelists: **William Dale Blair,** Georgia Tech Research Institute; **Erik P. Blasch,** Air Force Research Lab.; *Chee-Yee Chong,* BAE Systems Advanced Information Technologies; **Oliver Drummond,** CyberRnD, Inc.; **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **Xio-Rong Li,** Univ. of New Orleans; **Ronald P. Mahler,** Lockheed Martin Corp.

Tuesday 18 March

SESSION 6 . . . . . Tues. 8:00 to 9:00 am

Multisensor Fusion Methodologies and Applications I

Session Chair: **Ronald P. Mahler,** Lockheed Martin Corp.

Multitarget-moment filters for nonstandard measurement models, Ronald P. Mahler, Lockheed Martin Co.. . . [6968-21]

Joint search and sensor management for geosynchronous satellites, Aleksandar Zatezalo, Adel I. El-Fallah, Scientific Systems Co., Inc.; Ronald P. Mahler, Lockheed Martin Corp.; Raman K. Mehra, Scientific Systems Co., Inc.; Khanh D. Pham, Air Force Research Lab. . . . . [6968-22]

Dynamic sensor management of dispersed and disparate sensors for tracking resident space objects, Adel I. El-Fallah, Aleksandar Zatezalo, Scientific Systems Co., Inc.; Ronald P. Mahler, Lockheed Martin Corp.; Raman K. Mehra, Scientific Systems Co., Inc.; Delia Donatelli, Air Force Research Lab. . . . . [6968-23]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen, Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 7 . . . . . Tues. 10:30 to 11:30 am

Multisensor Fusion Methodologies and Applications II

Session Chair: **Ronald P. Mahler,** Lockheed Martin Corp.

An initial investigation into incorporating human reports into a road-constrained random set tracker, David W. Winters, James Witkoskie, Walter Kuklinski, The MITRE Corp. . . . . [6968-24]

Service-based extensions to the JDL fusion model, Richard T. Antony, Science Applications International Corp.; Joseph A. Karakowski, U.S. Army. . . . . [6968-25]

Handling target obscuration through Markov chain observations, Michael A. Kouritzin, Dandan Luo, Biao Wu, Univ. of Alberta (Canada) . . . . . [6968-26]

Lunch/Exhibition Break . . . . . 11:30 am to 1:00 pm

SESSION 8 . . . . . Tues. 1:00 to 2:20 pm

Multisensor Fusion Methodologies and Applications III

Session Chairs: **Martin E. Liggins,** MITRE Corp.; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Michael L. Hinman,** Air Force Research Lab.

Statistical, biological and categorical sensor fusion: an integrated methodology, James R. Bonick, Christopher Marshall, U.S. Army Night Vision & Electronic Sensors Directorate. . . . . [6968-27]

A framework for confidence in classification, Nathan J. Leap, Kenneth W. Bauer, Jr., Air Force Institute of Technology . . . . . [6968-28]

The confidence manifold of an ROC manifold, Mark E. Oxley, Steven N. Thorsen, Air Force Institute of Technology; Christine M. Schubert, Virginia Commonwealth Univ.[6968-29]

ROC manifolds of multiple fused independent classification systems, Mark E. Oxley, Air Force Institute of Technology . . . . . [6968-30]

SESSION 9 . . . . . Tues. 2:20 to 4:10 pm

Multisensor Fusion Methodologies and Applications IV

Session Chairs: **Martin E. Liggins,** MITRE Corp.; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Michael L. Hinman,** Air Force Research Lab.

Structured pedigree information for distributed fusion systems, Pablo O. Arambel, BAE Systems Advanced Information Technologies . . . . . [6968-31]

Analytical performance evaluation for autonomous sensor fusion, Kuo-Chu Chang, George Mason Univ.; Marty E. Liggins II, MITRE Corp. . . . . [6968-32]

Convergence study of message passing in arbitrary continuous Bayesian networks, Wei Sun, Kuo-Chu Chang, George Mason Univ. . . . . [6968-33]

Algebra of Dempster-Shafer evidence accumulation, Andrzej K. Brodzik, Robert H. Enders, The MITRE Corp. . . . . [6968-34]

SESSION 10 . . . . . Tues. 4:10 to 5:10 pm

Multisensor Fusion Methodologies and Applications V

Session Chair: **Michael L. Hinman,** Air Force Research Lab.; **Ivan Kadar,** Interlink Systems Sciences, Inc.

Incorporation of indirect evidence into an evidence accrual technique for higher level data fusion, Stephen C. Stubberud, Rockwell Collins, Inc.; Kathleen A. Kramer, Univ. of San Diego . . . . . [6968-36]

Results from levels 2/3 fusion implementations: issues, challenges, retrospectives and perspectives for the future, Ivan Kadar, Interlink Systems Sciences, Inc.; Eloi Bossé, Defence R&D Canada/Valcartier (Canada); John J. Salerno, Jr., Air Force Research Lab.; Dale Lambert, Defence Science and Technology Organisation (Australia); Subrata Das, Charles River Analytics, Inc.; Enrique H. Ruspini, SRI International; Bradley J. Rhodes, BAE Systems Advanced Information Technologies; Joachim Biermann, Research Establishment for Applied Science (Germany) . . . . . [6968-37]

A collaborative eye to the future, Kshanti Greene, Stottler Henke Associates, Inc. . . . . [6968-38]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Real-time geographical information exchange on mobile operation system, Jun He, Bo Sun, Beijing Normal Univ. (China) . . . . . [6968-60]

Object recognition in infrared image sequences using scale invariant feature transform, Changhan Park, Samsung Thales Co., Ltd. (South Korea) . . . . . [6968-61]

Image fusion in infrared image and visual image using normalized mutual information, Changhan Park, Jaeik Lee, Samsung Thales Co., Ltd. (South Korea); Jik-Han Jung, Dong-Jo Park, Korea Advanced Institute of Science and Technology (South Korea). . . . . [6968-62]

Dynamic fusion with Gabor-filtered images, Alan R. Pinkus, Air Force Research Lab. . . . . [6968-63]

Correlating military operators' visual demands with multispectral image fusion, Gary L. Martinsen, Jonathon S. Hosket, Mathew W. Swinney, Alan R. Pinkus, Air Force Research Lab. . . . . [6968-64]

Color transfer algorithm based on gray and edge value for popping out hot targets in dual-band color night vision, LingXue Wang, Yuanmeng Zhao, Weiqi Jin, Shiming Shi, Beijing Institute of Technology (China); Zhenyu Chu, Dayang Technology Development Inc. (China) . . . . . [6968-65]

Multisensory data exploitation using advanced image fusion and adaptive colorization, Yufeng Zheng, Alcorn State Univ. . . . . [6968-66]

Wednesday 19 March

SESSION 11 . . . . . Wed. 8:00 am to 12:10 pm

Signal and Image Processing I

Session Chairs: **Lynne L. Grewe,** California State Univ./East Bay; **Alastair D. McAulay,** Lehigh Univ.; **Mark G. Alford,** Air Force Research Lab.

Efficient superresolution image reconstruction applied to surveillance video captured by small unmanned aircraft systems, Qiang He, Richard R. Schultz, Univ. of North Dakota; Henry C. Chu, Univ. of Louisiana at Lafayette . . . . . [6968-39]

Superresolution image reconstruction from UAS surveillance video through affine invariant interest point-based motion estimation, Qiang He, Richard R. Schultz, Yi Wang, Aldo Camargo, Florent Martel, Univ. of North Dakota . . . . . [6968-40]

A smart iterative algorithm for multisensor image registration, Stephen P. DelMarco, Victor Tom, Helen F. Webb, BAE Systems Advanced Information Technologies; Todd Jenkins, Air Force Research Lab. . . . . [6968-41]

Three-dimensional organization of 2D urban imagery, Peter L. Cho, MIT Lincoln Lab. . . . . [6968-42]

Fusing images and maps, Mark J. Carlotto, General Dynamics Corp. . . . . [6968-43]

An investigation of image fusion algorithms using a visual performance-based image evaluation methodology, Kelly E. Neriani, Alan R. Pinkus, Air Force Research Lab.; David W. Dommett, General Dynamics Advanced Information Systems. . . . . [6968-44]

Compressive sensing technique for high-resolution radar imaging, Yeo-Sun Yoon, Moeness G. Amin, Villanova Univ. . . . . [6968-45]

Target detection from MPEG video based on low-rank filtering in the compressed domain, Teeradache Viangteeravat, Amir H. Shirkhodaie, Tennessee State Univ. . . . . [6968-46]

Fast algorithms for video target detection and tracking, Changchun Li, Jennie Si, Arizona State Univ.; Glen P. Abousleman, General Dynamics C4 Systems. . . . . [6968-47]

Interval least-squares filtering with applications to video target tracking, Baohua Li, Changchun Li, Jennie Si, Arizona State Univ.; Glen P. Abousleman, General Dynamics C4 Systems. . . . . [6968-48]

Multispectral image pan-sharpening using field programmable gate array architecture, Julian Meng, Peipei Gong, Univ. of New Brunswick (Canada) . . . . . [6968-49]

Lunch/Exhibition Break . . . . . 12:10 to 1:30 pm

SESSION 12 . . . . . .Wed. 1:30 to 3:10 pm

Signal and Image Processing II

Session Chairs: **Alastair D. McAulay,** Lehigh Univ.; **Lynne L. Grewe,** California State Univ./East Bay; **Mark G. Alford,** Air Force Research Lab.

Frustrated polarization fiber Sagnac interferometer displacement sensor, Alastair D. McAulay, Lehigh Univ. . . . . [6968-50]

On modeling sea clutter by diffusive models, Jing Hu, Univ. of Florida; Wen-wen Tung, Purdue Univ.; Jianbo Gao, Univ. of Florida; Robert S. Lynch, Jr., Naval Undersea Warfare Ctr.; Genshe Chen, Intelligent Automation, Inc. . . . . [6968-51]

On modeling sea clutter by noisy chaotic dynamics, Wen-wen Tung, Purdue Univ.; Jing Hu, Jianbo Gao, Univ. of Florida; Robert S. Lynch, Naval Undersea Warfare Ctr.; Genshe Chen, Intelligent Automation, Inc. . . . . [6968-52]

Identification and localization of potential mortar events, Sachi V. Desai, Myron E. Hohil, U.S. Army Research, Development and Engineering Command . . . . . [6968-53]

Localizing to potential chemical/biological events while on the move using acoustics, Sachi V. Desai, U.S. Army Research, Development and Engineering Command [6968-54]

SESSION 13 . . . . . .Wed. 3:30 to 5:10 pm

Signal and Image Processing III

Session Chairs: **Mark G. Alford,** Air Force Research Lab.; **Lynne L. Grewe,** California State Univ./East Bay; **Alastair D. McAulay,** Lehigh Univ.

The use of interferoceiver for the prevention of fratricide in missile defense, Ming-Chiang Li, Univ. of Maryland/ College Park . . . . . [6968-55]

High-resolution reconstruction of radar/SAR imagery: aggregation of robust regularization with neural computing, Yuriy V. Shkvarko, Ctr. de Investigación y de Estudios Avanzados (Mexico) . . . . . [6968-56]

Empirical performance of spectral independent morphological adaptive classifier using tactical missile signatures, Joel B. Montgomery, Christine Montgomery, M & M Aviation; Richard B. Sanderson, Air Force Research Lab. . . . . [6968-57]

Large spot size laser vibrometry insensitivity due to 1D mode BC's for strips or bars, Michael Kobold, General Dynamics Information Technology . . . . . [6968-58]

Comparison of theoretical and empirical statistics of wind measurements with validation lidar (VALIDAR), Jeffrey Y. Beyon, California State Univ./Los Angeles; Grady J. Koch, NASA Langley Research Ctr. . . . . [6968-59]

Related Courses

SC158 **Fundamentals of Automatic Target Recognition** *(Nasr)* Wednesday, 8:30 am to 5:30 pm

SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* Monday, 8:30 am to 5:30 pm

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Signal and Data Processing of Small Targets 2008

Conference Chair: **Oliver E. Drummond,** Consulting Engineer

Conference Co-Chair: **Richard D. Teichgraeber,** Consultant

Program Committee: **Liyi Dai,** U.S. Army Research Office; **Darren K. Emge,** U.S. Army Edgewood Chemical Biological Ctr.; **Charles W. Glover,** Oak Ridge National Lab.; **Lawrence E. Hoff,** Hoff Engineering; **Denise L. Jones,** U.S. Army Space and Missile Defense Command; **Cornelius T. Leondes,** Univ. of California/Los Angeles; **Rabinder N. Madan,** Office of Naval Research; **Steven W. Waugh,** Defense Threat Reduction Agency

Lunch breaks on Tuesday, Wednesday, and Thursday will provide an opportunity to meet in a small group with one or two distinguished individuals who will lead discussions on a topic of signal and data processing algorithms. Tables will be reserved for a no-host lunch. Make reservations at the entrance to the main conference room beginning Tuesday morning, 18 March.

Conference Location Will Alternate Each Year

In the year 2008, this conference is located in Orlando. Thereafter, it will alternate between San Diego in the Summer in odd years and Orlando in the Spring in even years.

Internet Web Posting

Program changes, workshop announcements, and the latest information about this conference will be posted on the Internet World Wide Web at: http://home.att.net/~drummond/

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 1 . . . . . Tues. 10:30 am to 12:10 pm

Signal Processing

Session Chairs: **Steven W. Waugh,** Defense Threat Reduction Agency; **Darren K. Emge,** U.S. Army Edgewood Chemical Biological Ctr.

An advanced missile warning processing suite, Joel B. Montgomery, M & M Aviation; Richard B. Sanderson, John F. McCalmont, Air Force Research Lab. . . . . [6969-01]

A benchmark data suite for chemical and biological(Chem/Bio) defense applications, Darren K. Emge, U.S. Army Edgewood Chemical Biological Ctr.; Steven W. Waugh, Defense Threat Reduction Agency; Mohamed-Adel M. Slamani, Brian Fisk, Tom Chyba, ITT Industries, Inc.. . . . . [6969-02]

Chemical detection and classification in Raman spectra, Steven Kay, Cuichun Xu, Univ. of Rhode Island; Darren K. Emge, U.S. Army Edgewood Chemical Biological Ctr.. . . . . [6969-03]

Detection of small objects in multilayered infrared images, Jing Wang, Shangqi Bao, Jason F. Ralph, John Y. Goulermas, The Univ. of Liverpool (United Kingdom) . . . . . [6969-04]

Lunch/Exhibition Break . . . . . 12:10 to 1:30 pm

SESSION 2 . . . . . Tues. 1:30 to 5:25 pm

Signal/Track Processing

Session Chairs: **Steven W. Waugh,** Defense Threat Reduction Agency; **Darren K. Emge,** U.S. Army Edgewood Chemical Biological Ctr.

Target detection by distributed sensors-distributed sensor concept for small target detection, Michael K. Rafailov, PSI RICHER, Inc. . . . . [6969-05]

Hyperspectral-aided small target tracking, Michael J. Mendenhall, Neil A. Soliman, Air Force institute of Technology . . . . . [6969-06]

Multiframe superresolution and nonlinear estimation for closely spaced object resolution, Linda A. Floyd, Randy C. Paffenroth, Numerica Corp. . . . . [6969-07]

Pixel decomposition for tracking in low-resolution videos, Vivekanand Govinda, Jason F. Ralph, Joe W. Spencer, John Y. Goulermas, The Univ. of Liverpool (United Kingdom); Alaa M. Abbas, Menoufia Univ. (Egypt). . . . . [6969-08]

Discriminating small extended targets at sea from clutter and other classes of boats in infrared and visual light imagery, Sebastiaan P. van den Broek, Henri Bouma, Marianne A. C.Degache, TNO Defence, Security and Safety (Netherlands) . . . . . [6969-09]

A recurrent velocity filter for detecting large numbers of moving objects, Reid B. Porter, Edward Rosten, Rohan C. Loveland, Los Alamos National Lab.. . . . . [6969-10]

Feature-aided target tracking in an urban environment, Thomas Lenz, Juan R. Vasquez, Air Force Institute of Technology . . . . . [6969-11]

Robust method for detecting an infrared small moving target based on the facet-based model, Hwal-Suk Lee, Seok-Kon Kim, Dong-Jo Park, Korea Advanced Institute of Science and Technology (South Korea); Changhan Park, Samsung Thales Co., Ltd. (South Korea) . . . . . [6969-12]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster sessions provided as an opportunity to enjoy refreshments while reviewing poster papers. This session provides a great opportunity for networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are requested to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Oral Standby/Poster Presentations

Optical recognition of biological agents, Chris W. Baumgart, Kim D. Linder, Honeywell, Inc. . . . . [6969-42]

Small-object hyperspectral detection from low-flying UAV, Jeremy J. Murray-Krezan, SFA, Inc.; Jonathan G. Neumann, Robert A. Leathers, Melvin R. Kruer, Naval Research Lab. . . . . [6969-43]

Suppression of subpixel jitter fluctuations using temporal whitening, Steven M. Adler-Golden, Steven C. Richtsmeier, Robert M. Shroll, Spectral Sciences, Inc. . . . . [6969-44]

Multisensor range-only tracking for a distributed architecture of imaging sensors, Thomas L. Homsley, Radiance Technologies, Inc.. . . . . [6969-45]

Tracking with poorly localized sensors in multistatic sensor networks, Ratnasingham Tharmarasa, McMaster Univ. (Canada); Tom Lang, General Dynamics Canada Ltd. (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6969-46]

Surveillance by multiple cooperative UAVs in adversarial environments, Xin Tian, Yaakov Bar-Shalom, Univ. of Connecticut; Abhijit Sinha, McMaster Univ. (Canada); Krishna R. Pattipati, Univ. of Connecticut . . . . . [6969-47]

Passive tracking with sensors of opportunity using PCL, Maheswaran Subramaniam, Ratnasingham Tharmarasa, McMaster Univ. (Canada); Mike McDonald, Defence Research and Development Canada (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6969-48]

Differential geometry measures of nonlinearity for the video filtering problem, Mahendra K. Mallick, Science Applications International Corp.; Barbara F. La Scala, The Univ. of Melbourne (Australia) . . . . . [6969-49]

Concurrent MAP data association and absolute bias estimation with an arbitrary number of sensors, Bret D. Kragel, Aubrey B. Poore, Shawn M. Herman, Scott Danford, Numerica Corp. . . . . [6969-50]

Out-of-sequence measurement updates for multi-hypothesis tracking algorithms, Stephanie Chan, Randy C. Paffenroth, Numerica Corp. . . . . [6969-51]

Poster Presentations

Robust scale invariant small target detection using the Laplacian scale-space theory, Sungho Kim, Yukyung Yang, Joo-Hyoung Lee, Yong-Chan Park, Agency for Defense Development (South Korea) . . . . . [6969-52]

Tomography using CWR and SART, Maria F. Serrano-Guzman, Univ. de Puerto Rico Mayagüez . . . . . [6969-53]

A real-time small target detection algorithm in large field and deep sky, Jin Zhou, Qinzhang Wu, Mei Yang, Ping Jiang, Institute of Optics and Electronics (China) . . . . . [6969-54]

Demonstrations and Open Discussion. . . . . Tues. 8:00 to 10:00 pm

Moderator: **Oliver Drummond,** Consulting Engineer

Wednesday 19 March

SESSION 3 . . . . . Wed. 8:30 am to 12:00 pm

Target Tracking

Session Chair: **Richard D. Teichgraeber,** Consultant

Conference Overview *(Presentation Only)*, Oliver E. Drummond, Consulting Engineer . . . . . [6969-100]

Removal of bias due to propagation of estimates through nonlinear mappings, Trond Jorgensen, Ronald L. Rothrock, SPARTA, Inc.. . . . . [6969-13]

Improving multiple target tracking in structured environments using velocity priors, Rohan C. Loveland, Edward Rosten, Reid B. Porter, Los Alamos National Lab. . . . . [6969-14]

Joint detection and tracking in the presence of a wake, Anders Rodningsby, Oddvar Hallingstad, Norwegian Univ. of Science and Technology (Norway); John H. Glattetre, Kongsberg Simrad Maritime AS (Norway). . . . . [6969-15]

Assurance regions in tracking, David D. Sworder, Univ. of California/San Diego; John E. Boyd, Cubic Corp.; Robert G. Hutchins, Naval Postgraduate School . . . . . [6969-16]

Spline filter for multidimensional nonlinear/non-Gaussian Bayesian tracking, Kumaradevan Punithakumar, McMaster Univ. (Canada); Mike McDonald, Defence Research and Development Canada (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6969-17]

Tracking extended targets with and without clustering, Edmund F. Brekke, Oddvar Hallingstad, Norwegian Univ. of Science and Technology (Norway); John H. Glattetre, Kongsberg Simrad Maritime AS (Norway). . . . . [6969-18]

Lunch/Exhibition Break . . . . . 12:00 to 1:30 pm

SESSION 4 . . . . . .Wed. 1:30 to 5:25 pm

Multiple Sensor Processing

Session Chairs: **Liyi Dai,** U.S. Army Research Office; **Charles W. Glover,** Oak Ridge National Lab.

Game theoretic target assignment approach in ballistic missile defense, Genshe Chen, Mo Wei, Intelligent Automation, Inc.; Khanh Pham, Erik Blasch, Air Force Research Lab. . . . . [6969-19]

Multihypothesis multiresolutional registration for ballistic missile defense, Shan Cong, Lang Hong, Wright State Univ. . . . . [6969-20]

Integrated bias removal and sensor calibration in passive radar systems, Maheswaran Subramaniam, Kumaradevan Punithakumar, McMaster Univ. (Canada); Mike McDonald, Defence Research and Development Canada (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) [6969-21]

Determining the optimal time frame for multisensor track correlation, Lisa M. Ehrman, William D. Blair, Georgia Tech Research Institute . . . . . [6969-22]

Accurate 3D extended target motion and structure estimation by using GMTI/HRR with template information, Shunguang Wu, Sarnoff Corp.; Lang Hong, Wright State Univ. . . . . [6969-23]

Joint path planning and sensor subset selection for multistatic sensor networks, Ratnasingham Tharmarasa, McMaster Univ. (Canada); Tom Lang, General Dynamics Canada Ltd. (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6969-24]

Aspect aware UAV detection and tracking, Christian R. Berger, Shengli Zhou, Peter K. Willett, Univ. of Connecticut . . . . . [6969-25]

Efficiency and sensitivity of methods for assessing ambiguity in data association decisions, Bret D. Kragel, Shawn M. Herman, Numerica Corp. . . . . [6969-26]

Thursday 20 March

SESSION 5 . . . . . Thurs. 8:30 am to 12:00 pm

Sensor Data Fusion

Session Chair: **Rabinder N. Madan,** Office of Naval Research

Multitarget multisensor tracking in an urban environment: a closed-loop approach, Patricia R. Barbosa, Edwin K. P.Chong, Colorado State Univ.; Sofia Suvorova, Bill Moran, The Univ. of Melbourne (Australia) . . . . . [6969-27]

Comparison of track-to-track fusion algorithms using video sensors on multiple unmanned aerial vehicles, Mahendra K. Mallick, Science Applications International Corp.; Kuo-Chu Chang, George Mason Univ. . . . . [6969-28]

Track fusion with feedback for local trackers using MHT, Daniel G. Danu, Abhijit Sinha, Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6969-29]

Analysis of scan and batch processing approaches to static fusion in sensor networks, Marco Guerriero, Univ. of Connecticut; Stefano P. Coraluppi, NATO Undersea Research Ctr. (Italy); Peter K. Willett, Univ. of Connecticut . . . [6969-30]

Sequential track-to-track fusion algorithm: exact solution and approximate implementation, Xin Tian, Yaakov Bar-Shalom, Univ. of Connecticut. . . . . [6969-31]

Covariance compensation for measurement misassociations: alternative data association algorithms, Oliver E. Drummond, CyberRnD, Inc. . . . . [6969-32]

Distributed multiple-hypothesis correlation and feedback with applications to video data, Kyle M. Tarplee, David J. Trawick, Shawn M. Herman, Numerica Corp. . . . . [6969-33]

Lunch Break . . . . . 12:00 to 1:30 pm

SESSION 6 . . . . . Thurs. 1:30 to 5:25 pm

Signal and Data Processing

Session Chairs: **Oliver E. Drummond,** Consulting Engineer; **Denise L. Jones,** U.S. Army Space and Missile Defense Command

Tracking and classification using aspect-dependent RCS and kinematic data, Sivagnanam Sutharsan, Ratnasingham Tharmarasa, McMaster Univ. (Canada); Tom Lang, General Dynamics Canada Ltd. (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6969-34]

Scene context-aided tracking in an urban environment with persistent video, Juan R. Vasquez, Air Force Institute of Technology . . . . . [6969-35]

A distributed database view of network tracking systems, Jason Yosinski, Randy C. Paffenroth, Numerica Corp. . . . . [6969-36]

Trade-off of covariance compensation methods for misassociation versus complexity, Oliver E. Drummond, CyberRnD, Inc. . . . . [6969-37]

Efficient data association for move-stop-move target tracking, Thuraiappah Sathyan, McMaster Univ. (Canada); Mike McDonald, Defence Research and Development Canada (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [6969-38]

Particle flow for nonlinear filters with log-homotopy, Frederick E. Daum, Jim Huang, Raytheon Co. . . . . [6969-39]

Performance metrics for separation point estimates and track parent-child relationships in multiple target tracking, Susan A. Frost, Darin T. Dunham, Vectraxx; William D. Blair, Georgia Tech Research Institute. . . . . [6969-40]

The probability of misassociation between neighboring targets, Javier A. Areta, Yaakov Bar-Shalom, Univ. of Connecticut; Ronald L. Rothrock, SPARTA, Inc. . . . [6969-41]

Related Courses

SC158 **Fundamentals of Automatic Target Recognition** *(Nasr)* Wednesday, 8:30 am to 5:30 pm

SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* Monday, 8:30 am to 5:30 pm

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Monday-Tuesday 17-18 March 2008 • Proceedings of SPIE Vol. 6970

Algorithms for Synthetic Aperture Radar Imagery XV

Conference Chair: **Edmund G. Zelnio,** Air Force Research Lab.; **Frederick D. Garber,** Wright State Univ.

Program Committee: **Bir Bhanu,** Univ. of California/Riverside; **Mujdat Çetin,** Sabanci Univ. (Turkey); **Dan E. Dudgeon,** BAE Systems plc; **Gil J. Ettinger,** BAE Systems Advanced Information Technologies; **Robert A. Hummel,** Booz Allen Hamilton; **Charles V. Jakowatz,** Sandia National Labs.; **Eric R. Keydel,** Science Applications International Corp.; **John M. Miller,** Army Research Lab.; **Randolph L. Moses,** The Ohio State Univ.; **Brian D. Rigling,** Wright State Univ.; **Timothy D. Ross,** Air Force Research Lab.; **Gerard W. Titi,** BAE Systems Advanced Information Technologies; **Stephen P. Welby,** DARPA; **Robert L. Williams,** Air Force Research Lab.

Innovative Format

Once again, this conference will follow a "Briefing, Poster Workshop, Panel Discussion" format. During the first sessions of each day, authors will highlight the results for their work in 10 minute briefings. After the presentations, these same authors will be available for in-depth discussions in an extended poster session setting. After the Poster Workshop, there will be a Panel Discussion where experts and audience will address pressing issues from the sessions that day.

Monday 17 March

Prolog . . . . . Mon. 8:25 to 8:30 am

Session Chair: **Edmund G. Zelnio,**
Air Force Research Lab.

Session Introduction . . . . . Mon. 8:30 to 8:35 am

Session Chair: **Randolph L. Moses,**
The Ohio State Univ.

SESSION 1 . . . . . Mon. 8:35 to 10:35 am

Invited Session: Sparse Recognition for Imaging

Session Chair: **Randolph L. Moses,**
The Ohio State Univ.

Compressive sensing and RADAR *(Invited Paper)*, Richard G. Baraniuk, Rice Univ. . . . . [6970-01]

Sparse reconstruction for RADAR *(Invited Paper)*, Lee C. Potter, The Ohio State Univ. . . . . [6970-02]

Mono- and multistatic polarimetric sparse aperture SAR imaging, Stuart DeGraph, Charles Twigg, Louis C. Phillips, Essex Corp. . . . . [6970-03]

Joint space aspect reconstruction of wide-angle SAR exploiting sparsity, Ivana Stojanovic, W. Clem Karl, Boston Univ.; Müjdat Çetin, Sabanci Univ. (Turkey) . . . . . [6970-04]

Basis pursuit versus a clean algorithm for 3D moving target imaging, Matthew A. Ferrara, Air Force Research Lab.; Emre Ertin, Randolph L. Moses, Lee C. Potter, The Ohio State Univ.; Mark A. Stuff, Michigan Tech Research Institute . . . . . [6970-05]

3D ISAR imaging of satellites, Greg Ushomirsky, MIT Lincoln Lab. . . . . [6970-06]

Multibaseline IFSAR for 3D target reconstruction, Emre Ertin, Randolph L. Moses, Lee C. Potter, The Ohio State Univ. . . . . [6970-07]

Hyper-parameter selection in non-quadratic regularization-based radar image formation, Özge Batu, Müjdat Çetin, Sabanci Univ. (Turkey) . . . . . [6970-08]

Session Introduction . . . . . Mon. 11:00 to 11:05 am

Session Chair: **Gerard W. Titi,** BAE Systems
Advanced Information Technologies

SESSION 2 . . . . . Mon. 11:05 am to 12:35 pm

Circular SAR

Session Chair: **Gerard W. Titi,** BAE Systems
Advanced Information Technologies

GOTCHA technology challenges *(Invited Paper)*, Michael J. Minardi, Air Force Research Lab. . . . . [6970-09]

3D imaging results using circular flight track SAR, Steve Jaroszewski, Wayne Haack, Technology Service Corp.; Charles Morgan, Technology Service Corp.; Curtis H. Casteel, Jr., Air Force Research Lab. . . . . [6970-10]

Fast CSAR algorithm, Jehanzeb Burki, Christopher F. Barnes, Georgia Institute of Technology. . . . . [6970-11]

Gotcha GUI: a software tool to process SAR data on a supercomputer system, Curtis H. Casteel, Jr., Uttam K. Majumder, Michael J. Minardi, LeRoy A. Gorham, Steven Scarborough, Air Force Research Lab.; John W. Nehrbass, Ohio Supercomputer Ctr. . . . . [6970-12]

SAR backprojection on a Sony Playstation 3, Mark J. Backues, SET Corp.; Uttam K. Majumder, Curtis H. Casteel, Jr., LeRoy A. Gorham, Steven Scarborough, Michael J. Minardi, Daniel York, Air Force Research Lab. . . . . [6970-13]

An analytical expression for the three-dimensional response of a point scatterer for circular synthetic aperture radar, Linda J. Moore, Univ. of Dayton; Uttam K. Majumder, Air Force Research Lab. . . . . [6970-14]

Lossless SAR data compression for staring RADAR application, Daniel Bishop, Russell M. Mersereau, Georgia Institute of Technology; Uttam K. Majumder, Michael J. Minardi, Air Force Research Lab. . . . . [6970-15]

Lunch Break . . . . . 12:35 to 1:40 pm

POSTERS-Monday . . . . . Mon. 1:40 to 3:00 pm

Panel Discussion/ Workshop . . . . . Mon. 3:30 to 4:30 pm

Tuesday 18 March

Session Introduction . . . . . Tues. 8:00 to 8:05 am

Session Chair: **Charles V. Jakowatz,**
Sandia National Labs.

SESSION 3 . . . . . Tues. 8:05 to 9:05 am

Advanced Imaging I

Session Chair: **Charles V. Jakowatz,**
Sandia National Labs.

An implementation of a fast back-projection image formation algorithm for spotlight-mode SAR, Daniel E. Wahl, David A. Yocky, Charles V. Jakowatz, Jr., Sandia National Labs. . . . . [6970-16]

Imaging moving targets from scattered waves, Margaret Cheney, Rensselaer Polytechnic Institute; Brett H. Borden, Naval Postgraduate School. . . . . [6970-17]

Distributed aperture imaging with multiple transmitters in complex environments, Trond K. Varslot, The Australian National Univ. (Australia); Birsen Yazici, Margaret Cheney, Rensselaer Polytechnic Institute . . . . . [6970-18]

Wavelet denoising for IFSAR processing, Kenneth Sartor, Harris Corp.; Samuel P. Kozaitis, Gnana Bhaskar Tenali, Florida Institute of Technology . . . . . [6970-19]

Subsidence measurement and DSM extraction of IFSAR data using anisotropic diffusion, Kenneth Sartor, Josef D. Allen, Emile Ganthier, Harris Corp.; Gnana Bhaskar Tenali, Florida Institute of Technology . . . . . [6970-20]

Multipath simulation and removal from SAR imagery, Daniel B. Andre, Robert D. Hill, Christopher P. Moate, QinetiQ Ltd. (United Kingdom) . . . . . [6970-21]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology,
U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 4 . . . . . Tues. 10:30 to 11:30 am

Advanced Imaging II

Session Chair: **Charles V. Jakowatz,**
Sandia National Labs.

Through-the-wall polarimetric imaging, Fauzia Ahmad, Yeo-Sun Yoon, Moeness G. Amin, Villanova Univ. . . [6970-22]

Autofocus for 3D imaging, F. A. Lee-Elkin, SET Corp. . . . . [6970-34]

Recursive image updating for persistent synthetic aperture radar surveillance, Randolph L. Moses, The Ohio State Univ. . . . . [6970-23]

Beamforming as a foundation for spotlight-mode SAR image formation by backprojection *(Invited Paper)*, Charles V. Jakowatz, Jr., Daniel E. Wahl, David A. Yocky, Sandia National Labs. . . . . [6970-24]

Session Introduction . . . . . Tues. 11:30 to 11:35 am

Session Chair: **Stephen P. Welby,**
Defense Advanced Research Projects Agency

SESSION 5 . . . . . Tues. 11:35 am to 12:25 pm

Detection, Tracking, and Identification Techniques I

Session Chair: **Stephen P. Welby,**
Defense Advanced Research Projects Agency

SAR ATR performance prediction via probabilistic inverse scattering models, David Blacknell, Cranfield Univ. (United Kingdom) . . . . . [6970-25]

Analyzing the effects of square versus non-square resolutions on automatic target recognition performance, Lee J. Montagnino, Mary L. Cassabaum, Shawn D. Halversen, Christina L. Hebert, Chad T. Rupp, Matthew T. Young, Raytheon Missile Systems . . . . . [6970-26]

An ATR challenge problem using HRR data, Bart Kahler, General Dynamics Advanced Information Systems; John Querns, General Dynamics Information Technology [6970-27]

Performance model for joint tracking and ATR with HRR radar, Shan Cong, Lang Hong, Wright State Univ.; Erik Blasch, Air Force Research Lab. . . . . [6970-28]

Vehicle tracking for urban surveillance, William L. Roberts, Univ. of Florida; Leslie G. Watkins, North Carolina State Univ.; Dapeng Wu, Jian Li, Univ. of Florida. . . . . [6970-29]

Lunch/Exhibition Break . . . . . 12:25 to 1:30 pm

SESSION 6 . . . . . Tues. 1:30 to 2:20 pm

Detection, Tracking, and Identification Techniques II

Session Chair: **Stephen P. Welby,**
Defense Advanced Research Projects Agency

Dismount data collection and exploitation utilizing a low-cost multisensor data collection system, John D. Gorman, King-Sang Chan, Brandon Jasionowski, SET Corp.; Uttam K. Majumder, LeRoy A. Gorham, Michael J. Minardi, Steven Scarborough, Air Force Research Lab. . . . . [6970-30]

A rotation/translation-invariant transform for target detection in SAR images, Wenxing Ye, Christopher R. Paulson, Dapeng O. Wu, Jian Li, Univ. of Florida . . . [6970-31]

Ripplet transform for feature extraction, Jun Xu, Dapeng Wu, Univ. of Florida. . . . . [6970-32]

A target detection scheme for VHF SAR ground surveillance, Wenxing Ye, Christopher R. Paulson, Dapeng Wu, Jian Li, Univ. of Florida. . . . . [6970-33]

Discrimination of civilian vehicles using wide-angle SAR, K. E. Dungan, L. C. Potter, The Ohio State Univ.; J. W. Nehrbass, Ohio Supercomputer Ctr. . . . . [6970-35]

POSTERS-Tuesday . . . . . Tues. 2:20 to 3:30 pm

Panel Discussion/ Workshop . . . . . Tues. 4:00 to 5:00 pm

Related Courses

SC893 **SAR Signal Processing Laboratory** *(Soumekh)*
NEW Tuesday, 8:30 am to 5:30 pm

SC162 **SAR Signal Processing** *(Soumekh)* Sunday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Acquisition, Tracking, Pointing, and Laser Systems Technologies XXII

Conference Chairs: **Steven L. Chodos,** Boeing-SVS, Inc.; **William E. Thompson,** Air Force Research Lab.

Program Committee: **Ali T. Alouani,** Tennessee Technological Univ.; **James E. Kimbrell,** L-3 Brashear; **Jim F. Riker,** Air Force Research Lab.; **William Dale Blair,** Georgia Tech Research Institute; **John E. Gray,** Naval Surface Warfare Ctr.; **Gillian K. Groves,** Raytheon Co.; **Christopher J. Musial,** Boeing-SVS, Inc.; **James M. Hilkert,** Alpha-Theta Technologies; **Glenn A. Tyler,** The Optical Sciences Co.; **Juan R. Vasquez,** Air Force Institute of Technology

Thursday 20 March

SESSION 1 . . . . . Thurs. 8:00 to 11:30 am

Signal/Image Processing for Tracking

Session Chair: **Steven L. Chodos,** Boeing-SVS, Inc.

