Technical Program

SPIE Defense, Security + Sensing

Conferences + Courses: 13–17 April 2009
Exhibition: 14–16 April 2009

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

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The Ultimate Infrared Semi-Conductor

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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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Monday	Tuesday	Wednesday	Thursday	Friday
13 April	14 April	15 April	16 April	17 April

Special Events

	FREE Exhibition 10:00 am to 6:00 pm	10:00 am to 5:00 pm	10:00 am to 2:00 pm	
A Student Networking Event: **Lunch with the Experts**, 12:30 to 1:30 pm, p. 12	*Symposium-Wide Plenary Presentation:* **Re-Engineering Engineering** *(Norman R. Augustine)*, 9:00 to 10:00 am, p. 16	*Special Anniversary Session:* **HgCdTe: 50 Year Anniversary,** Held in conjunction with Conf. 7298, 8:00 am to 5:30 pm, p. 10	*Workshop:* **Active and Passive Signatures** *(Gilbreath, Hawley)* *Keynote Speaker: The Hon. James B. Longley, Jr.,* Held in conjunction with Conf. 7324, 8:20 am to 5:00 pm, p. 11	*Panel Discussion:* **Fiber Optic Sensors Panel on Industry, Lab, and University Cooperation** *(Udd, Vlekken, Mendez, Du, Wang)* Held in conjunction with Conf. 7316, 11:00 am to 12:00 pm, p. 11
Vendor Presentations and Reception *(Peacock, Kaplanr)* Held in conjunction with Conf. 7299, 5:00 to 8:00 pm, p. 7	*Technical Program Track Plenary Presentation:* **Flight Operations at U.C. Berkeley: Earth Orbit and Beyond** *(Bester)* 10:30 to 11:30 am, p. 8	*Technical Program Track Plenary Presentation:* **A History of US Infrared Capability in Space** *(Irvin)* 8:10 to 9:00 am, p. 8	*Special Anniversary Session:* **HgCdTe: 50 Year Anniversary,** Held in conjunction with Conf. 7298, 8:00 am to 12:00 pm, p. 10	
Invited Panel Discussion: **Issues and Challenges** *(Kadar)* Held in conjunction with Conf. 7336, 7:15 to 9:45 pm, p. 10	*Workshop:* **Leading Successful Product Innovation** *(Carrano)* 1:30 to 5:30 pm, p. 14 **Women in Optics Presentation and Reception,** 4:30 to 6:00 pm, p. 12 **All Symposium Welcome Reception,** 5:00 to 6:00 pm, p. 12	**CYBER SENSING HOT TOPICS**, 8:30 to 11:00 am, p. 7 **A chipless sensor tag based RFID technology for cyber-oriented environment sensing applications** *(Shrestha, Agarwal, Phoha, Varahramyan)* **An immunological model for detecting bot activities** *(Karim, Phoha, Balagani)* **Decentralized detection and patching of coverage holes in wireless sensor networks** *(Yao, Zhang, Kanno, Selmic)* **Using Qualia and novel representations in malware detection** *(Birrer, Raines, Baldwin, Oxley, Rogers)*	*Industry Forum:* **Technical Requirements for Unmanned Aerial Vehicle Systems,** 9:00 to 9:40 am, p. 13	
	Fifty Years of Noise Radar: The Legacy of Billy Horton *(Narayanan)* 5:00 to 6:00 pm, p. 10	*Workshop:* **Essential Skills for Engineering Project Leaders** *(Hinkle)* 8:30 am to 12:30 pm, p. 14	**POSTER SESSION,** 6:00 to 7:30 pm, p. 12	
	POSTER SESSION, 6:00 to 7:30 pm, p. 12	*Workshop:* **Complying with the ITAR: A Case Study** *(Scarlott)* 1:30 to 5:30 pm, p. 14		
	SPIE Works **Career Fair** 10:00 am to 3:00 pm	10:00 am to 3:00 pm		
		Early Career Networking Social 5:00 to 6:00 pm, p. 12		
		SPECIAL SESSION: Future Direction in US Government Funding (*McManamon),* 3:30 to 5:45 pm, p. 7 *Presentations Include:* **Army Strategic Research Directions in Sensors and Processing** *(Pellegrino)* **Air Force Basic Research** *(Godfrey)* **Creating the Future: the Naval Science and Technology Strategy** *(Jones)*		
		Banquet & Award Presentation, 7:00 to 9:30 pm am, p. 9		