Real-time object tracking with feature fusion particle filter, Meng Bo, Guangliang Han, Changchun Institute of Optics, Fine Mechanics and Physics (China) . . . . . [6971-01]

A hardware neural network for target tracking, Wendall C. Deck, Gilles Labonté, Royal Military College of Canada (Canada) . . . . . [6971-02]

Online contour structure from motion with known camera pose, Vitaliy Kaganovich, Raytheon Space and Airborne Systems. . . . . [6971-03]

A unified framework for capturing facial images in video surveillance systems using cooperative camera system, Fai Chan, Yiu-Sang Moon, The Chinese Univ. of Hong Kong (Hong Kong China) . . . . . [6971-04]

A real-time multimode electro-optical tracking system, Jin Zhou, Qin-zhang Wu, Mei Yang, Pin Jiang, Institute of Optics and Electronics (China) . . . . . [6971-05]

Multisensor 3D tracking for counter small unmanned air vehicles, Juan R. Vasquez, Air Force Institute of Technology; Kyle M. Tarplee, Numerica Corp.; Brian D. Rigling, Wright State Univ.. . . . . [6971-06]

A robust real-time object detection and tracking system, Zhanfeng Yue, Bhavani Gopalakrishnan, Pankaj Topiwala, FastVDO LLC. . . . . [6971-07]

Energy efficient collaborative target tracking by Gaussian Rao-Blackwellised particle filter in wireless sensor networks, Zhi-Jun Yu, Jian-Ming Wei, Hai-Tao Liu, Shanghai Institute of Microsystem and Information Technology (China) . . . . . [6971-08]

Non-photorealistic synthesis of video sequences for an accurate evaluation of tracking algorithms on complex scenes, Christine Dubreu, Cedip Infrared Systems (France); Antoine Manzanera, Ecole Nationale Supérieure de Techniques Avancées (France); Eric Bohain, Cedip Infrared Systems (France). . . . . [6971-09]

Lunch/Exhibition Break . . . . . 11:30 am to 1:00 pm

SESSION 2 . . . . . Thurs. 1:00 to 3:00 pm

Hardware Implementation

Application of network control systems for adaptive optics, Robert J. Eager, The Boeing Co. and Air Force Research Lab. . . . . [6971-10]

Control of a deformable mirror subject to structural disturbance, Matthew R. Allen, Jae Jun Kim, Brij N. Agrawal, Naval Postgraduate School. . . . . [6971-11]

Practical application of periodic error correction techniques in the design of a low-cost high-accuracy pan-tilt unit utilizing high-resolution modular encoders, James L. Selikoff, Automated Solutions Enterprises, Inc. . . [6971-12]

A unique three-axis gimbal mechanism, James M. Hilkert, Alpha-Theta Technologies; Matt Jonas, Raytheon Co.. . . . . [6971-13]

Sin/Cos encoder interpolation methods and system level configuration of encoder to digital tracking converters for rate and position loop controllers, Steven T. Jenkins, Texas Instruments Inc. and Alpha-Theta Technologies; James M. Hilkert, Alpha-Theta Technologies . . . . . [6971-14]

An analog, non-mechanical beam-steerer with an 80-degree field of regard for lidar applications, Scott R. Davis, George Farca, Scott D. Rommel, Michael H. Anderson, Vescent Photonics Inc. . . . . [6971-15]

SESSION 3 . . . . . Thurs. 3:30 to 4:30 pm

System Applications

Session Chair: **William E. Thompson,** Air Force Research Lab.

Deriving predictive turbulence models from local measurements, Michael J. Curley, Holger M. Jaenisch, Alabama A&M Univ.; James W. Handley, AXIOM Corp.; Matthew E. Edwards, Alabama A&M Univ. . . . . [6971-16]

Automatic object recognition implications of attentive ladar scanning, Mike Mamanakis, Rollin R. Fullmer, Scott E. Budge, Robert T. Pack, Utah State Univ. . . . . [6971-17]

Robust control of photovoltaic generators under uncertain load conditions, Ali T. Alouani, Mohammed S. Alam, Tennessee Technological Univ. . . . . [6971-18]

Related Courses

SC158 **Fundamentals of Automatic Target Recognition** *(Nasr)* Wednesday, 8:30 am to 5:30 pm

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* Wednesday, 8:30 am to 5:30 pm

SC167 **Introduction to Laser Radar** *(Kamerman)* Tuesday, 1:30 to 5:30 pm

SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* Monday, 8:30 am to 5:30 pm

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Tuesday-Wednesday 18-19 March 2008 • Proceedings of SPIE Vol. 6972

Polarization: Measurement, Analysis, and Remote Sensing VIII

Conference Chairs: **David B. Chenault,** Polaris Sensor Technologies, Inc.; **Dennis H. Goldstein,** Polaris Sensor Technologies, Inc.

Program Committee: **Thomas R. Caudill,** Air Force Research Lab.; **Russell A. Chipman,** College of Optical Sciences/The Univ. of Arizona; **Aed M. El-Saba,** Univ. of South Alabama; **Matthew P. Fetrow,** Air Force Research Lab.; **Joseph A. Shaw,** Montana State Univ./Bozeman; **J. Scott Tyo,** College of Optical Sciences/The Univ. of Arizona; **Kyle J. Zeringue,** Photon Research Associates, Inc.

Tuesday 18 March

Welcome and Nomenclature Overview . . . . . Tues. 8:10 to 8:30 am

Polarization: nomenclature and background, David B. Chenault, Polaris Sensor Technologies, Inc.. . . . . [6972-01]

SESSION 1 . . . . . Tues. 8:30 to 9:00 am

Invited Presentation

Fine structure and optical properties of biological polarizers in crustaceans and cephalopods *(Invited Paper)*, Tsyr-Huei Chiou, Thomas W. Cronin, Univ. of Maryland/ Baltimore County. . . . . [6972-02]

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 2 . . . . . Tues. 10:30 am to 12:10 pm

Polarization-based Devices I

Fiber faceplates and tapers to mitigate diffraction effects in an imaging snapshot polarimeter, Alvaro A. Cruz-Cabrera, Shanalyn A. Kemme, Sandia National Labs. . . . . [6972-03]

High-speed polarization imaging camera based on electrically driven waveplates and split focal plane, Nicolas A. Lefaudeux, Sebastien Breugnot, Philippe Clemenceau, Bossa Nova Technologies. . . . . [6972-04]

Hybrid optical retarders fabricated from liquid crystal polymer and form birefringent thin films, Karen D. Hendrix, Paul McKenzie, David M. Shemo, Kim Tan, Nada A. O'Brien, JDS Uniphase Corp. . . . . [6972-05]

Automated detection of EOS-ESD in electronic circuits using a polarization modulation sensing system, Niels F. Jacksen, ITT Industries Night Vision; Thomas Odom, Vcd Technologies L.L.C.; James P. Karins, Pukoa Scientific, LLC; John Slewenski, Steven Hampton, Vcd Technologies L.L.C.. . . . . [6972-06]

Fast switchable FLC modulators for application in polarization optics, Anastasia M. Suvorova, South Ural State Univ. (Russia); Fedor V. Podgornov, South Ural State Univ. (Russia) and Technische Univ. Darmstadt (Germany); Yakov Korepanov, South Ural State Univ. (Russia); Wolfgang Haase, Technische Univ. Darmstadt (Germany) . . . . . [6972-07]

Lunch/Exhibition Break . . . . . 12:10 to 2:00 pm

SESSION 3 . . . . . Tues. 2:00 to 3:40 pm

Developments in Polarization Instrumentation I

Liquid-crystal tunable polarization filter for target detection applications, Karen N. Zachery, Bruce K. Winker, Dong-Feng Gu, Bing Wen, John Mansell, Keith A. Sage, Donald B. Taber, Teledyne Scientific Co. . . . . [6972-08]

Polarimetric systems based on ferroelectric liquid crystals, Fedor V. Podgornov, South Ural State Univ. (Russia) and Technische Univ. Darmstadt (Germany); Anastasia M. Suvorova, South Ural State Univ. (Russia); Ivan V. Chernyaev, Wolfgang Haase, Technische Univ. Darmstadt (Germany) . . . . . [6972-09]

Compact and robust linear Stokes polarization imaging camera, Nicolas A. Lefaudeux, Nicolas Lechocinski, Sebastien Breugnot, Philippe Clemenceau, Bossa Nova Technologies . . . . . [6972-10]

Acousto-optic tunable filter-based spectropolarimetric imagers, Neelam Gupta, Army Research Lab. . . . . [6972-11]

Snapshot imaging spectropolarimetry in the visible and infrared, Riley W. Aumiller, Corrie Vanderlugt, Eustace L. Dereniak, College of Optical Sciences/The Univ. of Arizona; Bob Sampson, I Technology Applications . . . . . [6972-12]

SESSION 4 . . . . . Tues. 4:10 to 5:50 pm

Polarization in Remote Sensing

Polarimetric lidar signatures for remote detection of biological warfare agents, Jonathan M. Richardson, John C. Aldridge, Adam B. Milstein, MIT Lincoln Lab. . . . . [6972-13]

Utility of polarimetric imagery as ancillary data for thematic classification as predicted by the use of spectral separability, Clyde H. Spencer, Ball Aerospace & Technologies Corp. . . . . [6972-14]

Visible-NIR imaging polarimetry of metal surfaces viewed under a variable atmosphere, Nathan J. Pust, Joseph A. Shaw, Andrew R. Dahlberg, Montana State Univ./ Bozeman . . . . . [6972-15]

Mapping wetlands cover types with directional polarization signatures, Vern C. Vanderbilt, NASA Ames Research Ctr.; Jonathan Greenberg, Shruti Khanna, Susan L. Ustin, Univ. of California/Davis; Gerald P. Livingston, Univ. of Vermont . . . . . [6972-16]

Polarization technique for medium-density distribution measurements, Ishkhan G. Harutyunyan, Hovhannes A. Movsesyan, Vardan G. Harutyunyan, Yerevan State Univ. (Armenia) . . . . . [6972-17]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

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Ferroelectric liquid-crystal modulators for application in polarization optics, Ivan V. Chernyaev, Technische Univ. Darmstadt (Germany); Anastasia M. Suvorova, Ivan Popkov, Evelina Bibikova, South Ural State Univ. (Russia); Fedor V. Podgornov, South Ural State Univ. (Russia) and Technische Univ. Darmstadt (Germany); Wolfgang Haase, Technische Univ. Darmstadt (Germany) . . . . . [6972-36]

Spectropolarimetric reflectance of minerals in the infrared, Dennis H. Goldstein, Polaris Sensor Technologies, Inc.. . . . . [6972-37]

Backup: design and performance of a polarized IR scene generator, Peter S. Erbach, David B. Chenault, Polaris Sensor Technologies, Inc.. . . . . [6972-38]

Generalized conditions for eigenpolarizations orthogonality: Jones matrix calculus, Sergey N. Savenkov, National Taras Shevchenko Univ. of Kyiv (Ukraine) . [6972-39]

A comparison of MWIR and LWIR polarimetric imaging for surface swimmer detection, John S. Harchanko, Polaris Sensor Technologies, Inc.. . . . . [6972-40]

Wednesday 19 March

Welcome and Nomenclature Overview . . Wed. 8:00 am

SESSION 5 . . . . . .Wed. 8:10 to 9:50 am

Developments in Polarization Instrumentation II

Astrophysical polarimetry: science, techniques, and methodology *(Invited Paper)*, Christopher C. Packham, Univ. of Florida . . . . . [6972-18]

Four camera complete Stokes imaging polarimeter *(Invited Paper)*, J. L. Pezzaniti, Polaris Sensor Technologies, Inc.; Howard J. Schultz, Univ. of Massachusetts; Michael E. Roche, John E. Reinhardt, Polaris Sensor Technologies, Inc.. . . . . [6972-19]

2-Cam LWIR imaging Stokes polarimeter, Michael W. Kudenov, College of Optical Sciences/The Univ. of Arizona; J. L. Pezzaniti, Polaris Sensor Technologies, Inc.; Eustace L. Dereniak, College of Optical Sciences/The Univ. of Arizona; Grant R. Gerhart, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. . . . . [6972-20]

Optimized multispectral Mueller imaging polarimeter with nematic liquid crystals, Antonello De Martino, Makrina Anastasiadou, Sami Ben Hatit, Ecole Polytechnique (France) . . . . . [6972-21]

SESSION 6 . . . . . .Wed. 10:20 to 11:40 am

Analysis: Polarization Mathematics, Algorithms, and Processing I

Product decompositions of Mueller matrices in polarimetry, Antonello De Martino, Razvigor Ossikovski, Makrina Anastasiadou, Ecole Polytechnique (France); Sami Ben Hatit, Ecole Polytechnique (France) and Horiba Jobin Yvon (France); Steve Guyot, Univ. Paris 12 Val-de-Marne (France) . . . . . [6972-22]

Polarization visual enhancement technique for LWIR microgrid polarimeter imagery, Bradley M. Ratliff, J. Scott Tyo, College of Optical Sciences/The Univ. of Arizona; Wiley T. Black, James K. Boger, David L. Bowers, Applied Technology Associates . . . . . [6972-23]

Emission polarization from rough surfaces, Chang-Hyuk An, Kyle J. Zeringue, Photon Research Associates, Inc.. . . . . [6972-24]

Detection comparisons between LWIR and MWIR polarimetric sensors, Neil R. Malone, Raytheon Vision Systems. . . . . [6972-25]

Polarization Technical Event/ Lunch Break . . . . . .Wed. 11:40 am to 1:20 pm

Workshop Chairs: **David B. Chenault,** Polaris Sensor Technologies, Inc.; **Dennis H. Goldstein,** Polaris Sensor Technologies, Inc.

This meeting is focused on research, development, engineering, and applications in fields of optics where polarization and its measurement are key issues.

SESSION 7 . . . . . .Wed. 1:20 to 4:00 pm

Analysis: Polarization Mathematics, Algorithms, and Processing II

The effect of sensing geometry on polarimetric reflectance data *(Invited Paper)*, David G. Edwards, Air Force Research Lab. . . . . [6972-26]

Description and visualizations of a 3D polarized Monte Carlo raytracing program, Christoph C. Borel, Mark A. Manzardo, Ball Aerospace & Technologies Corp. . . [6972-27]

Fusion of Stokes vector imagery using simple logical operators: application to the problem of surface land mine detection, Aed M. El-Saba, Tadele Bezuayehu, Univ. of South Alabama . . . . . [6972-28]

Correction of erroneous degree of polarization of moving objects in a video sequence, Luc Gendre, Alban Foulonneau, Laurent Bigue, Univ. de Haute Alsace (France) . . . . . [6972-29]

Estimation of the index of refraction and reflection angle from Mueller matrix imagery, Vimal Thilak, David G. Voelz, Charles D. Creusere, New Mexico State Univ. . . . . [6972-30]

Single-frame polarization measurement techniques, Robert W. McMillan, U.S. Army Space and Missile Defense Command . . . . . [6972-31]

SESSION 8 . . . . . .Wed. 4:00 to 5:20 pm

Polarization Measurements

Higher probability of detection of subsurface land mines with a single sensor using multiple polarized and unpolarized image fusion, Aed M. El-Saba, Tadele Bezuayehu, Univ. of South Alabama. . . . . [6972-32]

Spectropolarimetric characteristics of automobile paints, Dennis H. Goldstein, Polaris Sensor Technologies, Inc.. . . . . [6972-33]

Variation in MidIR and LWIR polarimetric imagery due to diurnal and meteorological impacts, Kristan Gurton, Melvin A. Felton, Army Research Lab. . . . . [6972-34]

Evaluation of passive polarimetric electro-optic imagery for civilian and military targets discrimination, Daniel A. Lavigne, Defence Research and Development Canada (Canada); Mélanie Breton, AEREX Avionics Inc. (Canada); Mario Pichette, Vincent Larochelle, Jean-Robert Simard, Defence Research and Development Canada (Canada) . . . . . [6972-35]

Related Courses

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* Monday, 1:30 to 5:30 pm

SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* Thursday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Information Fusion, Data Mining, and Information Networks Security Related Technologies

Chair: **Belur V. Dasarathy,** Consultant

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6973 **Data Mining, Intrusion Detection, Information Assurance, and Data Networks Security 2008** *(Dasarathy)* p. 81

6974 **Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2008** *(Dasarathy)* p. 82

Panel Discussion: Performance Evaluation for Impact Assessment Systems *(Yang)* 3:30 to 5:10 pm, p. 8
This event is held in conjunction with Conference 6974.

Courses of Related Interest

SC891 ***NEW*** **Security of Information and Communication Networks** *(Kartalopoulos)* 1:30 to 5:30 pm, p. 110

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* 8:30 am to 5:30 pm, p. 110

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works

11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair

11:00 am to 3:00 pm

FREE Exhibition

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Monday-Tuesday 17-18 March 2008 • Proceedings of SPIE Vol. 6973

Data Mining, Intrusion Detection, Information Assurance, and Data Networks Security 2008

Conference Chair: **Belur V. Dasarathy,** Consultant, Information Fusion Technologies

Program Committee: **Thomas G. L. Allen,** Air Force Research Lab.; **Jonathan A. Gloster,** The Van Dyke Technology Group, Inc.; **Bahareh Haji-Saeed,** Solid State Scientific Corp.; **Sajid Hussain,** Acadia Univ. (Canada); **Robert S. Lynch,** Naval Undersea Warfare Ctr.; **Vahid R. Riasati,** Boeing Satellite Systems; **John J. Salerno,** Air Force Research Lab.; **Martin R. Stytz,** Institute for Defense Analyses; **Shusaku Tsumoto,** Shimane Univ. (Japan)

Monday 17 March

SESSION 1 . . . . . .Mon. 1:20 to 3:00 pm

Information Assurance and Security

Session Chairs: **Jonathan A. Gloster,** The Van Dyke Technology Group, Inc.; **Thomas G.L. Allen,** Air Force Research Lab.

Integrated mandatory access control for digital data, George Hsieh, Gregory Patrick, Keith Foster, Gerald Emamali, Norfolk State Univ.; Lisa M. Marvel, Army Research Lab. . . . . [6973-01]

Addressing security issues related to virtual institute distributed activities, Martin R. Stytz, Institute for Defense Analyses; Sheila B. Banks, Calculated Insight . . . . . [6973-02]

An innovative middle tier design for protecting federal privacy act data, Thomas G. L.Allen, Air Force Research Lab. . . . . [6973-03]

Mathematical model for security effectiveness measurement and optimization, Sheela V. Belur, Jonathan A. Gloster, The Van Dyke Technology Group, Inc. . . [6973-04]

A grid security model based on PKI, Yahui Liu, Beijing Univ. of Information and Technology (China); Jie Su, Harbin Univ. of Science and Technology (China). . . . . [6973-05]

SESSION 2 . . . . . .Mon. 3:30 to 5:10 pm

Data Mining

Session Chairs: **Martin R. Stytz,** Institute for Defense Analyses; **Shusaku Tsumoto,** Shimane Univ. (Japan)

Is mining of knowledge possible?, Jim E. Brander, Interactive Engineering Pty Ltd. (Australia) . . . . . [6973-06]

Application of data mining to medical risk management, Shusaku Tsumoto, Shimane Univ. (Japan) . . . . . [6973-07]

Data mining for intelligence and operations, Nasrullah Memon, Aalborg Univ. (Denmark) . . . . . [6973-08]

Effect of vaccination in a heterogeneous population and global public health security, Doracelly Hincapie, Univ. de Antioquia (Colombia) . . . . . [6973-09]

Observational study of content of Hg in fog water relative to air pollution in suburbs of Nanjing, Lili Tang, Shengjie Niu, Shuxian Fan, Xiaofeng Xu, Saihua Jin, Jie Xu, Nanjing Univ. of Information Science & Technology (China) . [6973-10]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 3 . . . . . Tues. 10:30 am to 12:10 pm

Intrusion Detection

Session Chairs: **John J. Salerno,** Air Force Research Lab.; **Sajid Hussain,** Acadia Univ. (Canada)

Applicability of clustering to cyber intrusion detection, Gilbert R. Hendry, Shanchieh J. Yang, Rochester Institute of Technology . . . . . [6973-11]

Securing MANETs with BITSI: danger theory and mission continuity, Marco M. Carvalho, Institute for Human and Machine Cognition; Richard Ford, William H. Allen, Gerald Marin, Florida Institute of Technology. . . . . [6973-12]

VTAC: virtual terrain assisted impact assessment for cyber attacks, Brian J. Argauer, Jr., Shanchieh J. Yang, Rochester Institute of Technology . . . . . [6973-13]

Virtual terrain: a common representation of a computer network, Jared Holsopple, CUBRC; Shanchieh J. Yang, Brian J. Argauer, Jr., Rochester Institute of Technology . . [6973-14]

Usefulness of DARPA dataset for intrusion detection system evaluation, Ciza Thomas, Indian Institute of Science (India). . . . . [6973-15]

Lunch/Exhibition Break. . . . . 12:10 to 1:30 pm

SESSION 4 . . . . . Tues. 1:30 to 2:50 pm

Miscellaneous Topics

Session Chairs: **Robert S. Lynch,** Naval Undersea Warfare Ctr.; **Vahid R. Riasati,** Boeing Satellite Systems

Performance comparison of the automatic data reduction system (ADRS), Robert S. Lynch, Jr., Naval Undersea Warfare Ctr.; Dan Patterson, Fei Liu, David Turner, Arturo Concepcion, California State Univ./San Bernardino . [6973-16]

Two-beam coupling correlation synthetic aperture radar image recognition with power-law scattering centers pre-enhancement, Bahareh Haji-Saeed, Solid State Scientific Corp. and Air Force Research Lab.; Jed Khoury, Charles L. Woods, Air Force Research Lab.; John Kierstead, Solid State Scientific Corp. . . . . [6973-17]

Adaptive Markov feature estimation and categorization using the projection-slice theorem, Vahid R. Riasati, Boeing Satellite Systems. . . . . [6973-18]

The interface design and implementation by using JGraph on probabilistic interval algebra network, Haiyi Zhang, Acadia Univ. (Canada). . . . . [6973-19]

SESSION 5 . . . . . Tues. 3:20 to 4:40 pm

Miscellaneous Applications

Session Chair: **Sajid Hussain,** Acadia Univ. (Canada); **Bahareh Haji-Saeed,** Solid State Scientific Corp.

A new approach to chemical agent detection, classification, and estimation, Tao Qian, Genshe Chen, Yin Chen, Intelligent Automation, Inc.; Erik Blasch, Air Force Research Lab.; Robert S. Lynch, Jr., Naval Undersea Warfare Ctr.. . . . . [6973-20]

Using received signal strength variation for surveillance in residential areas, Sajid Hussain, Daniel L. Silver, Andrei Gagarin, Richard Peters, Acadia Univ. (Canada) . . . [6973-21]

Power-law radon-transformed superimposed inverse filter synthetic discriminant correlator for facial recognition, Bahareh Haji-Saeed, Solid State Scientific Corp. and Air Force Research Lab.; Jed Khoury, Charles L. Woods, Air Force Research Lab.; John Kierstead, Solid State Scientific Corp. . . . . [6973-22]

Improvement in minority attack detection with skewness in network traffic, Ciza Thomas, Narayanaswamy Balakrishnan, Indian Institute of Science (India) . . . . [6973-23]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

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An improved clone selection immune algorithm, Peili Qiao, Tong Wang, Jie Su, Harbin Univ. of Science and Technology (China) . . . . . [6973-24]

An immunity-based model for dynamic distributed intrusion detection, Peili Qiao, Tong Wang, Jie Su, Harbin Univ. of Science and Technology (China) . . . . . [6973-25]

Research on parallel algorithm for sequential pattern mining, Lijuan Zhou, Capital Normal Univ. (China); Bai Qin, Yu Wang, Zhongxiao Hao, Harbin Univ. of Science and Technology (China) . . . . . [6973-26]

Related Courses

SC891 **Security of Information and Communication Networks** *(Kartalopoulos)* Sunday, 1:30 to 5:30 pm *NEW*

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Wednesday-Thursday 19-20 March 2008 • Proceedings of SPIE Vol. 6974

Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2008

Conference Chair: **Belur V. Dasarathy,** Consultant, Information Fusion Technologies

Program Committee: **Sheela V. Belur,** The Van Dyke Technology Group, Inc.; **Jerome J. Braun,** MIT Lincoln Lab.; **Nour-Eddin El Faouzi,** Institut National de Recherche sur les Transports (France); **Michael Heizmann,** Fraunhofer Institute for Information and Data Processing IITB (Germany); **Mieczyslaw M. Kokar,** Northeastern Univ.; **Christopher J. Matheus,** VIStology, Inc.; **Damian M. Lyons,** Fordham Univ.; **Firooz A. Sadjadi,** Lockheed Martin Corp.; **S. Richard F. Sims,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Pierre Valin,** Defence R&D Canada/Valcartier (Canada); **Shanchieh Jay Yang,** Rochester Institute of Technology

Tuesday 18 March

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

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Intermediate view reconstruction using adaptive disparity search algorithm for real-time 3D processing, Kyung-Hoon Bae, Samsung Thales Co., Ltd. (South Korea); Dong-Choon Hwang, Kwangwoon Univ. (South Korea) . . . . . [6974-31]

Automatic extraction of corresponding points for image registration, Jik-Han Jung, Won-Chul Choi, Dong-Jo Park, Korea Advanced Institute of Science and Technology (South Korea); Chang-Han Park, Jae-Ik Lee, Samsung Thales Co., Ltd. (South Korea) . . . . . [6974-32]

Design of time-pulse coded optoelectronic neuronal elements for nonlinear transformation and integration, Vladimir G. Krasilenko, Alexander A. Lazarev, Alexander I. Nikolsky, Vinnitsa State Technical Univ. (Ukraine); Maria V. Lazareva, Vinnitsa Social Economy Institute (Ukraine) . . . . . [6974-33]

Wednesday 19 March

SESSION 1 . . . . . .Wed. 8:30 to 10:10 am

Image Level Issues and Applications

Session Chairs: **S. Richard F. Sims,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Michael Heizmann,** Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany)

Portable real-time color night vision, Alexander Toet, Maarten A. Hogervorst, TNO Human Factors (Netherlands) . . . . . [6974-01]

Method for applying daytime colors to night-time imagery in realtime, Maarten A. Hogervorst, Alexander Toet, TNO Human Factors (Netherlands) . . . . . [6974-02]

Advances in image registration and fusion, Christopher A. Steer, Moira I. Smith, Jamie P. Heather, Mark Bernhardt, Waterfall Solutions Ltd. (United Kingdom); Paul K. Kimber, SELEX Sensors and Airborne Systems Ltd. (United Kingdom); Karen M. Brosseaud, Waterfall Solutions Ltd. (United Kingdom) . . . . . [6974-03]

Image registration via invariant object/image equations and O/I-metrics, Olga L. Mendoza, D. Gregory Arnold, Air Force Research Lab.; Peter F. Stiller, Texas A&M Univ. . . . . [6974-04]

Fusion of combined stereo and spectral series for obtaining 3D information, Ioana Gheta, Markus Mathias, Univ. Karlsruhe (Germany); Michael Heizmann, Jürgen Beyerer, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany) . . . . . [6974-05]

SESSION 2 . . . . . Wed. 10:40 am to 12:20 pm

Detection and Classification

Session Chairs: **Sheela V. Belur,** The Van Dyke Technology Group, Inc.; **Damian M. Lyons,** Fordham Univ.

Multi-class classification fusion using boosting for identifying steganography methods, Benjamin M. Rodriguez II, Gilbert L. Peterson, Air Force Institute of Technology . . . . . [6974-06]

Comparing discrimination and CFA for selecting tracking features, Damian M. Lyons, D. F. Hsu, Fordham Univ. . . . . [6974-07]

Iris and face information fusion for efficient human identification, Richard C. Tompkins, Satyanadh Gundimada, Old Dominion Univ. . . . . [6974-08]

Object-based fusion of electro optic and infrared sensor data using fuzzy logic system for automatic target detection, Pramod L. Narasimha, Zhanfeng Yue, Pankaj Topiwala, FastVDO LLC . . . . . [6974-09]

A large heterogeneous sensor network simulation system with integrated terrain data for real-time target detection, Hong Lin, The Univ. of Alabama in Huntsville . . . . . [6974-10]

Lunch/Exhibition Break . . . . . 12:20 to 1:20 pm

SESSION 3 . . . . . .Wed. 1:20 to 3:00 pm

Surveillance and Tracking

Session Chairs: **Jerome J. Braun,** MIT Lincoln Lab.; **Shanchieh Jay Yang,** Rochester Institute of Technology

Vehicle tracking in UAV video using multi-spectral spatiogram models, Noel E. O'Connor, Peter Kehoe, Ciarán E. Ó Conaire, Alan F. Smeaton, Dublin City Univ. (Ireland) . . . . . [6974-11]

Dynamic resource management for adaptive distributed information fusion in large volume surveillance, Uwe P. Glässer, Roozbeh Farahbod, Simon Fraser Univ. (Canada); Hans W. Wehn, MacDonald, Dettwiler and Associates Ltd. (Canada) . . . . . [6974-12]

Situation-aware BDI agents in support of autonomous intelligence, surveillance, and reconnaissance (ISR) analysis, Lundy Lewis, Gabe Jakobson, John Buford, Altusys Corp. . . . . [6974-13]

A system for testing distributed information fusion applications for maritime surveillance, Hans W. Wehn, Jens Happe, MacDonald, Dettwiler and Associates Ltd. (Canada); Adel Guitouni, Pierre Valin, Eloi Bossé, Defence R&D Canada/Valcartier (Canada) . . . . . [6974-14]

A standards-based multi-sensor system for surveillance, Arthur J. Na, Argon ST, Inc. . . . . [6974-15]

PANEL SESSION . . . . . Wed. 3:30 to 5:10 pm

Performance Evaluation for Impact Assessment Systems

Panel Moderator: **Shanchieh Jay Yang,** Rochester Institute of Technology

Panelists: **John J. Salerno,** Air Force Research Lab.; **James Llinas,** Univ. at Buffalo; **Robert S. Lynch,** Naval Undersea Warfare Ctr.; **Jerome J. Braun,** MIT Lincoln Lab.; **Erik Blasch,** Air Force Research Lab.

Traditionally, fusion systems are evaluated via Monte-Carlo simulations against the ground truth. ROC charts and associated metrics are typically used to assess performance of object detection and tracking. In the case of Impact Assessment, a fusion system presumably aims at projecting future actions of the RED and BLUE teams and assessing the consequences of such actions. Because it involves "future actions" and "potential consequences," evaluating performance of an impact assessment system becomes a nontrivial problem. Techniques, metrics and data sets suitable for evaluating lower level fusion systems may no longer applicable. This panel will identify challenges and discuss methodologies in evaluating impact assessment systems for general and specific application domains.

Thursday 20 March

SESSION 5 . . . . . Thurs. 8:50 to 10:10 am

Higher Level Fusion and Architecture Issues

Session Chairs: **Christopher J. Matheus,** VIStology, Inc.; **S. Richard F. Sims,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.

A Markov game model for space threat prediction, Dan Shen, Genshe Chen, Intelligent Automation, Inc.; Erik Blasch, Khanh Pham, Air Force Research Lab. . . . . [6974-16]

Evaluating a level 2/3 information fusion system, Erik Blasch, Air Force Research Lab.; Genshe Chen, Intelligent Automation, Inc.; Li Bai, Temple Univ. . . . . [6974-17]

The use of a multidimentional space for fusion candidate representation in a maritime domain awareness application, Eric Lefebvre, Lockheed Martin Canada (Canada); Christopher Helleur, Defense Research and Development Canada (Canada) . . . . . [6974-18]

Using a metadata-based model driven architecture to integrate existing legacy systems, Daniel J. Hall, Objectivity, Inc. . . . . [6974-20]

SESSION 6 . . . . . Thurs. 10:40 am to 12:20 pm

Applications

Session Chairs: **Pierre Valin,** Defence R&D Canada/Valcartier (Canada); **Nour-Eddin El Faouzi,** Institut National de Recherche sur les Transports (France)

Data and sensor fusion for bistatic radar applications, Anne L. Lee, Antonia T. Cheung, Vahid R. Riasati, Boeing Satellite Systems. . . . . [6974-21]

Smart optical receiver for beamforming and enhancement of field-of-view in LADAR systems, Jed Khoury, Air Force Research Lab.; Bahareh Haji-Saeed, Solid State Scientific Corp.; Charles L. Woods, Air Force Research Lab.; John Kierstead, Solid State Scientific Corp. . . . . [6974-22]

Data fusion based target tracking in FLIR imagery, Mohammad S. Alam, Univ. of South Alabama . . . . . [6974-23]

Remote monitoring of soldier safety through body posture identification using wearable sensor networks, Subir Biswas, Michigan State Univ. . . . . [6974-25]

Lunch Break . . . . . 12:20 to 1:20 pm

Conference 6974

SESSION 7 . . . . . Thurs. 1:20 to 3:00 pm

Miscellaneous Topics

Session Chairs: **Jerome J. Braun,** MIT Lincoln Lab.; **Michael Heizmann,** Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany)

Non-algorithmic information fusion, Jim E. Brander, Interactive Engineering Pty Ltd. (Australia) . . . . . [6974-26]

About the fusion of default knowledge, Eric Gregoire, Univ. d'Artois (France) . . . . . [6974-27]

Advanced algorithms for distributed fusion (A2DF), Andrew E. Gelfand, Mike Colony, Chris Smith, Decisive Analytics Corp.; Christopher L. Bowman, Data Fusion and Neural Networks; Richard S. Pei, Clinton Brown, Thien Huynh, U.S. Army Night Vision & Electronic Sensors Directorate. [6974-28]

Dynamic adaptive learning for decision-making supporting systems, Haibo He, Stevens Institute of Technology; Sachi V. Desai, Myron E. Hohil, U.S. Army Research, Development and Engineering Command [6974-29]

Distributed multi-sensor fusion, Robert Fish, McQ, Inc.. . . . . [6974-30]

Related Course

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Signal, Image, and Neural Net Processing

Chair: **Andrew R. Pirich,** ACP Consulting

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6979 **Independent Component Analyses, Wavelets, Unsupervised Nano-Biomimetic Sensors and Neural Networks VI** *(Szu, Agee)* p. 89

6976 **Quantum Information and Computation VI** *(Donkor, Pirich, Brandt)* p. 86

6977 **Optical Pattern Recognition XIV** *(Casasent, Chao)* p. 87

6975 **Enabling Photonic Technologies for Defense, Security, and Aerospace Applications IV** *(Hayduk, Delfyett)* p. 85

6978 **Visual Information Processing XVII** *(Rahman, Reichenbach, Neifeld)* p. 88

Courses of Related Interest

SC902 ***NEW*** **Compressive Sensing: Theory and Applications** *(DeVore, Baraniuk)* 1:30 to 5:30 pm, p. 112

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* 8:30 am to 5:30 pm, p. 110

SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* 8:30 am to 12:30 pm, p. 107

SC901 ***NEW*** **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, p. 111

SC715 **Independent Component Analysis and Beyond: Blind Signal Processing and its Applications** *(Lee, Lee)* 8:30 am to 12:30 pm, p. 112

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works **Career Fair**
11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

FREE Exhibition
10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair
11:00 am to 3:00 pm

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

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Enabling Photonic Technologies for Defense, Security, and Aerospace Applications IV

Conference Chairs: **Michael J. Hayduk,** Air Force Research Lab.; **Peter J. Delfyett,** College of Optics & Photonics/Univ. of Central Florida

Conference Co-Chairs: **Andrew R. Pirich,** ACP Consulting; **Eric J. Donkor,** Univ. of Connecticut

Program Committee: **John P. Barrios,** Air Force Research Lab.; **H. John Caulfield,** Diversified Research Corp.; **Reinhard K. Erdmann,** Air Force Research Lab.; **Michael L. Fanto,** Air Force Research Lab.; **Bahram Javidi,** Univ. of Connecticut; **Robert L. Kaminski,** Air Force Research Lab.; **Guifang Li,** College of Optics & Photonics/ Univ. of Central Florida; **Joseph M. Osman,** Air Force Research Lab.; **Edward W. Taylor,** International Photonics Consultants, Inc.; **Henry Zmuda,** Univ. of Florida; **Monte Ross,** FastMetrix, Inc.

Monday 17 March

SESSION 1 . . . . . .Mon. 1:00 to 3:10 pm

Photonic Systems and Subsystems

Session Chairs: **Andrew R. Pirich,** ACP Consulting; **Guifang Li,** College of Optics & Photonics/Univ. of Central Florida

Managing thermal emission: plasmon/photon coupling using subwavelength diffractive optics technology *(Invited Paper)*, Shanalyn A. Kemme, Alvaro A. Cruz-Cabrera, David W. Peters, A. R. Ellis, Tony R. Carter, Sally Samora, Sandia National Labs. . . . . [6975-01]

A new electro-optic waveguide architecture and the unprecedented devices it enables, Scott R. Davis, George Farca, Scott D. Rommel, Michael H. Anderson, Vescent Photonics Inc. . . . . [6975-02]

Expermental results for a photonic time reversal processor for the adaptive control of an ultra-wideband phased array antenna, Henry Zmuda, Univ. of Florida; Michael L. Fanto, Thomas McEwen, Air Force Research Lab. . . . . [6975-03]

Demonstration of an all-optical flip-flop using a Lyot filter and a semiconductor optical amplifier arrangement, Catherine M. Emmons, Patrick D. Kumavor, Eric J. Donkor, Univ. of Connecticut . . . . . [6975-04]

Photonically-enabled RF spectrum analyzer demonstration, Elizabeth T. Kunkee, Ken Tsai, Andrew D. Smith, T. Jung, Lawrence Lembo, Richard Davis, Northrop Grumman Space Technology; W. R. Babbitt, R. Krishna-Mohan, Montana State Univ./Bozeman; Z. Cole, Scientific Materials Corp.; K. Merkel, S2 Corp.; Kelvin Wagner, Univ. of Colorado at Boulder . . . . . [6975-05]

Improved technique for high-precision FSR measurement, Ibrahim Ozdur, Sarper Ozharar, Franklyn J. Quinlan, Peter J. Delfyett, Jr., College of Optics & Photonics/Univ. of Central Florida . . . . . [6975-06]

SESSION 2 . . . . . .Mon. 3:40 to 5:50 pm

Optical Communications

Session Chairs: **Eric J. Donkor,** Univ. of Connecticut; **Joseph M. Osman,** Air Force Research Lab.

Free-space, laser-based data transmission: satellite communication as a technology driver for the development of fast, reliable terrestrial data networks, Martin Gerken, Martin Theis, Georg Luichtel, Carl Zeiss Optronics GmbH (Germany) . . . . . [6975-07]

Nonlinearity compensation in coherent optical transmission, Gilad Goldfarb, Xiaoxu Li, Guifang Li, College of Optics & Photonics/Univ. of Central Florida . . . . . [6975-08]

Security of reconfigurable FSO mesh networks and application to disaster areas, Stamatios V. Kartalopoulos, Sr., Univ. of Oklahoma . . . . . [6975-09]

Needle-in-the-haystack secure optical communication *(Invited Paper)*, Guifang Li, College of Optics & Photonics/ Univ. of Central Florida; Michael Taylor, Atlantic Sciences . . . . . [6975-10]

Performance analysis of an optical identification and interrogation system, Anandkumar Venugopalan, Anjan K. Ghosh, Pramode Verma, Sam Cheng, Univ. of Oklahoma . . . . . [6975-11]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 3 . . . . . Tues. 10:30 to 11:10 am

Keynote Presentation

Session Chairs: **Michael J. Hayduk,** Air Force Research Lab.; **Peter J. Delfyett,** College of Optics & Photonics/Univ. of Central Florida

Optically compressed image sensing using random aperture coding (Keynote Presentation) *(Invited Paper)*, Adrian Stern, Ben-Gurion Univ. of the Negev (Israel); Bahram Javidi, Univ. of Connecticut . . . . . [6975-13]

SESSION 4 . . . . . Tues. 11:10 am to 12:10 pm

Photonic Analog to Digital Converters

Session Chairs: **Michael J. Hayduk,** Air Force Research Lab.; **Peter J. Delfyett,** College of Optics & Photonics/Univ. of Central Florida

Optically synchronized decoder and multiplexer scheme for interleaved photonics analog to digital conversion, Carlos Villa-Angulo, Patrick Kumavor, Eric Donkor, Univ. of Connecticut . . . . . [6975-14]

Recirculating optical delay line for high-speed, high-resolution analog-to-digital conversion and other radar applications, Henry Zmuda, Univ. of Florida; Michael L. Fanto, Thomas McEwen, Air Force Research Lab.; Jared Pawloski, State Univ. of New York/Binghamton; Kristina Norelli, Syracuse Univ. . . . . [6975-15]

High-speed optoelectronics polyphase scheme for sampling/demultiplexing RF analog signals, Carlos Villa-Angulo, Patrick Kumavor, Aaron Feldstein, Jennifer Hernandez, Eric Donkor, Univ. of Connecticut . . . . . [6975-16]

Lunch/Exhibition Break . . . . . 12:10 to 1:10 pm

SESSION 5 . . . . . Tues. 1:10 to 3:20 pm

Lasers and Emitters

Session Chairs: **Michael L. Fanto,** Air Force Research Lab.; **Eric J. Donkor,** Univ. of Connecticut

Interband injection locking of a quantum dot mode-locked two-section diode laser, Jimyung Kim, Peter J. Delfyett, Jr., College of Optics & Photonics/Univ. of Central Florida . . . . . [6975-17]

Stabilized optical frequency combs from diode lasers: applications in optical communications, signal processing, and instrumentation *(Invited Paper)*, Peter J. Delfyett, Jr., College of Optics & Photonics/Univ. of Central Florida . . . . . [6975-18]

Optical frequency comb generation by direct modulation of CW light, Sarper Ozharar, Ibrahim Ozdur, Franklyn J. Quinlan, Peter J. Delfyett, Jr., College of Optics & Photonics/ Univ. of Central Florida . . . . . [6975-19]

Low-noise high-power ultra-stable diode-pumped Er-Yb phosphate glass laser, Robert van Leeuwen, Bing Xu, Laurence S. Watkins, Qing Wang, Chuni Ghosh, Princeton Optronics, Inc.. . . . . [6975-20]

Linearly chirped nanosecond stretched pulses from an eXtreme chirped pulse semiconductor mode-locked oscillator (XCPO), Shinwook Lee, College of Optics & Photonics/Univ. of Central Florida; Dimitrios Mandridis, Univ. of Central Florida; Peter J. Delfyett, Jr., College of Optics & Photonics/Univ. of Central Florida . . . . . [6975-21]

Modeling of generalized Lambertian sources for military and homeland security applications, Mark Bennahmias, Vladimir Esterkin, Thomas Forrester, Min-Yi Shih, Ranjit Pradhan, Andrew Kostrzewski, Naresh Menon, Paul Shnitser, Michael Reznikov, Tomasz Jannson, Physical Optics Corp.; Kevin Yu, Engin Arik, Luminit LLC. . . . . [6975-22]

SESSION 6 . . . . . Tues. 3:50 to 5:40 pm

RF Links and Components

Session Chairs: **Peter J. Delfyett,** College of Optics & Photonics/Univ. of Central Florida; **Andrew R. Pirich,** ACP Consulting

Characterization of an electroabsorption modulator design with high-dynamic range for broadband analog applications, Rebecca J. Bussjaeger, Richard J. Michalak, Brian McKeon, Paul Cook, Air Force Research Lab.; Henry Zmuda, Univ. of Florida; Reinhard K. Erdmann, Air Force Research Lab.; Songsheng Tan, Nancy Stoffel, Charles Schick, Terrance G. McDonald, Infotonics Technology Ctr.. . . . . [6975-23]

Design and development of a package for a peripheral-coupled waveguide electro-absorption modulator *(Invited Paper)*, Songsheng Tan, Nancy Stoffel, Charles Shick, Terrance G. McDonald, Al Whitbeck, Infotonics Technology Ctr.; Reinhard K. Erdmann, Richard J. Michalak, Rebecca J. Bussjager, Air Force Research Lab.; Ivan N. Shubin, Paul K. L.Yu, Univ. of California/San Diego. . . . . [6975-24]

Compact WDM bidirectional fiber optic RF link, Alex Rosiewicz, Markus Renlind, EM4, Inc. . . . . [6975-25]

Measurement of SFDR and noise in EDF amplified analog RF links using all-optical downconversion and balanced receivers, Charles Middleton III, Michael R. Borbath, Richard DeSalvo, Harris Corp. . . . . [6975-26]

High-power handling, ultra-fast GRIN lens-coupled photodetectors, Abhay Joshi, Don Becker, Shubhashish Datta, Discovery Semiconductors, Inc.. . . . . [6975-27]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Multimode interference mode generator, Jose E. Antonio-Lopez, Daniel A. May-Arrioja, Jose J. Sánchez-Mondragón, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico). . . . . [6975-28]

Picosecond standoff multiphoton detection of gas phase species: initial results, J. B. Johnson, Kevin Lyon, William D. Murry, Daniel R. Britton, Arkansas State Univ.; Michael J. Johnson, Brigham Young Univ.. . . . . [6975-12]

Related Course

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Quantum Information and Computation VI

Conference Chairs: **Eric J. Donkor,** Univ. of Connecticut; **Andrew R. Pirich,** ACP Consulting; **Howard E. Brandt,** Army Research Lab.

Program Committee: **Chip Brig Elliott,** BBN Technologies; **Michael J. Hayduk,** Air Force Research Lab.; **Louis H. Kauffman,** Univ. of Illinois/Chicago; **Vladimir E. Korepin,** Stony Brook Univ.; **Samuel J. Lomonaco,** Univ. of Maryland/Baltimore County; **John M. Myers,** Harvard Univ.; **Vladimir Privman,** Clarkson Univ.; **Alexander V. Sergienko,** Boston Univ.; **Tai Tsun Wu,** Harvard Univ.

Wednesday 19 March

SESSION 1 . . . . . .Wed. 8:50 to 10:20 am

Quantum Gates and Processors

Session Chair: **Howard E. Brandt,** Army Research Lab.

Room temperature solid state quantum processors in diamond *(Invited Paper)*, Philip R. Hemmer, Texas A&M Univ.; Mikhail D. Lukin, Harvard Univ. . . . . [6976-01]

Entanglement and coherence in double well optical lattices, Philip R. Johnson, American Univ. . . . . [6976-02]

A quantum-mathematical model to state single photon (electron) double slit experiment, Fraunhofer and Fresnel diffractions, Akbar Rahmani Nejad, Civil Aviation Organization (Iran) . . . . . [6976-03]

Universal entanglement decoherence of warm qubits, Ting Yu, Joseph H. Eberly, Univ. of Rochester . . . . . [6976-04]

SESSION 2 . . . . . Wed. 10:50 am to 12:20 pm

Quantum Networks, Detectors and Sensors

Session Chairs: **Michael J. Hayduk,** Air Force Research Lab.; **Eric J. Donkor,** Univ. of Connecticut

High-speed infrared photon counting with Superconducting Single-Photon Detectors (SSPD) for quantum communication *(Invited Paper)*, Olga Minaeva, Alexander V. Sergienko, Boston Univ.; Gregory N. Goltsman, Moscow State Pedagogical Univ. (Russia) . . . . . [6976-05]

High-count rate germanium single photon detectors at 1310nm, Malcolm Carroll, John Seamons, Sandia National Labs. . . . . [6976-06]

Quantum sensor miniaturization, Gerald N. Gilbert, Michael D. Hamrick, Yaakov S. Weinstein, Stephen P. Pappas, Anthony Donadio, The MITRE Corp. . . . . [6976-07]

Quantum sensors in a lossy medium, Hwang Lee, Louisiana State Univ. . . . . [6976-08]

Lunch/Exhibition Break. . . . . .12:20 to 1:20 pm

SESSION 3 . . . . . .Wed. 1:20 to 3:00 pm

Quantum Measurement

Session Chairs: **Alexander V. Sergienko,** Boston Univ.; **Andrew R. Pirich,** ACP Consulting

On the quantum-mechanical form of experimental reports, John M. Myers, Harvard Univ. . . . . [6976-09]

Non-destructive quantum measurement scheme for quantum states in superposition, Patrick D. Kumavor, Eric J. Donkor, Univ. of Connecticut . . . . . [6976-10]

Accelerated control of quantum systems using two qubit feedback and guidance, Charles Hill, Jason F. Ralph, The Univ. of Liverpool (United Kingdom) . . . . . [6976-11]

Hilbert-Schmidt disturbance due to measurement, Michael R. Frey, Bucknell Univ. and Naval Research Lab. . . . [6976-12]

Weak measurements, quantum random walk and majorization, Debabrata Ghoshal, George Mason Univ. . . . . [6976-13]

SESSION 4 . . . . . .Wed. 3:30 to 5:10 pm

Quantum Key Distribution, Secure Communication

Session Chair: **Samuel J. Lomonaco,** Univ. of Maryland/Baltimore County

Free space QKD in daylight, Matthew P. Peloso, Alexander Ling, Antia Lamas-Linares, Christian Kurtsiefer, National Univ. of Singapore (Singapore). . . . . [6976-14]

Spying on an entanglement-based QKD system through a timing side-channel, Antia Lamas-Linares, Christian Kurtsiefer, National Univ. of Singapore (Singapore) . [6976-15]

Nonextensive statistics framework for secret shared key construction using continuous variables, Ravi C. Venkatesan, Systems Research Corp. (India) . . . . . [6976-16]

Hastening, delaying, or averting sudden death of qauntum entanglement, Ravi P. Rau, Louisiana State Univ . . [6976-17]

Generalized statistics framework for privacy amplification in quantum cryptography, Ravi C. Venkatesan, Systems Research Corp. (India). . . . . [6976-18]

Thursday 20 March

SESSION 5 . . . . . Thurs. 8:50 to 10:20 am

Quantum Information Theory I

Session Chair: **Andrew R. Pirich,** ACP Consulting

Quantum braids and knots *(Invited Paper)*, Samuel J. Lomonaco, Jr., Univ. of Maryland/Baltimore County; Louis H. Kauffman, Univ. of Illinois at Chicago . . . . . [6976-19]

Estimation of classical and quantum entropy and other information-theoretic quantities, Alexei Kaltchenko, Wilfrid Laurier Univ. (Canada). . . . . [6976-20]

Topological quantum computing, Louis H. Kauffman, Univ. of Illinois at Chicago . . . . . [6976-21]

Model link and knot mapping in quantum electrodynamics, Howard E. Brandt, Army Research Lab. . . . . [6976-22]

SESSION 6 . . . . . Thurs. 10:50 am to 12:30 pm

Quantum Information Theory II

Session Chair: **Howard E. Brandt,** Army Research Lab.

Quantum algorithms for the Bollobas-Riordan-Tutte polynomial, Juan F. Ospina, Univ. EAFIT (Colombia)[6976-23]

The Grover iteration from Noether's theorem, Ravi C. Venkatesan, Systems Research Corp. (India) . . . . . [6976-24]

Generalized statistics analysis of bound information and bound quantum entanglement in quantum cryptography, Ravi C. Venkatesan, Systems Research Corp. (India)[6976-25]

Memory, contextuality and quantum mechanics, John E. Gray, Naval Surface Warfare Ctr.; Jeff Tollaksen, George Mason Univ. . . . . [6976-26]

The A-V formula, its justification and implications for "Signal Enhancement", John E. Gray, Naval Surface Warfare Ctr.; Jeff Tollaksen, George Mason Univ. . . . . [6976-27]

Lunch Break . . . . . 12:30 to 1:30 pm

SESSION 7 . . . . . Thurs. 1:30 to 3:20 pm

Quantum Algorithms

Session Chairs: **Louis H. Kauffman,** Univ. of Illinois at Chicago; **Eric J. Donkor,** Univ. of Connecticut

Operator quantum fault tolerance *(Invited Paper)*, Gerald N. Gilbert, Michael D. Hamrick, Yaakov S. Weinstein, The MITRE Corp.; Vaneet Aggarwal, A. Robert Calderbank, Princeton Univ. . . . . [6976-28]

Quantum lattice algorithms for quantum turbulence in BEC, Jeffrey Yepez, Air Force Research Lab.; George Vahala, The College of William & Mary; Linda L. Vahala, Old Dominion Univ. . . . . [6976-31]

Finite temperature quantum algorithm and majorization, Debabrata Ghoshal, Richard Gomez, Marco O. Lanzagorta, George Mason Univ.; Jeffrey K. Uhlmann, Univ. of Missouri/Columbia . . . . . [6976-32]

Is quantum parallelism real?, Marco O. Lanzagorta, George Mason Univ.; Jeffrey K. Uhlmann, Univ. of Missouri/Columbia . . . . . [6976-33]

Differential geometry of quantum computation, Howard E. Brandt, Army Research Lab. . . . . [6976-34]

Related Course

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

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Optical Pattern Recognition XIV

Conference Chair: **David P. Casasent,** Carnegie Mellon Univ.; **Tien-Hsin Chao,** Jet Propulsion Lab.

Program Committee: **Mohammad S. Alam,** Univ. of South Alabama; **Don A. Gregory,** The Univ. of Alabama in Huntsville; **Bahram Javidi,** Univ. of Connecticut; **Richard D. Juday,** NASA Johnson Space Ctr.; **Dennis R. Pape,** AlphaLaunch; **Yunlong Sheng,** Univ. Laval (Canada); **Joseph L. Stufflebeam,** NewTec; **Ashit Talukder,** Univ. of Southern California; **B. V. K. Vijaya Kumar,** Carnegie Mellon Univ.; **Rupert C. D. Young,** Univ. of Sussex (United Kingdom)

Monday 17 March

SESSION 1 . . . . . .Mon. 8:30 to 10:00 am

Invited Papers I

Session Chair: **David P. Casasent,** Carnegie Mellon Univ.

Optical ID tags for automatic vehicle identification and authentication (Keynote Presentation) *(Invited Paper)*, Bahram Javidi, Univ. of Connecticut; Elisabet Pérez-Cabré, Maria S. Millan, Univ. Politècnica de Catalunya (Spain) . . . . . [6977-01]

Distortion-invariant kernel filters for ATR *(Invited Paper)*, Rohit Patnaik, David P. Casasent, Carnegie Mellon Univ. . . . . [6977-02]

Grayscale optical correlator for CAD/CAC applications *(Invited Paper)*, Tien-Hsin Chao, Thomas T. Lu, Jet Propulsion Lab. . . . . [6977-03]

SESSION 2 . . . . . Mon. 10:30 am to 12:00 pm

Invited Papers II

Session Chair: **David P. Casasent,** Carnegie Mellon Univ.

Multiple target detection in video using quadratic multi-frame correlation filtering *(Invited Paper)*, Ryan A. Kerekes, Oak Ridge National Lab.; B. V. K. Vijaya Kumar, Carnegie Mellon Univ.. . . . . [6977-04]

Dynamic range compression deconvolution for enhancement of automatic target recognition system performance *(Invited Paper)*, Bahareh Haji-saeed, Solid State Scientific Corp.; W. D. Goodhue, Univ. of Massachusetts/ Lowell; Jed Khoury, Charles L. Woods, Air Force Research Lab.; John Kierstead, Solid State Scientific Corp. . . [6977-05]

Mine detection in multispectral imagery data using constant energy minimization *(Invited Paper)*, Mohamed I. Elbakary, Mohammad S. Alam, Univ. of South Alabama . . . . . [6977-06]

Lunch/Exhibition Break. . . . . 12:00 to 1:20 pm

SESSION 3 . . . . . .Mon. 1:20 to 3:00 pm

Pattern Recognition Correlators

Session Chair: **Tien-Hsin Chao,** Jet Propulsion Lab.

Pseudorandom phase function for phase encoded JTC, Abdul Rahman Alsamman, Univ. of New Orleans. . . [6977-07]

Probability density function-based Fisher ratio applied to polarization-enhanced patterns, Aed M. El-Saba, Mohammad S. Alam, Hari Nalluri, Univ. of South Alabama . . . . . [6977-08]

Pattern recognition using Gaussian-filtered, shifted phase-encoded fringe-adjusted joint transform correlation, Mohammed N. Islam, Old Dominion Univ.; Mohammad S. Alam, Univ. of South Alabama; K. V. Asari, Mohammad A. Karim, Old Dominion Univ. . . . . [6977-09]

Two-stage automatic target recognition system for false alarm reduction, Thomas T. Lu, Tien-Hsin Chao, Jet Propulsion Lab. . . . . [6977-10]

LPCC invariant correlation filters: realization in 4-f holographic correlator, Nikolay Evtikhiev, Eugene Zlokazov, Sergey Starikov, Rostislav Starikov, Sergey Sirotkin, Moscow Engineering Physics Institute (Russia). . . . . [6977-11]

SESSION 4 . . . . . .Mon. 3:30 to 5:10 pm

Pattern Recognition Filters and Applications

Session Chair: **Mohammad S. Alam,** Univ. of South Alabama.

A method for synthesizing training images using feature prediction, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control. . . . . [6977-12]

Space vehicle pose estimation via optical correlation and nonlinear estimation, John M. Rakoczy, NASA Marshall Space Flight Ctr. . . . . [6977-13]

Improved training for target detection using Fukunaga-Koontz transform and distance classifier correlation filter, Mohammad S. Alam, Univ. of South Alabama . . . . . [6977-14]

Multiscale beamlet transform application to airfield runway detection, Samir Sahli, Yunlong Sheng, Univ. Laval (Canada) . . . . . [6977-15]

Land cover mapping after the TSUNAMI event over Nanggroe Aceh Darussalam (NAD) Province, Indonesia, Hwee-San Lim, Chow Jeng Wong, Mohd Zubir Mat Jafri, Khiruddin Abdullah, Azrul Nizam Alias, Nasirun Mohd. Saleh, Univ. Sains Malaysia (Malaysia); Muhammad Syukri Surbakti, Syiah Kuala Univ. (Indonesia) . . . . . [6977-16]

Tuesday 18 March

SESSION 5 . . . . . Tues. 8:30 to 10:10 am

Image Processing

Session Chair: **Rupert C. D. Young,** Univ. of Sussex at Brighton (United Kingdom)

Optoelectronic multifractal and directional wavelet analysis for accurate detection of precipitation events in weather radar images, Abdul Rahman Alsamman, Univ. of New Orleans . . . . . [6977-17]

Noise elimination methods in topological pattern recognition, Chia-Lun J. Hu, Univ. of Colorado at Boulder . . . . . [6977-18]

The suppression of non-aligned gradients in the correlation between two grayscale images, Antonio F. Ramirez, Raytheon Missile Systems . . . . . [6977-19]

Image watermarking extraction using Fourier domain wiener filter, Philip M. Birch, Ioannis Kypraios, Bhargav Mitra, Rupert Young, Chris Chatwin, Univ. of Sussex at Brighton (United Kingdom). . . . . [6977-20]

Computational sensing algorithms for image reconstruction and the detection of moving objects in multiplexed imaging systems, Robert R. Muise, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control. . . . . [6977-21]

SESSION 6 . . . . . Tues. 10:40 am to 12:00 pm

Tracking and Applications

Session Chair: **Tien-Hsin Chao,** Jet Propulsion Lab.

Near real-time extraction of planar features from 3D flash-lidar video frames, Don T. Venable, Maarten Uijt de Haag, Ohio Univ. . . . . [6977-22]

Neural network augmented Kalman filter for high-precision target tracking, Michael X. Zhao, Etonnet, Inc.; Thomas T. Lu, Tien-Hsin Chao, Jet Propulsion Lab. [6977-23]

Compact liquid crystal waveguide based Fourier transform spectrometer for in-situ and remote gas and chemical sensing, Tien-Hsin Chao, Thomas T. Lu, Jet Propulsion Lab.; Scott R. Davis, Michael H. Anderson, Vescent Photonics Inc. . . . . [6977-24]

Predictive control and resource management of a distributed coastal monitoring sensor network, Ashit Talukder, Jet Propulsion Lab.; Anand Panangadan, Alan Blumberg, Nickitas Georgias, Thomas Herrington, Univ. of Southern California . . . . . [6977-25]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Pattern Recognition Filters and Applications

Using commercial photo camera's RAW-based images in optical-digital correlator for pattern recognition, Sergey N. Starikov, Mikhail V. Konnik, Moscow Engineering Physics Institute (Russia) . . . . . [6977-26]

Fast and robust face detection based on human skin color detection and the modified census transform, Xinyu Wang, Huosheng Xu, Heng Wang, Heng Li, Wuhan Digital Engineering Institute (China) . . . . . [6977-27]

Image Processing

High-spatial resolution land cover mapping using remotely sensed image, Hwee-San Lim, Univ. Sains Malaysia (Malaysia); Sultan AlSultan, Qassim Univ. (Saudi Arabia); Chow Jeng Wong, Mohd Zubir Mat Jafri, Khiruddin Abdullah, Azrul Nizam Alias, Nasirun Mohd. Saleh, Univ. Sains Malaysia (Malaysia) . . . . . [6977-28]

The cognitive structural approach for image restoration, Igor Mardare, Veacheslav L. Perju, Technical Univ. of Moldova (Moldova); David Casasent, Carnegie Mellon Univ. . [6977-29]

Face recognition on the basis of moment invariant, principal component analysis and correlation, Veacheslav L. Perju, Technical Univ. of Moldova (Moldova); David Casasent, Carnegie Mellon Univ.; Igor Mardare, Andrei Crivat, Technical Univ. of Moldova (Moldova) . . . . . [6977-30]

Related Course

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Visual Information Processing XVII

Conference Chairs: **Zia-ur Rahman,** Old Dominion Univ.; **Stephen E. Reichenbach,** Univ. of Nebraska/Lincoln; **Mark Allen Neifeld,** The Univ. of Arizona

Program Committee: **Gary W. Euliss,** The MITRE Corp.; **Richard D. Juday,** NASA Johnson Space Ctr.; **Ram Mohan Narayanan,** The Pennsylvania State Univ.; **John M. Pellegrino,** Army Research Lab.; **Robert A. Schowengerdt,** The Univ. of Arizona; **Joseph van der Gracht,** HoloSpex, Inc.

Tuesday 18 March

Symposium-Wide Plenary Presentation
Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 1 . . . . . Tues. 10:30 to 11:50 am

Enhancement Methods

Session Chair: **Glenn A. Woodell,** NASA Langley Research Ctr.

Gaussian model-based statistical matching for image enhancement and segmentation, Yufeng Zheng, Alcorn State Univ.. . . . . [6978-01]

A nonlinear technique for the enhancement of extremely high contrast images, Saibabu Arigela, Vijayan K. Asari, Zia-ur Rahman, Old Dominion Univ. . . . . [6978-02]

A multiresolution approach to image enhancement via histogram shaping and adaptive wiener filtering, Teresa L. Pace, Drew Manville, Harry Lee, Gene Cloud, Jim Puritz, DRS Technologies, Inc.. . . . . [6978-03]

A fast and robust wavelet-based dynamic range compression and contrast enhancement model, Numan Unaldi, K. Vijayan Asari, Zia-ur Rahman, Sertan Erkanli, Old Dominion Univ. . . . . [6978-04]

Lunch/Exhibition Break. . . . . 11:50 am to 1:20 pm

SESSION 2 . . . . . Tues. 1:20 to 3:00 pm

Applications

Session Chair: **Zia-ur Rahman,** Old Dominion Univ.

Indoor localization of tactical mobile robots via sensor data fusion, Emin Kuscu, Amir H. Shirkhodaie, Haroun Rabbabaah, Tennessee State Univ. . . . . [6978-05]

A modular approach on adaptive thresholding for the extraction of mammalian cell regions from bioelectric images in complex background environments, Praveen Sankaran, Inder Purohit, Vijayan Asari, Mohammad A. Karim, Old Dominion Univ. . . . . [6978-06]

A modular high-precision digital system for hypervelocity projectile performance measurements, Vivek V. Nagarkar, Bipin Singh, Stuart Miller, Radiation Monitoring Devices, Inc.; Larry Campbell, Ron Bishel, Rick Rushing, U.S. Air Force . . . . . [6978-07]

Automated visual inspection of jet engine aerofoils based on soft computing techniques, Amir H. Shirkhodaie, Naresh Hanchate, Mohammad Habibi, Tennessee State Univ. . . . . [6978-08]

Determination of aerosol concentration using a digital SLR camera, Chow Jeng Wong, Mohd Zubir Mat Jafri, Khiruddin Abdullah, Hwee San Lim, Khee Lam Low, Univ. Sains Malaysia (Malaysia) . . . . . [6978-09]

SESSION 3 . . . . . Tues. 3:30 to 5:10 pm

Compression and Metrics

Session Chair: **Gary W. Euliss,** The MITRE Corp.

Lossless compression of the geostationary imaging Fourier transform spectrometer (GIFTS) by the codebook-guided point-to-line vector quantization, Bormin Huang, Jing Ma, Allen H.Huang, Univ. of Wisconsin/ Madison. . . . . [6978-10]

Region-of-interest-based ultra-low-bit-rate video coding, Wei-Jung Chien, Nabil G. Sadaka, Arizona State Univ.; Glen P. Abousleman, General Dynamics C4 Systems; Lina J. Karam, Arizona State Univ. . . . . [6978-11]

Wavelet-based image registration with JPEG2000 compressed imagery, Derrick S. Campbell, William D. Reynolds, Jr., ITT Corp. . . . . [6978-12]

A structure-based image similarity measure using homogeneity regions, Eric P. Lam, Thales Raytheon Systems. . . . . [6978-13]

Analysis of the general image quality equation, Samuel T. Thurman, James R. Fienup, Univ. of Rochester . . . . [6978-14]

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

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A secure workflow-based automated research manager for hyperspectral image processing, Jonathan K. Riek, Brian Wemett, VirtualScopics, Inc.; Robert A. Leathers, Trijntje V. Downes, Naval Research Lab.; Dale Keefer, Robert Weetman, Anthony Mazzola, VirtualScopics, Inc.. . . [6978-30]

Feasibility of a portable morphological scene change detection security system for use in various environments on a field programmable gate array, Andrew J. Tickle, Jeremy S. Smith, Q. H. Wu, The Univ. of Liverpool (United Kingdom). . . . . [6978-31]

Feasibility of a morphological forensic document recovery system for burnt documents using mobile phone camera and field programmable gate array technology, Andrew J. Tickle, The Univ. of Liverpool (United Kingdom); Jeremy S. Smith, The Univ. of Liverpool; Q. H. Wu, The Univ. of Liverpool (United Kingdom). . . . . [6978-32]

Next generation network based intermediate-view reconstruction using variable block matching algorithm, Kyung-Hoon Bae, Samsung Thales Co., Ltd. (South Korea); Dong-Choon Hwang, Eun-Soo Kim, Kwangwoon Univ. (South Korea) . . . . . [6978-33]

Optimization and application of retinex algorithm in aerial image processing, Jun He, Beijing Normal Univ. (China) . . . . . [6978-34]

Linear restoration methods for wavefront coded imaging system based on digital photo camera, Sergey N. Starikov, Mikhail V. Konnik, Edward A. Manykin, Vladislav G. Rodin, Moscow Engineering Physics Institute (Russia) . . . . [6978-35]

Linearization of RAW data from commercial photo cameras for optical-digital imaging systems, Sergey N. Starikov, Mikhail V. Konnik, Moscow Engineering Physics Institute (Russia) . . . . . [6978-36]

Anomalous behavior detection in crowded maritime port facilities, Mikel D. Rodriguez, Univ. of Central Florida . . . . . [6978-37]

Embedded system automated target recognition for force protection, Amber Fischer, Michael C. Simon, 21st Century Systems, Inc.. . . . . [6978-38]

Transferring color to single band infrared images based on orientation texture feature analysis, Yuan-Meng Zhao, Ling-Xue Wang, Wei-Qi Jin, Shi-Ming Shi, Beijing Institute of Technology (China) . . . . . [6978-39]

Statistical simulation of deformations using wavelet independent component analysis, Ahmed S. Elsafi, Rami Zewail, Nelson G. Durdle, Univ. of Alberta (Canada) [6978-40]

Wednesday 19 March

SESSION 4 . . . . . .Wed. 8:50 to 10:40 am

Compuational Imaging

Session Chair: **Mark Allen Neifeld,** The Univ. of Arizona

Recent developments in coded aperture multiplexed imaging systems *(Invited Paper)*, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control. . . . . [6978-15]

Scaling analysis of computational imaging systems *(Invited Paper)*, Ravindra A. Athale, Gary Euliss, The MITRE Corp.; Joseph Mait, Army Research Lab. . . . . [6978-16]

Adaptive spectroscopy: towards adaptive spectral imaging *(Invited Paper)*, Michael E. Gehm, Joseph Kinast, The Univ. of Arizona . . . . . [6978-17]

The application of a compressed sensing technique to a networked surveillance camera system, Jing Zheng, Eddie L. Jacobs, The Univ. of Memphis . . . . . [6978-18]

SESSION 5 . . . . . Wed. 11:10 am to 12:50 pm

Analysis and Algorithms

Session Chair: **Stephen E. Reichenbach,** Univ. of Nebraska/Lincoln

Direct object brightness estimation from atmospheric turbulence degraded images using a new high-speed, modified phase diversity method, William W. Arrasmith, Florida Institute of Technology . . . . . [6978-19]

Scene context dependency of pattern constancy of time series imagery, Glenn A. Woodell, Daniel Jobson, NASA Langley Research Ctr.; Zia-ur Rahman, Old Dominion Univ. . . . . [6978-20]

Building prediction models of large hierarchical simulation models with artificial neural networks, June F. D.Rodriguez, John O. Miller, Kenneth W. Bauer, Jr., Air Force Institute of Technology . . . . . [6978-21]

Adaptive methods of two-scale edge detection in post-enhancement visual pattern processing, Zia-ur Rahman, Old Dominion Univ.; Daniel J. Jobson, Glenn A. Woodell, NASA Langley Research Ctr. . . . . [6978-22]

Stereo correspondence with robust correlation measures in a hypothetical reasoning model, Jean Saad, Didier Guériot, Christophe Sintes, Basel Solaiman, Ecole Nationale Supérieure des Télécommunications Bretagne (France) . . . . . [6978-23]

Lunch/Exhibition Break . . . . . 12:50 to 1:50 pm

SESSION 6 . . . . . .Wed. 1:50 to 3:30 pm

Security and Surveillance

Session Chair: **Zia-ur Rahman,** Old Dominion Univ.

Detecting building facades in urban imagery, Philip David, Army Research Lab. . . . . [6978-24]

A grayscale skin and facial detection mechanism for use in conjunction with security system technology via graphical block methodologies on field programmable gate arrays, Andrew J. Tickle, Jeremy S. Smith, Q. H. Wu, The Univ. of Liverpool (United Kingdom) . . . . . [6978-25]

Adaptive skin pixel classification technique based on hybrid color spaces and skin textural information, Ramya Reddy Maaram, Satyanadh Gundimada, Vijayan K. Asari, Old Dominion Univ. . . . . [6978-26]

The A.C.E. surveillance, Dmitry O. Gorodnichy, National Research Council Canada (Canada) . . . . . [6978-27]

Intelligent preprocessing for fast-moving object detection, Chris Poppe, Sarah De Bruyne, Peter Lambert, Rik Van de Walle, Univ. Gent (Belgium). . . . . [6978-28]

SESSION 7 . . . . . .Wed. 4:00 to 4:30 pm

ATR

Overview of the ATR Center *(Invited Paper)*, D. Gregory Arnold, Air Force Research Lab.; Lawrence Carin, Duke Univ.; Randolph L. Moses, The Ohio State Univ.; Lori A. Westerkamp, Air Force Research Lab. . . . . [6978-29]

Related Courses

SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* Tuesday, 8:30 am to 12:30 pm

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Conference 6979

Monday-Tuesday 17-18 March 2008 • Proceedings of SPIE Vol. 6979

Independent Component Analyses, Wavelets, Unsupervised Nano-Biomimetic Sensors and Neural Networks VI

Conference Chairs: **Harold H. Szu,** Office of Naval Research; **F. Jack Agee,** Rice Univ.