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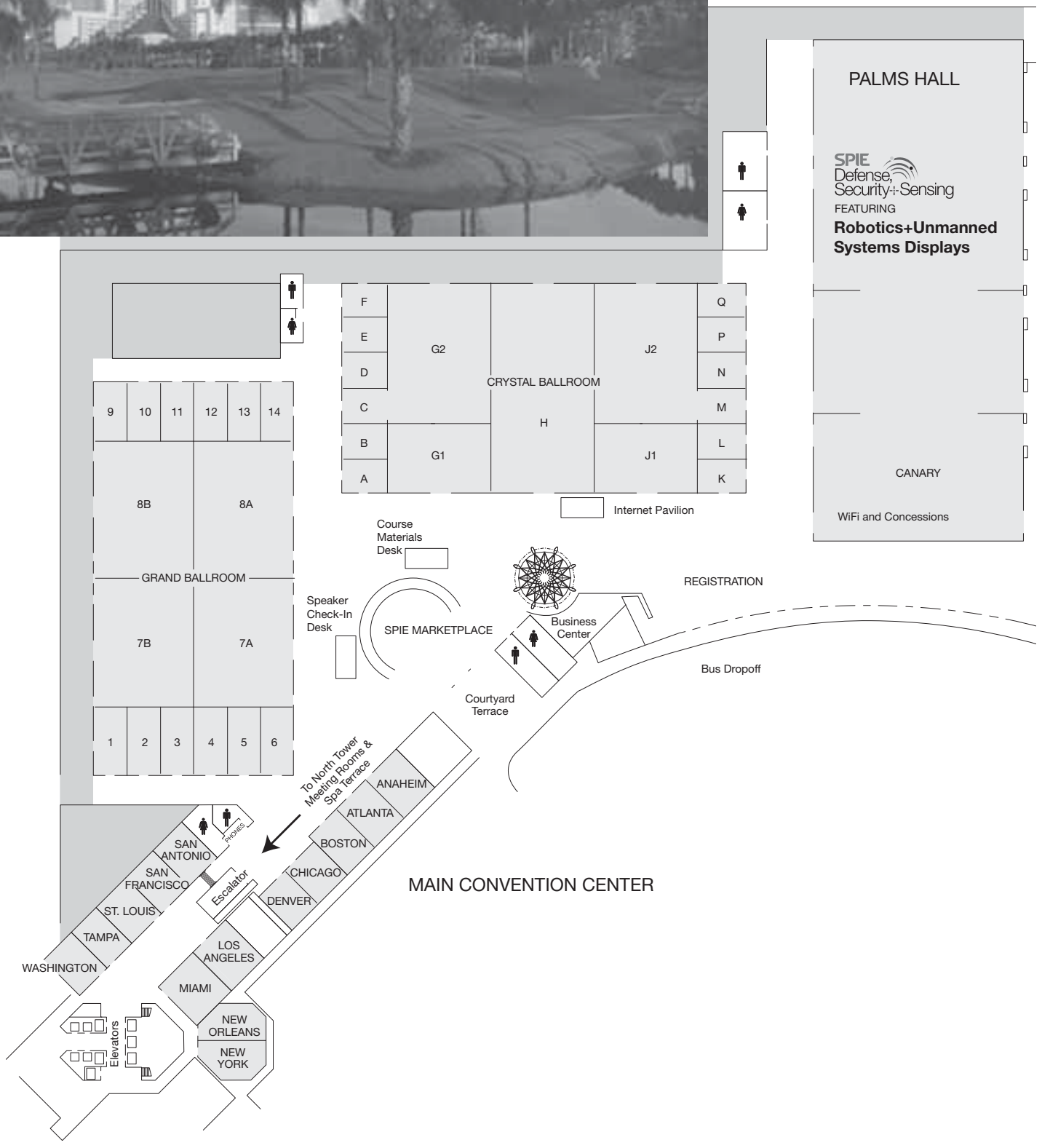
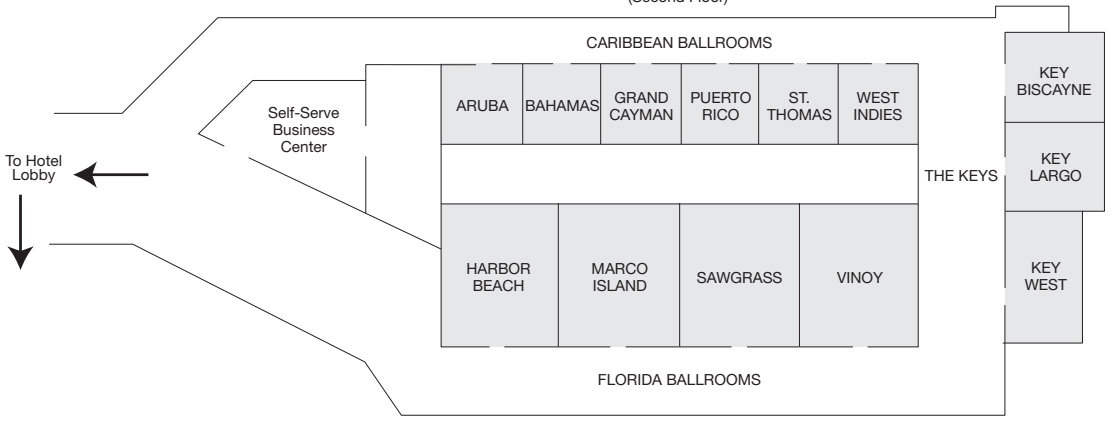


NORTH TOWER MEETING ROOMS

(Second Floor)



Norman R. Augustine
Retired Chairman and
Chief Executive Officer,
Lockheed Martin Corp.

Symposium-Wide Plenary Presentation

Open to all Attendees

Re-engineering Engineering

Tuesday 14 April · 9:00 to 10:00 am · Crystal H Ballroom

The pace of change of modern technology requires that the engineering profession reinvent itself. This will be demanding because of the explosion of new knowledge coupled with the growing importance of engineering to the solution of many global problems. The engineer of the 21st century will have certain fundamentals in common with the one of the 20th century; however, the 21st century engineer is unlikely to recognize the education received by his or her predecessor. Even the language is different … think about it: mouse, chip, computer, virus, and more!