Conference Co-Chair: **Fredric M. Ham,** Florida Institute of Technology

Program Committee: **Shun-ichi Amari,** The Institute of Physical and Chemical Research (RIKEN) (Japan); **C. Sidney Burrus,** Rice Univ.; **Chang Wen Chen,** Florida Institute of Technology; **Wen-Yan Danny Chung,** Chung Yuan Christian Univ. (Taiwan); **Andrzej S. Cichocki,** The Institute of Physical and Chemical Research (RIKEN) (Japan); **Ronald A. DeVore,** Univ. of South Carolina; **Qian Du,** Mississippi State Univ.; **Norden E. Huang,** NASA Goddard Space Flight Ctr.; **Phillip Q. Hwang,** National Imagery and Mapping Agency; **Joseph Landa,** BriarTek Inc.; **Soo-Young Lee,** Korea Advanced Institute of Science and Technology (South Korea); **Te-Won Lee,** Univ. of California/San Diego; **William Liou,** Western Michigan Univ.; **Kevin W. Lyons,** National Institute of Standards and Technology; **Shoji Makino,** Nippon Telegraph and Telephone Corp. (Japan); **Anke Meyer-Bäse,** Florida State Univ.; **Uwe Meyer-Bäse,** Florida State Univ.; **Francesco Carlo Morabito,** Univ. degli Studi di Reggio Calabria (Italy); **Erkki Oja,** Helsinki Univ. of Technology (Finland); **Dennis W. Prather,** Univ. of Delaware; **Hairong Qi,** The Univ. of Tennessee; **Mark J. T. Smith,** Purdue Univ.; **Wim Sweldens,** Lucent Technologies/Bell Labs.; **Mladen Victor Wickerhauser,** Washington Univ. in St. Louis; **Donald C. Wunsch,** Univ. of Missouri/Rolla; **Ning Xi,** Michigan State Univ.; **Takeshi Yamakawa,** Kyushu Institute of Technology (Japan); **Fred Yang,** Missioncare Hospital Group (Taiwan)

Monday 17 March

SESSION 1 . . . . . .Mon. 8:30 to 10:10 am

Sensors, Biometrics, and Security

Fixed analysis-adaptive synthesis filter banks, Clyde A. Lettsome, Georgia Institute of Technology; Mark J. T.Smith, Purdue Univ.; Russell M. Mersereau, Georgia Institute of Technology . . . . . [6979-01]

Texture-based iris recognition system, Phalguni Gupta, Hunny Mehrotra, Indian Institute of Technology Kanpur (India). . . . . [6979-02]

Facial expression recognition using 2D DCT of binarized edge images and constructive neural networks, Khashayar Khorasani, Concordia Univ. (Canada); Liying Ma, Tokyo Polytechnic Univ. (Japan) . . . . . [6979-03]

Sensor performance evaluation analysis of imitation fingerprint, Kyoung H. Yu, Hyun-Suk Lee, You-Suk Bae, Korea Polytechnic Univ. (South Korea) . . . . . [6979-04]

A novel scheme for non-cooperative long-range biometric recognition, Xiaokun Li, Genshe Chen, Intelligent Automation, Inc.; Erik Blasch, Air Force Research Lab.; Harold Szu, Office of Naval Research. . . . . [6979-05]

SESSION 2 . . . . . Mon. 10:40 am to 12:20 pm

Digital Programmable Logic

FPGA design of MOMS-based sampling rate converters, Uwe Meyer-Bäse, Florida State Univ. . . . . [6979-06]

DSP with FPGAs: a Xilinx/Simulink-based course and laboratory, Uwe Meyer-Bäse, Florida State Univ.; Alonzo Vera, Marios Pattichis, The Univ. of New Mexico; Anke Meyer-Baese, Reginald Perry, Florida State Univ. . . . . [6979-07]

Performance evaluation of a FPGA implementation of a digital rotation support vector machine *(Invited Paper)*, Horacio Lamela, Matías Jiménez, Jesús Gimeno, Marta Ruiz, Univ. Carlos III de Madrid (Spain) . . . . . [6979-08]

An analogue circuit for sequential minimal optimization for support vector machines *(Invited Paper)*, Matías Jiménez, Horacio Lamela, Jesús Gimeno, Marta Ruiz, Univ. Carlos III de Madrid (Spain). . . . . [6979-09]

Lunch Break . . . . . 12:20 to 1:40 pm

SESSION 3 . . . . . .Mon. 1:40 to 3:00 pm

Applications in Medicine

Robust stability analysis under considerations of uncertainties applied to the heat shock response in e. coli, Anke Meyer-Bäse, Florida State Univ. . . . . [6979-10]

West meets East: psychophysics studies for understanding mysterious Oriental health promoting practices, Hai-Wen Chen III, Science Applications International Corp.. . . . . [6979-11]

Biological networks reduced by nonlinear balanced truncation, Anke Meyer-Bäse, Florida State Univ.. . [6979-12]

Dependent component analysis applied to lesions' characterization in breast MRI, Anke Meyer-Bäse, Florida State Univ.. . . . . [6979-13]

SESSION 4 . . . . . .Mon. 3:30 to 4:20 pm

Nanoscience and Nanotechnology

Nanotechnology for aerospace: potential transitions from university research *(Invited Paper)*, Forrest J. Agee, Rice Univ. . . . . [6979-14]

Plasmon-enhanced terahertz near-field microscopy for nanometer-scale sensing, Daniel Mittleman, Victoria Astley, Hui Zhan, Feng Hao, Peter Nordlander, Forrest J. Agee, Rice Univ. . . . . [6979-15]

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 5 . . . . . Tues. 10:30 to 11:30 am

IP Protection of Electronics and Wireless Networks

HDL-level automated watermarking of IP cores, Encarnacion Castillo, Univ. de Granada (Spain); Uwe Meyer-Baese, Florida State Univ.; Luis Parrilla, Antonio García, Antonio Lloris, Univ. de Granada (Spain) . . . . . [6979-16]

Dynamic watermark technique based on neural network, Tao Gu, Li Xu, North China Institute of Science and Technology (China) . . . . . [6979-17]

Fuzzy neighborhood tracking filters for UWB range radios in multipath environments, Ka C. Cheok, Oakland Univ. and Jadi, Inc. . . . . [6979-18]

Lunch Break . . . . . 11:30 am to 12:30 pm

SESSION 6 . . . . . Tues. 12:30 to 1:10 pm

Neural Networks Applied

Associated neural network independent component analysis structure, Keehoon Kim, Andrew A. Kostrzewski, Physical Optics Corp. . . . . [6979-19]

Neural networks utilized to provide mortar classification, Sachi V. Desai, U.S. Army Research, Development and Engineering Command . . . . . [6979-20]

SESSION 7 . . . . . Tues. 1:10 to 2:50 pm

Imaging Applications

Using a genetic algorithm to find an optimized pulse coupled neural network solution, Richard P. Edmondson, Michael Rodgers, Michele Banish, Polaris Sensor Technologies, Inc. . . . . [6979-21]

Graph-theoretic segmentation of airborne lidar data, Lu Wang, Henry Chu, Univ. of Louisiana at Lafayette . . [6979-22]

Denoising of imagery using higher-order statistics, Samuel P. Kozaitis, Florida Institute of Technology; Timothy Young, Northrop Grumman Corp. . . . . [6979-23]

A canonical minimised Adder graph representation, Uwe Meyer-Bäse, Florida State Univ.; Oscar Gustafsson, Linköpings Univ. (Sweden); Andrew Dempster, Univ. of New South Wales (Australia) . . . . . [6979-24]

Advance image registration techniques and applications, Hai-Wen Chen, Dennis Braunreiter, Science Applications International Corp. . . . . [6979-25]

Related Courses

SC902 **Compressive Sensing: Theory and Applications** *(DeVore, Baraniuk)* Sunday, 1:30 to 5:30 pm

SC715 **Independent Component Analysis and Beyond: Blind Signal Processing and its Applications** *(Lee, Lee)* Wednesday, 8:30 am to 12:30 pm

See pp. 101–117 for course descriptions.

PROGRAM ON

Communications and Networking Technologies and Systems

Chair: **Raghuveer M. Rao,** Rochester Institute of Technology

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Technical Conferences

6980 **Wireless Sensing and Processing III** *(Dianat, Zoltowski)* p. 92

6982 **Mobile Multimedia/Image Processing, Security, and Applications 2008** *(Agaian, Jassim)* p. 94

6981 **Defense Transformation and Net-Centric Systems 2008** *(Suresh)* p. 93

Courses of Related Interest

SC197 **Fundamentals of Digital Signal/Image Processing** *(Dianat)* 8:30 am to 5:30 pm, p. 112

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* 8:30 am to 5:30 pm, p. 110

SC901 ***NEW*** **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, p. 111

SC891 ***NEW*** **Security of Information and Communication Networks** *(Kartalopoulos)* 1:30 to 5:30 pm, p. 110

Special Events

Technical Program Space Technologies and Operations Track Plenary Presentation: **Deep Space Flight of Hayabusa Asteroid Explorer** *(Kuninaka)*, 8:00 to 9:00 am, p. 5

Technical Program Display Track Plenary Presentation: **Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concernts** *(Kuninaka, Kawaguchi)*, 10:30 to 11:30 am, p. 5

HOT TOPICS:
Food Safety *(Kim, Chao)*, 8:00 am to 12:30 pm, p. 6
Visual Analytics for Homeland Defense and Security *(Tolone, Ribarsky)* 8:30 am to 2:20 pm, p. 6
Resource Restricted Embedded and Sensor Networks *(Balandin)* 1:30 to 5:30 pm, p. 7
Forensic Science: Emerging Needs (Fitzpatrick) 4:00 to 6:00 pm, p. 7

All Symposium Welcome Reception, 6:00 to 7:00 pm, p. 10

FREE Exhibition

10:00 am to 5:00 pm

Technical Program Space Technologies and Operations Track Plenary Presentation: **Protecting the Moon's Environment Display Content in Advanced NVG and HMD Systems: a Pilot/Flight Surgeon's Concerns** *(Maclure)*, 8:00 to 9:00 am, p. 5

Symposium-Wide Plenary Presentation, 9:15 to 10:00 am, p. 4

SPIE Works

11:00 am to 3:00 pm

HOT TOPIC:
3D Imaging and Display *(Javidi)* 1:00 to 4:30 pm, p. 7

Future Directions for CBRNE Sensors and Systems Development *(George/Gardner)* 5:00 to 7:00 pm, p. 9

Poster Session, 6:00 to 7:30 pm, p. 10

Industry Workshop: **Intellectual Property Issues in the Defense and Security Industries** *(Gortych/StanleyKauget/Pellenbarg)*, 8:30 am to 12:30 pm, p. 9

Industry Workshop: **Playing the SBIR Game to Win** *(Patterson)*, 1:30 to 5:30 pm, p. 9

10:00 am to 5:00 pm

Technical Program Tactical Sensors and Imagers Track Plenary Presentation: **Radar Horizons** *(Guerci)*, 11:00 to 11:45 am, p. 5

Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 4

Innovation and the Wealth of Nations *(Appleby/Chisholm)* 5:00 to 6:00 pm, p. 9

Career Fair

11:00 am to 3:00 pm

10:00 am to 2:00 pm

Industry Workshop: **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)*, 8:30 am to 12:30 pm, p. 9

Wireless Sensing and Processing III

Conference Chairs: **Sohail A. Dianat,** Rochester Institute of Technology; **Michael David Zoltowski,** Purdue Univ.

Program Committee: **Moeness G. Amin,** Villanova Univ.; **Sirisha R. Medidi,** Washington State Univ.; **John W. Nieto,** Harris Corp.; **Raghuveer M. Rao,** Rochester Institute of Technology; **Pramod Kumar Varshney,** Syracuse Univ.

Monday 17 March

SESSION 1 . . . . . .Mon. 8:30 to 10:10 am

Diversity and Multicarrier Techniques

Session Chair: **Fred C. Kellerman,** Harris Corp.

An investigation of constant-envelope variations of OFDM and OFDM-CDMA waveforms on HF multipath/fading channels, John W. Nieto, Harris Corp.. . . . . [6980-01]

Reduced dimension equalizer and interference canceller for MIMO-OFDM, Michael D. Zoltowski, Chad Lau, Purdue Univ. . . . . [6980-02]

Carrier diversity via code-spreaded OFDM, Michael D. Zoltowski, Muthanna Al-Mahmoud, Purdue Univ. . . [6980-03]

Waveform diversity for wireless sensing, Michael D. Zoltowski, Purdue Univ. . . . . [6980-04]

OFDM LDPC performance comparison on an HF multipath fading channel, Fred C. Kellerman, Harris Corp.. . . [6980-05]

SESSION 2 . . . . . .Mon. 10:40 to 11:40 am

Radio Frequency and Identification (RFID)

Session Chair: **Moeness G. Amin,** Villanova Univ.

An RF tag communications system model for noise radar, Qihe Pan, Ram M. Narayanan, The Pennsylvania State Univ. . . . . [6980-06]

Smart radio: spectrum access for first responders, Mark D. Silvius, Feng Ge, Alex Young, Allen B. MacKenzie, Charles W. Bostian, Virginia Polytechnic Institute and State Univ. . . . . [6980-07]

Nonuniform pulse quantization for multiplication-free correlation in ultrawideband receivers, Khalil Naghdali, Serkan Dursun, David Akopian, The Univ. of Texas at San Antonio . . . . . [6980-08]

SESSION 3 . . . . . Mon. 11:40 am to 12:20 pm

Implementation and Application

Session Chair: **Raghuveer M. Rao,** Rochester Institute of Technology

An unattended ground sensor architecture for persistent border surveillance, Robert A. Johnson, Harris Corp.; Gervasio Prado, SenTech Inc.. . . . . [6980-09]

Wireless bio-telemetry link with implantable LC sensor, Jayanti Venkataraman, Marie Yvanoff, Rochester Institute of Technology . . . . . [6980-10]

Lunch Break . . . . . 12:20 to 1:50 pm

SESSION 4 . . . . . .Mon. 1:50 to 3:30 pm

Sensor Networks

Session Chair: **John W. Nieto,** Harris Corp.

Distributed event region detection in wireless sensor networks, Jun Fang, Hongbin Li, Stevens Institute of Technology; Shafik A. Quoraishee, Myron E. Hohil, U.S. Army Armament Research, Development and Engineering Ctr.. . . . . [6980-11]

A lightweight key distribution for wireless sensor networks, Sirisha R. Medidi, Lynsey Compton-Drake, Muralidhar Medidi, Washington State Univ. . . . . [6980-12]

Predicting sybil attack in wireless sensor network using swarm-based reasoning algorithm, Rajani S. Muraleedharan-Sreekumaridevi, Syracuse Univ. . . . [6980-13]

Application of wireless sensor network for group personel localization in large scale public site, Chihhsiong Shih, Tunghai Univ. (Taiwan) . . . . . [6980-14]

Remote monitoring of soldier safety through body posture identification using wearable sensor networks, Subir Biswas, Muhannad Quwaider, Michigan State Univ. [6980-15]

SESSION 5 . . . . . .Mon. 4:00 to 5:00 pm

Wireless Networks

Session Chair: **Sohail A. Dianat,** Rochester Institute of Technology

Asynchronous ad hoc network discovery for low-power systems, Todd Joslin, Harris Corp. . . . . [6980-16]

Multibeam antenna scheduling in ad hoc wireless networks, Xin Li, Yimin Zhang, Moeness G. Amin, Villanova Univ. . . . . [6980-17]

Miniature, ruggedized wireless mesh network radio for UGS applications, Wade Calcutt, Barry Jones, McQ, Inc.. . . . . [6980-18]

Tuesday 18 March

SESSION 6 . . . . . Tues. 8:50 to 10:30 am

Localization and Multipath

Session Chair: **Michael David Zoltowski,** Purdue Univ.

Uplink transmit beamforming design for SINR maximization with full multiuser channel state information, Songnan Xi, Michael D. Zoltowski, Purdue Univ. . . . . [6980-19]

A direction finding algorithm for MIMO radar system with transmitting diversity, Wei-Jen Chen, Ram M. Narayanan, The Pennsylvania State Univ. . . . . [6980-20]

Realization and capacity analysis of cooperative communications based on multiplexing, Yao Zhao, Western Michigan Univ. . . . . [6980-21]

Near-field MVDR source localization, Joseph Handfield, Raghuveer M. Rao, Sohail A. Dianat, Rochester Institute of Technology . . . . . [6980-22]

An iterative maximum-likelihood-based parameter estimation algorithm for nakagami-m distribution, Sohail A. Dianat, Raghuveer M. Rao, Rochester Institute of Technology . . . . . [6980-23]

Related Courses

SC197 **Fundamentals of Digital Signal/Image Processing** *(Dianat)* Sunday, 8:30 am to 5:30 pm

SC901 **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm
NEW

See pp. 101–117 for course descriptions.

Tuesday-Thursday 18-20 March 2008 • Proceedings of SPIE Vol. 6981

Defense Transformation and Net-Centric Systems 2008

Conference Chair: **Raja Suresh,** General Dynamics Advanced Information Systems

Program Committee: **Michael James DeWeert,** BAE Systems; **John S. Eicke,** Army Research Lab.; **Paul S. Gaertner,** Defence Science and Technology Organisation (Australia); **John W. Gowens,** Army Research Lab.; **Gayle D. Grant,** U.S. Army Communications-Electronics Command; **Robert G. Hillman,** Air Force Research Lab.; **Michael A. Kolodny,** Army Research Lab.; **Chung-Hye Read,** National Geospatial-Intelligence Agency; **Brian M. Sadler,** Army Research Lab.; **Larry B. Stotts,** Defense Advanced Research Projects Agency; **Venkataraman Sundareswaran,** Teledyne Scientific Co.; **George Vachtsevanos,** Georgia Institute of Technology; **Guy Vézina,** Defence R&D Canada/Valcartier (Canada)

Tuesday 18 March

Symposium-Wide Plenary Presentation

Tues. 9:15 to 10:00 am

The Honorable Jay Cohen,
Under Secretary for Science and Technology, U.S. Dept. of Homeland Security

See p. 4 for details.

SESSION 1 . . . . . Tues. 10:30 to 11:50 am

Sensor Networks

Session Chair: **Raja Suresh,** General Dynamics Advanced Information Systems

Exposing and manipulating human networks *(Invited Paper)*, Martin Kruger, Office of Naval Research . . . [6981-01]

Focused long term challenges *(Invited Paper)*, Leo J. Rose, U.S. Air Force . . . . . [6981-02]

Probabilistic framework for characterizing uncertainty in the performance of networked battlefield sensors, D. Keith Wilson, U.S. Army Engineer Research and Development Ctr.; Chris L. Pettit, U.S. Naval Academy; Sean Mackay, Atmospheric and Environment Research, Inc.; Peter M. Seman, U.S. Army Engineer Research and Development Ctr.. . . . . [6981-03]

Lunch Break . . . . . 11:50 am to 1:20 pm

SESSION 2 . . . . . Tues. 1:20 to 3:40 pm

ARL International Technology Alliance

Session Chairs: **Tien Pham,** Army Research Lab.; **John S. Eicke,** Army Research Lab.

The challenge of sensor information processing and delivery within network and information science research, Gavin Pearson, Defence Science and Technology Lab. (United Kingdom); Tien Pham, Army Research Lab.. [6981-04]

A biologically inspired MANET architecture, Aaron Kershenbaum, Vasileios Pappas, Kang-Won Lee, IBM Thomas J. Watson Research Ctr.; Pietro Lio, Univ. of Cambridge (United Kingdom); Brian M. Sadler, Army Research Lab.; Dinesh C. Verma, IBM Thomas J. Watson Research Ctr. . . . . [6981-05]

On the resilience of wireless sensor network with circulatory graphs, Vasileios Pappas, Dinesh C. Verma, IBM Thomas J. Watson Research Ctr.; Ananthram Swami, Army Research Lab.. . . . . [6981-06]

Policy enabled interconnection of sensor networks, Dinesh C. Verma, IBM Thomas J. Watson Research Ctr.; Greg Cirincione, Army Research Lab. . . . . [6981-07]

Matching sensors to missions using a knowledge-based approach, Alun Preece, Univ. of Aberdeen (United Kingdom) and Cardiff Univ. (United Kingdom); Mario Gomez, Geeth de Mel, Wamberto W. Vasconcelos, Derek Sleeman, Univ. of Aberdeen (United Kingdom); Stuart R. Colley, Gavin Pearson, Defence Science and Technology Lab. (United Kingdom); Thomas La Porta, The Pennsylvania State Univ. . . . [6981-08]

Providing rapid adaptation for dynamic missions in mobile, wireless sensor environments, Sharanya Eswaran, The Pennsylvania State Univ.; Archan Misra, IBM Thomas J. Watson Research Ctr.; Thomas F. La Porta, The Pennsylvania State Univ.; Kin Leung, Imperial College London (United Kingdom) . . . . . [6981-09]

Location dependent heuristics for sensor coverage planning, Dinesh C. Verma, IBM Thomas J. Watson Research Ctr.; Mark S. Nixon, Univ. of Southampton (United Kingdom); Theodore Brown, The Graduate Ctr./CUNY . . . . . [6981-10]

Wednesday 19 March

SESSION 3 . . . . . Wed. 8:00 to 10:10 am

Self-organizing, Collaborative Unmanned ISR Robotic Teams I

Session Chairs: **George Vachtsevanos,** Georgia Institute of Technology; **Venkataraman Sundareswaran,** Teledyne Scientific Co.

Joint Session with Conference 6962

Sensors as robots *(Invited Paper)*, Michael C. Wicks, Air Force Research Lab.. . . . . [6981-11]

Bringing UAVs to the fight: recent army autonomy research and a vision for the future *(Invited Paper)*, Jayashree Moorthy, Keith Arthur, Raymond Higgins, U.S. Army Aviation Applied Technology Directorate. . . . . [6981-12]

Tactical service-oriented architecture *(Invited Paper)*, Brent Rickenbach, General Dynamics Advanced Information Systems. . . . . [6981-13]

Fault tolerant and lifetime control architecture for autonomous vehicles, Alexander Bogdanov, Yi-Liang Chen, Venkataraman Sundareswaran, Thomas Altshuler, Teledyne Scientific Co.. . . . . [6981-14]

Global image registration using shape space tracking, Liangyin Yu, Jose Molineros, Venkataraman Sundareswaran, Teledyne Scientific Co. . . . . [6981-15]

SESSION 6 . . . . . Wed. 10:40 am to 12:10 pm

Special Topics Session I

Session Chairs: **Scott Fish,** The Univ. of Texas at Austin; **Douglas W. Gage,** XPM Technologies

Joint Session with Conference 6962

Perspectives on the DARPA Urban Challenge *(Invited Paper)*, Douglas W. Gage, XPM Technologies . . . . . [6962-31]

FCS-UGV safe operations, Scott Fish, The Univ. of Texas at Austin; Joshua Ruedin, Science Applications International Corp.; Michael R. Perschbacher, RovnoTech; John E. Bares, Carnegie Mellon Univ.. . . . . [6962-32]

Near-Nash targeting strategies for heterogeneous teams of unmanned combat air vehicles, David G. Galati, Carnegie Mellon Univ.; Marwan A. Simaan, Univ. of Pittsburgh[6962-33]

Adaptive collaborative control of highly redundant robots, David A. Handelman, American Android Corp.. . . . . [6962-34]

Lunch/Exhibition Break . . . . . 12:10 to 1:30 pm

SESSION 7 . . . . . Wed. 1:30 to 2:50 pm

Special Topics Session II

Session Chairs: **Scott Fish,** The Univ. of Texas at Austin; **Douglas W. Gage,** XPM Technologies

Joint Session with Conference 6962

Skid steer fuel cell-powered unmanned ground vehicle (Burro), Jay S. Meldrum, Michigan Technological Univ. . . . . [6962-35]

Hands-free device control using sound picked up in the ear canal, Siddharth Chhatpar, Lester Ngia, Chris Vlach, Dong Lin, Craig Birkhimer, Amit Juneja, Tarun Pruthi, Think-A-Move, Ltd. . . . . [6962-36]

Argumentation-based negotiation for automated sensor tasking, Daniel Gutchess, Christopher Mow, Magnús Snorrason, Stephen Ho, Charles River Analytics, Inc.. . . . . [6962-37]

Low-cost robotic arm control, John R. Rogers, United States Military Academy . . . . . [6962-38]

SESSION 8 . . . . . Wed. 3:20 to 5:40 pm

Self-organizing, Collaborative Unmanned ISR Robotic Teams II

Session Chairs: **Nahid N. Sidki,** Science Applications International Corp.; **Venkataraman Sundareswaran,** Teledyne Scientific Co.; **George Vachtsevanos,** Georgia Institute of Technology

Joint Session with Conference 6962

Sagittarius: UAV/UGV cooperation for shared situational awareness in urban environments, Brian M. Yamauchi, iRobot Corp.; Christopher Geyer, Carnegie Mellon Univ. . . . . [6962-44]

Coordination of UAVs with resource constraints using market-based approach, Bandi B. K.Reddy, Abdollah M. Homaifar, Albert C. Esterlin, Eisa M. Osman, North Carolina A&T State Univ.. . . . . [6962-39]

Multi-objective optimization to support mission planning for constellations of unmanned aerial systems, Daniel W. Stouch, Sofya Tenenbaum, Ted Fichtl, Charles River Analytics, Inc. . . . . [6962-40]

UAV-UGV collaboration with a PackBot UGV and Raven SUAV for pursuit and tracking of a dynamic target, Carol Cheung, iRobot Corp.; Ben Grocholsky, Carnegie Mellon Univ. . . . . [6962-41]

A novel real-time impact monitoring dystem for unmanned vehicles, David C. Zhang, Peter Qing, Shawn J. Beard, Amrita Kumar, Irene Li, Acellent Technologies, Inc.; Fukuo Chang, Stanford Univ.. . . . . [6962-42]

Autonomous and intelligent diagnosis, prognosis and health management of a team of unmanned systems, Khashayar Khorasani, Concordia Univ. (Canada); Liying Ma, Tokyo Polytechnic Univ. (Japan). . . . . [6962-43]

Modeling and simulation of reliability of unmanned intelligent vehicles, Harpreet Singh, Arati M. Dixit, Wayne State Univ.. . . . . [6962-45]

Thursday 20 March

SESSION 4 . . . . . Thurs. 8:30 to 10:40 am

Persistent Surveillance Systems

Session Chair: **Larry B. Stotts,** Defense Advanced Research Projects Agency

Autonomous real-time ground ubiquitous surveillance: imaging system (ARGUS-IS) *(Invited Paper)*, Brian S. Leininger, Defense Advanced Research Projects Agency . . . . . [6981-16]

Track-based video compression, Mark J. Carlotto, General Dynamics Corp.. . . . . [6981-17]

Multisensor staring exploitation *(Invited Paper)*, Michael L. Bryant, Air Force Research Lab. . . . . [6981-18]

EO system technology for tactical applications *(Invited Paper)*, Deepak Varshneya, Defense Advanced Research Projects Agency . . . . . [6981-19]

Analysis of tower locations for the secure border initiative network, Keith W. Brendley, Artis LLC. . . . . [6981-20]

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SESSION 5 . . . . . Thurs. 11:10 am to 12:20 pm

Networks and Net-centric Systems I

Session Chairs: **Gayle D. Grant,** U.S. Army Communications-Electronics Command; **Paul S. Gaertner,** Defence Science and Technology Organisation

Routing protocols and management for high-capacity networks *(Invited Paper)*, Tim Gibson, Defense Advanced Research Projects Agency . . . . . [6981-21]

Characterization framework and design patterns for the tactical edge disadvantaged user, Fatma Dandashi, The MITRE Corp. . . . . [6981-22]

Embedded instrumentation systems architecture: supporting system of systems concept, Nikita A. Visnevski, Khaled Bahei-Eldin, GE Global Research . . . . . [6981-23]

Lunch Break . . . . . 12:20 to 1:50 pm

SESSION 6 . . . . . Thurs. 1:50 to 2:50 pm

Networks and Net-centric Systems II

Development of IPv6 based distributed NCW management software architecture, Michael X. Zhao, Leo H. Li, Etonnet, Inc.; Thomas T. Lu, Jet Propulsion Lab. . . . . [6981-24]

Predictive ad hoc routing for tactical information management systems, Marco M. Carvalho, Institute for Human and Machine Cognition; Robert Winkler, Army Research Lab.; Carlos Perez, Institute for Human and Machine Cognition; Jesse Kovach, Steven Choy, Army Research Lab. . . . . [6981-25]

Extended range 10 Gbps free space optical communications experiment, David W. Young, Joseph E. Sluz, Juan C. Juarez, Marc B. Airola, Raymond M. Sova, Harry Hurt III, The Johns Hopkins Univ. Applied Physics Lab.; Malcolm J. Northcott, John Phillips, Andy McClaren, Don Driver, J. Elon Graves, David D. Abelson, AOptix Technologies, Inc.; James J. Foshee, Air Force Research Lab. . . . . [6981-26]

SESSION 7 . . . . . Thurs. 3:20 to 4:40 pm

C2 Systems

Session Chair: **Guy Vézina,** Defence R&D Canada/Valcartier (Canada)

Collaborative agents for C2 of tactical urban combat operations, Gabriel Jakobson, Altusys Corp.; John Buford, Avaya Inc.; Lundy Lewis, Southern New Hampshire Univ. . . . . [6981-27]

Building net-centric systems for the tactical environment, Mel R. Crocker, Mark Adcock, General Dynamics Canada Ltd. (Canada) . . . . . [6981-28]

Semantic technology for rapid integration and event aggregation across heterogeneous information sources, Suzette Kruger Stoutenburg, Leo Obrst, The MITRE Corp. . . . . [6981-29]

Distributed technology for global dominance, Peter S. Sapaty, National Academy of Sciences of Ukraine (Ukraine) . . . . . [6981-30]

Related Courses

SC891 **Security of Information and Communication** *NEW* **Networks** *(Kartalopoulos)* Sunday, 1:30 to 5:30 pm

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* Monday, 8:30 am to 5:30 pm

See pp. 101–117 for course descriptions.

Conference 6982

Wednesday-Thursday 19-20 March 2008 • Proceedings of SPIE Vol. 6982

Mobile Multimedia/Image Processing, Security, and Applications 2008

Conference Chairs: **Sos S. Agaian,** The Univ. of Texas at San Antonio; **Sabah A. Jassim,** Univ. of Buckingham (United Kingdom)

Program Committee: **Salim Alsharif,** Univ. of South Alabama; **David Akopian,** The Univ. of Texas at San Antonio; **Patrick D. Baier,** The George Washington Univ.; **Cesar Bandera,** BanDeMar Networks; **Chang Wen Chen,** Florida Institute of Technology; **Reiner Creutzburg,** Fachhochschule Brandenburg (Germany); **Martin Dietze,** 4G Systeme GmbH (Germany); **Yingzi Du,** Indiana Univ.-Purdue Univ. Indianapolis; **Frederic Dufaux,** École Polytechnique Fédérale de Lausanne (Switzerland); **Touradj Ebrahimi,** École Polytechnique Fédérale de Lausanne (Switzerland); **Erlan H. Feria,** College of Staten Island/CUNY; **Phalguni Gupta,** Indian Institute of Technology Kanpur (India); **Jacques Koreman,** Norwegian Univ. of Science and Technology (Germany); **Yo-Ping Huang,** Tatung Univ. (Taiwan); **Maryline Maknavicius,** Institut National des Télécommunications (France); **Alessandro Neri,** Univ. degli Studi di Roma Tre (Italy); **Gilbert L. Peterson,** Air Force Institute of Technology; **Salil Prabhakar,** Digital Persona Inc.; **Sonia Salicetti,** GET/INT (France); **Xiyu Shi,** Univ. of Surrey (United Kingdom); **Yuri Shukuryan,** National Academy of Sciences of Armenia (Armenia); **Gregory B. White,** The Univ. of Texas at San Antonio; **Prem Kumar Kalra,** Indian Institute of Technology Kanpur (India)

Tuesday 18 March

POSTERS-Tuesday . . . . . Tues. 6:00 to 7:30 pm

All symposium attendees are invited to attend the poster session as an opportunity to enjoy refreshments while reviewing poster papers and networking with colleagues in your field. Attendees are encouraged to review the high-quality papers that are presented in this alternate format and to interact with the poster authors. Attendees are required to wear their conference registration badges to the poster sessions.

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

A novel digital watermarking system based on web services, Zude Zhou, Qingsong Ai, Quan Liu, Wuhan Univ. of Technology (China); Shengquan Xie, The Univ. of Auckland (New Zealand) . . . . . [6982-30]

Restoration of images damaged by semi-transparent water blotches using localized image enhancement, Aaron B. Greenblatt, Karen Panetta, Tufts Univ.; Sos S. Agaian, The Univ. of Texas at San Antonio . . . . . [6982-31]

Techniques for detection and classification of edges in color images, Karen Panetta, Sadaf Qazi, Tufts Univ.; Sos Agaian, The Univ. of Texas at San Antonio . . . . . [6982-32]

Logical wavelets-based secured multimedia systems, Ravindrnath C. Cherukuri, Sos S. Agaian, The Univ. of Texas at San Antonio . . . . . [6982-33]

Preventive security information systems based on massive user data collection, David Akopian, Philip Chen, Susheel Miryakar, The Univ. of Texas at San Antonio[6982-34]

Projection image segmentation for luggage explosive detection systems utilizing computed tomography, Yesna O. Yildiz, Douglas Q. Abraham, Analogic Corp.; Sos Agaian, The Univ. of Texas at San Antonio . . . . . [6982-35]

Latency-information theory and applications: part I, Erlan H. Feria, City Univ. of New York . . . . . [6982-36]

Latency-information theory and applications: part II, Erlan H. Feria, City Univ. of New York . . . . . [6982-37]

Latency-information theory and applications: part III, Erlan H. Feria, City Univ. of New York . . . . . [6982-38]

Wednesday 19 March

SESSION 1 . . . . . .Wed. 8:30 to 10:00 am

Wireless Networking I

Session Chair: **Sabah A. Jassim,** Univ. of Buckingham (United Kingdom)

Overview of JPEG 2000 extensions for security and wireless applications *(Invited Paper)*, Touradj Ebrahimi, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [6982-01]

Private synchronization technique for heterogeneous wireless network (WiFi and WiMAX), Ali Al-Sherbaz, Chris Adams, Sabah Jassim, Univ. of Buckingham (United Kingdom) . . . . . [6982-02]

Credibility based secure route finding in wireless ad hoc networks, Fanzhi Li, Ali Al-Sherbaz, Sabah Jassim, Chris Adams, Univ. of Buckingham (United Kingdom). . . . [6982-03]

Intrusion detection using wireless positioning technologies, David Akopian, Philip Chen, Maheedhar Gunturu, The Univ. of Texas at San Antonio . . . . . [6982-04]

SESSION 2 . . . . . Wed. 10:30 am to 12:00 pm

Wireless Networking II

Session Chairs: **Yo-Ping Huang,** Tatung Univ. (Taiwan); **Chang Wen Chen,** Florida Institute of Technology

Novel armoured plated networking with intelligent high-speed wireless ad-hoc capability *(Invited Paper)*, Garik Markarian, Lancaster Univ. (United Kingdom). . . . . [6982-05]

Integrating RFID technique to design mobile handheld inventory management system, Yo-Ping Huang, Wei Yen, Shih-Chung Chen, Tatung Univ. (Taiwan) . . . . . [6982-06]

IDMA: improving the defense against malicious attack for ad hoc networks based on ARIP, Chaorong Peng, Chang Wen Chen, Florida Institute of Technology . . . . . [6982-07]

Performance study of MPLS and DS techniques to improve QoS routing for critical applications on IP networks, Salim Alsharif, Univ. of South Alabama. . [6982-08]

Lunch/Exhibition Break . . . . . 12:00 to 1:00 pm

SESSION 3 . . . . . .Wed. 1:00 to 3:30 pm

Data Hiding and Watermarking

Session Chairs: **Marco Carli,** Univ. degli Studi di Roma Tre (Italy); **Alessandro Neri,** Univ. degli Studi di Roma Tre (Italy)

Q-filter structures with application *(Invited Paper)*, Magdi A. Mohamed, Motorola, Inc.. . . . . [6982-09]

Reversible data hiding by exploiting DCT structure information in JPEG images, Hong Cai, Sos Agaian, The Univ. of Texas at San Antonio. . . . . [6982-10]

Fractal steganography using artificially generated images, Sos S. Agaian, Johanna M. Susmilch, Ravindrnath C. Cherukuri, The Univ. of Texas at San Antonio . . . . . [6982-11]

A spatial data hiding scheme based on generalized Fibonacci sequence, Elena Mammi, Federica Battisti, Marco Carli, Alessandro Neri, Univ. degli Studi di Roma Tre (Italy); Karen Egiazarian, Tampereen Teknillinen Yliopisto (Finland). . . . . [6982-12]

Sum-SINR/sum-capacity optimal multisignature spread-spectrum steganography, Lili Wei, Dimitris A. Pados, Stella N. Batalama, Univ. at Buffalo; Michael J. Medley, Air Force Research Lab. . . . . [6982-13]

Secure and robust digital watermarking algorithms in parametric slant transform domain, Jiong Xie, Tufts Univ.; Sos Agaian, The Univ. of Texas at San Antonio; Joseph P. Noonan, Tufts Univ.. . . . . [6982-14]

MPEG 4 AVC domain watermarking transparency, Sorin A. Duta, Mihai Mitrea, Françoise Prêteux, Maher Belhaj Abdallah, Institut National des Télécommunications (France) . [6982-15]

SESSION 4 . . . . . .Wed. 4:00 to 5:40 pm

Security & Integrity of Multimedia Objects

Session Chair: **Prem Kumar Kalra,** Indian Institute of Technology Kanpur (India)

Alpha rooting for scalable encryption, Eric J. Wharton, Karen Panetta, Tufts Univ.; Sos Agaian, The Univ. of Texas at San Antonio. . . . . [6982-16]

P-recursive sequence and multimedia scrambling, Yicong Zhou, Karen Panetta, Tufts Univ.; Sos Agaian, The Univ. of Texas at San Antonio . . . . . [6982-17]

Attacks to context triggered piecewise hashing and countermeasures, Long Chen, Guoyin Wang, Institute of Computer Science and Technology (China) and SouthWest JiaoTong Univ. (China) . . . . . [6982-18]

On finite state machine reasoning for digital forensics, Long Chen, Guoyin Wang, SouthWest JiaoTong Univ. (China) and Chongqing Univ. of Posts and Telecommunications (China) . . . . . [6982-19]

Perception measures for digital restoration of semi-transparent blotches, Vittoria Bruni, Andrew J. Crawford, Istituto per le Applicazioni del Calcolo (Italy); Anil C. Kokaram, The Univ. of Dublin, Trinity College (Ireland); Domenico Vitulano, Istituto per le Applicazioni del Calcolo (Italy) . . . . . [6982-20]

Thursday 20 March

SESSION 5 . . . . . Thurs. 8:50 to 10:10 am

Identification and Feature Detection I

Session Chair: **Yingzi Du,** Indiana Univ.-Purdue Univ. Indianapolis

Can we ID from CCTV? Image quality in digital CCTV and face identification performance, Hina Keval, M. Angela Sasse, Univ. College London (United Kingdom) . . . . [6982-21]

Fingeprint separation: an application of independent component analysis, Meenakshi Singh, Deepak K. Singh, Prem K. Kalra, Indian Institute of Technology Kanpur (India). . . . . [6982-22]

A special purpose knowledge-based face localization method, Ahmad B. Hassanat, Sabah Jassim, Univ. of Buckingham (United Kingdom) . . . . . [6982-23]

Face recognition using facial expression: a novel approach, Deepak K. Singh, Indian Institute of Technology Kanpur (India); Priya Gupta, Capgemini India (India); Uma Shanker Tiwari, Indian Institute of Information Technology (India). . . . . [6982-24]

SESSION 6 . . . . . Thurs. 10:40 am to 12:20 pm

Identification and Feature Detection II

Session Chairs: **Alessandro Neri,** Univ. degli Studi di Roma Tre (Italy); **Patrizio Campisi,** Univ. degli Studi di Roma Tre (Italy)

Contrast invariant quality measure for iris recognition, Craig S. Belcher, Yingzi Du, Indiana Univ.-Purdue Univ. Indianapolis . . . . . [6982-25]

Video-based iris image processing, Yingzi Du, Zhi Zhou, Indiana Univ.-Purdue Univ. Indianapolis . . . . . [6982-26]

Multilevel approach for iris recognition, Yingzi Du, Emrah Arslanturk, Indiana Univ.-Purdue Univ. Indianapolis. [6982-27]

On-line signature authentication: user adaptive template protection and renewability, Emanuele Maiorana, Patrizio Campisi, Alessandro Neri, Univ. degli Studi di Roma Tre (Italy) . . . . . [6982-28]

Classifier dependent feature preprocessing methods, Benjamin M. Rodriguez II, Gilbert L. Peterson, Air Force Institute of Technology . . . . . [6982-29]

KNOWLEDGE — NETWORKING — ADVANCEMENT

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Technologies for Homeland Security and Law Enforcement

SC891 ***NEW*** **Security of Information and Communication Networks** *(Kartalopoulos)* 1:30 to 5:30 pm, $265 / $315, p. 110

SC719 FC **Chemical & Biological Detection: Overview of2 Point and Standoff Sensing Technologies** *(Gardner)* 1:30 to 5:30 pm, $265 / $315, p. 101

SC836 **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, $315 / $365, p. 104

IR Sensors and Systems Engineering

SC134 **Optical Design Fundamentals for Infrared Systems** *(Kampe)* 8:30 am to 5:30 pm, $505 / $605, p. 102

SC835 **Infrared Systems - Technology & Design** *(Daniels)* 8:30 am to 5:30 pm / 8:30 am to 12:30 pm, $955 / $1095, p. 103

SC900 ***NEW*** **Uncooled Thermal Imaging Detectors and Systems** *(Hanson)* 8:30 am to 5:30 pm, $505 / $605, p. 101

SC178 FC **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $390 / $490, p. 114

SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* 8:30 am to 12:30 pm, $265 / $315, p. 102

SC796 **Allowable Stresses in Glass and Engineering Ceramics** *(Pepi)* 8:30 am to 12:30 pm, $265 / $315, p. 115

SC789 FC **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $470 / $570, p. 106

SC896 ***NEW*** **Optical Testing of Focal Plane Array Imagers- Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* 8:30 am to 5:30 pm, $470 / $570, p. 104

SC710 **NIR and SWIR Imaging Applications** *(Richards)* 8:30 am to 12:30 pm, $305 / $355, p. 104

SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* 8:30 am to 5:30 pm, $485 / $585, p. 103

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, $265 / $315, p. 105

SC278 **Infrared Detectors** *(Dereniak)* 1:30 to 5:30 pm, $345 / $395, p. 102

SC892 ***NEW*** **Infrared Search and Track Systems** *(Schwering)* 1:30 to 5:30 pm, $265 / $315, p. 102

SC836 FC **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, $315 / $365, p. 104

Thermosense

SC836 FC **Using IR Thermographic Instruments - A Primer for Thermographers** *(Kaplan)* 1:30 to 5:30 pm, $315 / $365, p. 104

SC710 **NIR and SWIR Imaging Applications** *(Richards)* 8:30 am to 12:30 pm, $305 / $355, p. 104

Key:

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Daily Course Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Tactical Sensors and Imagers

SC713 FC **Engineering Approach to Imaging System Design** *(Holst)* 8:30 am to 5:30 pm, $525 / $625, p. 106

SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $265 / $315, p. 106

SC178 FC **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $390 / $490, p. 114

SC157 **MTF in Optical and Electro-Optical Systems** *(Ducharme)* 8:30 am to 5:30 pm, $505 / $605, p. 105

SC896 ***NEW*** **Optical Testing of Focal Plane Array Imagers-Quick Performance Testing in the UV, Visible, and Near IR Ranges** *(Gazerro)* 8:30 am to 5:30 pm, $470 / $570, p. 104

SC067 **Testing and Evaluation of E-O Imaging Systems** *(Holst)* 8:30 am to 5:30 pm, $535 / $635, p. 104

SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 1:30 to 5:30 pm, $265 / $315, p. 105

SC901 ***NEW*** **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $470 / $570, p. 111

SC154 **Electro-Optical Imaging System Performance** *(Holst)* 8:30 am to 5:30 pm, $540 / $640, p. 105

SC789 FC **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $470 / $570, p. 106

Laser Sensors and Systems

SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* 8:30 am to 12:30 pm, $265 / $315, p. 107

SC784 **Fiber Lasers for Defense Applications: Fibers, Components and System Design Considerations** *(Samson, Torruellas)* 8:30 am to 5:30 pm, $470 / $570, p. 107

SC167 FC **Introduction to Laser Radar** *(Kamerman)* 1:30 to 5:30 pm, $265 / $315, p. 107

SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, $470 / $570, p. 107

Intelligent and Unmanned Systems

SC894 ***NEW*** **Introduction to INS and INS-Based Integrated Navigation** *(Soloviev)* 8:30 am to 5:30 pm, $470 / $570, p. 108

SC549 **Incorporating GPS Technology into Commercial and Military Applications** *(Uijt de Haag)* 8:30 am to 12:30 pm, $265 / $315, p. 108

SC898 ***NEW*** **Path Planning for Autonomous Vehicles** *(Flann)* 8:30 am to 12:30 pm, $265 / $315, p. 108

Displays

SC159 **Head-Mounted Displays: Design and Applications, Including Night Vision** *(Melzer, Browne)* 8:30 am to 5:30 pm, $470 / $570, p. 108

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Modeling and Simulation

SC783 **How to Validate Your Models and Simulations** *(Law)* 8:30 am to 5:30 pm, $590 / $690, p. 109

Sensor Data Exploitation and Target Recognition

SC174 **Multispectral Image Processing** *(Schowengerdt)* 8:30 am to 5:30 pm, $545 / $645, p. 100

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* 8:30 am to 5:30 pm, $470 / $570, p. 110

SC893 ***NEW*** **SAR Signal Processing Laboratory** *(Soumekh)* 8:30 am to 5:30 pm, $470 / $570, p. 111

SC158 **Fundamentals of Automatic Target Recognition** *(Nasr)* 8:30 am to 5:30 pm, $470 / $570, p. 109

SC162 **SAR Signal Processing** *(Soumekh)* 8:30 am to 5:30 pm, $565 / $665, p. 111

SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* 8:30 am to 5:30 pm, $470 / $570, p. 110

SC901 ***NEW*** **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $470 / $570, p. 111

SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $265 / $315, p. 106

Information Fusion, Data Mining, and Information Networks Security Related Technologies

SC891 ***NEW*** **Security of Information and Communication Networks** *(Kartalopoulos)* 1:30 to 5:30 pm, $265 / $315, p.

Signal, Image, and Neural Net Processing

SC197 **Fundamentals of Digital Signal/Image Processing** *(Dianat)* 8:30 am to 5:30 pm, $470 / $570, p. 112

SC066 FC **Fundamentals of Electronic Image Processing** *(Weeks)* 8:30 am to 5:30 pm, $530 / $630, p. 112

SC893 ***NEW*** **SAR Signal Processing Laboratory** *(Soumekh)* 8:30 am to 5:30 pm, $470 / $570, p. 111

SC715 **Independent Component Analysis and Beyond: Blind Signal Processing and its Applications** *(Lee, Lee)* 8:30 am to 12:30 pm, $380 / $440, p. 112

SC162 **SAR Signal Processing** *(Soumekh)* 8:30 am to 5:30 pm, $565 / $665, p. 109

SC901 ***NEW*** **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $470 / $570, p. 111

SC902 ***NEW*** **Compressive Sensing** *(DeVore, Baraniuk)* 1:30 to 5:30 pm, $265 / $315, p. 112

Communications and Networking Technologies and Systems

SC891 ***NEW*** **Security of Information and Communication Networks** *(Kartalopoulos)* 1:30 to 5:30 pm, $265 / $315, p. 113

SC728 **Network Centric Target Tracking and Classification** *(Drummond)* 8:30 am to 5:30 pm, $470 / $570, p. 110

SC901 ***NEW*** **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $470 / $570, p. 111

Battlespace Technologies

SC719 FC **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)* 1:30 to 5:30 pm, $265 / $315, p. 101

SC895 ***NEW*** **Introduction to Cognitive Situation Management for Tactical Operations** *(Jakobson)* 8:30 am to 12:30 pm, $265 / $315, p. 113

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Daily Course Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday
16 March	17 March	18 March	19 March	20 March

Optical and Optomechanical Engineering

Sunday

SC156 **Basic Optics for Engineers** *(Ducharme)* 8:30 am to 5:30 pm, $505 / $605, p. 114 (FC)

Monday

SC254 **Integrated Opto-Mechanical Analysis** *(Doyle, Genberg)* 8:30 am to 5:30 pm, $515 / $615, p. 115

SC178 **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $390 / $490, p. 114 (FC)

Tuesday

SC013 **Precision Mounting of Optical Components** *(Yoder, Jr.)* 8:30 am to 5:30 pm, $540 / $640, p. 114 (FC)

Wednesday

SC796 **Allowable Stresses in Glass and Engineering Ceramics** *(Pepi)* 8:30 am to 12:30 pm, $265 / $315, p. 15

SC781 **Optomechanical Analysis** *(Hatheway)* 8:30 am to 5:30 pm, $470 / $570, p. 115 (FC)

SC220 **Optical Alignment Mechanisms** *(Guyer)* 1:30 to 5:30 pm, $265 / $315, p. 114

Industry Workshops

The Business of Defense

Tuesday

WS639 **Intellectual Property Issues in the Defense and Security Industries** *(Gortych, Stanley, Kauget, Pellenbarg)* 8:30 am to 12:30 pm, $265 / $315, p. 116

WS843 **Playing the SBIR Game to Win** *(Patterson)* 1:30 to 5:30 pm, $265 / $315, p. 116

Thursday

WS845 **Compliance with the International Traffic in Arms Regulations (ITAR)** *(Palmer)* 8:30 am to 12:30 pm, $265 / $315, p. 116

Professional Development

Tuesday

WS846 **Essential Skills for Engineering Project Leaders** *(Hinkle)* 1:00 to 5:00 pm, $265 / $315, p. 117

Wednesday

WS667 **The Craft of Scientific Presentations: A Workshop on Technical Presentations** *(Alley)* 8:30 am to 12:30 pm, $75 / $125, p. 117

WS668 **The Craft of Scientific Writing: A Workshop on Technical Writing** *(Alley)* 1:30 to 5:30 pm, $75 / $125, p. 117

Technologies for Homeland Security and Law Enforcement

Security of Information and Communication Networks

SC891 NEW

Course level: Introductory
CEU .35 $265 / $315 USD
Sunday 1:30 to 5:30 pm

See p. 000 for full description.

Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies

SC719 FC

Course level: Introductory
CEU .35 $265 / $315 USD
Monday 1:30 to 5:30 pm

This course introduces chemical and biological detection and identification techniques which are commonly utilized for military and civil applications. Remote and sampled detection, discrimination, and identification techniques are introduced with design parameters and performance models. A sampling of specific technology applications for chemical point, chemical standoff, biological point, and biological standoff sensing will be described. These technologies include Ion Mobility Spectrometry, Surface Acoustic Waves, Fourier Transform Infrared Spectrometry, Differential Absorption Lidar, Laser-Induced Fluorescence, and Lidar Backscatter systems. The course will include a brief overview of chemical and biological agents and features which may be interrogated by detection systems.

LEARNING OUTCOMES

This course will enable you to:
- list and analyze chemical/biological detection and discrimination techniques
- understand the trade space for point and standoff detection
- estimate spatial, spectral, and temporal variations in chemical/biological media
- formulate fundamental design and performance equations for chemical/biological sensors
- compare mass and mobility techniques for point detection
- compare active and passive techniques for standoff detection

INTENDED AUDIENCE

This course is intended for those interested in the design and development of chemical and biological sensors for applications ranging from military to industrial sensing. Mathematical models for the various sensors will be presented and discussed; however, this course does not require an in-depth understanding of the mathematical principles to appreciate the technological benefits of the various approaches. Some background in electro-optical and infrared systems is helpful, but not required.

INSTRUCTOR

Patrick Gardner Ph.D. is a Principal Scientist at the Center for Rapid Product Realization and an Associate Professor in Electrical Engineering at Western Carolina University, Cullowhee NC. He is also the Executive Director for CatsTech, Inc., a small business specializing in proposal writing, red-team reviews, and general instruction for contract pursuits with the Federal Government. Prior to joining Western Carolina in 2007, he was Chief Scientist, Detection Systems, General Dynamics Armament and Technical Products. There he led a team of scientists and engineers in the discovery and development of chemical, biological, and explosive detection techniques and products. Patrick is a retired Lieutenant Colonel, U.S. Air Force, with numerous assignments in research, development, acquisition & test of systems for the Air Force and Special Operations.

DISCLAIMER: The information provided in this short course was developed from a compilation of sources available in open literature The information delivered in written and oral form does not represent the official position or interests of, or endorsement by the Department of Defense or General Dynamics Corporation.

Using IR Thermographic Instruments - A Primer for Thermographers

SC836 FC

Course level: Introductory
CEU .35 $315 / $365 USD
Monday 1:30 to 5:30 pm

See p. 000 for full description.

IR Sensors and Systems Engineering

Uncooled Thermal Imaging Detectors and Systems

SC900 NEW

Course level: Intermediate
CEU .65 $505 / $605 USD
Sunday 8:30 am to 5:30 pm

The success of uncooled infrared imaging in commercial and military markets has greatly increased the number of participants in the field, and, consequently, the variety of products available and in development. The intent of this course is to provide attendees a broad view of the field as well as an in-depth look at important technologies. The course describes the fundamentals of uncooled IR imaging arrays, emphasizing resistive bolometric and ferroelectric/pyroelectric detectors, but also including a number of innovative technologies such as thermally activated cantilevers, thin films with temperature-dependent optical transmission properties, and thermal-capacitive detectors. Students will learn the fundamentals of uncooled IR sensors, how the various technologies operate, the merits and deficiencies of the different technologies, quantitative metrics for evaluating and comparing performance, and how key factors influence those metrics. The course also explores the limits of performance of uncooled IR imaging, as well as trends to be expected in future products.

LEARNING OUTCOMES

This course will enable you to:
- describe the operation of uncooled IR detectors and basic readout circuits
- evaluate performance in terms of responsivity, noise, noise equivalent temperature difference, minimum resolvable temperature, and response time
- gauge the fundamental limits to their performance, including temperature-fluctuation noise and background fluctuation noise
- compare theory with measured performance of the uncooled arrays
- evaluate practical issues and limitations of current technology
- ascertain the state of development of new IR technologies by asking the right questions
- differentiate well-developed concepts from ill-conceived notional concepts
- identify the uncooled IR technology best suited to your needs
- assess the performance potential of novel IR imaging technologies
- evaluate quantitatively the performance of a wide variety of uncooled IR detectors
- summarize construction details from the technical literature.

INTENDED AUDIENCE

This material is intended for engineers, scientists, and managers who need a background knowledge of uncooled IR technologies, for those who need to be able to evaluate those technologies for usefulness in particular applications, and for those working in the field who wish to deepen their knowledge and understanding. Anyone concerned with current and future directions in thermal imaging or involved in the development of IR detector technology or advanced uncooled IR system concepts will find this course valuable. The course has a significant mathematical content designed to illustrate the origin of the principles involved, but knowledge of the mathematics is not required to understand the concepts and results.

INSTRUCTOR

Charles Hanson is a principal fellow and Chief Technologist at L-3 Communications Infrared Products, and has held government and industrial positions in infrared imaging for more than 38 years. He is a past chairman of Military Sensing Symposia (MSS) Passive Sensors. He is also a member of the board of directors of The Living Opera.

COURSE PRICE INCLUDES the textbook *Uncooled Thermal Imaging Arrays, Systems, and Applications* (SPIE Press, 2001) by Paul Kruse.

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Infrared Search and Track Systems

SC892 NEW

Course level: Intermediate
CEU .35 $265 / $315 USD
Monday 1:30 to 5:30 pm

This short course provides an overview of the role that Infrared Search and Track systems (IRST) can provide in the protection of military and non-military platforms. All system aspects will be discussed, including the definition of the threat and associated scenarios, requirements, target signatures, background- and atmospheric effects, sources of false alarm, sensor design, signal processing, range performance, test and evaluation, situational awareness, sensor fusion. The applications include the defense of compounds, vehicles, helicopters, planes and ships as they are used in peace keeping and peace-enforcing operations. The threat includes small arms weapons, rocket propelled grenades, missiles, unmanned aerial vehicles, small surface targets, operating in complex, such as littoral, environments.

LEARNING OUTCOMES

This course will enable you to:
- describe the relationship between the various system design aspects of IRST systems and the performance requirements
- know how to design a modern IRST sensor for a given set of requirements for a specific application
- make trade-offs between and optimize the choice of the various sensor parameters for minimum false alarm rate and maximum signal to clutter ratio
- have knowledge of how to test and evaluate IRST sensors and system concepts with realistic threats in a realistic environment

INTENDED AUDIENCE

Scientists, engineers, technicians, users and managers involved in the defense of military platforms. Undergraduate level of knowledge on physics, optics, electronics and signal processing is recommended.

INSTRUCTOR

Piet Schwering is senior scientist in the electro-optics department of TNO Defense, Security and Safety (Netherlands). He has 25 years of experience in infrared sensors for various applications and has been active in the development and testing of IRST systems for more than 20 years, and is well experienced in associated field trials on land and at sea. He has participated in NATO Task Groups and EDA joint projects. In the last decade he has presented more than 10 papers on IRST related topics with emphasis on system concepts, backgrounds, and signal processing. At present he is leading the TNO program for the development of electro-optics techniques for the next generation IRST.

Optical Testing of Focal Plane Array Imagers - Quick Performance Testing in the UV, Visible, and Near IR Ranges

SC896 NEW

Course level: Introductory
CEU .65 $470 / $570 USD
Monday 8:30 am to 5:30 pm

See 104 for full description.

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Optical Design Fundamentals for Infrared Systems

SC134 FC

Course level: Intermediate
CEU .65 $505 / $605 USD
Sunday 8:30 am to 5:30 pm

This course provides attendees with practical and directly applicable design and evaluation guidelines and tools for the initial layout of infrared systems. Simple but powerful expressions are developed as approximations to quickly assess expected system performance. Since single point diamond turning has become such an effective method for producing IR components, including aspheres and diffractive elements, details and practical hints are presented for using these elements in the design phase of IR systems.

LEARNING OUTCOMES

This course will enable you to:
- acquire basic radiometric and fundamental optical design principles
- predict third order aberration impacts on image quality
- weigh the tradeoffs between specific IR optical configurations
- evaluate whether a chosen optical system will be a good candidate for your application
- incorporate manufacturing aspects of single point diamond turning at the layout stage and take advantage of the additional design freedom this technology offers

INTENDED AUDIENCE

This material is intended for engineers, scientists, and technicians who need to be able to apply a basic knowledge of optical design to infrared systems. Also included in the audience are managers who need to understand the basic principles of optical design. The fabrication aspect of diamond turning of IR optical components will be of interest to designers as well as manufacturing personnel.

INSTRUCTOR

Thomas Kampe is current a Staff Consultant, Optical Engineering at Ball Aerospace & Technologies Corp. where he works in the Advanced Systems Group. He has been actively involved in optical design and engineering for over 20 years. He holds a BS in Physics from UCLA and an MS in Astrophysics, Atmospheric, and Oceanic Sciences from the University of Colorado, Boulder.

COURSE PRICE INCLUDES the textbook *Optical Design Fundamentals for Infrared Systems* (SPIE, 2001), by Max Riedl.

Infrared Focal Plane Arrays

SC152

Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 8:30 am to 12:30 pm

The course presents a fundamental understanding of two-dimensional arrays applied to detecting the infrared spectrum. The physics and electronics associated with 2-D infrared detection are stressed with special emphasis on the hybrid architecture unique to two-dimensional infrared arrays.

LEARNING OUTCOMES

This course will enable you to:
- develop the building blocks of 2-D arrays
- explain charge transfer concepts of various architectures
- describe various input electronics circuits
- discuss testing techniques used in the IR for 2-D arrays
- provide an overview of current technologies
- demonstrate aliasing effects
- review room temperature arrays
- discuss dual band arrays.

INTENDED AUDIENCE

This material is intended for engineers, scientists and project managers who need to learn more about two-dimensional IR arrays from a user's point of view. It gives the student insight into the optical detection process, as well as what is available to application engineers, advantages, characteristics and performance.

INSTRUCTORS

Eustace Dereniak is a Professor of Optical Sciences and Electrical and Computer Engineering at the University of Arizona, Tucson, AZ. His research interests are in the areas of detectors for optical radiation, imaging spectrometers and imaging polarimeters instrument development. Dereniak is a co-author of several textbooks and has authored book chapters. His publications also include over 100 authored or co-authored refereed articles. He spent many years in industrial research with Raytheon, Rockwell International, and Ball Brothers Research Corporation. He has taught extensively and is a Fellow of the SPIE and OSA, and a member of the Board of Directors of SPIE.

John Hubbs is an engineer with Ball Aerospace and Technologies.

Introduction to Radiometry and Photometry

SC178

Course level: Introductory
CEU .35 $390 / $490 USD
Monday 8:30 am to 12:30 pm

See p. 114 for full description.

Imaging Polarimetry

SC180

Course level: Advanced
CEU .35 $265 / $315 USD
Monday 1:30 to 5:30 pm

See p. 105 for full description.

Infrared Detectors

SC278

Course level: Introductory
CEU .35 $345 / $395 USD
Tuesday 1:30 to 5:30 pm

This course will provide a broad and useful background on optical detectors, both photon and thermal, with a special emphasis placed on the infrared detectors. Discussion of optical detection will be stressed. The fundamentals of responsivity (RI), noise equivalent power (NEPI) and specific detectivity (D*) will be discussed. These figures of merit will be extended to photon noise limited performance and Johnson noise limitations (RA product). Discussion of optical detector fundamentals will be stressed. To aid the attendee in selecting the proper detector choice, the detailed behavior of the more important IR detector materials will be described in detail. Newer technologies such as quantum well infrared photodetectors and blocked impurity bands as well as IR detectors will be covered briefly.

LEARNING OUTCOMES

This course will enable you to:
- understand optical radiation detection processes
- explain noise mechanisms related to optical detectors
- derive figures of merit for optical detectors
- compare BLIP condition to RA product performance

- evaluate and discuss HgCdTe detectors' unique features
- understand why room temperature thermal detectors are so important
- derive the wavelength dependence of detectors

INTENDED AUDIENCE

This class is directed at people who need to learn more about optical detectors from a user point of view. It will give the student insight into the optical detection process as well as what is available to application engineers, advantages, shortcomings, and pitfalls.

INSTRUCTOR

Eustace Dereniak is a Professor of Optical Sciences and Electrical and Computer Engineering at the Univ. of Arizona, Tucson, Arizona. His research interests are in the areas of detectors for optical radiation, imaging spectrometers and imaging polarimeters instrument development. Dereniak is a co-author of several textbooks and has authored book chapters. His publications also include over 100 authored or co-authored refereed articles. He spent many years in industrial research with Raytheon, Rockwell International, and Ball Brothers Research Corporation. He has taught extensively and is a Fellow of the SPIE and OSA, and a member of the Board of Directors of SPIE.

COURSE PRICE INCLUDES the text *Infrared Detectors and Systems* (Wiley, 1996), by E. L. Dereniak and G. D. Boreman.

Infrared Characterization of Sources and Backgrounds

SC545

Course level: Intermediate
CEU .65 $485 / $585 USD
Wednesday 8:30 am to 5:30 pm

This course will treat the most important physical processes and parameters which are used to describe the infrared (IR) contrast between targets and backgrounds. Theoretical and empirical IR modeling, image calibration methodology and field experiments will be discussed.

LEARNING OUTCOMES

This course will enable you to:
- understand the relative importance of the physical processes which establish the apparent temperature of an object
- explain the influence and measurement of the meteorological parameters involved
- perform field calibration procedures and will help you to collect calibrated IR imagery
- deal with IR background characterization through measurements and empirical modeling
- design effective IR camouflage measures

INTENDED AUDIENCE

Engineers and scientists working in the area of IR detection and countermeasure development, with a special focus on the characterization of target and background signatures. Basic familiarity with flow dynamics and heat and radiation transfer mechanisms is helpful.

INSTRUCTOR

Pieter Jacobs is a senior scientist at the Physics and Electronics Lab. FEL, which is part of the Dutch Organization for Applied Physics TNO.

COURSE PRICE INCLUDES the textbook *TT70: Thermal Infrared Characterization of Ground Targets and Backgrounds, Second Edition* (SPIE, 2006), by Pieter A. Jacobs.

NIR and SWIR Imaging Applications

SC710

Course level: Introductory
CEU .35 $305 / $355 USD
Tuesday 8:30 am to 12:30 pm

See p. 104 for full descriptio2n.

Introduction to Optical and Infrared Sensor Systems

SC789

FC

Course level: Introductory
CEU .65 $470 / $570 USD
Thursday 8:30 am to 5:30 pm

See p. 106 for full description.

Allowable Stresses in Glass and Engineering Ceramics

SC796

Course level: Intermediate
CEU .35 $265 / $315 USD
Wednesday 8:30 am to 12:30 pm

See p. 000 for full description.

Infrared Systems - Technology & Design

SC835

Course level: Intermediate
CEU 1.00 $955 / $1095 USD
Monday / Tuesday 8:30 am to 5:30 pm / 8:30 am to 12:30 pm

This course covers the range of topics necessary to understand the theoretical principles of modern infrared-technology. It combines numerous engineering disciplines necessary for the development of infrared systems. Practical engineering calculations are highlighted, with examples of trade studies illustrating the interrelationships among the various hardware characteristics. This course is comprised of four sections:

Section 1: introduces the geometrical optics concepts including image formation, stops and pupils, thick lenses and lens combinations, image quality, and the properties of infrared materials.

Section 2: covers the essentials of radiometry necessary for the quantitative understanding of infrared signatures and flux transfer. These concepts are then developed and applied to flux-transfer calculations for blackbody, graybody, and selective radiator sources. Remote temperature calibrations and measurements are then used as an illustration of these radiometric principles.

Section 3: is devoted to fundamental background issues for optical detection-processes. It compares the characteristics of cooled and uncooled detectors with an emphasis on spectral and blackbody responsivity, detectivity (D*), as well as the noise mechanisms related to optical detection. The detector parameters and capabilities of single detectors and third generation focal plane arrays (FPAs) are analyzed.

With this acquired background, Section 4 considers the systems-design aspects of infrared imagers. The impact of scan format on signal-to-noise ratio is described, and the engineering tradeoffs inherent in the development of infrared search and track (IRST) systems are explained. Figures of merit such as MTF, NETD, and MRTD of staring arrays are examined for the performance metrics of thermal sensitivity and spatial resolution of thermal imaging systems (TIS). Contrast threshold functions based on Johnson and visible cycles (often denoted as N- and V-cycles) are specified. The interrelationships among the design parameters are identified through trade-study examples.

LEARNING OUTCOMES

This course will enable you to:
- learn the principles and fundamentals of infrared optical design
- choose the proper infrared materials suite for your applications
- quickly execute flux-transfer calculations
- calibrate infrared sources and target signatures
- recognize the importance of background in thermal signatures
- have an appreciation for the capacity of infrared systems and learn the interaction of its critical components (optics, detectors, and electronics) in the production of a final infrared image
- assess the influence of noise mechanisms related to optical detection
- comprehend the fundamental response mechanisms and differences between cooled and uncooled single detectors as well as focal plane arrays (FPAs)
- comprehend the central theory behind third generation infrared imagers
- define and use common descriptors for detector and system performance (R, D*, NEP, NEI, MTF, NETD, and MRTD)
- estimate system performance given subsystem and component specifications
- apply design tradeoffs in both infrared search and track systems (IRST) and thermal-imaging systems (TIS)
- carry out the preliminary design of infrared systems for different thermal applications

INTENDED AUDIENCE

This course is directed to the practicing engineers and/or scientists who require both theoretical and effective practical technical information to design, build, and/or test infrared systems in a wide variety of thermal applications. A background at the bachelor's level in engineering is highly recommended. The participant should also have ample understanding of Fourier analysis and random processes.

INSTRUCTOR

Arnold Daniels is a senior engineer with extensive experience in the development of advanced optical and electro-optical systems. His areas of expertise include applications for infrared search & track and thermal imaging systems, infrared radiometry testing and measurements, thermographic nondestructive testing, Fourier analysis, image processing, data acquisition systems, precision optical alignment, and adaptive optics. He earned an M.S. in Electrical Engineering from the University of Tel-Aviv and received a doctoral degree in Electro-Optics from the school of Optics (CREOL) at the University of Central Florida. In 1995 he received the Rudolf Kingslake medal and prizefor the most noteworthy original paper to appear in SPIE's Journal of Optical Engineering. He is presently developing aerospace systems for network centric operations and defense applications at Boeing-SVS.

COURSE PRICE INCLUDES the *SPIE Field Guide to Infrared Systems Design* by Arnold Daniels (2006, SPIE), and *Infrared Detectors and Systems*, by Eustace L. Dereniak and Glenn D. Boreman (Wiley, 1996.)

Using IR Thermographic Instruments - A Primer for Thermographers

SC836

FC

Course level: Introductory
CEU .35 $315 / $365 USD
Monday 1:30 to 5:30 pm

See p. 104 for full description.

Thermosense

NIR and SWIR Imaging Applications

SC710

Course level: Introductory
CEU .35 $305 / $355 USD
Tuesday 8:30 am to 12:30 pm

This course provides attendees with an overview of the diverse range of applications for NIR and SWIR imaging systems and how these systems are calibrated and characterized. The emphasis is on the capabilities of InGaAs and InSb sensors operating in the 0.7 to 3.0 micron NIR and SWIR bands with discussions of optics and tunable filter technology. Discussion will also include extended InGaAs and VisGaAs, a sensor material with both visible and NIR response.

LEARNING OUTCOMES

This course will enable you to:
- learn about the many applications for NIR/SWIR imaging technology
- specify a detector type and optics for various NIR/SWIR applications
- calibrate NIR/SWIR camera systems and characterize their performance
- understand spectral selection in the NIR/SWIR bands

INTENDED AUDIENCE

This material is intended for anyone wishing to become familiar with NIR/SWIR technology and imaging applications.

INSTRUCTOR

Austin Richards is a research scientist at Indigo Systems Corp., and has specialized in NIR/SWIR imaging technology for over 5 years. He holds a Ph.D. in physics from UC Berkeley.

COURSE PRICE INCLUDES the text *Alien Vision: Exploring the Electromagnetic Spectrum with Imaging Technology* by the instructor.

Using IR Thermographic Instruments - A Primer for Thermographers

SC836

FC

Course level: Introductory
CEU .35 $315 / $365 USD
Monday 1:30 to 5:30 pm

Infrared thermal sensing and imaging instruments allow us to see in the dark and to measure and map surface temperature and thermal distribution passively and non-intrusively. In addition, we have learned to use active or "thermal injection" techniques to study and evaluate the structural integrity of buildings, materials and fabricated bonds.

This short course is to familiarize attendees with the operating principles and practical performance characteristics of commercial infrared thermal sensing and imaging instruments, and to provide guidance in their selection and application. The curriculum will include a brief review of the basic principles of infrared sensing and imaging, and illustrations of how the new generation of instruments is utilized in the solution of a wide variety of applications problems in:
- Buildings and infrastructure
- Products and processes
- Night vision (Security and surveillance, firefighting, search and rescue)
- Plant predictive maintenance
- Materials testing
- Life sciences

LEARNING OUTCOMES

This course will enable you to:
- analyze the significant performance parameters of infrared sensing and imaging equipment
- apply basic heat transfer concepts to the interpretation of thermograms
- select the most appropriate instrument for the job
- plan and carry out a thermographic field mission
- check instrument performance against manufacturer's published specifications

INTENDED AUDIENCE

Technologists and managers who wish to gain familiarity with currently available commercial infrared thermal sensing and imaging instruments and to learn how these instruments are applied to solving problems.

INSTRUCTOR

Herbert Kaplan has developed and conducted numerous training courses in the practical use of infrared sensing and imaging instruments. He has authored various publications and articles on photonics subjects including his just-published text, Practical Applications of Infrared Thermal Sensing and Imaging Equipment, Third Edition. A practicing thermographer for more than 40 years, he is an SPIE Fellow, past chairman of the "ThermoSense" Working Group of SPIE and past chairman of the ThermoSense conference.

COURSE PRICE INCLUDES the text *Practical Applications of Infrared Thermal Sensing and Imaging Equipment, Third Edition* (SPIE Press, 2007) by Herbert Kaplan. It is also expected that samples of the new IR cameras will be available for hands-on operation.

Tactical Sensors and Imagers

Optical Testing of Focal Plane Array Imagers - Quick Performance Testing in the UV, Visible, and Near IR Ranges

SC896

NEW

Course level: Introductory
CEU .65 $470 / $570 USD
Monday 8:30 am to 5:30 pm

This course provides basic instruction in the optical testing of focal plane array imagers. The course presents and clearly explains the most useful and important figures of merit associated with focal plane array imagers. Methods for understanding and using single point measures and figures of merit, as well as the basis of single point measures and figures of merit in imager transfer functions, will be illustrated. The course then identifies and describes the basic types of instruments and software needed to do the job. The emphasis throughout is on the most 'useful', 'quick', and affordable methods and equipment. Both novice and expert engineers will find the information valuable.

LEARNING OUTCOMES

This course will enable you to:
- construct simple optical testing configurations for imagers using light sources, illumination optics, and image data acquisition systems and diagnostic instruments
- measure the most useful figures of merit of an imager, including responsivity, resolution, signal to noise ratio, linearity, and uniformity
- interpret the meaning of the test results when using single point measures and figures of merit, including the inherent limitations of these techniques
- make good engineering and marketing use of the information you have obtained, including how to report your results in engineering and marketing materials, and what, if anything, to do about exisiting imager performance standards

INTENDED AUDIENCE

This material is intended for anyone who needs to learn how to test imagers, focal plane arrays, and camera systems in the 350-1500 nm ranges. Those who either design their own imagers or test completed camera modules, or who work with imaging engineers, will find this course valuable.

INSTRUCTOR

Robert Gazerro is Product Manager for Digital Sources at Gamma Scientific Company, and President of Digital Optics Corporation. He has been been testing and measuring imagers for over 25 years, has contributed to imager and camera measurement standards, published papers, and holds several patents.

Testing and Evaluation of E-O Imaging Systems

SC067

Course level: Advanced
CEU .65 $535 / $635 USD
Monday 8:30 am to 5:30 pm

This course will describe all the quantitative and qualitative metrics that are used to characterize imaging system performance. These include resolution, responsivity, the aperiodic transfer function, the slit response function, random noise, uniformity, fixed pattern noise, modulation transfer function, contrast transfer function, and the minimum resolvable contrast. All imaging systems spatially sample the scene, sampling artifacts occur in all imagery. Sampling effects become evident when viewing test targets such as bar patterns.

LEARNING OUTCOMES

This course will enable you to:
- write concise test procedures with unambiguous system specifications
- identify all appropriate test parameters
- differentiate between observer variability and system response during MRC and MRT testing
- understand how jitter, linearity, amplitude normalization, frequency scaling and noise affect CTF and MTF measurements
- discern the difference between poor system performance, peculiarities of the system under test and measurement errors
- understand how sampling affects test results.

INTENDED AUDIENCE

This course is for managers, specification writers and test engineers involved imaging system characterization; from satisfying customer requirements to insuring that specifications are unambiguous and testable.

INSTRUCTOR

Gerald Holst is an independent consultant for imaging system analysis and testing. He was a technical liaison to NATO, research scientist for DoD, and a member of the Lockheed-Martin senior technical staff. Dr. Holst has chaired the SPIE conference *Infrared Imaging Systems: Design, Analysis, Modeling and Testing* since 1989. He is author of over 30 journal articles and 6 books (published by SPIE and/or JCD Publishing). Dr. Holst is a member of OSA and IEEE and is a SPIE Fellow.

COURSE PRICE INCLUDES the text, *Testing and Evaluation of Infrared Imaging Systems, Second Edition*, (SPIE and JCD Publishing, 1998) by Gerald C. Holst.

Electro-Optical Imaging System Performance

SC154

Course level: Intermediate
CEU .65 $540 / $640 USD
Thursday 8:30 am to 5:30 pm

While this course highlights thermal imaging systems, most concepts are generic and can be applied to all imaging systems (CCDs, intensified CCDs, and near IR cameras). The minimum resolvable temperature (MRT) and minimum resolvable contrast (MRC) are coupled with the target signature and atmospheric transmittance to provide range performance predictions. The MRT and MRC depend upon the subsystem MTFs, noise (primarily NEDT and fixed pattern noise), and the eye's response. Limitations of back-of-the-envelope approximations such as sensitivity and resolution are discussed. The two-dimensional (fictitious) spatial frequency approach, three-dimensional noise model, and new target discrimination metrics (Johnson criteria) are applied to performance predictions. Limitations and applications of FLIR92 and NVTherm are discussed.

LEARNING OUTCOMES

This course will enable you to:
- use the correct MTFs when analyzing an imaging system
- understand the difference between resolution and sensitivity
- understand the differences between scanning and staring array performance
- apply MTF analyses to image quality metrics
- understand range performance predictions
- use trade-off analyses to optimize system performance.

INTENDED AUDIENCE

This course is intended for engineers and managers who desire an appreciation of imaging system end-to-end analysis. It is assumed that the students are familiar with linear system theory (MTF analysis).