Mr. Augustine has been presented the National Medal of Technology by the President of the United States and received the Joint Chiefs of Staff Distinguished Public Service Award. He has five times received the Department of Defense's highest civilian decoration, the Distinguished Service Medal. He is co-author of The Defense Revolution and Shakespeare in Charge and author of Augustine's Laws and Augustine's Travels. He was selected by Who's Who in America and the Library of Congress as one of "Fifty Great Americans" on the occasion of the Who's Who's 50th Anniversary.

All-Symposium Welcome Reception

Tuesday 14 April · 5:00 to 6:00 pm · Cypress Exhibition Hall

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

Special Session

Open to all Attendees

Future Direction in U.S. Government Funding

Wednesday 15 April · 3:30 to 5:45 pm

Session Chair: **Paul F. McManamon,** Air Force Research Lab. (ret)

Learn from US Government program experts about the future areas of Army, Navy, and Air Force Funding. Discover which technical problems program managers are trying to solve and tie in your organizational strategy to impact potential solutions.

Presentations include:

Army Strategic Research Directions in Sensors and Processing

John M. Pellegrino
Chair, US Army Research, Development, & Engineering Command Sensors Technical Focus Team and Director, Sensors & Electron Devices Directorate, US Army Research Laboratory

Air Force Basic Research Directions

Brendan B. Godfrey
Director, Air Force Office of Scientific Research

Creating the Future: the Naval Science and Technology Strategy

Walter F. Jones
Executive Director, Office of Naval Research

Hot Topics Session

Open to all Attendees

Hear leaders in government and industry discuss recent advances, current challenges, and opportunities.

Cyber Sensing Hot Topics

(Conference 7352B)

Wednesday 15 April · 8:30 am to 11:00 am • Crystal J1 Ballroom

Conference Chair: **Stephen Mott,** Sensors Directorate, Air Force Research Lab.

The term "cyber" has traditionally been used to refer to information systems and the networks which bind them. With the growing dependence on information systems by the modern world, cyber is thought of as a domain of operations where the entire electromagnetic spectrum (including electrons flowing over wires) is the medium. Although this seems overly broad, the medium itself is not what is truly important – it is how the operation of information systems is affected which defines what is and is not a part of the cyber domain. A basic example is that a "traditional" RF sensor can be considered a cyber sensor if it is being used in such a way as to detect the presence of a wireless network. As with any domain, the cyber domain requires the environment to be sensed in order to be able to have situational awareness. Cyber sensing seeks to exploit any part of the electromagnetic spectrum in order to provide the information necessary for that situational awareness so the integrity of information assets and the networks that bind them can be better maintained and defended.

A chipless sensor tag based RFID technology for cyber-oriented environment sensing applications
Authors: **Sudhir Shrestha, Mangilal Agarwal, Vir V. Phoha, Kody Varahramyan,** Louisiana Tech Univ. (United States)

An immunological model for detecting bot activities
Authors: **Md. E. Karim, Vir V. Phoha, Kiran S. Balagani,** Louisiana Tech Univ. (United States)

Decentralized detection and patching of coverage holes in wireless sensor networks
Authors: **Jixing Yao, Guyu Zhang, Jinko Kanno, Rastko R. Selmic,** Louisiana Tech Univ. (United States)

Using Qualia and novel representations in malware detection
Authors: **Bobby D. Birrer, Richard A. Raines, Rusty O. Baldwin, Mark E. Oxley,** Air Force Institute of Technology (United States); **Steven K. Rogers,** Air Force Research Lab. (United States)

Technical Program Track Plenary Presentations

Flight Operations at U.C. Berkeley: Earth Orbit and Beyond

Tuesday 14 April · 10:30 to 11:30 am · Crystal L Room

Manfred Bester
Director of Operations,
Operations and Ground Systems,
Univ. of California, Berkeley

Manfred Bester joined Space Sciences Laboratory at the University of California at Berkeley in 1986 where he established the Mission and Science Operations Center and the Berkeley Ground Station. In his current position as Director of Operations he leads the Operations and Ground Systems group that has conducted on-orbit operations of eight NASA funded spacecraft – FAST, RHESSI, CHIPS and the five-spacecraft THEMIS constellation. As Mission Operations Manager he led the post-launch commissioning, navigation and science operations activities of THEMIS. At present, he oversees the planning and implementation of operations for the extended THEMIS mission that involves transfer of two of the five spacecraft from Earth to lunar orbits. In 1996 he founded Bester Tracking System (BTS), a company providing software development and consulting services to the aerospace community. The flagship product of BTS is the SatTrack Suite. Manfred Bester has a doctorate in Physics from the University of Cologne, Germany. His areas of interest include mission analysis, multi-mission ground systems, process automation, space communications and operations, flight dynamics, software development and systems engineering. He is a member of AIAA, AGU, AAS, ASP and OSA, and a session organizer at the IEEE Aerospace Conference.

A History of U.S. Infrared Capability in Space

Wednesday 15 April · 8:10 to 9:00 am · Crystal L Room

David J. Irvin
Chief, Space Based Infrared System (SBIRS)
Systems Engineering Div.
Space and Missile Systems Ctr.
Air Force Space Command, Los Angeles Air Force Base

Major David J. Irvin is the Chief of the Space Based Infrared System (SBIRS) Systems Engineering Division, Space and Missile Systems Center, Air Force Space Command, Los Angeles Air Force Base, California. He is responsible for managing the technical resources necessary to plan and direct cross discipline activities to ensure the integrated, tested and deployed $10B SBIRS system meets user requirements.