INSTRUCTOR

Gerald Holst is an independent consultant for imaging system analysis and testing. He was a technical liaison to NATO, research scientist for DoD, and a member of the Lockheed-Martin senior technical staff. Dr. Holst has chaired the SPIE conference *Infrared Imaging Systems: Design, Analysis, Modeling and Testing* since 1989. He is author of over 30 journal articles and 6 books (published by SPIE and/or JCD Publishing). Dr. Holst is a member of OSA and IEEE and is a SPIE Fellow.

COURSE PRICE INCLUDES the text, *Electro-Optical Imaging System Performance, Third Edition* (SPIE and JCD Publishing, 2002), by Gerald Holst.

Key:
Price = SPIE Member / Non-Member
SC000 = Course Number
WS000 = Workshop Number
FC = Foundation Course

MTF in Optical and Electro-Optical Systems

SC157

Course level: Introductory
CEU .65 $505 / $605 USD
Monday 8:30 am to 5:30 pm

Modulation transfer function (MTF)is used to specify the image quality achieved by an imaging system. It is useful in analysis of situations where several independent subsystems are combined. This course provides a background in the application of MTF techniques to performance specification, estimation and characterization of optical and electro-optical systems.

LEARNING OUTCOMES

This course will enable you to:
- list the basic assumptions of linear systems theory, including the concept of spatial frequency
- identify relationship between impulse response, resolution, MTF, OTF, PTF, and CTF
- estimate the MTF for both diffraction-limited and aberration-limited systems
- explain the relationship between MTF, line response, and edge response functions
- identify MTF contributions from finite detector size, crosstalk, charge transfer inefficiency, and electronics
- summarize the effects of noise.

INTENDED AUDIENCE

Engineers, scientists, and managers who need to understand and apply the basic concepts of MTF to specifying, estimating, or characterizing performance. Some prior background in Fourier concepts is helpful.

INSTRUCTOR

Alfred Ducharme is a professor of optics and electrical engineering in the College of Engineering and Computer Science at the University of Central Florida. He received a B.S. in Electrical Engineering from the University of Massachusetts - Lowell, and both a M.S. and Ph.D. in Electrical Engineering from the University of Central Florida - School of Optics (CREOL). Dr. Ducharme is the Program Coordinator for the 4-year undergraduate program in Photonics (BSEET-Photonics) offered by the Engineering Technology Department.

COURSE PRICE INCLUDES the text, *Modulation Transfer Function in Optical and Electro-Optical Systems* (SPIE, 2001) by Glenn D. Boreman.

Introduction to Radiometry and Photometry

SC178 FC

Course level: Introductory
CEU .35 $390 / $490 USD
Monday 8:30 am to 12:30 pm

See p. 114 for full description.

Imaging Polarimetry

SC180

Course level: Advanced
CEU .35 $265 / $315 USD
Monday 1:30 to 5:30 pm

This course covers imaging polarimeters from an instrumentation-design point of view. Basic polarization elements for the visible, mid-wave infrared, and long-wave infrared are described in terms of Mueller matrices and the Poincaré sphere. Polarization parameters such as the degree of polarization (DOP), the degree of linear polarization (DOLP) and the degree of circular polarization (DOCP) are explained in an imaging context. Emphasis is on imaging systems designed to detect polarized light in a 2-D image format. System concepts are discussed using a Stokes-parameter (s0,s1,s2,s3) image. Imaging-polarimeter systems design, pixel registration, and signal to noise ratios are explored. Temporal artifacts, characterization and calibration techniques are defined.

LEARNING OUTCOMES

This course will enable you to:
- explain imaging-polarimetry fundamentals using a Mueller matrix description and make use of the Poincaré sphere
- formulate mathematical models to describe an imaging polarimeter and to optimize its design
- discuss natural and manmade phenomena that give rise to polarized light in the visible and the infrared parts of the spectrum
- discuss techniques for spectro-polarimetry, i.e., the collection of (x,y,...)data hypercubes
- evaluate polarimeter designs
- compare representative scanning and non-scanning imaging-polarimeter designs
- explain sources of error in imaging polarimeters.

INTENDED AUDIENCE

This course is for engineers, scientists, and program managers interested in an overview of imaging polarimetry. The tutorial is intended to give students intuitive insight into fundamental concepts with a minimum of rigorous mathematical treatment. To benefit maximally from this course, attendees should be familiar with the materials covered in SPIE SC206, Introductory and Intermediate Topics in Polarized Light.

INSTRUCTORS

Eustace Dereniak is a Professor of Optical Sciences and Electrical and Computer Engineering at the University of Arizona, Tucson, AZ. His research interests are in the areas of detectors for optical radiation, imaging spectrometers and imaging polarimeters instrument development. Dereniak is a co-author of several textbooks and has authored book chapters. His publications also include over 100 authored or co-authored refereed articles. He spent many years in industrial research with Raytheon, Rockwell International, and Ball Brothers Research Corporation. He has taught extensively and is a Fellow of the SPIE and OSA, and a member of the Board of Directors of SPIE.

Brian Miles is a Senior Scientist with FastMetrix, Inc., where he performs optical system design, systems engineering analysis and test development. He was previously a Senior Research Physicist with the Seeker Branch of the Munitions Directorate of the Air Force Research Lab at Eglin Air Force Base, Florida. Dr. Miles' research interests include laser radar, laser remote sensing, imaging polarimetry, imaging spectro-polarimetry, and mine detection. Dr. Miles is an Optical Sciences Ph.D. graduate from the University of Arizona Optical Sciences Center.

Derek Sabatke holds M.S. and Ph.D. degrees in Optical Engineering and Optical Sciences from the Univ. of Arizona. His research interests center on optical sensors and instruments, and include microsensors, imaging polarimeters and spectropolarimeters. He has conducted research at the Univ. of Minnesota, Honeywell Technology Center, and Univ. of Arizona, and is currently an optical engineer with Ball Aerospace and Technologies Corp. in Bolder, Colorado.

Multispectral and Hyperspectral Image Sensors

SC194

Course level: Advanced
CEU .35 $265 / $315 USD
Sunday 1:30 to 5:30 pm

This course will describe the imaging capabilities and applications of the principal types of multispectral (MS) and hyperspectral (HS) sensors. The focus will be on sensors that work in the visible, near-infrared and shortwave-infrared spectral regimes, but the course will touch on longwave-infrared applications. A summary of the salient features of classical color imaging (human observation) will also be provided in an appendix.

LEARNING OUTCOMES

This course will enable you to:
- understand many of the applications and advantages of multispectral (MS) and hyperspectral (HS) imaging
- describe and categorize the properties of the principal MS / HS design types (multi-band scanner, starers with filter wheels, dispersive, wedge, and Fourier transform imagers with 2D arrays, etc.)
- list and define the relevant radiometric radiometric quantities, concepts and phenomenology
- understand the process of translating system requirements into sensor hardware constraints and specifications
- analyze signal-to-noise ratio, modulation-transfer-function, and spatial / spectral sampling for MS and HS sensors
- define, understand and apply the relevant noise-equivalent figures-of-merit (Noise-equivalent reflectance difference, Noise-equivalent temperature difference, Noise-equivalent spectral radiance, Noise-equivalent irradiance, etc.)
- describe the elements of the image chain from photons-in to bits-out (photon detection, video signal manipulation, analog processing, and digitization)
- list and review key imager subsystem technology elements (optical, focal plane, video electronics, and thermal)
- formulate a detailed end-to-end design example of a satellite imaging scanning HS sensor
- provide an appendix that summarizes color imaging principles and sensor associated elements for human observation applications (e.g. color television, still cameras, etc.)

INTENDED AUDIENCE

Engineers, scientists, and technical managers who are interested in understanding and applying multispectral and hyperspectral sensors in advanced military, civil, scientific and commercial applications.

INSTRUCTOR

Terrence Lomheim holds the position of Distinguished Engineer at The Aerospace Corp. He has 27 years of hardware and analysis experience in visible and infrared electro-optical systems, focal plane technology, and applied optics, and has authored and co-authored 45 publications in these technical areas. He is a Fellow of the SPIE.

Engineering Approach to Imaging System Design

SC713 FC

Course level: Intermediate
CEU .65 $525 / $625 USD
Sunday 8:30 am to 5:30 pm

This course discusses the three popular approaches to electro-optical imaging system design: spatial resolution, sensitivity (signal-to-noise ratio), and modulation transfer function (MTF) analysis. While often evaluated individually, all three must be considered to optimize system design. Usually, the dominant MTFs in machine vision devices are image motion (including random vibration of the sensor), optics (including aberrations), and the detector. For man-in-the-loop operation, the display and the eye are of concern and, in many situations, these limit the overall system performance.

Equally important, but often neglected is sampling; an inherent feature of all electronic imaging systems. Sampling, which creates blocky images are particularly bothersome with periodic targets such as test targets and bar codes. An engineering approach is taken. This course will provide numerous practical design examples (case studies) to illustrate the interplay between subsystem MTFs, resolution, sensitivity, and sampling.

LEARNING OUTCOMES

This course will enable you to:
- use approximations; often called 'rules-of-thumb,' or 'back-of-the-envelope' analysis
- identify the subsystem components that affect resolution and sensitivity
- determine if your system is resolution or sensitivity limited
- equivalently determine if your system is detector-limited or optics-limited
- determine which subsystem limits system performance and why
- understand sampling artifacts (Nyquist frequency limit, aliasing, Moiré patterns, and variations in object edge location and width)
- use MTFs, resolution, sensitivity, and sampling concepts for system optimization
- understand the trade?off between MTF and aliasing

INTENDED AUDIENCE

The course is for managers, system designers, test engineers, machine vision specialists, and camera users who want the best performance from their systems. It is helpful if the students are familiar with linear system theory (MTF analysis).

INSTRUCTOR

Gerald Holst is an independent consultant for imaging system analysis and testing. He was a technical liaison to NATO, research scientist for DoD, and a member of the Lockheed-Martin senior technical staff. Dr. Holst has chaired the SPIE conference *Infrared Imaging Systems: Design, Analysis, Modeling and Testing* since 1989. He is author of over 30 journal articles and 6 books (published by SPIE and/or JCD Publishing). Dr. Holst is a member of OSA and IEEE and is a SPIE Fellow.

Course price includes the text *Holst's Practical Guide to Electro-Optical Systems* (JCD Publishing, 2003) by Gerald C. Holst.

Introduction to Optical and Infrared Sensor Systems

SC789 FC

Course level: Introductory
CEU .65 $470 / $570 USD
Thursday 8:30 am to 5:30 pm

This course provides a broad introduction to optical (near UV-visible) and infrared sensor systems, with an emphasis on systems used in defense and security. Topics include both passive imagers and active laser radars (lidar/ladar). We begin with a discussion of radiometry and radiometric calculations to determine how much optical power is captured by a sensor system. We survey atmospheric propagation and phenomenology (absorption, emission, scattering, and turbulence) and explore how these issues affect sensor systems. Finally, we perform signal calculations that consider the source, the atmosphere, and the optical system and detector, to arrive at a signal-to-noise ratio for typical passive and active sensor systems. These principles of optical radiometry, atmospheric propagation, and optical detection are combined in examples of real sensors studied at the block-diagram level. Sensor system examples include passive infrared imagers, polarization imagers, and hyperspectral imaging spectrometers, and active laser radars (lidars or ladars) for sensing distributed or hard targets. The course organization is approximately one third on the radiometric analysis of sensor systems, one third on atmospheric phenomenology and detector parameters, and one third on example calculations and examination of sensor systems at the block-diagram level.

LEARNING OUTCOMES

This course will enable you to:
- understand and use radiometry for describing and calculating the flow of optical energy in an optical or infrared sensor system
- determine the radiometric throughput of sensor systems
- describe atmospheric phenomenology relevant to propagation of optical and infrared radiation
- explain how the atmosphere affects the performance of sensor systems
- use detector parameters with radiometric calculations to predict the signal received by passive and active sensors
- calculate signal-to-noise ratio for typical sensor systems
- understand real-world sensor systems at the block-diagram level
- explain the difference between and important concepts of passive reflection-based and emission-based imaging
- understand the basic operating principles of passive imagers and active laser radar (lidar/ladar) systems for distributed and solid target sensing

INTENDED AUDIENCE

Scientists, engineers, technicians, or managers who find themselves working on (or curious about) optical (uv-vis) and infrared sensor systems without formal training in this area. Undergraduate training in engineering or science is assumed.

INSTRUCTOR

Joseph Shaw has been developing optical sensors and using them in defense, security, and environmental sensing for 17 years, first at NOAA and currently as an Associate Professor of Electrical Engineering and Physics at Montana State University. Recognition for his work in this field includes NOAA research awards, a Presidential Early Career Award for Scientists and Engineers, and the World Meteorological Organization's Vaisala Prize. He earned a Ph.D. in Optical Sciences at the University of Arizona. Dr. Shaw is a Fellow of the Optical Society of America.

Sensor Array Signal Processing

SC901 *NEW*

Course level: Introductory
CEU .65 $470 / $570 USD
Tuesday 8:30 am to 5:30 pm

See p. 111 for description

Laser Sensors and Systems

Precision Stabilization and Laser Pointing Systems

SC160

Course level: Intermediate
CEU .65 $470 / $570 USD
Wednesday 8:30 am to 5:30 pm

This course provides a practical description of the design, analysis, integration, and evaluation processes associated with development of precision stabilization, pointing and tracking systems. Major topics include stabilized platform technology, electro-mechanical system configuration and analysis, and typical pointing and tracking system architectures.

LEARNING OUTCOMES

This course will enable you to:
- acquire the terminology of stabilization, pointing, and tracking systems and understand the common system architectures and operation
- define typical electro-mechanical configurations and key sub-systems and components used in precision stabilization and laser pointing systems
- describe the primary systems engineering tradeoffs and decisions that are required to configure and design stabilization, pointing and tracking systems
- distinguish the performance capabilities of specific design configurations

INTENDED AUDIENCE

This material is designed for engineers and managers responsible for design, analysis, development, or test of electro-optical stabilization, pointing and tracking systems or components. A minimum BS degree in an engineering discipline and familiarity with basic control systems is recommended.

INSTRUCTOR

James Hilkert is president of Alpha-Theta Technologies, an engineering consulting firm specializing in precision pointing, tracking and stabilization applications for clients such as Raytheon, General Dynamics, Northrop Grumman, DRS, Atlantic Positioning and the U.S. Navy. Prior to founding Alpha-Theta Technologies in 1994, he spent 20 years at Texas Instruments Defense Systems (now Raytheon) where he designed inertial tracking and pointing systems for a variety of military applications and later managed the Control Systems Technology Center. He received the Dr. Engineering degree from Southern Methodist University and MSME and BSME degrees from Mississippi State University, is a member of ASME, AIAA and SPIE, and lectures on control systems at The University of Texas at Dallas.

Introduction to Laser Radar

SC167 FC

Course level: Intermediate
CEU .35 $265 / $315 USD
Tuesday 1:30 to 5:30 pm

This course explains the principles of operation and the basis of laser radar systems. An analytical approach to the evaluation of system performance is presented. This approach is derived from physical optics and from classical antenna theory. Practical applications for laser radar and alternative system architectures are described. Major system components are identified.

LEARNING OUTCOMES

This course will enable you to:
- identify the major elements of laser radar systems
- list important applications of laser radar
- predict the performance of real or conceptual systems
- estimate the effect of environmental factors on system performance
- formulate system level designs for common applications
- explain the critical issues affecting various classes of laser radars
- compare the laser radar approaches for selected applications

INTENDED AUDIENCE

This material is intended for engineers, managers, scientists, and students to become familiar with laser radar or to evaluate the performance of laser radar systems.

INSTRUCTOR

Gary Kamerman is the Chief Scientist of FastMetrix, Inc. and a Fellow of the International Society for Optical Engineering. He is the author of Laser Radar: in the Infrared and Electro-Optical Handbook, the editor of the SPIE Milestone Series Laser Radar and a member of the Board of Editors for Optical Engineering. He has designed, built and field tested laser radars for over 15 years and serves as a technical advisor to the Department of Defense, NASA and major international corporations.

3D Visualization Techniques for Laser Radar

SC717

Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 8:30 am to 12:30 pm

Visualization of 3D-laser-radar data has special challenges beyond those for conventional computer graphics for 3D scanners. Such challenges include sampling limitations, very large data sets, obscuring material, increased noise, and the need for rapid identification of interesting features. The course provides an introduction to 3D-laser-radar characteristics relevant to visualization. Several key 3D processing and visualization methods (e.g., jitter noise reduction, data classification, surface generation, point-cloud display-enhancement, selectable transparency, and rapid display of large data sets) will be discussed.

LEARNING OUTCOMES

This course will enable you to:
- promote the perception of 3D shape
- cut through interference and distractions
- show where to look in a large dataset
- support time-critical operations and untrained users
- present 3D-laser-radar data so that an observer can readily comprehend the 3D shape of an object, assess its condition, and positively recognize its identity

INTENDED AUDIENCE

Engineers, scientists, researchers, and managers who need a basic understanding of visualization techniques for 3D laser radar. Some prior background with image processing and computer technology will be helpful.

INSTRUCTOR

Michael Roth is the co-inventor of QT Viewer, has been developing and leading innovative processing and visualization software projects for over 27 years, and is the Project Manager for Mapping Systems at The Johns Hopkins University Applied Physics Laboratory. He is a past Co-Chairman of the SPIE Conferences on Laser Radar Technology and Applications.

Key:
Price = SPIE Member / Non-Member
SC000 = Course Number
WS000 = Workshop Number
FC = Foundation Course

Fiber Lasers for Defense Applications: Fibers, Components and System Design Considerations

SC784

Course level: Intermediate
CEU .65 $470 / $570 USD
Tuesday 8:30 am to 5:30 pm

Fiber laser technology has the potential to make a significant impact in many defense applications, from LIDAR and remote sensing to high energy laser weapons systems. This emerging laser technology offers many intrinsic advantages over traditional DPSSLs. Widespread publications in the research community have demonstrated an impressive array of power scaling results, both CW and pulsed and at wavelengths from 1µm to the eyesafe 1.5µm and 2µm wavelengths. Advantages associated with the technology are high wallplug efficiency leading to reduced electrical power requirements and easier system cooling, but also robustness, good beam quality and highly flexible system performance. These, coupled with (remote) fiber delivery options make the technology unique in certain applications.

The topics to be covered include: an explanation of the basic fiber parameters, double-clad fiber designs and covering such concepts such as large mode area fibers, modal/beam quality, PM fibers etc.; rare earth doping and spectroscopy of Yb-1µm, Yb:Er-1550 and Tm-2µm; component specifications and availability (couplers, isolators, seed laser diodes etc); limitations to scaling fiber devices, non-linear limitations, damage thresholds, etc.; design rules and concepts for pulsed fiber lasers and amplifier chains, recent results from the literature; and system specifications and possible application areas, comparison and advantages over other laser technologies.

This tutorial will cover the major aspects of designing and building a fiber laser, from the fiber itself through the various state of the art fiber components and discuss the system parameter space that best makes use of the intrinsic advantages of the technology.

LEARNING OUTCOMES

This course will enable you to:
- understand the advantages fiber laser technology compared to other lasers and how the technology is best utilized in various system designs and applications
- identify the relevant architectures, components and fibers involved in designing a fiber laser and the know the steps involved in building one
- have an overview of the recent advances in fiber laser technology and an understanding of what the future technology roadmap looks like

INTENDED AUDIENCE

The tutorial is designed for researchers and engineers interested in investigating this application area but without the detailed knowledge of fibers and fiber based devices. Higher level managers and system designers/integrators will also be interested in the broad comparisons made between the fiber laser technology and current lasers and how this can impact future system designs.

INSTRUCTORS

Bryce Samson s Vice-President of Business Development for Nufern, and previously served as a a senior research scientist at the corporate research labs of Corning Inc. for 5 years. Previous to that, Dr. Samson was a research fellow at Southampton University's Optoelectronic Research Centre (ORC) based in the UK, also for 5 years. He holds a PhD in semiconductor physics from Essex University, UK, has published over 60 refereed scientific and conference papers, and has 8 patents. Dr. Samson has been active in the field of optical fiber research for over 12 years, specializing in fiber laser and amplifiers for sensors, telecom and industrial applications and has

a well documented interest in optical spectroscopy of rare earth doped glasses.

William Torruellas received his PhD from the Optical Sciences Center, University of Arizona in 1991. He is currently a member of the Senior professional staff at the Johns Hopkins University Applied Physics Laboratory. His work addresses the design of High-Energy-Lasers and their system development. He is also involved in active remote sensing evaluations. Previously he was Director of Fiber Optronics for Fibertek, focusing his work on dual core fiber amplifiers and transferring terrestrial WDM systems technology to the area of IR remote sensing and space based laser systems. Previous industry positions include Corvis and Raytheon; additionally, he was a senior research associate for CREOL and an assistant professor at Washington State University, where he helped establish an inter-departmental M.Sc in Opto-Electronics supported by the National Science Foundation. He has 51 refereed publications and 30 conference proceedings, one awarded patent, 55 invited talks, and 60 contributed oral presentations. He has been involved in the organization of conferences for SPIE and OSA, and has co-edited a book.

Intelligent and Unmanned Systems

Path Planning for Autonomous Vehicles

SC898 NEW

Course level: Introductory
CEU .35 $265 / $315 USD
Monday 8:30 am to 12:30 pm

This course gives a comprehensive overview of path planning in autonomous systems. Attendees will gain a theoretical and practical understanding of both path planning problems and their solutions. The course will emphasize the best algorithms for solving a variety of real-world path planning problems from simple single-vehicle route planning to complex multi-vehicle area coverage. The course will discuss how to best integrate information systems into planners including GIS and vehicle constraints into static planning and real-time sensors into dynamic re-planning. All the concepts in the course will be illustrated by fully-worked out design examples and their implementation in a real-world application. The course content will be generally applicable to all types of autonomous systems, but will focus on unmanned ground systems.

LEARNING OUTCOMES

This course will enable you to:
- identify the appropriate problem class and algorithm set for a given specific application
- describe the classic algorithms for route and coverage planning, how they work, their time and space complexity and their limitations
- take into account vehicle geometry and constraints such as turning radius
- best integrate map-knowledge into planning and real-time sensor information into re-planning
- utilize the state of the art in single-vehicle route planning, coverage planning and multi-vehicle coordinated planning

INTENDED AUDIENCE

This course is intended for engineers and scientists involved in or interested in the design of autonomous path-planning systems. Attendees are expected to have the technical maturity equivalent to an undergraduate degree in science or engineering.

INSTRUCTOR

Nicholas Flann is an Associate Professor of Computer Science at Utah State University and one of the founders of Autonomous Solutions Inc., where he currently consults. He has been active in research and development for 15 years in intelligent vehicle task achievement, planning and adaptive behaviors.

Introduction to INS and INS-Based Integrated Navigation

SC894 NEW

Course level: Introductory
CEU .65 $470 / $570 USD
Sunday 8:30 am to 5:30 pm

Inertial navigation technology is currently being used in a variety of application areas that range from highly specialized military systems to mass-market consumer devices. This course provides attendees with a knowledge of inertial navigation principles, overviews integration of the inertial navigation system (INS) with other sensors, and gives various examples of practical INS applications. The course teaches basic INS computations, describes INS error behavior, classifies inertial sensors and discusses techniques for integrating the INS with other navigation technologies. Practical examples are given to illustrate the use of the INS in various application areas including a stand-alone airborne INS, GPS/INS integration, INS/Electro optical integration and INS/Lidar applications.

LEARNING OUTCOMES

This course will enable you to:
- gain a background in current trends for practical applications of inertial navigation technology
- learn the basics of performing INS computations
- identify INS limitations
- specify inertial sensor characteristics for your application area
- learn strategies for integrating inertial systems with other sensors

INTENDED AUDIENCE

This course is intended for anyone who is interested in learning about inertial navigation and the use of inertial navigation technology in various application areas.

INSTRUCTOR

Andrey Soloviev is a senior research engineer at the Ohio University Avionics Engineering Center. He has over 10 years of experience in the area of navigation system research and development. His current research focuses on multi-sensor integration including deep GPS/inertial integration for tracking very weak GPS signals and Lidar/inertial integration for GPS denied applications.

Incorporating GPS Technology into Commercial and Military Applications

SC549

Course level: Introductory
CEU .35 $265 / $315 USD
Monday 8:30 am to 12:30 pm

The Global Positioning System (GPS) has evolved from its military roots to an ideal example of dual-use technology. This course briefly describes the GPS theory and the state of art in GPS technology. The issues involved in incorporating GPS in various commercial and military applications will be highlighted and various technologies will be illustrated using case studies.

LEARNING OUTCOMES

This course will enable you to:
- understand the basic principles and capabilities of GPS
- understand the GPS technology available for commercial and military applications
- be exposed to the latest advances in GPS
- identify the conditions under which certain levels of performance are achievable with current hardware and software
- identify commercially available GPS chipsets and modules
- evaluate concepts of GPS integration with other sensors
- evaluate the suitability of GPS as an alternative means of positioning, attitude, and time determination

INTENDED AUDIENCE

This course is for engineers, systems designers, and managers who wish to understand the recent innovations in GPS technology and how to design systems that take advantage of these capabilities for commercial and military applications. Some familiarity with basic GPS operation is helpful. Examples will be presented from airborne systems for remote sensing and other applications.

INSTRUCTOR

Maarten Uijt de Haag is an Assistant Professor of Electrical Engineering and a Principal Investigator with the Avionics Engineering Center at Ohio University. He has been involved with GPS research since 1993. Most recently, he has worked on the use of GPS for Synthetic Vision Systems, Local Area Augmentation Systems, GPS/INS Integration, and MLS/GPS integration.

Displays

Head-Mounted Displays: Design and Applications, Including Night Vision

SC159

Course level: Introductory
CEU .65 $470 / $570 USD
Wednesday 8:30 am to 5:30 pm

Head-mounted displays (HMD) and their military counterparts helmet-mounted displays, are personal information-viewing devices that can provide information in a way that no other display can because the information is always available for viewing. By making the imagery reactive to head and body movements we replicate the way humans view, navigate and explore the world. This unique capability lends itself to applications such as Virtual Reality for creating artificial environments, medical visualization as an aid in surgical procedures, military vehicles for viewing sensor imagery, aircraft simulation and training, and for fixed and rotary wing avionics display applications.

This course covers design fundamentals for head-mounted displays from the user's point of view starting with the basics of human perception, head and neck biomechanics, image sources, optical design and head mounting. In addition, we will cover the dramatic advances in night vision systems, some of the key new technologies (such as EBAPS, EMCCD and MCP-CMOS) and how they are being incorporated into head mounted display systems. We will also discuss the impact of user task requirements and applications on various HMD parameters, as well as a detailed discussion of HMD optical designs (pupil and non-pupil forming, see-through and non-see-through, monocular, biocular and binocular, exit pupil and eye relief).

From there we will delve into various image source technologies, discussing advantages and disadvantages of the various approaches and methods for producing color imagery, with their implications for use in the near-eye presentation of imagery. We will also discuss head/neck anatomy and biomechanics and the implications of HMD weight and center of gravity on crash and ejection safety. Also presented will be guidelines for preventing eye fatigue, neck strain, cybersickness and

other adverse physiological effects that have been attributed to poor HMD design. Throughout the course, we will use examples of current HMD systems and hardware to illustrate these issues.

LEARNING OUTCOMES

This course will enable you to:
- define basic components and attributes of head-mounted displays and visually coupled systems
- describe important features and enabling technologies of an HMD and their impact on user performance and acceptance
- identify key user-oriented performance requirements and link their impact on HMD design parameters
- understand basic features of the human visual system and biomechanical attributes of the head and neck and the guidelines to follow to prevent fatigue or strain
- identify key tradeoffs for monocular, binocular and biocular systems
- understand current image source technologies and their methods for producing color imagery
- understand digital night vision sensors, how to choose them, and how to integrate them into a head mounted display
- understand methods of producing wide field of view, high resolution HMDs
- understand tradeoffs for critical display performance parameters

INTENDED AUDIENCE

This course is intended for managers, engineers and scientists involved in the procurement, evaluation, specification or design of HMDs for air or ground-based applications.

INSTRUCTORS

James Melzer is Product Manager for Advanced Headgear Systems at Rockwell Collins Optronics (formerly Kaiser Electro-Optics) in Carlsbad, California. He has been designing and building HMDs for over 20 years for military, professional, medical, and training/simulation applications.

Michael Browne PhD, is the President of SoldierView, an opto-mechanical engineering consulting company which provides clients with state-of-the-art advice in the design of head mounted displays and digital night vision devices. Mike has been working with image intensification and head mounted displays for the past 20 years.

Modeling and Simulation

How to Validate Your Models and Simulations

SC783

Course level: Introductory
CEU .65 $590 / $690 USD
Monday 8:30 am to 5:30 pm

In this course we present practical techniques for building valid and credible simulation models. Ideas to be discussed include the importance of a definitive problem formulation, discussions with subject-matter experts, interacting with the decision-maker on a regular basis, development of a written assumptions document (conceptual model), structured walk-through of the assumptions document, use of sensitivity analysis to determine important model factors, and comparison of model and system performance measures for an existing system (if any). Each idea will be illustrated by one or more real-world examples. We will also discuss the difficulty in using formal statistical techniques (e.g., confidence intervals and hypothesis tests) to validate simulation models.

LEARNING OUTCOMES

This course will enable you to:
- gain familiarity with the 11 fundamental validation techniques and how to apply them to your models and simulations
- effectively document the model's assumptions, algorithms, concepts, and data summaries, and to evaluate their correctness and completeness
- understand the 7 critical pitfalls in model development and validation and how to avoid them

INTENDED AUDIENCE

This course is designed for anyone who wants to learn practical techniques for validating their models and simulations.

INSTRUCTOR

Averill Law Ph.D. has presented more than 420 simulation short courses in 18 countries, and he is the author of the book Simulation Modeling and Analysis (Fourth Edition), which is widely considered to be the bible of simulation. He has been funded by the Defense Modeling and Simulation Office, the Navy Modeling and Simulation Office, and the Office of Naval Research to develop practical techniques for model validation. He has consulted on model validation for the Federal Highway Administration, the U.S. Army, and the U.S. Air Force.

COURSE PRICE INCLUDES the text *Simulation Modeling and Analysis* by the instructor.

Sensor Data Exploitation and Target Recognition

SAR Signal Processing Laboratory

SC893 *NEW*

Course level: Intermediate
CEU .65 $470 / $570 USD
Tuesday 8:30 am to 5:30 pm

See p. 111 for description.

Sensor Array Signal Processing

SC901 *NEW*

Course level: Introductory
CEU .65 $470 / $570 USD
Tuesday 8:30 am to 5:30 pm

See p. 111 for description.

Fundamentals of Automatic Target Recognition

SC158

Course level: Intermediate
CEU .65 $470 / $570 USD
Wednesday 8:30 am to 5:30 pm

This course is an overview of ATR systems, architecture, and components. First, it describes the basic components of an ATR system: preprocessing, target detection, segmentation, feature extraction, tracking, and classifications. Then conventional statistical pattern recognition approaches and other advanced concepts such as: multi-sensor systems, model-based, adaptive and neural net, and other artificial intelligence techniques are described. Finally, we discuss evaluation techniques of ATR systems.

LEARNING OUTCOMES

This course will enable you to:
- have a broad understanding of ATR systems and technology
- have knowledge of current technology limitations
- understand key research areas and trends.

INTENDED AUDIENCE

This course is for engineers entering the field or currently working in ATR, managers and marketing personnel, and program managers.

INSTRUCTOR

Hatem Nasr has published several papers and chaired several conferences on the subject. He is the editor of two related books, *Automatic Object Recognition* and *Model-Based Vision*. He holds three patents in ATR related areas.

SAR Signal Processing

SC162

Course level: Intermediate
CEU .65 $565 / $665 USD
Sunday 8:30 am to 5:30 pm

This course presents a signal theory framework for understanding the functional properties of a Synthetic Aperture Radar (SAR) signal, the requirements and algorithms for its digital signal processing. The emphasis is on developing principles that are applicable in both stripmap and spotlight SAR systems for practical radar signals in the HF to Ka band. Applications in reconnaissance with ultra-wideband foliage-penetrating UHF-band SAR and X-band SAR systems are discussed.

LEARNING OUTCOMES

This course will enable you to:
- provide an introduction on stripmap and spotlight SAR/ISAR modalities, and omega-k (wavefront) SAR reconstruction
- discuss the sampling constraints and processing issues associated with SAR/ISAR signals
- provide an overview of the basic digital signal processing and omega-k (wavefront) reconstruction algorithms for SAR/ISAR systems, and their implementation using Matlab
- discuss the contribution of a target in the backscattered signal of stripmap and spotlight SAR systems, and provide multidimensional digital signal processing methods for deducing target information in these radar systems.
- discuss the potential as well as present reconnaissance and surveillance imaging problems of SAR/ISAR systems.

INTENDED AUDIENCE

This course is intended for engineers with interest in radar imaging, array processing, and applications of multidimensional digital signal processing.

INSTRUCTOR

Mehrdad Soumekh is a consultant on signal and image processing for electronic sensors. In that capcity, he has worked for the Air Frorce Laboratories at Eglin, Kirtland, Rome and Wright Patterson, the Army Laboratories at Adelphi and Fort Belvoir, the Navy Laboratory at San Diego, MITRE and Northrop Grumman. He is the author of the books "Fourier Array Imaging" (Prentice Hall, 1994) and "Synthetic Aperture Radar Signal Processing with MATLAB Algorithms" (Wiley, 1999), and holds a U.S. patent for SAR wavefront reconstruction (omega-k or range migration) algorithm.

COURSE PRICE INCLUDES the textbook, *Synthetic Aperture Radar Signal Processing with MATLAB Algorithms* (Wiley, 1999), by Mehrdad Soumekh.

Multispectral Image Processing

SC174

Course level: Advanced
CEU .65 $545 / $645 USD
Sunday 8:30 am to 5:30 pm

Multispectral imagery contains a wealth of information beyond panchromatic imagery. This course describes and evaluates computer processing techniques used to extract information from multispectral imagery. The emphasis is on earth remote sensing, but the techniques discussed apply to any multispectral imagery.

LEARNING OUTCOMES

This course will enable you to:
- interpret color composite image displays
- perform fusion of multispectral and high-resolution panchromatic imagery
- evaluate spectral band combinations for information extraction
- apply per-pixel multispectral classification algorithms
- explain sub-pixel unmixing algorithms
- explain hyperspectral signature matching.

INTENDED AUDIENCE

This course is for engineers and scientists who need an introduction to multi/hyperspectral imagery and technical knowledge of computer algorithms for processing multi/hyperspectral data. A BS degree in physical science or engineering is a prerequisite. Prior experience with computer image processing is highly recommended.

INSTRUCTOR

Robert Schowengerdt received his Ph.D. in optical sciences form the University of Arizona in 1975 and has worked in remote sensing and image processing since 1969. He is the author of over 70 technical papers and two textbooks, Techniques for Image Processing and Classification in Remote Sensing (1983) and Remote Sensing-Models and Methods for Image Processing (1997). Dr. Schowengerdt is a professor of electrical and computer engineering, optical sciences, and arid lands sciences at the University of Arizona.

COURSE PRICE INCLUDES the text *Remote Sensing--Models and Methods for Image Processing, Third Edition* (Academic Press, 2006) by Robert Schowengerdt.

Predicting Target Acquisition Performance of Electro-Optical Imagers

SC181

Course level: Advanced
CEU .65 $470 / $570 USD
Monday 8:30 am to 5:30 pm

This course describes how to predict the range-dependent probability that a target will be detected, recognized, or identified when using an electro-optical (EO) imager. The "target" can be a tank, a man, a handgun, a knife, or any object of interest. The detection, recognition, and identification tasks are discussed, and the meaning of acquisition probabilities is explained. The basic theory of operation of thermal imagers, image intensifiers, and video cameras is presented. This course describes how to quantify the resolution and noise characteristics of an EO imager. The theory and analysis of sampled imagers is emphasized. Image quality metrics are described, and the relationship between image quality and target acquisition performance is explained. The course provides a complete overview of how to analyze the performance of EO imagers.

LEARNING OUTCOMES

This course will enable you to:
- understand what a target acquisition model does
- understand the operation of thermal sensors, video cameras and other EO imagers
- learn how to analyze EO imagers, especially sampled imagers
- understand the concept and utility of image quality metrics
- predict the probability of acquiring targets when using EO imagers

INTENDED AUDIENCE

This course is intended for the design engineer or system analyst who is interested in quantifying the performance of EO imagers. Some background in linear systems analysis is helpful but not mandatory.

INSTRUCTOR

Richard Vollmerhausen recently retired from the Army's Night Vision and Electronic Sensors Directorate. He is currently consulting. Mr. Vollmerhausen is the developer of the current generation of target acquisition models used by the Army.

Multispectral and Hyperspectral Image Sensors

SC194

Course level: Advanced
CEU .35 $265 / $315 USD
Sunday 1:30 to 5:30 pm

Se p. 106 for description.

Network Centric Target Tracking and Classification

SC728

Course level: Intermediate
CEU .65 $470 / $570 USD
Monday 8:30 am to 5:30 pm

This course is offered in response to the growing interest in network centric processing systems. It is designed to provide each attendee with the knowledge and insights to effectively deal with systems for multiple target tracking and classification with distributed sensor data. The emphasis is on the information needed to analyze, select, design, develop, and evaluate algorithms for practical sensor fusion to track and classify small targets. The term classification is used here in the more general sense to include decisions, detection, target typing, identification, or recognition. Of particular interest are algorithms that provide a single consistent target view across platforms (sometimes called SIAP) so that users on the distributed platform can coordinate their actions. This course is based on pertinent material of the speaker's intensive five-day short course supplemented by recent findings.

LEARNING OUTCOMES

This course will enable you to:
- describe the issues and alternative algorithm concepts for tracking multiple targets using sensor data corrupted by close targets, sensor biases, merged measurements, false signals, and background clutter
- explain the challenges of fusing data from multiple, distributed sensors
- explain the algorithms for feature aided tracking and processing attributes provided by legacy sensors
- describe the issues and alternative algorithm architectures for tracking with multiple sensors (sensor data fusion), including recent developments in tracklets and hybrid fusion
- list the alternatives and challenges of developing a network centric tracking with multiple frame data association such as MHT or MFA
- enumerate appropriate alternative algorithm designs and formulate the equations for your applications
- establish criteria and conduct trade-offs to select the algorithm architecture and algorithms for network centric tracking and classification systems
- design, develop, and evaluate tracking systems for a tactical, strategic, or air traffic control systems

INTENDED AUDIENCE

This intensive course is designed for engineers, scientists, and managers concerned with fusing multiple sensor data for target tracking and classification systems. Familiarity with single sensor data association and manipulations of vector-matrix equations is desirable. The course starts at the introductory level and builds up to advanced sensor data fusion techniques. The critical details for designing algorithms for network centric processing under challenging conditions, such as clutter and dim targets that are close or crossing, are highlighted.

INSTRUCTOR

Oliver Drummond , an independent consulting engineer or casual employee for a variety of organizations, is recognized internationally as an expert in multiple-sensors multiple-target tracking and classification. He earned his Ph.D. at UCLA and has over 25 years experience in various aspects of single and multiple sensor target tracking. He has presented his advanced, intensive five-day course on this topic (or portions of it) throughout the United States, Europe, Turkey, and Israel. He has worked for The Aerospace Corp., Hughes Aircraft Co., and General Dynamics. He is currently working for a number of organizations on DOD funded sensor fusion projects on multiple target tracking and classification. In 1989, he introduced and has chaired ever since the SPIE ongoing sequence of annual SPIE conferences entitled Signal and Data Processing of Small Targets.

Information Fusion, Data Mining, and Information Networks Security Related Technologies

Security of Information and Communication Networks

SC891 *NEW*

Course level: Introductory
CEU .35 $265 / $315 USD
Sunday 1:30 to 5:30 pm

Private and sensitive data are transported over the communications network, which unfortunately is not immune to eavesdroppers, attackers, and impersonators who access the network and harvest or destroy electronic data. This short course provides attendees with a thorough introduction to data security and cryptographic methods, such as DES, AES, RC4, elliptic curve, and RSA. It provides an introduction to key distribution methods such as Diffie-Hellman, ECC, Digital Signature, Key Escrow and quantum key distribution in optical networks. It also provides a thorough introduction in network security, and how it differentiates from data security. Other topics in this course include vulnerabilities and countermeasures, biometrics in the communications network and security in the next generation network.

LEARNING OUTCOMES

This course will enable you to:
- explain encryption and message security
- distinguish security levels and security layers in communication networks
- describe the mathematical foundation for security; prime numbers, mod arithmetic, greatest common denominator, and more
- classify ciphers (symmetric, asymmetric, RSC, DES, AES, RC4, elliptic curve, RSA)

- classify key distribution algorithms (Merkley, Shamir, Diffie-Hellman, ECC, Digital Signature, Key Escrow)
- identify Quantum Cryptography and QKD (Polarization, Entangled-States, Teleportation)
- identify vulnerabilities and countermeasures in QC
- justify biometrics in communication networks
- summarize security in Next Generation Optical Networks

INTENDED AUDIENCE

This course is intended for anyone who needs to learn about data and network security, cryptographic methods, security issues, attack detection and countermeasures strategies. Those who develop their own cryptographic methods or who work with or supervise security-based communication products will find this course valuable.

INSTRUCTOR

Stamatios Kartalopoulos, Sr. PhD, (SPIE member, IEEE Fellow and Distinguished Lecturer) is the Williams Professor in Telecommunications Networking of the University of Oklahoma and principal consultant of PhotonExperts. He is the author of nine textbooks, holds nineteen patents and has authored more that 150 research papers.

Signal, Image, and Neural Net Processing

Sensor Array Signal Processing

SC901 *NEW*

Course level: Introductory
CEU .65 $470 / $570 USD
Tuesday 8:30 am to 5:30 pm

The capture of data using an array of sensors is common in various wave propagation environments such as electromagnetic, underwater acoustics, ultrasound and other modes. The processing of such sensor array data in space and time leads to meaningful information or output such as source localization, image reconstruction, range-velocity estimation, target identification etc. A variety of signal processing techniques have been developed since the early 1980s for achieving effective extraction of such information. New signal processing techniques are now being developed to handle emerging applications such as multi-input multi-output (MIMO) radar, millimeter wave imaging and Terahertz imaging. This course will provide an introduction to the principles of sensor array signal processing and its applications in defense, security, communication and medicine.

Specific topics will be examined in detail, including sensor array configurations; resolution performance of different approaches; signal procesing algoriithms for direction finding; image reconstruction in the far field; super-resolution techniques; array processing algorithms in radar and space-time adaptive processing; near field source localization and image reconstruction; and tomography arrays. Application examples will also be given.

LEARNING OUTCOMES

This course will enable you to:
- describe the various sensor array configurations used in different applications
- identify the types of information provided by signal processing of sensor array data
- determine performance limits of sensor arrays as a function of array configuration, source properties, and the signal processing algorithm
- evaluate relative advantages of the different processing algorithms as a function of the application

INTENDED AUDIENCE

Engineers and scientists with involvement or interest in the processing of sensor array data.

INSTRUCTOR

Raghuveer Rao earned his Ph.D. degree in Electrical Engineering from the University of Connecticut in 1984. He was a Member of the Technical Staff at Advanced Micro Devices Inc. from 1985 to 1987. He joined the Rochester Institute of Technology in 1987 where he is a Professor of Electrical Engineering and Imaging Science. He has also held IPA (Intergovernmental Personnel Act) appointments with the US Naval Surface Warfare Center and the US Air Force Research Laboratory, and visiting appointments with the Indian Institute of Science and Princeton University. Rao has served as an Associated Editor of the IEEE Transactions on Signal Processing and the IEEE Transactions on Circuits and Systems - II, and is currently an Associate Editor for the Journal of Electronic Imaging. He is a recipient of the IEEE Signal Processing Society's Young Author Best Paper Award. He is an elected Fellow of SPIE and a Fellow of the Center for Advanced Defense Studies.

SAR Signal Processing Laboratory

SC893 *NEW*

Course level: Intermediate
CEU .65 $470 / $570 USD
Tuesday 8:30 am to 5:30 pm

This hands-on course is intended to provide a laboratory experience using the fundamental signal processing algorithms for Synthetic Aperture Radar (SAR) systems. SAR MATLAB-based signal processing algorithms are provided by the instructor and analyzed during the course. The attendees are to bring their own laptops that are equipped with MATLAB.

LEARNING OUTCOMES

This course will enable you to:
- perform chirp pulse compression and deskewing
- perform spatial and spectral properties of synthetic aperture (spherical PM) signal
- perform spatial and spectral properties of spotlight/stripmap SAR signal
- perform wavefront (range migration) reconstruction for spotlight/stripmap SAR
- perform polar format reconstruction for spotlight SAR
- perform backprojection reconstruction for stripmap SAR
- perform motion compensation for spotlight/stripmap SAR
- perform moving target signature analysis
- perform moving target detection with SAR (SAR-MTI)

INTENDED AUDIENCE

This course is intended for engineers and researchers with interest in developing signal processing algorithms for SAR. It is intendend as a companion to the related short course SC162 SAR Signal Processing, and attendees will benefit maximally by attending both courses.

INSTRUCTOR

Mehrdad Soumekh has served as a consultant on signal and image processing for electronic sensors. In that capacity, he has worked for the Air Force Laboratories at Eglin, Rome and Wright Patterson, the Army Laboratories at Adelphi and Fort Belvoir, the Navy Laboratory at San Diego, MITRE and Northrop Grumman. He is the author of the books "Fourier Array Imaging" (Prentice Hall, 1994), and "Synthetic Aperture Radar Signal Processing with MATLAB Algorithms" (Wiley, 1999). He holds a patent for SAR wavefront (range migration or omega-k) reconstruction algorithm.

Students must bring a laptop computer with MATLAB installed to the course.

SAR Signal Processing

SC162

Course level: Intermediate
CEU .65 $565 / $665 USD
Sunday 8:30 am to 5:30 pm

This course presents a signal theory framework for understanding the functional properties of a Synthetic Aperture Radar (SAR) signal, the requirements and algorithms for its digital signal processing. The emphasis is on developing principles that are applicable in both stripmap and spotlight SAR systems for practical radar signals in the HF to Ka band. Applications in reconnaissance with ultra-wideband foliage-penetrating UHF-band SAR and X-band SAR systems are discussed.

LEARNING OUTCOMES

This course will enable you to:
- provide an introduction on stripmap and spotlight SAR/ISAR modalities, and omega-k (wavefront) SAR reconstruction
- discuss the sampling constraints and processing issues associated with SAR/ISAR signals
- provide an overview of the basic digital signal processing and omega-k (wavefront) reconstruction algorithms for SAR/ISAR systems, and their implementation using Matlab
- discuss the contribution of a target in the backscattered signal of stripmap and spotlight SAR systems, and provide multidimensional digital signal processing methods for deducing target information in these radar systems.
- discuss the potential as well as present reconnaissance and surveillance imaging problems of SAR/ISAR systems.

INTENDED AUDIENCE

This course is intended for engineers with interest in radar imaging, array processing, and applications of multidimensional digital signal processing.

INSTRUCTOR

Mehrdad Soumekh is a consultant on signal and image processing for electronic sensors. In that capcity, he has worked for the Air Frorce Laboratories at Eglin, Kirtland, Rome and Wright Patterson, the Army Laboratories at Adelphi and Fort Belvoir, the Navy Laboratory at San Diego, MITRE and Northrop Grumman. He is the author of the books "Fourier Array Imaging" (Prentice Hall, 1994) and "Synthetic Aperture Radar Signal Processing with MATLAB Algorithms" (Wiley, 1999), and holds a U.S. patent for SAR wavefront reconstruction (omega-k or range migration) algorithm.

COURSE PRICE INCLUDES the textbook, *Synthetic Aperture Radar Signal Processing with MATLAB Algorithms* (Wiley, 1999), by Mehrdad Soumekh.

Key:
Price = SPIE Member / Non-Member
SC000 = Course Number
WS000 = Workshop Number
FC = Foundation Course

Fundamentals of Electronic Image Processing

SC066

Course level: Introductory
CEU .65 $530 / $630 USD
Monday 8:30 am to 5:30 pm

Many disciplines of science and manufacturing acquire and evaluate images on a routine basis. Typically these images must be processed so that important features can be measured or identified This short course introduces the fundamentals of electronic image processing to scientists and engineers who need to know how to manipulate images that have been acquired and stored within a digital computer.

LEARNING OUTCOMES

This course will enable you to:
- understand image storage, acquisition, and digitization
- become familiar with image transforms such as Fourier, Hough, Walsh, Hadamar, Discrete Cosine, and Hotelling
- understand the difference between the types of linear and non-linear filters and when to use each
- learn the difference between types of noise in the degradation of an image
- apply color image processing techniques to enhance key features in color and gray scale images
- recognize image segmentation techniques and how they are used to extract objects from an image
- understand software approaches to image processing
- demonstrate how to use the UCFImage image processing software program included with the course.

INTENDED AUDIENCE

This course will be useful to engineers and scientists who have a need to understand and use image processing techniques, but have no formal training in image processing. It will give the individual insight into a number of complex algorithms as it applies to several different applications of this very interesting and important field.

INSTRUCTOR

Arthur Weeks holds an associate professor position with the Dept. of Electrical and Computer Engineering at the Univ. of Central Florida. He recently left his position as a vice president of corporate technology to continue his research in image processing and bio-medical signal processing. He has published over 30 articles and three books in image processing.

COURSE PRICE INCLUDES the text, *Fundamentals of Electronic Image Processing* (SPIE, 1996), by Arthur Weeks.

Fundamentals of Digital Signal/ Image Processing

SC197

Course level: Intermediate
CEU .65 $470 / $570 USD
Sunday 8:30 am to 5:30 pm

This course covers: fundamental concepts of digital signal processing (DSP) systems such as analog to digital converter (A/D), aliasing, scalar and vector quantization, and coding; point spread function (PSF) of imaging systems; modulation transfer function (MTF); circularly symmetric imaging systems; techniques used for analyzing DSP based systems such as convolution, frequency response, MTF measurement, etc.; Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) algorithms, fast convolution and correlation; design of 1-D and 2-D digital FIR filters; sampling rate conversion; spectral estimation; adaptive signal processing with applications to deconvolution, system identification, and noise removal; adaptive arrays and beamforming; signal detection and estimation techniques; software for simulating some of the component blocks will be provided by the instructor.

LEARNING OUTCOMES

This course will enable you to:
- understand modern DSP techniques
- relate DSP system performance to fundamental limits
- design some of the component blocks of DSP systems

INTENDED AUDIENCE

This course is planned for practicing engineers and scientists who work with programmed equipments and software that involve DSP elements as well as managers who oversee technical groups working on DSP based products. The course is appropriate for people working in biology and biomedical engineering.

INSTRUCTOR

Sohail Dianat is a professor of Electrical Engineering and Imaging Science at the Rochester Institute of Technology and a research consultant to Xerox Corporation. He is an active researcher in the areas of signal/image processing and digital communications He is the author of numerous publications in the areas of signal processing and communications and a recipient of MILCOM's best unclassified paper award.

Independent Component Analysis and Beyond: Blind Signal Processing and its Applications

SC715

Course level: Intermediate
CEU .35 $380 / $440 USD
Wednesday 8:30 am to 12:30 pm

Blind Signal Processing (BSP) is an emerging area of research and technology with solid theoretical foundations and many potential applications. The problems of separating or extracting of the source signals from sensor arrays, without knowledge of the transmission channel characteristics and the real sources can be expressed briefly as a number of blind source separation (BSS) or related generalized component analysis (GCA) methods: Independent Component Analysis (ICA) (and its extensions), Sparse Component Analysis (SCA), Sparse Principal Component Analysis (SPCA), Non-negative Matrix Factorization (NMF), Time-Frequency Component Analyzer (TFCA) and Multichannel Blind Deconvolution (MBD).

BSP is not limited to ICA or BSS. With BSP we aim to discover and validate principles or laws which govern relationships between inputs (hidden components) and outputs (observations) when the information about the propagation Multi-Input Multi-Output (MIMO) system and its inputs are limited or hindered. BSP incorporates many problems, like blind identification of channels of unknown systems or a problem of suitable decomposition of signals into basic latent (hidden) components which do not necessary represent true sources but rather some of their features or sub-components. This four-hour course presents the fundamentals of blind signal processing, especially blind source separation and extraction, and in the remaining time discusses their applications in several important signal processing areas including estimation of sources, novel enhancement, denoising, artifact removal, filtering, detection, classification of multi-sensory signals and data, especially in biomedical applications and Brain Computer Interface (BCI)

LEARNING OUTCOMES

This course will enable you to:
- understand the basic principles and models for independent component analysis, blind source separation and blind signal extraction from recorded sensor data
- learn how to use specific algorithms and computer programs for blind source separation such as ICALAB for real-world signals, images and data
- apply blind source separation techniques and algorithms to your own data or problems

INTENDED AUDIENCE

Engineers, applied mathematicians, scientists, and technical managers seeking to understand this new emerging technology for extraction, enhancement, decomposition, filtering and denoising of hidden source signals or components from superimposed, and overlapped multi-sensory signals or images or extract hidden information from multidimensional data. Some prior background in signal processing, mathematics, statistics concepts would be very helpful.

INSTRUCTORS

Te-Won Lee received his degrees in electrical engineering with highest honors from the Technische Universitaet in Berlin and the Max Planck Institute. He has published over 100 papers in the field of machine learning and advanced signal processing and is mostly known for his work on ICA with real world applications. Dr. Lee is also co-founder of SoftMax, Inc. a technology focused company that commercializes the signal separation technology.

Soo-Young Lee has led a multidisciplinary, multi-organization Brain Neuroinformatics Research Program for Artificial Brains with human-like intelligent functions since 1998. He is a Past-President of the Asia-Pacific Neural Network Assembly, and has received Leadership Award and Presidential Awards from the International Neural Network Society in 1994 and 2001, and the APPNA (Asia-Pacific Neural Network Assembly) Service Award in 2004. He is the Editor-in-Chief of the journal Neural Information Processing-Letters and Reviews. His research is focused on artificial brains, intelligent systems based on the biological information processing mechanism in the human brain. Especially, he is interested in combining computational neuroscience and information theory, including Independent Component Analysis for blind signal separation and feature extraction.

The course price includes the extended edition of *Adaptive Blind Signal and Image Processing* (Wiley, 2002) by Andrzej Cichoki and Shun-ichi Amari, and the software package ICALAB in MATLAB.

Compressive Sensing: Theory and Applications

SC902 *NEW*

Course level: Introductory
CEU .35 $265 / $315 USD
Sunday 1:30 to 5:30 pm

Sensors and signal processing hardware and algorithms are under increasing pressure to accommodate ever larger and higher-dimensional data sets; ever faster capture, sampling, and processing rates; ever lower power consumption; communication over ever more difficult channels; and radically new sensing modalities. This four-hour course presents the fundamental theory and selected applications of Compressive Sensing, a new approach to data acquisition in which analog signals are digitized for processing not via uniform sampling but via inner products with random test functions. Unlike Nyquist-rate sampling, which completely describes a signal by exploiting its bandlimitedness, Compressive Sensing reduces the number of measurements required to completely describe a signal by exploiting its compressibility. The implications are promising for many applications and enable the design of new kinds of analog-to-digital converters, imaging systems and cameras, and radar systems, among others.

LEARNING OUTCOMES

This course will enable you to:
- grasp the basic principles of signal and image sparsity and compressibility

- describe the Compressive Sensing acquisition process
- describe the Compressive Sensing reconstruction process
- apply the theory to new applications

INTENDED AUDIENCE

Engineers, applied mathematician, scientists, and technical managers seeking to understand this new technology and its implications in data, signal, and image analysis and processing will benefit from this course. Some prior background in Fourier domain concepts is helpful.

INSTRUCTORS

Ronald A. DeVore is the former Director of the Industrial Mathematics Institute (IMI) of the University of South Carolina. He received his Ph. D. in Mathematics from Ohio State University and founded the IMI in 1992. He has held visiting positions at the University of Wisconsin, Texas A&M, Rice University, RWTH Aachen, University of Paris VI, and is currently a visiting professor at the Courant Institute. He is the winner of an Alexander von Humboldt Prize, the Gold Medal of Science of Bulgaria, and several best paper awards for his research. He is an elected member of the American Academy of Arts and Sciences. He has given invited plenary lectures to the American Mathematical Society, the Society of Industrial and Applied Mathematics, the Canadian Mathematical Society, the Foundations of Computational Mathematics, and the International Congress of Mathematics. He has published over 100 papers and three books on mathematics and its application to image/signal processing, numerical computation, and learning theory.

Richard G. Baraniuk is the Victor E. Cameron Professor of Electrical and Computer at Rice University. His research interests lie in the area of multiscale signal and image processing with applications to natural image modeling, sensor networks, time-frequency analysis, and compressive sensing. He has received the National Young Investigator award from NSF, the Young Investigator Award from ONR, the Rosenbaum Fellowship from the Isaac Newton Institute of Cambridge University, the University of Illinois ECE Young Alumni Achievement Award and been elected a Fellow of the IEEE. His recent work on the Rice single-pixel compressive camera was selected by MIT Technology Review Magazine as a TR10 Top 10 Emerging Technology.

Communications and Networking Technologies and Systems

Security of Information and Communication Networks

SC891 *NEW*

Course level: Introductory
CEU .35 $265 / $315 USD
Sunday 1:30 to 5:30 pm

Private and sensitive data are transported over the communications network, which unfortunately is not immune to eavesdroppers, attackers, and impersonators who access the network and harvest or destroy electronic data. This short course provides attendees with a thorough introduction to data security and cryptographic methods, such as DES, AES, RC4, elliptic curve, and RSA. It provides an introduction to key distribution methods such as Diffie-Hellman, ECC, Digital Signature, Key Escrow and quantum key distribution in optical networks. It also provides a thorough introduction in network security, and how it differentiates from data security. Other topics in this course include vulnerabilities and countermeasures, biometrics in the communications network and security in the next generation network.

LEARNING OUTCOMES

This course will enable you to:
- explain encryption and message security
- distinguish security levels and security layers in communication networks
- describe the mathematical foundation for security; prime numbers, mod arithmetic, greatest common denominator, and more
- classify ciphers (symmetric, asymmetric, RSC, DES, AES, RC4, elliptic curve, RSA)
- classify key distribution algorithms (Merkley, Shamir, Diffie-Hellman, ECC, Digital Signature, Key Escrow)
- identify Quantum Cryptography and QKD (Polarization, Entangled-States, Teleportation)
- identify vulnerabilities and countermeasures in QC
- justify biometrics in communication networks
- summarize security in Next Generation Optical Networks

INTENDED AUDIENCE

This course is intended for anyone who needs to learn about data and network security, cryptographic methods, security issues, attack detection and countermeasures strategies. Those who develop their own cryptographic methods or who work with or supervise security-based communication products will find this course valuable.

INSTRUCTOR

Stamatios Kartalopoulos, Sr. PhD, (SPIE member, IEEE Fellow and Distinguished Lecturer) is the Williams Professor in Telecommunications Networking of the University of Oklahoma and principal consultant of PhotonExperts. He is the author of nine textbooks, holds nineteen patents and has authored more that 150 research papers.

Sensor Array Signal Processing

SC901 *NEW*

Course level: Introductory
CEU .65 $470 / $570 USD
Tuesday 8:30 am to 5:30 pm

See p. 111 for description.

Network Centric Target Tracking and Classification

SC728

Course level: Intermediate
CEU .65 $470 / $570 USD
Monday 8:30 am to 5:30 pm

See p. 110 for description.

Battlespace Technologies

Introduction to Cognitive Situation Management for Tactical Operations

SC895 *NEW*

Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 8:30 am to 12:30 pm

Modern wars are characterized by high mobility of troops and weapon systems, increasing operational tempo, and asymmetric and often unpredictable situations. Such new characteristics predicate the need for comprehensive and effective methods of battlespace situation management. Situation Management (SM) is as a synergistic goal-directed process of situation awareness, control, and prediction in dynamic operational spaces. The essential components of SM include sensing and intelligence gathering, information fusion and event correlation, modeling of the domain entities and their inter-relations, detecting and reasoning about the situations, threat situation prediction, and action planning affecting the situations. This course gives an overview of a new direction in situation management called cognitive (intelligent) situation management, i.e. on SM, which is associated with the meaning of situations and the logical methods of reasoning about the situations. In order to exhibit such intelligent capabilities, the systems should possess fairly elaborated conceptual knowledge about the domain (domain ontology).

The first section of the course describes the domain of cognitive situation management, reviews the issues, and gives introductory notions of modeling complex dynamic systems and operational situation management. The second section introduces the basic elements of the formal framework of cognitive situation management. The third section gives examples of situation management. The fourth section describes the core technologies of building situation management systems. The fifth section presents a distributed architecture of a situation management system based on a multi-agent approach, describes the software system architecture based on component services, and refers to several tools of building the situation management applications. The last section will discuss some advanced topics of situation management and outline future research and development directions. Overall, the course concentrates on practical aspects, requirements, basic concepts, architecture, design and key enabling technologies of building cognitive situation management systems.

LEARNING OUTCOMES

This course will enable you to:
- identify the need of cognitive situation management systems for your application
- describe the basic concepts of situation awareness and decision support
- explain the architecture and key components of the situation management system
- define the key intelligent information technologies enabling the situation management systems
- demonstrate and evaluate solutions for your application

INTENDED AUDIENCE

This material is intended for anyone who needs to learn how to identify, analyze and design intelligent command and control systems. This is an introductory course; however several novel models and technological solutions will be described in sufficient depth to lead the students to practical engineering methods and tools. Those in defense and industry who are engaged in development of tactical battlespace, cyber security, communications networking, and disaster recovery operations management systems will find this course valuable.

INSTRUCTOR

Gabe Jakobson is Chief Scientist at Altusys Corp., and has been involved in research and design of intelligent information technologies for over 25 years. He is the current chair of the IEEE Communications Society Sub-Committee on Situation Management.

Key:
Price = SPIE Member / Non-Member
SC000 = Course Number
WS000 = Workshop Number
FC = Foundation Course

Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies

SC719

FC

Course level: Introductory
CEU .35 $265 / $315 USD
Monday 1:30 to 5:30 pm

See p. 101 for description.

Optical and Optomechanical Engineering

Precision Mounting of Optical Components

SC013

FC

Course level: Introductory
CEU .65 $540 / $640 USD
Tuesday 8:30 am to 5:30 pm

This introductory-level, one-day course reviews key influences of adverse environments on optical components and instruments, important characteristics of materials, and techniques commonly used to mount individual and multiple lenses, windows, shells, optical filters, prisms and small to moderate sized mirrors. Mounting means include retaining rings, flanges, spring clips, adhesives, sealing compounds, and flexures. Techniques for estimating stress buildup within typical optical components due to imposed mounting forces are summarized. Effects of temperature changes on optomechanical assemblies and athermalization techniques are also summarized. Examples of component mountings in typical optical instrument applications are considered throughout the course in order to illustrate successful design configurations.

LEARNING OUTCOMES

This course will enable you to:
- appreciate the effects of the environment on optics
- identify critical aspects of the optic-to-mount interface
- compare alternative mounting designs for individual lenses, lens assemblies, catadioptric systems, windows, shells, filters, prisms, and small to moderate sized mirrors
- estimate axial contact stresses in optics due to mounting forces
- anticipate how temperature changes may affect optical instruments

INTENDED AUDIENCE

Participation in this course will help optical and mechanical technicians, engineers, designers, scientists, project managers, and team supervisors as well as individuals from other technical disciplines learn how optical components can best be integrated into instruments and basic techniques for analyzing optomechanical designs.

INSTRUCTOR

Paul Yoder, Jr. has continued to serve various clients as an independent consultant in optical and optomechanical engineering following a 40-year career in optical engineering with U.S. Government and industrial organizations. During this period, he designed optical instruments for military, aerospace, commercial, and medical applications. He is a fellow of both OSA and SPIE, and a founding member of SPIE's Optomechanical Instrument Working Group. For many years, Yoder also has taught short courses on optical and optomechanical engineering for industry, government agencies, and SPIE as well as graduate-level courses for the University of Connecticut.

COURSE PRICE INCLUDES the newly revised and expanded text PM110, *Mounting Optics in Optical Instruments, 2nd edition* (SPIE Press, 2008), by Paul R. Yoder, Jr.

Basic Optics for Engineers

SC156

FC

Course level: Introductory
CEU .65 $505 / $605 USD
Sunday 8:30 am to 5:30 pm

This course introduces each of the following basic areas of optics, from an engineering point of view: geometrical optics, image quality, flux transfer, sources, detectors, and lasers. Basic calculations and concepts are emphasized.

LEARNING OUTCOMES

This course will enable you to:
- compute the following image properties: size, location, fidelity, brightness
- estimate diffraction-limited imaging performance
- explain optical diagrams
- describe the factors that affect flux transfer efficiency, and their quantitative description
- compute the spectral distribution of a source
- describe the difference between photon and thermal detectors
- calculate the signal to noise performance of a sensor (D* and noise equivalent power)
- differentiate between sensitivity and responsivity
- explain the main factors of laser beams: monochromaticity, collimation, and propagation.

INTENDED AUDIENCE

This class is intended for engineers, technicians, and managers who need to understand and apply basic optics concepts in their work. The basics in each of the areas are covered, and are intended for those with little or no prior background in optics, or for those who need a fundamental refresher course.

INSTRUCTOR

Alfred Ducharme is a professor of optics and electrical engineering in the College of Engineering and Computer Science at the University of Central Florida. He received a B.S. in Electrical Engineering from the University of Massachusetts - Lowell, and both a M.S. and Ph.D. in Electrical Engineering from the University of Central Florida - School of Optics (CREOL). Dr. Ducharme is the Program Coordinator for the 4-year undergraduate program in Photonics (BSEET-Photonics) offered by the Engineering Technology Department.

COURSE PRICE INCLUDES the text *Basic Electro-Optics for Electrical Engineers* by Glenn D. Boreman (SPIE, 1998).

Introduction to Radiometry and Photometry

SC178

FC

Course level: Introductory
CEU .35 $390 / $490 USD
Monday 8:30 am to 12:30 pm

In this half-day course, the four basic quantities of radiometry, units, and the relationships to electro-magnetic field quantities are presented. Photometry, its units, and conversion factors to old units are also addressed. The course covers the basics of black body radiation and transfer, showing the basic equations needed to set up and solve problems and the instrumentation for each. The textbook offers more detail in detector optical/ electrical characterization, color theory, and optical properties of specific materials.

LEARNING OUTCOMES

This course will enable you to:
- understand the methodology used in quantifying and describing nearly all forms of electromagnetic radiation, from the extreme UV through the visible portions of the spectrum and the far IR
- master the basics of photometry, the system of terminology and units used whenever the eye is the detector
- be conversant in the concepts, terminology, and units of both radiometry and photometry
- master the characterization of optical properties of surfaces, materials, and objects
- apply radiometric principles to image formation in optical systems
- set up and solve simple problems of flux transfer in lossless, nonabsorbing media, including imaging and nonimaging systems
- design and calibrate radiometers and photometers.

INTENDED AUDIENCE

This course is for engineers and scientists who deal with electromagnetic radiation who need to quantify this radiation using international standard units and terminology. The course is for teachers, students, and researchers interested in using proper methods, terminology, symbols, and units in their courses and their research work. It is also for practitioners solving problems in radiation transfer, and in measuring radiant and luminous flux in optical systems and in nature.

INSTRUCTOR

Ross McCluney worked for over 30 years as a principal research scientist at the Florida Solar Energy Center, a research institute of the University of Central Florida, until his retirement in 2007. He holds B.A., M.S., and Ph.D. degrees in physics, with optics as his specialty. His most recent research interests include the energy and illumination performances of windows and other solar lighting systems in buildings. Dr. McCluney has worked for Eastman Kodak Company as an optical engineer, and for NASA/Goddard Space Flight Center as an optical oceanographer. He has also written chapters on radiometry and photometry for the *Encyclopedia of Physical Science and Technology*, on photometry for the *Encyclopedia of Optical Engineering*, and on window energy and daylighting for the *Encyclopedia of Energy Engineering*. Currently residing in Chattanooga, Tennessee, Dr. McCluney pursues an active consulting practice and is a founding director and VP Research for Sunflower Corporation of Boulder, CO, an interior solar lighting system manufacturer. He is also a popular lecturer on global warming and more general environmental issues, and has published several books on the latter topic. www.rossmccluney.com.

COURSE PRICE INCLUDES the text *Introduction to Radiometry and Photometry* (Artech House, 1994), by Ross McCluney.

Optical Alignment Mechanisms

SC220

Course level: Intermediate
CEU .35 $265 / $315 USD
Wednesday 1:30 to 5:30 pm

This is a practical "how to" course dealing with the design and fabrication of precision optical alignment and adjustment devices. The course uses example optical systems to identify typical alignment requirements and provides a catalog of proven adjustment techniques.

LEARNING OUTCOMES

This course will enable you to:
- learn to assess degrees-of-freedom an optical element must have to align it in its system
- define range-of-adjustment vs. resolution-of-adjustment for these mechanisms
- identify appropriate design guidelines and pitfalls
- understand material choices, important tolerances, and mount stability
- determine where to get the hardware made.

INTENDED AUDIENCE

This course is intended to help the mechanical or opto-mechanical design engineer identify and characterize the degrees-of-freedom necessary to align an optical system and to provide him with a catalog of proven configurations. While the course primarily addresses small optics, the concepts apply to larger systems as well. A general knowledge of optics is required; familiarity with optical measurement and mounting techniques is highly recommended.

INSTRUCTOR

Robert Guyer specializes in the design of lasers, stable optical mounts, gimbaled systems, and precision mechanisms. Mr. Guyer is an Engineering Fellow at BAE Systems in Nashua, New Hampshire, and has over 40 years military, space, and commercial opto-mechanical product development experience with BAE Systems, RCA, GE, Lockheed Martin, and AFAB Group. He is a registered Professional Engineer and committed Corvette enthusiast.

Integrated Opto-Mechanical Analysis

SC254

Course level: Advanced
CEU .65 $515 / $615 USD
Monday 8:30 am to 5:30 pm

This course presents the basic elements of opto-mechanical analysis to assess the impact of static, dynamic, and thermal loads on the performance of imaging systems. Material is drawn from the instructor's collective 75 years' experience in high performance optical systems along with courses taught at the University of Rochester. Emphasized are the application of finite element techniques to model optical elements and support structures. Students will learn how to evaluate the effect of gravity, pressure, stress, temperature, random, and shock loads on optical systems using models of varying degree of complexity. The integration of thermal and structural response quantities into optical design software is also presented that allow optical performance metrics such as wavefront error to be computed as a function of the environment and mechanical design variables. Advanced techniques including the modeling of adaptive optics and design optimization are also discussed. Examples will be drawn from ground-based, airborne, and spaceborne optical systems.

LEARNING OUTCOMES

This course will enable you to:
- accurately model optical mounts, flexures, bonds, lightweight mirrors and metering structures
- predict pointing errors and line-of-sight jitter in thermal and random vibration environments
- perform thermo-elastic analyses and evaluate the impact of temperature on optical systems
- predict optical surface distortions using Zernike polynomials
- perform stress analyses and assess the impact of stress birefringence
- develop diagnostic analyses and back-outs for test and assembly induced optical errors
- integrate thermal and structural results into optical models
- design and analyze vibration isolation systems
- model adaptive optics, predict system correctability and system performance
- use numerical optimization techniques to improve designs

INTENDED AUDIENCE

This course is intended for mechanical and optical engineers interested in learning about opto-mechanical analysis and the use of modern software tools including finite element analysis and optical design software to design and analyze optical systems. Familiarity with finite element software and a basic understanding of opto-mechanics and optical systems is recommended.

INSTRUCTORS

Keith Doyle has 20-years experience in the field of optical engineering, specializing in opto-mechanics and the multidisciplinary modeling of optical systems. He has worked on a diverse range of optical instruments including those for the astronomy, microlithography, telecommunications, consumer optics, and defense industries. He is currently a Vice President of Sigmadyne and has authored or co-authored over 25-publications in this field. Previous employers include Optical Research Associates and MIT Lincoln Laboratory. He received his Ph.D. in engineering mechanics and a minor in optical sciences from the University of Arizona in 1993.
Victor Genberg has over 40 years' experience in the application of finite element methods to high-performance optical structures and is a recognized expert in opto-mechanics. He is currently President of Sigmadyne, Inc. and a professor at the University of Rochester where he has taught courses in opto-mechanics, finite element analysis, and design optimization for 34-years. He has over 40 publications in this field including two chapters in the CRC Handbook of Optomechanical Engineering. Prior to founding Sigmadyne, Dr. Genberg spent 28-years at Eastman Kodak serving as a technical specialist for military and commercial optical systems.

COURSE PRICE INCLUDES the text *Integrated Opto-mechanical Analysis* (SPIE, 2002), by Keith Doyle, Victor Genberg, and Gregory Michels. The text includes an accompanying CD-ROM with examples.

Optomechanical Analysis

SC781 FC

Course level: Advanced
CEU .65 $470 / $570 USD
Wednesday 8:30 am to 5:30 pm

This course teaches the basic requirements for accurately predicting the influences of thermal, structural and servo system designs on the performance and quality of optical imaging systems. It is based upon the instructor's forty years' experience in designing, analyzing and building complex optical systems, especially for the Federal market place. It incorporates elements from some of his earlier tutorials, "Finite Element Methods in Optics," "Optical Flexures" and "Optomechanics and the Toleranc-ing of Instruments." The instructor will review the goals of "Integrated Analysis" as promoted by NASA and DoD since the early 90's. Strengths and weakness of various approaches will be discussed. Special optomechanical modeling tools (the Optomechanical Constraint Equations and the Optical Analog) will be presented in some detail. Analytical error functions will be developed and evaluated. Sources of analytical error will be discussed and analyzed. Analytical error budgets will be developed and compared for various approaches to end-to-end analysis of systems. A candidate strategy will be presented for consideration.

The course will be illuminated with both text book-type problems and actual examples of applications from the instructor's experiences. The students will learn the strengths and weakness of the analytical methods in the various disciplines, how to estimate the sources and magnitudes of errors in various approaches to analysis, how to put together an error budget for a proposed analytical effort and how to select the most appropriate methods for end-to-end system analysis.

LEARNING OUTCOMES

This course will enable you to:
- plan and execute multidisciplinary analytical procedures
- know the strengths and weakness of individual analytical routines
- estimate the errors contributed by various steps in the analytical process
- make a complete error budget for end-to-end analysis of optical systems
- evaluate alternative approaches to the system analysis process

INTENDED AUDIENCE

Optics professionals (engineers, scientists, and their managers) who are responsible for planning, designing and building optical instruments.

INSTRUCTOR

Alson Hatheway is a mechanical engineer and president of his own company. He has over forty years experience in designing, analyzing and building new optical and photonic products. He has authored 59 technical papers, presented three different tutorials and holds four patents. He is a fellow of SPIE, a founder of the Optomechanical / Instrument Technical Group and currently its chairman.