Major Irvin graduated from the United States Air Force Academy in 1996 with a Bachelor of Science in Astronautical Engineering. His first assignment was with the 5th Space Launch Squadron as a mechanical engineer on the Centaur cryogenic upper stage for the Titan IV program. He has attended the Air Force Institute of Technology for both his Masters (2001) and PhD (2007) in Astronautical Engineering. He has also served as both project engineer and executive officer at the Air Force Research Laboratory, Munitions Directorate.

Banquet and Award Presentation

Wednesday 15 April · 7:00 to 9:30 pm · Banquet location on ticket

Dinner will start at 7:00 pm. Tickets for the banquet and presentation are $90 per person and are sold separately from the conference registration fees. Tickets may be ordered on your registration form or purchased onsite at the SPIE Cashier. Banquet tickets must be purchased by 13 April at 1:00 pm.

Keynote Speaker:

Kazuo Hotate, Professor,
Department of Electrical Engineering and Information Systems,
School of Engineering, The University of Tokyo (Japan)

Fiber Optic Nerve Systems for Safety and Security

Abstract: Optical fibers can act as a sensor for strain, pressure and temperature through the optical properties, such as scattering, propagation-modes coupling, and so on. By additionally applying appropriate ways to analyze distribution of these properties along the fiber, "distributed optical fiber sensors" can be realized. These sensor systems, which are sometimes called as "fiber optic nerve systems," sense damages induced in materials and structures, such as aircraft wings, pipe lines, bridges and tunnels, in which the fiber is embedded. The materials and structures that can feel their pain, which are realized by the "fiber optic nerve systems," are expected to be the key for enhancing the safety and security in the 21st century society.

As the ways to analyze the distributed information, several techniques have been proposed and developed. Time domain techniques, in which pulsed lightwave is launched into the fiber and the backscattered component is measured as a function of time, have been developed. Distributed temperature sensing systems based on Raman scattering have already been available commercially. Distributed strain sensing based on Brillouin scattering has also been developed. In these time domain techniques, however, typical spatial resolution is about 1m, which is not enough for various applications. Dynamic strain sensing is also required for the health monitoring of the structures and the materials. However, the measurement time of these techniques is more than several minutes.

To overcome these difficulties, optical correlation domain techniques have been proposed, in which interference nature of continuous lightwave is manipulated to obtain the distributed information. By applying the technique, for example, to the fiber Brillouin distributed strain sensing, the spatial resolution of about 2mm and the sampling rate of 1kHz have already been realized, respectively. Aircraft health monitoring has been demonstrated with this technique. Additionally, a technique to measure simultaneously the distributed strain and temperature has recently been proposed. By applying the correlation domain technique, distributed lateral force measurement and a multiplexing scheme of fiber Bragg grating sensors have also been developed.

In this Keynote presentation, various types of the Fiber Optic Nerve Systems are explained, showing the principle, the performance and the applications.

Biography: **Kazuo Hotate** was born in Tokyo, Japan, on June 20, 1951. He received the B.E., M.E., and Dr.Eng. degrees in electronic engineering from the University of Tokyo, Tokyo, Japan, in 1974, 1976, and 1979, respectively. In 1979, he joined the University of Tokyo as a Lecturer. He became a Professor in 1993 in the Research Center for Advanced Science and Technology (RCAST), the University of Tokyo, and currently he is a Professor in the Department of Electrical Engineering and Information Systems, School of Engineering, the University of Tokyo. Since April, 2008, he serves as the Dean of the School of Engineering.

He was engaged in research of projection-type holography, and measurement and analysis of optical fiber characteristics. At present, he is working on photonic sensing, including "fiber optic nerve systems." He has authored and coauthored several books on optical fibers and optical fiber sensors, and more than 300 journal papers and international conference presentations.

Prof. Hotate is Fellow of the IEEE, Fellow of the Institute of Electronics, Information, and Communication Engineers (IEICE), Fellow of the Society of Instrumentation and Control Engineers (SICE), and Fellow of the Japan Society of Applied Physics (JSAP). He is a Board of Governor member of the IEEE/LEOS. He received awards on photonic sensing, such as the Ichimra Prize from the New Technology Development Foundation (2001), the Hasunuma Prize from the SICE (2002), and the Electronics Society Prize from the IEICE (2003).

He served as the co-chairs for the SPIE Fiber Optic Gyros: Twentieth Anniversary Conference (1996), the Technical Program Committee Chair for OFS-13 (1999), and the General Chair for OFS-16 (2003). He has been serving as the Leader of the 21st Century COE (Center of Excellence) Program (2002-2006) and the Global COE Program (2007-) in Electronics formed in the University of Tokyo by the Ministry of Education, Culture, Sports, Science and Technology, Japan.

Invited Panel Discussion

Issues and Challenges in:

(1) Robust Methods in Tracking, Fusion, and Decision Making, and

(2) Sensor Bias Estimation and Data Fusion with Applications to Real-World Problems

Monday 13 April · 7:15 to 9:45 pm · Grand Ballroom 3

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

Moderators: **Ivan Kadar,** Interlink Systems Sciences, Inc., and **Frederick E. Daum,** Raytheon Co.

Panelists: **Dale Blair,** GTRI; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Frederick E. Daum,** Raytheon Co.; **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **Ronald P. Mahler,** Lockheed Martin Tactical Systems

This event is held in conjunction with the Signal Processing, Sensor Fusion, and Target Recognition conference, 7336.

Vendor Presentations and Reception

Monday 13 April · 5:00 to 8:00 pm · Crystal J2 Ballroom

Chairs: **G. Raymond Peacock,** Temperatures.com, Inc.; **Herbert Kaplan,** Honeyhill Technology Co.

This event features 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 2009 DSS Exhibition?

This Special Session was started four 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 on-site.

Your company must be an exhibitor at DSS09 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

Herbert Kaplan: hkaplan@earthlink.net

This vendor session is held in conjunction with the Thermosense conference, 7299.

Fifty Years of Noise Radar: The Legacy of Billy Horton

Tuesday 14 April · 5:00 to 6:00 pm · Crystal K Ballroom

Presenter:
Ram M. Narayanan, The Pennsylvania State Univ.

The concept of noise radar was pioneered 50 years ago by Billy Horton of the former Diamond Ordnance Fuze Laboratory (renamed Harry Diamond Laboratories and then combined with other entities to form what is now the Army Research Laboratory) in Washington, D.C., USA. Horton recognized that one way to eliminate range and Doppler ambiguities was to use random noise as the modulating function and perform range determination by cross-correlating the return signal with a time-delayed replica of the transmit waveform. The talk will provide a historical account of noise radar from 1959 to 2009, describe notable results from worldwide R&D activities in noise radar, and predict possible developments over the next 50 years. Our efforts to track down Mr. Horton made us aware of some sad news. An obituary in the Washington Post on May 3, 2003, read in part: "Billy Mitchusson Horton, 84, an inventor and Army Department civilian who worked for the Harry Diamond Laboratories from 1953 to 1974 and became its technical director, died of a respiratory ailment April 28 at a hospice in Cleveland." However, his legacy lives on.

This talk is held in conjunction with the Radar Sensor Technology conference, 7308.

Special Anniversary Session

HgCdTe: 50 Year Anniversary

Wednesday 15 April · 8:00 am to 5:30 pm · Grand Ballroom 8A
Thursday 16 April · 8:00 am to 12:00 pm · Grand Ballroom 8A

A special session at this year's conference will acknowledge the 50th anniversary of HgCdTe – the most widely used detector in modern infrared systems. The invited papers in this session will cover both the history of this technology's development and a summary of the current state-of-the-art. Speakers have been invited from the United Kingdom, France, Germany, Russia, Poland, the United States, Israel, Japan, Korea, China, Australia, and India to present a world-wide summary of the status of this detector technology. The session also includes a Government Panel Discussion on Thursday 16 April from 11:20 am to 12:00 pm.

This special session is held in conjunction with the Infrared Technology and Applications conference, 7298.

Dr. Joseph (Chuck) Antonio of the Naval Air Warfare Center discusses recent developments in Advanced NVG and HMD Systems at SPIE Defense+Security 2008.

Workshop

Active and Passive Signatures

Thursday 16 April · 8:20 am to 5:00 pm · Crystal A Ballroom

Conference Chairs: **G. Charmaine Gilbreath,** Naval Research Lab.; **Chadwick T. Hawley,** National Signature Program

Keynote Speaker:
The Honorable James B. Longley, Jr., The Advanced Technical Intelligence Association
This workshop will focus on active and passive signatures, which are key to detection and identification of events. Such signatures can be characterized as either phenomenological or as a predictable marker or pattern. In this new workshop, we will be presenting papers on how signature science can address the challenges of the changing world.

This workshop is held in conjunction with the Atmospheric Propagation conference, 7324.

Panel Discussion

Fiber Optic Sensors Panel on Industry, Lab, and University Cooperation

Friday 17 April · 11:00 am to 12:00 pm · Grand Ballroom 7B

Panelists: **Eric Udd,** Columbia Gorge Research; **Johan Vlekken,** Fibre Optic Sensors and Sensing Systems (Belgium); **Alexis Mendez,** MCH Engineering LLC; **Henry H. Du,** Stevens Institute of Technology; **Anbo Wang,** Virginia Polytechnic Institute and State Univ.
This one-hour panel discussion and workshop will be directed toward a discussion of business and development issues associated with commercialization and deployment of fiber optic sensor technology. Considerable success has been achieved in certain areas such as civil structures and there have been successes in oil and gas, wind power, aerospace, and the medical field. It is also apparent that there is a great deal more to do and that the deployments that have been made represent the early stages of the introduction of this new technology. Questions and participation by the audience will be encouraged.

This panel discussion is held in conjunction with the Fiber Optic Sensors and Applications conference, 7316.

Networking Events · Student Events · SPIE Member Events

Make the most of your time at SPIE Defense, Security, and Sensing—make lifelong colleagues and friends through these social and networking events, and sharpen your career skills through professional development workshops and events for students.

Lunch with the Experts

A Student Networking Event

Monday 13 April · 12:30 to 1:30 pm
Seating is Limited. Ticket 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.

Early Career Networking Social

Wednesday 15 April · 5:00 to 6:00 pm · Crystal P Ballroom

Meet distinguished SPIE contributors for a casual pre-dinner social. This event boasts one-on-one networking opportunities with SPIE volunteers from committees and leadership.

All-Symposium Welcome Reception

Tuesday 14 April · 5:00 to 6:00 pm · Cypress

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

Women in Optics Presentation and Reception

Tuesday 14 April · 4:30 to 6:00 pm · Boston Room
Open to all conference attendees.