Allowable Stresses in Glass and Engineering Ceramics

SC796

Course level: Intermediate
CEU .35 $265 / $315 USD
Wednesday 8:30 am to 12:30 pm

This course provides attendees with a basic understanding of the terminology and analyses used in a fracture mechanics approach to determine the strength of glass, crystals, and ceramics. The course focuses on the determination of inert strength based on surface flaws, and reduction of such strength of these materials in the presence of time and moisture. Included are the effects of residual stress on lifetime, and basic reliability predictions. Examples from the literature are presented to bear out the theoretical design principles.

LEARNING OUTCOMES

This course will enable you to:
- review the strength of unflawed, perfect surfaces
- identify the processes that reduce glass strength
- name and define the critical fracture mechanics terms
- estimate the strength of glass, crystals, and ceramics in the presence of flaws and moist environments
- compose strength vs. time diagrams
- understand the effects of residual stress and design limitations
- list and compare alternative methods of crack propagation strength analyses

INTENDED AUDIENCE

This material is intended for structural, mechanical and optical engineers who wish to obtain an understanding of the principles of strength determination for optical components. Those who work with ground, air, or space-based systems will leave with a keen understanding of fracture mechanics applications without the need for complex and unwieldy computation.

INSTRUCTOR

John Pepi is a principal engineer with SSG Precision Optronics in Wilmington, MA. He holds a Master's degree in Structural Engineering, and has over 30 years experience in the design of lightweight optical systems. He is an internationally recognized authority on mirror design principles, has authored over a dozen papers on optostructural design principles, and has been a previous instructor for SPIE at its annual meetings.

Industry Workshops

The Business of Defense

Intellectual Property Issues in the Defense and Security Industries

WS639

Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 8:30 am to 12:30 pm

Intellectual property (IP), in the form of copyrights, trademarks, trade secrets, ideas and patents, is of great importance in the defense and security industries. Many companies and contractors are involved with developing and manufacturing specialized products or processes (read: inventions) for use by the government, often with the assistance of the government. This governmental connection creates special issues for developing, managing, protecting and leveraging IP. For many companies and government contractors, their IP is their most valuable asset, so that having a modern view of IP and the IP issues in the defense and security business is critical.

The aim of this course is to provide an overview of the numerous IP issues and considerations related to doing business in the defense and security industries. Topics covered include: the basic forms of IP and their relevance to the defense and security industries, government rights to inventions, export control issues, confidentiality and information-handling issues, litigation and related administrative proceedings, and the specialized IP interactions defense/security contractors have with the government. The course is taught in a round-table format with a panel of experts so that specific questions and issues of particular interest to the course attendees can be explored in detail from a variety of angles.

LEARNING OUTCOMES

This course will enable you to:
- describe the basic forms of IP
- evaluate the nuances of using certain types of IP in the defense/security industries
- learn about the main IP issues faced by defense contractors and by the government
- list the special IP laws related to government-funded IP and government-used IP
- appreciate the procedural and notification requirements for protecting data and software
- describe the role of litigation in both civil and administrative forums
- appreciate issues and laws relating the handling, sharing and theft of confidential information

INTENDED AUDIENCE

This course is designed for managers, engineers, inventors, administrators and executives that are interested in the IP-related aspects of working in the defense and security industries, particularly as these aspects relate to and impact small- and medium-sized businesses.

INSTRUCTORS

Joseph Gortych is a registered patent attorney and is president of Opticus IP Law PLLC, based in Sarasota, Florida. He specializes in the strategic development, management and protection of intellectual property for optics, photonics and semiconductor technologies.

Timothy Stanley is Intellectual Property Counsel for Lockheed Martin Corporation and is based in Texas. He is responsible for protecting and coordinating the use of Lockheed Martin's intellectual property in various government contracts both domestic and foreign.

Harvey Kauget is a partner at Phelps Dunbar LLP in the firm's regional commercial litigation group in the Tampa office. He practices in the area of intellectual property litigation, focusing primarily upon patent litigation including governmental ownership of IP.

Eric Pellenbarg is an associate at Phelps Dunbar LLP in the firm's regional commercial litigation group in the Tampa office. He practices in the area of intellectual property litigation and all aspects of government procurement law. Prior to joining the firm, Eric served in the U.S. Air Force Judge Advocate General's (JAG) Corps where he was a government contracts attorney at the Air Force's Electronic Systems Center.

Playing the SBIR Game to Win

WS843

Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 1:30 to 5:30 pm

This course provides attendees with a working knowledge of the Small Business Innovation Research (SBIR) Program and presents proven strategies to win awards. The course concentrates on those elements for Phase I that will enhance the likelihood of getting a favorable review and an Agency decision to fund your research project. Many practical and useful examples that prepare you to win more funding will be included throughout. You will learn to construct and submit winning proposals.

LEARNING OUTCOMES

This course will enable you to:
- identify and understand the target Agency's funding priorities
- define the Collaboration Partners for a winning team
- construct a Commercialization Plan that will be viewed as achievable
- understand the Grant or Contract negotiation processes
- ensure positioning for follow-on Phase II and III money

INTENDED AUDIENCE

This material is intended for anyone who wishes to submit SBIR proposals to win research funding from the U.S. Government.

INSTRUCTOR

Fred Patterson, The SBIR Coach (www.SBIRcoach.com), has been involved with the SBIR Program and all of its aspects for over twenty years. As the co-founder of two of Texas' most successful SBIR companies, and a well-recognized consultant with dozens of clients nationwide, he has guided his companies and clients to unparalleled SBIR successes in all three phases of the program.

Compliance with the International Traffic in Arms Regulations (ITAR)

WS845

Course level: Introductory
CEU .35 $265 / $315 USD
Thursday 8:30 am to 12:30 pm

This course provides background on the ITAR and the importance to national security of licensing defense articles. An interactive format ensures students will gain a working knowledge of the ITAR and will be able to identify potential trouble spots.

LEARNING OUTCOMES

This course will enable you to:
- identify the important elements of the ITAR and key players in the licensing process
- define potential exports within your company
- explain the federal penalties for non-compliance with the ITAR
- classify an article on the U.S. Munitions List (USML)
- describe the differences between technical and public domain data

INTENDED AUDIENCE

The material is intended for anyone involved in the export process to include Export Compliance Directors & Managers, Contracts and Subcontract Officers, Business and Marketing Managers, Program and Proposal Managers, Shipping and Logistics Personnel and Legal Counsel.

INSTRUCTOR

Suzanne Palmer founded Export Compliance Solutions LLC (ECS) after 15 years of experience in the State Department followed by five years of hands-on import and export experience in the defense industry sector. The company assists a wide range of businesses in their understanding of the very complex area of federal regulations that control exports and imports administered by the Departments of State and Commerce. ECS offers Basic, Intermediate and Advanced level interactive training for those seeking a comprehensive understanding of the International Traffic in Arms Regulations (ITAR). Ms. Palmer holds two Bachelor's degrees from Mary Washington College in International Affairs and French. She also earned a Masters of Arts degree from American University in International Affairs.

COURSE PRICE INCLUDES a copy of the International Traffic in Arms Regulations (ITAR).

Key:
Price = SPIE Member / Non-Member
SC000 = Course Number
WS000 = Workshop Number
FC = Foundation Course

Professional Development

The Craft of Scientific Presentations: A Workshop on Technical Presentations

WS667

Course level: Introductory
CEU .35 $75 / $125 USD
Wednesday 8:30 am to 12:30 pm

This course provides attendees with an overview of what distinguishes the best scientific presentations. The course introduces a new design for presentation slides that is both more memorable and persuasive from what is typically shown at conferences.

LEARNING OUTCOMES

This course will enable you to:
- account for the audience, purpose, and occasion in a presentation,
- logically structure the introduction, middle, and ending of a scientific presentation,
- create a memorable and persuasive set of presentation slides, and
- deliver a presentation with more confidence.

INTENDED AUDIENCE

This material is intended for anyone who needs to present scientific research. Those who either have not yet presented or have made several presentations will find this course valuable.

INSTRUCTOR

Michael Alley teaches writing and speaking to engineering students at Penn State. Alley has taught this workshop to researchers at the Army Research Laboratory, Lawrence Livermore National Laboratory, United Technologies, the University of Illinois, the University of Oslo, and Virginia Tech.

Course price includes the text *The Craft of Scientific Presentations* by the instructor. This workshop is free to SPIE Student Members. You must register to attend.

The Craft of Scientific Writing: A Workshop on Technical Writing

WS668

Course level: Introductory
CEU .35 $75 / $125 USD
Wednesday 1:30 to 5:30 pm

This course provides an overview on writing a scientific paper. The course focuses on the structure, language, and illustration of scientific papers.

LEARNING OUTCOMES

This course will enable you to:
- account for the audience, purpose, and occasion in a scientific paper,
- logically structure the introduction, middle, and ending of a scientific paper,
- understand how to make your language clear, energetic, and fluid, and
- avoid the most common mechanical errors in scientific writing.

INTENDED AUDIENCE

This material is intended for anyone who needs to write about scientific research. Those who either have not yet written a paper or have written several papers will find this course valuable.

INSTRUCTOR

Michael Alley teaches writing and speaking to engineering students at Penn State. Alley has taught this workshop to researchers at the Army Research Laboratory, Lawrence Livermore National Laboratory, United Technologies, the University of Illinois, the University of Oslo, and Virginia Tech.

Course price includes the text *The Craft of Scientific Writing* by the instructor. This workshop is free to SPIE Student Members. You must register to attend.

Essential Skills for Engineering Project Leaders

WS846

Course level: Introductory
CEU .35 $265 / $315 USD
Tuesday 1:00 to 5:00 pm

This workshop teaches skills needed to lead technical projects, drive innovation, and influence others. Attendees learn the difference between leadership and management, and how to develop specific leadership skills that are important to technical professionals who lead projects or need assistance from others to get things done. Participants engage in exercises that assess their individual leadership abilities and provide guidance for further skill development.

LEARNING OUTCOMES

This course will enable you to:
- become more influential
- improve your ability to effectively lead projects and teams
- identify leadership development goals specific to your individual needs
- get more support for ideas that will benefit your company
- build rapport with your boss and your peers

INTENDED AUDIENCE

This material is intended for early-career technical professionals who can benefit from improving leadership skills. The course is tailored for engineers and other technical professionals through the use of real-world case studies, exercises and examples pertaining to the experiences of individuals and teams involved in technology projects.

INSTRUCTOR

Gary Hinkle is President and founder of Auxilium, Inc. His experience includes a broad variety of management and staff assignments with small, medium, and large companies involved in the development and manufacturing of high-tech products. Gary led several high-profile projects including the development of a U.S. Army vehicle maintenance system, and he directed the development of 9-1-1 systems used in the majority of Public Safety Answering Points in the U.S. He also served as engineering manager for the world's best selling oscilloscope product line at Tektronix. His design and management experience spans the electronics, mechanical and software engineering disciplines.

COURSE PRICE INCLUDES a comprehensive workbook and email/phone follow-up with the instructor after the workshop to assist with implementation.

Registration

SPIE Defense+Security is held at Orlando World Center Marriott Resort & Convention Center, 8701 World Center Drive, Orlando, Florida

Onsite Registration Hours

Orlando World Center Marriott Resort & Convention Center
Arrival Concourse next to Canary Ballroom

Sunday 16 March . . . . . 7:30 am to 4:00 pm
Monday 17 March . . . . . 7:15 am to 4:00 pm
Tuesday 18 March. . . . . 7:30 am to 5:00 pm
Wednesday 19 March . . . . . 7:30 am to 5:00 pm
Thursday 20 March . . . . . 7:30 am to 2:00 pm

Conference Registration

Includes access to the conferences, panels, technical events, poster sessions, coffee breaks, exhibition, desserts in the exhibition hall Tuesday through Thursday and the welcome reception. After 29 February 2008, prices increase by $100USD.

For those registering by fax or mail after 29 February 2008 please add the appropriate additional fees to your total.

Course and Workshop Registration

Courses and workshops are priced separately. Conference registration is not required to attend courses. Course only registration includes your selected course(s), course notes, coffee breaks, and admittance to the exhibition. Course prices include Florida state tax. Prices increase $50USD after 29 February 2008.

SPIE Student Members save 50% on Course Registration. Proof of full-time student status is required; please include your student ID number or proof of student status with your registration. Offer applies to undergraduate/graduate students who are enrolled full time and have not yet received their Ph.D.

Course Materials Desk

Convention Center lower arcade

Open during Registration hours

If you have registered to attend a course, stop by the Course Materials Desk after you pick up your badge, to obtain your course notes and course location. Pick up a copy of the latest Education Services catalog to see SPIE Courses at symposia, on video and CD-ROM, and to discover the opportunities of customized In-Company courses.

Exhibition Hours

Orlando World Center Marriott Resort & Convention Center · Cypress Ballroom

Tuesday 18 March. . . . . 10:00 am to 5:00 pm
Wednesday 19 March . . . . . 10:00 am to 5:00 pm
Thursday 20 March . . . . . 10:00 am to 2:00 pm

Exhibition Registration

Admission is included with conference, course or workshop registration. Or register online to attend only the exhibition; exhibition-only registration is complimentary.

SPIE Membership

SPIE Members receive 15% off conference and course registration fees. Sign up for SPIE Membership when you register and take immediate advantage of member pricing.

Order SPIE Publications with your registration

Choose an SPIE Digital Library subscription with your registration. Also available: Proceedings of SPIE and Symposium Proceedings on CD-ROM. Please see details on the registration form.

Proceedings and CD-ROMs as part of a registration include tax and shipping. Proceedings and CD-ROMs purchased separately do not include shipping.

Media/Press Representatives

For credentialed press and media representatives, please email contact information, title and organization to media@spie.org.

SPIE Receipts, Badge Corrections, Cashier

Receipts - Preregistered attendees who did not receive a receipt prior to the meeting may obtain a new copy of their registration receipt onsite at the Badge Corrections and Receipts counter in the registration area.

Badge Corrections - Attendees who need a correction to their badge information onsite may do so at the Badge Corrections and Receipts counter in the registration area.

Cashier Station - If you are paying by cash or check as part of your onsite registration, wish to add a short course, workshop, or special event requiring payment, or have questions regarding your registration please see the onsite cashier at the Cashier station in the registration area.

Author/Presenter Information

Speaker Check-In Desk/Preview Station

Across from Grand Ballroom

Sunday through Thursday. . . . . 7:30 am to 5:00 pm

All conference rooms will have a computer workstation, LCD projector, screen, lapel microphone, and laser pointer. All Presenters are requested to come to the speaker check-in desk to confirm display settings of their presentations from their memory devices or laptops with the audiovisual equipment being used at this symposium.

Poster Setup Instructions

Tuesday 18 March. . . . . 6:00 to 7:30 pm

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday. Poster presenters who have not set up by 5:00 pm on Tuesday will be considered a "no show" and their manuscript will not be published. Presenters must remove their posters immediately after the poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session. Poster authors are required to be by their posters from 6:00 to 7:30 pm to answer questions from attendees.

Apply now for your Visa!

If you need a travel visa, begin the visa application process now! Strict security requirements may cause delays in visa processing. More information about applying for a USA visa is available at:

http://national-academies.org/visas

Letters of Invitation for Visa Process

Individuals requiring letters of invitation to obtain travel visas to present their papers may access and print an Invitation Letter Request Form found on the event website.

Paper Submission

On-Site Manuscript Due Date: 7 January 2008

Post-Meeting Manuscript Due Date: 18 February 2008

*Please Note: Submissions imply the intent of at least one author to register, attend the symposium, present the paper (either orally or in poster format), and submit a full-length manuscript for publication in the conference Proceedings.

SPIE Onsite Services

SPIE Marketplace & Membership Services

Open during registration hours, Monday–Thursday

The SPIE Marketplace is your source for the latest SPIE Press books, Proceedings, and Educational and Professional Development materials. Become a member of SPIE, explore the Digital Library, and take home a souvenir.

Industry Resources Booth

The SPIE Industry Resources Booth provides the tools you need to move ideas and technology to the market. Visit the booth for information on events, marketing opportunities, education, and training that SPIE can provide you to make your venture a success. Books from SPIE Publications will be available for purchase.

SPIEWorks Career Fair

In addition to the onsite recruitment activities, SPIEWorks offers you online services to help you with your search for employment before, during and after the conference. Visit the online Career Fair being held in conjunction with Defense+Security; post your resume, view jobs, or sign-up for "Job Alerts" and receive opportunities by email long after this event is over. For more information see p. 11.

Press & Media Center

The Press & Media Center provides press conference facilities, refreshments, and press releases from exhibitors. Credentialed media are invited to communicate news via the provided telephone and high-speed internet connections. Registration and exhibition fees are waived for working journalists and editors. Preregister by e-mailing name, organization, title, address, e-mail, and phone number to media@spie.org.

Guest Hospitality Room

Guests of attendees are invited to meet, relax, and enjoy a cup of coffee and breakfast breads in the SPIE Guest Hospitality Room. The hotel concierge will be available during a portion of this time to answer travel, shopping, and tourist questions.

Internet Pavilion

SPIE will have a complimentary Internet Pavilion at the meeting site Sunday through Thursday where attendees can use provided workstations or hook up their laptop to an Ethernet connection to access the Internet.

Complimentary Internet Wireless Access

SPIE is pleased to provide complimentary wireless access to the Internet for all conference attendees bringing 802.11b wireless-enabled laptops or PDAs. Coverage location and connection settings will be posted in the final program and on-site.

Business Services

Concierge Desk

The Marriott Group Concierge will have a fully staffed Concierge Desk near SPIE registration to assist attendees with discounted attraction tickets, restaurant reservations, golf tee times, and local information.

SPIE Copy Center

San Diego Copy will provide a copy service during the week for symposium attendees. The rates are 5 cents per copy and $1 per transparency ($2.50 for color). The Copy Center will be located in the Atrium across from the Crystal Ballrooms.

SPIE Message Center

The SPIE Message Center telephone number is 407 238 4000. Messages will be taken during registration hours Sunday through Thursday. Please check the message board at the message center near SPIE registration daily to receive your messages.

Child Care

All About Kids Professional Child Care,
toll free 1-800-728-6506, Phone (407) 812-9300,
www.All-About-Kids.com, or
email AAboutKids@aol.com

Note: SPIE does not imply an endorsement nor recommendation of these services. They are provided on an "information only" basis for your further analysis and decision. Other services may be available.

Food and Beverage Services

Breakfast Breads

Breakfast breads and coffee will be served from 7:30 to 8:30 am Monday through Thursday for registered conference attendees.

Coffee Breaks

Complimentary coffee will be served Sunday through Thursday at approximately 10:00 am and 3:00 pm. Please check the individual technical conference listings for exact times and locations.

Desserts

Tuesday through Thursday

Dessert snacks will be served from 3:00 to 3:30 pm. Complimentary tickets for the dessert snacks will be included in attendee registration packets.

Policies

Refund Policy for Preregistration

There is a $35 service charge for processing refunds. Requests for registration refunds must be received no later than 6 March 2008. All registration fees will be forfeited after this date. Membership dues are not refundable. SPIE Digital Library subscriptions are not refundable.

Audio, Video, Digital Recording Policy

In the Meeting Rooms and Poster Sessions: For copyright reasons, recordings of any kind are strictly prohibited without prior written consent of the presenter in any conference session, course or of posters presented. Each presenter being taped must file a signed written consent form. Individuals not complying with this policy will be asked to leave a given session and asked to surrender their film or recording media. Consent forms are available at the SPIE Audiovisual Desk.

In the Exhibition Hall: For security and courtesy reasons, photographing or videotaping individual booths and displays in the exhibit hall is allowed ONLY with explicit permission from on-site company representatives. Individuals not complying with this policy will be asked to surrender their film and to leave the exhibit hall.

Laser Pointer Safety Information

SPIE supplies tested and safety approved laser pointers for all conference meeting rooms, and for short course rooms if instructors request one. For safety reasons, SPIE requests that presenters use our provided laser pointers available in each meeting room.

If using your own laser pointer, have it tested at your facility to make sure it has <5 mW power output. Laser pointers in Class II and IIIa (<5 mW) are eye safe if power output is correct - but don't automatically trust the labeling. Commercially available laser pointers, red or green (or any color), could be incorrectly labeled as to their wavelength and power output.

Presenters intending to use their own laser pointer for presentations are required to come to the Speaker Check In Desk onsite and test their pointer on our power meter. If the pointer fails the safe power level you may not use the pointer at the conference. You will be required to sign a waiver releasing SPIE of any liability for use of potentially non-safe laser pointers.

Use of a personal laser pointer at an SPIE event represents user's acceptance of liability for use of a non-SPIE supplied laser pointer device. Misuse of any laser pointer could lead to eye damage.

Underage Persons on Exhibition Floor

For safety and insurance reasons, no persons under the age of 16 will be allowed in the exhibition area during move-in and move-out. During open exhibition hours, only children over the age of 12 accompanied by an adult will be allowed in the exhibition area.

Unauthorized Solicitation

Any manufacturer or supplier who is not an exhibitor and is observed to be soliciting business in the aisles, or in another company's booth, will be asked to leave immediately. Unauthorized solicitation in the Exhibition Hall is prohibited.

Photography or Video Guidelines

Taking photos or video of booths, without the consent of the exhibiting company, is prohibited. Your film and/or camera will be confiscated and you will be asked to leave immediately.

Please report any violations you may observe to Show Management.

Unsecured Items

Personal belongings such as briefcases, backpacks, coats, book bags, etc. should not be left unattended in meeting rooms or public areas. These items will be subject to removal by security upon discovery.

SPIE Defense+Security will be held at the Orlando World Center Marriott, 8701 World Center Dr, Orlando, FL 32821 USA. www.marriottworldcenter.com

About Orlando

The Orlando area of central Florida is one of the world's favorite family vacation locations, featuring Disney World, Animal Kingdom, MGM Studios, Epcot, Universal, Sea World, and Wet 'n Wild. Beyond these theme parks, there is also golf, tennis, sporting and cultural events, ballooning, auto racing, canoeing, outdoor recreation and fishing.

Orlando's average yearly temperature is a mild 72°F (22°C). Though the summer months experience hotter weather, most of the year is very comfortable. For more information about Orlando, sightseeing, shopping and restaurants, visit http://www.orlandoinfo.com

Online Pre-Order for Attractions or Activities

To place your orders online go to www.localexpert.com/orlando/SPIEDSS08/

Phone Order for Attractions or Activities

Attractions tickets, individual or group dining arrangements, or golf tee times may be ordered by phone. You may call your personal in-house concierge Mary Ann Harrell at the following numbers:

Toll Free 1-800-557-7776 Ext. 1926 M-F 8:00 am to 5:00 pm EST

Or after hours on her cell phone at 407-437-6263

For international Calls Please Call: Michael Decker on his mobile at 001-407-383-2800

All attendees who order tickets on-line can pick-up their tickets at the concierge desk at the Orlando World Center Marriott upon arrival at no cost. Orders from Attendees within the USA can be shipped for the cost of the shipping. International orders are for on-site pickup only. On-line ticket orders received after the deadline date will still be processed, but the rates for the attraction tickets may differ.

Flying to Orlando

Orlando International Airport (MCO) is conveniently located 15 miles from the Orlando World Center Marriott. Numerous airlines fly into and out of MCO. For a complete listing view www.orlandoairports.net.

Driving to the Meeting

Directions From Orlando International Airport (MCO) - (15 mi SW) Take Route 417 (Central Florida Greenway) south to Exit 6 (536 East). There are two tolls along 417 ($1.00 each). Proceed through the cash lanes; change can be made. Take Exit 6 (536 East). Drive through two lights and the hotel is on the right.

Toll roads consist of cash lanes and pass lanes. Some cash lanes make change, some require exact change. Each toll pass lane will accept O-Pass, E-Pass and Sun Pass, which are prepaid passes popular with daily commuters. Cash toll rates are subject to change at any time.

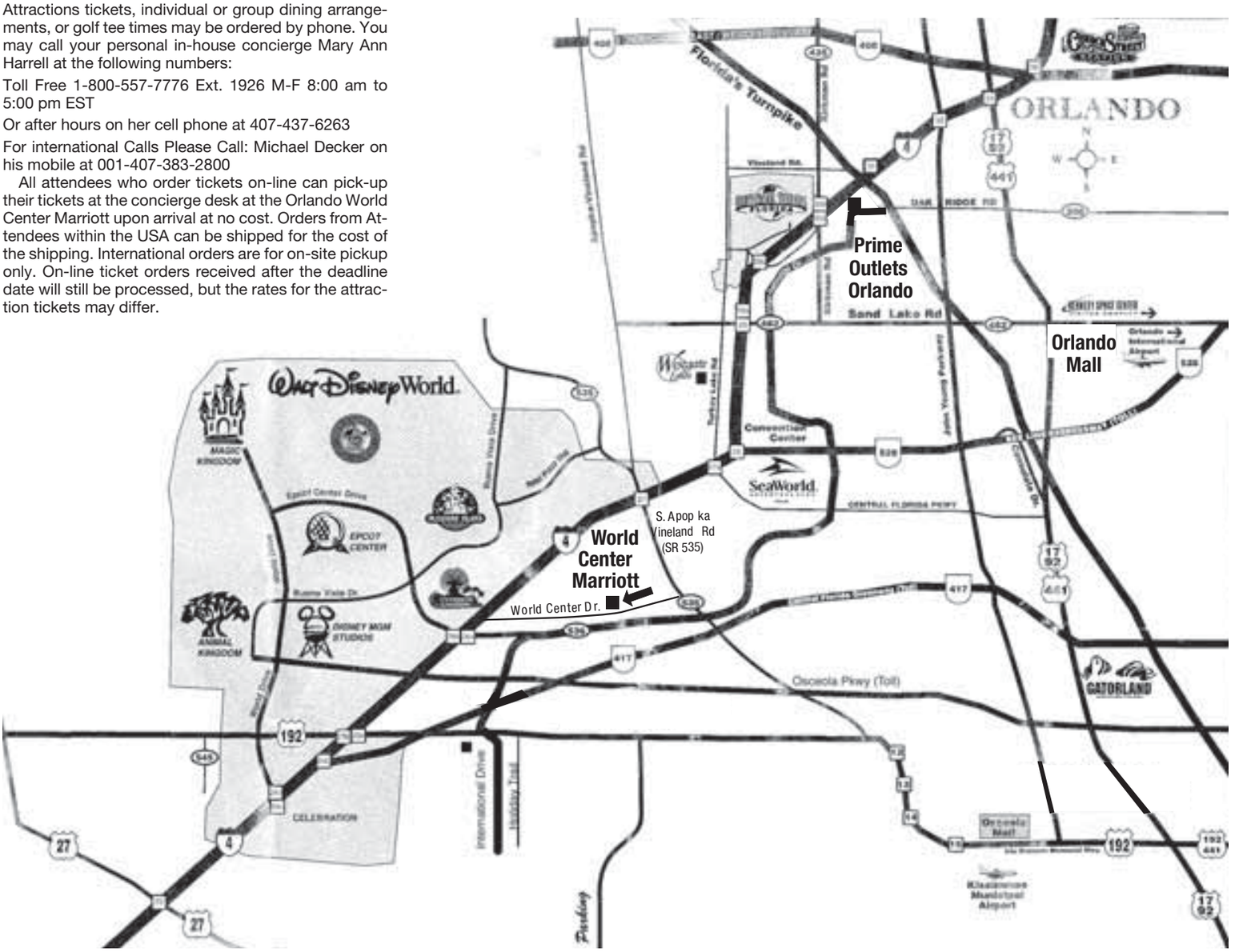
Parking

(Note: All rates are subject to change)
Self-parking at the Marriott is $7.00. Valet parking is $18. Both include in/out privileges. Tax is extra @ 7.5%. Parking can be billed to the guest's room.

Hertz Car Rental has been selected as the official car rental agency for this Symposium. To reserve a car, identify yourself as a Defense & Security Conference attendee using the Hertz Meeting Code CV# 029B0011. Note: When booking from International Hertz locations, the CV # must be entered with the letters CV before the number, i.e. CV029B0011.

- In the United States call 1-800-654-2240.
- In Canada call 1-800-263-0600, or 1-416-620-9620 in Toronto.
- In Europe and Asia call the nearest Hertz Reservation Center or travel agent. Outside of these areas call 1-405-749-4434.

Book on-line at www.hertz.com



Mears Motor Shuttle

Clip out the enclosed coupon and present it to the Mears Transportation booth attendant to receive an SPIE attendee discount of $4 off the round trip fare of $31 on shuttle transportation between the airport and the hotel. This coupon also applies to children (ages 4-11) - children's round trip fare is $23. The discount coupon can only be used towards round-trip fares, not one-way fares. (One way fare for adults is $19 and one way fare for children is $15.) Mears Shuttle runs 24 hours a day between the airport and the hotel, departing from the airport approximately every 30 minutes.

To arrange shuttle travel to your hotel, go to the nearest Mears Transportation counter in the baggage claim areas, Level 2, of Orlando International Airport when you arrive. All transportation will depart from Level 1. The counter personnel will direct you to the shuttle.

Arrival reservations are encouraged but not required. Return reservations are required. One day prior to your return to the airport at the end of your stay at the symposium, make a return reservation by calling Mears Transportation at 407-423-5566 or book on-line from the Defense+Security website. Please plan to allow three hours prior to your flight time for your transfer to the airport.

Taxi

Yellow Cab sedans will accommodate up to five passengers and Yellow Cab vans will accommodate up to seven passengers. Rates are not per person, but per vehicle; up to five or seven can ride for the price of one. Yellow Cab offers direct service to your destination with no stopping to pick up or drop off additional passengers. The approximate rate, based on time and mileage, is $45 one way from the airport to the Orlando World Center Marriott. At the airport, go to the ground transportation site located outside Level 1 below baggage claim. Ask the Taxi Starter for a Yellow Cab. Yellow Cab is a licensed, insured and permitted taxi service. Beware of any type of solicitation in the baggage claim area. Any driver, skycap or anyone else soliciting on behalf of a transportation company is unauthorized and either underinsured or not insured at all. For more information requesting Taxi Service while in Orlando, call (407) 422-2222, or email taxiquote@mearstransportation.com

Chauffeur-Driven Luxury Sedans

American Executive Town Car offers chauffeur driven luxury sedans which accommodate up to four passengers comfortably for one flat rate. The flat rate from the airport to the Orlando Marriott World Center is $50 one way, $95 round trip (rates are subject to change without notice). Gratuity is extra. On arrival at the airport, you will be met by your driver at the base of the escalator in the baggage claim area with a sign reading you or your party's name. You will be assisted with your luggage and taken directly to your destination. Reservations are required. All credit cards (except Diners), traveler's checks, and cash are accepted (no personal checks). Call toll free 1-877-248-9965, local phone (407) 854-3999 or book on-line at www.goamericantowncar.com.

Bus Transportation

LYNX is the Central Florida Regional Transportation Authority Bus Service. All LYNX rides start and end at officially designated LYNX stops. See www.golynx.com or call 1-407-841-5969 for schedule and fare information. At this time, LYNX has no service to or from the Orlando Marriott World Center. However, there is service from the airport to the Orlando Premium Outlet Malls (8200 Vineland Ave., Orlando, 32821) which are in the general area of the Marriott. Take the #42 bus from A side, level 1, of Orlando International Airport. The trip from the airport to the Orlando Premium Outlet Malls will take approximately 90 minutes followed by a short inexpensive taxi ride from the Malls to the Orlando World Center Marriott. The bus fare is tentatively increasing to $1.75 effective March 2008 (subject to change).

MEARS MOTOR SHUTTLE

A convenient and affordable transfer between Orlando International Airport and your hotel.

Instructions:

- Upon your arrival at Orlando International Airport, proceed to one of the Mears Motor Shuttle ticket counters and present this coupon to the Mears Counter Attendant.
- After redeeming your coupon below for a round trip ticket, please present your ticket to the Mears "Starter" located on level one at the curb.
- The starter will then direct you to a designated shuttle servicing the hotel. Our shuttles run 24-hours a day, 7 days a week, departing the curb approximately every 30 minutes providing shuttle service between the airport and your hotel.
- One day prior to your departure, please make a return reservation by calling our reservation number listed below.
- Plan to allow three hours prior to your flight time for your transfer to the airport.
- You can now book online! To receive your online discount, please go to www.mearstransportation.com, click on "*Shuttles*" in the "*Make a Reservation NOW!*" box and enter your priority code number: **315946019**
- For questions / reservations, please call our toll free number at **1-800-759-5219** (if calling from central Florida, please dial **(407) 423-5566**).
- You must present this coupon for discount.

Mears Motor Shuttle...a great way to start your meeting!

SPIE

ROUND TRIP

Conference Dates: 03/16/08 - 03/20/08 Valid Coupon Dates: 03/10/08 - 03/24/08

$4.00 Discount Off - Regular Round Trip Price Of: **$31.00** per adult **$23.00** child (4-11 yrs)

Present this coupon to **MEARS MOTOR SHUTTLE COUNTER** for round trip transportation to and from the **ORLANDO WORLD CENTER MARRIOTT AND ALL ZONE 4 RESORTS**

SALES # **019** ORDER # **315946**

MEARS MOTOR SHUTTLE

COUNTER COLLECTS PAYMENT

Tickets Must be Purchased at Airport Location for Discount. Gratuity not included.

This coupon is valid for shared ride shuttle service via Mears Motor Shuttle.
Wait time may be incurred at the airport prior to departure.
Each vehicle may make additional hotel stops prior to your destination.

A C (for office use only)

****2ND LEVEL****

"A" TERMINAL: DIRECTLY ACROSS FROM AMERICAN BAGGAGE CLAIM #5

"B" TERMINAL: DIRECTLY ACROSS FROM UNITED BAGGAGE CLAIM #24 OR DELTA BAGGAGE CLAIM #29

• THANK YOU FOR USING MEARS TRANSPORTATION GROUP •

SPIE Defense+Security

Hotel Reservation Form

Return form by the deadline date of 12 February 2008.

Headquarters Hotel
Orlando World Center Marriott Resort
& Convention Center
8701 World Center Drive, Orlando, FL 32821

I will be attending SPIE's Defense+Security Symposium **16–20 March 2008.** Please reserve the following type of room for me at the special reduced rates:

Orlando World Center Marriott Resort & Convention Center

Deadline Date for Reservation Form 6 March 2007.

☐ single $163
☐ double $184 Plus tax currently 12.5%

Rooms have one king bed or two double beds.
☐ 2 Double beds ☐ 1 King bed ☐ Handicap accessible

The cancellation to individual reservations policy is as follows: Prior to 6 weeks out (February 3rd, 2008) cancellations and changes are allowed without penalty. From 6 weeks out up to arrival, any cancellations are charged a penalty fee of one night's room and tax. Also, decreasing the length of stay from 6 weeks out is not allowed - attendees will still be charged for their original number of booked nights.

Number of people in room:_____

The Orlando World Center Marriott is a smoke-free facility.

_____
Name (please print) Arrival Date

_____
Business Address Arrival Time**

_____
Departure Date

_____
City, State, Zip or Country Code Departure Time

_____
Telephone/Fax (Foreign residents please include Country and City codes)

_____
E-mail for confirmation

Rooms must be guaranteed with a form of payment, either by credit card or by check. A check in the amount of the first night's room rate plus tax can be mailed with the Hotel Reservation Form. If a room is guaranteed and an attendee does not arrive, they will be charged a penalty fee of one night's room plus tax.The cancellation to individual reservations policy is as follows: Prior to 6 weeks out (February 3rd, 2008) cancellations and changes are allowed without penalty. From 6 weeks out up to arrival, any cancellations are charged a penalty fee of one night's room and tax. Also, decreasing the length of stay from 6 weeks out is not allowed - attendees will still be charged for their original number of booked nights.

Guests arriving before the official check-in time will be accommodated as rooms become available.

_____
Type of Credit Card

_____/_____
Number Expiration Date

_____/_____
Signature Date

For online reservations go to:

spie.org/dssadvance

Orlando World Center Marriott Resort & Convention Center—Headquarters Hotel

IMPORTANT!
The Orlando World Center Marriott Resort & Convention Center has reserved a block of rooms at reduced rates for SPIE attendees. Accommodations at the reduced rates cannot be guaranteed after the room block has been filled. Reservations received after the cut-off date of **12 February 2008** will be accepted on a first-come, first-served basis, according to availability. Complete and return this reservation form directly to the Orlando World Center Marriott without delay. If reservations are made by phone or other means, be sure to identify yourself as an Defense & Security Symposium attendee to obtain the reduced rates.

- **Phone:** Call 1-800-621-0638 or 407-239-4200, and ask for Ext. 85454
- **Fax:** Print off the hotel reservation form, complete and fax to 407-238-8991
- **Mail:** Print off the hotel reservation form, complete and mail with a check for 1st night's room + tax to:

  Orlando World Center Marriott
  Attention: Reservations
  8701 World Center Drive
  Orlando, FL 32821

Orlando World Center Marriott Resort & Convention Center

8701 World Center Drive, Orlando, FL 32821

Hotel Front Desk Phone: 407-239-4200

Hotel Front Desk Fax: 407-238-8777

Reservations Phone: 1-800-621-0638
or 407-239-4200, Ext. 85454.

Reservations Fax: 407-238-8991

Rates: Single $163 / Double $184 (plus 12.5% tax)

Rates include 15% discount on golf rates.

Cut-Off Date: 12 February 2008

Check in time is after 4:00 pm. Check out time is by 11:00 am. Rooms have one king bed or two double beds. The Convention rate is in effect up to 12 February 2008 as long as rooms in the block are available. Reduced rates cannot be guaranteed after the block has been filled.

SPIE Defense+Security

Order Proceedings volumes and searchable CD-ROMs with your registration and receive low prepublication prices.

Printed Proceedings of SPIE

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