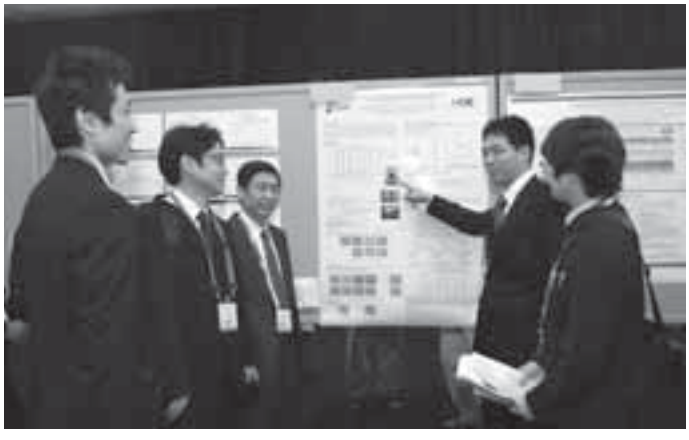
Join us for an evening of networking, information and inspiration. Connect with others in our industry while enjoying wine and cheese refreshments.

How to explore the cracks between the disciplines without falling through them.

Frances Ligler
US Navy Senior Scientist for Biosensors and Biomaterials, Naval Research Laboratory

How to explore the cracks between the disciplines without falling through them.

Biography: Frances S. Ligler, D.Phil., D.Sc. (Oxford University), is currently the Navy's Senior Scientist for Biosensors and Biomaterials and vice chair of the Bioengineering Section of the National Academy of Engineering. She has published over 300 full-length articles in scientific journals and has 24 issued patents; together they have been cited over 5300 times. She performs research in optical biosensors, microfluidics, and nanotechnology. In 2003, she was awarded the Homeland Security Award by the Christopher Columbus Foundation and the Presidential Rank of Distinguished Senior Professional by President Bush.



Poster Sessions

Tuesday 14 April · 6:00 to 7:30 pm · Palms Foyer
Thursday 16 April · 6:00 to 7:30 pm · Crystal M Ballroom

All symposium attendees are invited to attend the poster sessions 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.

SPIE Works

Special 2-Day Event!

Career Fair

Cypress Ballroom Foyer

Tuesday 14 April . . . . . 10:00 am to 3:00 pm

Wednesday 15 April. . . . 10:00 am to 3:00 pm

Top employers are coming together to interview and hire engineers and scientists like you. The SPIEWorks Career Fair at SPIE Defense, Security, and Sensing is a great place to:

- Get 'face to face' time with employers and interview on the spot
- Learn more about the jobs available in our industry
- Network!

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

Free Admission; Registration Required.

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

In addition to the onsite recruitment activities listed above, SPIEWorks offers you online services to help you with your search for employment before, during, and after the conference. Visit spieworks.com to post your resume, view jobs, or sign-up for email alerts.

Free Services for Employers

Don't Miss This Recruiting Opportunity—hire top talent at SPIE Defense, Security, and Sensing

- Stop by the SPIEWorks booth in the Career Fair and gain access to our proprietary resume database at no charge.
- Post jobs for free. That's right, there's no charge to post jobs to the Defense, Security+Sensing Career Fair. Go to spieworks.com, create an account and sign-in to post jobs online. Your free job(s) will be live 17-23 March.

For information on future recruiting events contact Dave Baggenstos at +1 360 715 3705 or email sales@spieworks.com

Industry Forum

Thursday 16 April · 9:00 to 9:40 am
Crystal H Ballroom

Open to All Attendees

Technical Requirements for Unmanned Aerial Vehicle Systems

Dr. Michael Perry, General Atomics, President of Photonics Division

Unmanned Aerial Vehicles require optics and photonics with exceptional performance at minimum size and weight. Combined with the increasing demand for ISR products from these platforms, the new needs for advanced EO/IR and radar technology provides fertile ground for innovation by scientists, engineers and end-users. During this presentation, you will learn about the technical challenges and requirements for optics, sensors, lasers and other technology utilized in remotely-piloted flight, reconnaissance and attack.

Hosted by:

SPIE Buyers Guide

Engineer Your Career Path

Build the career you want with business and professional development workshops from SPIE

Registration is required.
See SPIE Cashier to Register.

Essential Skills for Engineering Project Leaders

WS846

Course level: Introductory
CEU .35 $310 / $360 USD
Wednesday 8:30 am to 12:30 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.

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.

Complying with the ITAR: A Case Study

WS933 NEW

Course level: Introductory
CEU .35 $310 / $360 USD
Wednesday 1:30 to 5:30 pm

In the world of international trade, it's what you don't know that can hurt you. With the U.S. government's focus on homeland security and its increasing reliance on photonics for the development and production of defense-related products and services, your activities may well be subject to the ITAR.

This workshop will begin with a brief contextual overview of U.S. export controls, including the Export Administration Regulations, the ITAR, and special sanction programs administered by the Treasury Department's Office of Foreign Assets Control. We will then transition into a case study focused on the ITAR. Real world situations and lessons learned will be shared. Various aspects of the case study will likely be familiar to you in the context of your own experiences, allowing you to learn effectively how to spot ITAR issues before they negatively impact your business. You will also learn about current enforcement trends and best practices for avoiding violations.

INSTRUCTOR

Kerry Scarlott is a partner at Posternak Blankstein & Lund LLP, where he focuses his practice on business law and international trade. He is expert in advising technology-based companies on how to effectively and efficiently navigate U.S. export control laws and regulations.

Leading Successful Product Innovation

WS951 NEW

Course level: Intermediate
CEU .35 $310 / $360 USD
Tuesday 1:30 to 5:30 pm

The fundamental goal of this course is to answer the question: "How do I take an idea off the white-board and turn it into a windfall product?" We will explore and apply the principles of good leadership to create a culture of excellence within your organization- the most basic ingredient for success. A special emphasis will be placed on learning how to develop and construct an effective new project pitch using the instructor's "Disciplined Creativity" concept and framework. We will then describe the "Spiral Development Process" for rapid, effective, and successful prototype development, followed by an in-depth examination of the life-cycle approach to product development. This course will also enable you to conduct a "red teaming" exercise to identify competitive threats, identify weaknesses in your company, and most importantly, develop solution strategies. We will also place an emphasis on how to properly vet an idea and how to ask tough-minded questions designed to ferret out shortcomings.

INSTRUCTOR

John Carrano is President of Carrano Consulting. Previously, he was the Vice President, Research & Development, Corporate Executive Officer, and Chairman of the Scientific Advisory Board for Luminex Corporation, where he led the successful development of several major new products from early conception to market release and FDA clearance. Before joining Luminex, Dr. Carrano was as a Program Manager at DARPA, where he created and led several major programs related to bio/chem sensing, hyperspectral imaging and laser systems. He retired from the military as a Lieutenant Colonel in June 2005 after over 24 years' service; his decorations include the "Defense Superior Service Medal" from the Secretary of Defense. Dr. Carrano is a West Point graduate with a doctorate in Electrical Engineering from the University of Texas at Austin. He has co-authored over 50 scholarly publications and has 3 patents pending. He is the former DSS Symposium Chairman (2006-2007).

CREOL, The College of Optics and Photonics presents

Industrial Affiliates Day 2009

High Power Optical Sources for the 21st Century

April 17, 2009 • 8:30 am - 6:00 pm

UCF Student Union & CREOL Building, Orlando, FL

PROGRAM OUTLINE

Morning Program begins in the UCF Student Union

8:30 Continental Breakfast—Walk-in Registrations
9:00 Welcoming Remarks
9:20 Plenary Presentations
12:10 Lunch Served

Afternoon session in the CREOL Building

1:00 Walk to CREOL Building—Exhibits Open
1:15 Plenary Presentations
2:10 CREOL, The College of Optics & Photonics: Research Overview
2:50 Student of the Year—Research Presentation
3:20 Poster Sessions; Lab Tours (contiguous) Vendor exhibits
5:00 Reception & Award Presentations

PLENARY SPEAKERS

Dr. MJ Soileau, UCF Vice-President for Research

CREOL, The College of Optics & Photonics
Dr. Bahaa Saleh, Dean and Director
Dr. Martin Richardson
Dr. Leonid Glebov

Prof. Dr. Reinhart Poprawe,
M.A. Fraunhofer—Institut für Lasertechnik (ILT), Aachen, Germany

Mr. Albert Ogloza, HEL/JTO—Albuquerque, NM

Mr. Bill Krupke, WFK Lasers—Pleasanton, CA

Dr. Peter Moulton, Q-Peak—Bedford, MA

For more information on CREOL's Industrial Affiliates Day, go to www.optics.ucf.edu/partnerships/affiliates/AffiliatesDay2009

Attendees are invited to a party the next day: Spring Thing 2009!

Don’t Miss the Exhibition!



Moving Technology to Market™

SPIE Defense, Security + Sensing

Welcome Reception
in the Exhibition Hall
Tuesday • 5:00 to 6:00 pm

Exhibition: 14–16 April 2009
Orlando, Florida, USA

Exhibition Hours

Tuesday 14 April. . . . . 10:00 am to 6:00 pm

Wednesday 15 April . . . . . 10:00 am to 5:00 pm

Thursday 16 April . . . . . 10:00 am to 2:00 pm

The largest showcase of unclassified defense, security, and sensors equipment

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

Don’t Miss the Robotics and Unmanned Systems Displays

The Palms Exhibition Hall features displays and demonstrations from a select group of robotics and unmanned systems vendors.

Advanced Imaging Magazine
Defense Tech Briefs
Earth Imaging Journal
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4D Technology Corp.
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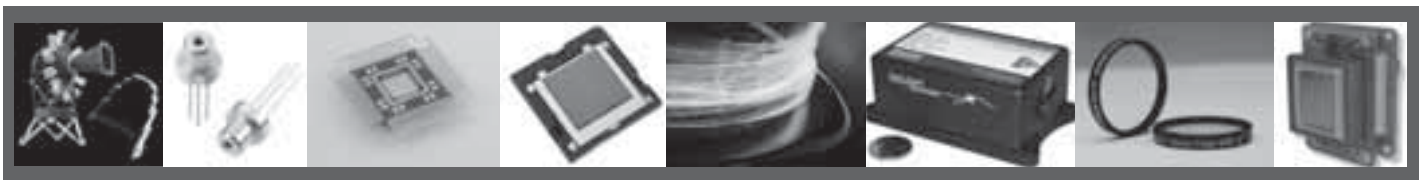

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Don't miss the
Robotics+Unmanned Systems Displays

SPIE Defense, Security, and Sensing Exhibition will again feature the Robotics+Unmanned Systems Displays in the Palms Ballroom adjacent to the main Exhibition Hall.

Featuring:

- **Robotics and unmanned systems currently deployed by the United States Armed Forces**
- **General Atomics Predator B Reconnaissance Model mounted with a Goodrich DB-110 Digital Sensor Wing Pod**
- **Germfree mobile laboratory set up to analyze hazardous biological and chemical samples**
- **Live demonstrations of unmanned ground vehicles**
- **Cutting-edge technology in use, or being developed, for defense, industrial, and commercial applications**
- **The latest real world applications of IR imagers, sensors, and optics**

See floor plan on page 4 for display location

"The robotics pavilion was what brought me down here to see what's new. Thank you for what you are doing."
–Dr. Mike Beasock,
Raytheon Missile Systems
2008 Attendee

"The mobile laboratory was developed under a CRADA with E.C.B.C. and is designed to safely analyze hazardous biological and chemical samples. Most important the laboratory supports newly developed analytical equipment, including Raman and FTIR, integrated in the Class III Glovebox."

Product Demonstrations on the Exhibition Floor

TIME	Tuesday	Wednesday	Thursday
	14 April	15 April	16 April
10:30 am	**Compact ECqcL Products for Mid-IR Detection and Illumination** **Eric Takeuchi,** Daylight Solutions	**GigE Vision Video Transmission** **Vincent Rowley,** Pleora Technologies/ GigE Vision	**CCD + Thermal Fusion** **Ernest Grimberg,** Opgal Optronic Industries Ltd.
11:30 am	**Miniature Motion Control Systems: Auto Focus Zoom Demo** **Ralph Weber,** New Scale Technologies, Inc.	**Stray Light Elimination** **Dina Katsir,** Acktar Ltd.	
12:30 pm	**New Passive Materials for Controlled Thermal Signature** **Daniel Feinman,** Acktar Ltd.		
1:30 pm	**MWIR Hyperspectral Imager** **Dario Cabib,** CI Systems	**Live Demonstration of MWAVE Infrared Zoom Camera** **Jonathan S. Kane,** IRZoom.com/ Computer Optics, Inc.	

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Wednesday 15 April . . . . . 10:00 am-3:00 pm

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Monday	Tuesday	Wednesday	Thursday	Friday
13 April	14 April	15 April	16 April	17 April
IR Sensors and Systems				
SC713 **Engineering Approach to Imaging System Design** *(Holst)* 8:30 am to 5:30 pm, $565 / $660	SC214 **Infrared Window and Dome Materials** *(Harris)* 8:30 am to 5:30 pm, $570 / $660	SC835 **Infrared Systems - Technology & Design** *(Daniels)* 8:30 am to 3:30 pm, $880 / $1120		SC796 **Allowable Stresses in Glass and Engineering Ceramics** *(Pepi)* 8:30 am to 12:30 pm, $310 / $360
SC545 **Infrared Characterization of Sources and Backgrounds** *(Jacobs)* 8:30 am to 5:30 pm, $525 / $620	SC178 **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $420 / $470	SC134 **Optical Design Fundamentals for Infrared Systems** *(Kampe)* 8:30 am to 5:30 pm, $555 / $645	SC710 **NIR and SWIR Imaging Applications** *(Richards)* 8:30 am to 12:30 pm, $350 / $400	SC154 **Electro-Optical Imaging System Performance** *(Holst)* 8:30 am to 5:30 pm, $580 / $670
SC278 **Infrared Detectors** *(Dereniak)* 8:30 am to 12:30 pm, $420 / $470	SC838 **Laser Range Gated Imaging Techniques** *(Duncan)* 8:30 am to 12:30 pm, $310 / $360	SC900 **Uncooled Thermal Imaging Detectors and Systems** *(Hanson)* 8:30 am to 5:30 pm, $550 / $640	SC067 **Testing and Evaluation of E-O Imaging Systems** *(Holst)* 8:30 am to 5:30 pm, $580 / $670	SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $515 / $605
SC892 **Infrared Search and Track Systems** *(Schwering)* 8:30 am to 5:30 pm, $515 / $605	SC944 **The Radiometry Case Files** *(Grant)* 1:30 to 5:30 pm, $310 / $360	SC659 **Understanding Reflective Optical Design** *(Contreras)* 8:30 am to 5:30 pm, $515 / $605	SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* 8:30 am to 5:30 pm, $515 / $605	
SC840 **IR Detector Cryocoolers** *(Rühlich)* 8:30 am to 12:30 pm, $310 / $360		SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* 1:30 to 5:30 pm, $310 / $360		
		SC950 ***NEW*** **Advanced Infrared Imaging Radiometry** *(Richards)* 8:30 am to 12:30 pm, $310 / $360		
Thermosense				
		SC950 ***NEW*** **Advanced Infrared Imaging Radiometry** *(Richards)* 8:30 am to 12:30 pm, $310 / $360	SC710 **NIR and SWIR Imaging Applications** *(Richards)* 8:30 am to 12:30 pm, $350 / $400	
Imaging and Sensing				
SC713 **Engineering Approach to Imaging System Design** *(Holst)* 8:30 am to 5:30 pm, $565 / $660	SC178 **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $420 / $470	SC950 ***NEW*** **Advanced Infrared Imaging Radiometry** *(Richards)* 8:30 am to 12:30 pm, $310 / $360	SC901 **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $515 / $605	SC154 **Electro-Optical Imaging System Performance** *(Holst)* 8:30 am to 5:30 pm, $580 / $670
SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $310 / $360	SC157 **MTF in Optical and Electro-Optical Systems** *(Ducharme)* 8:30 am to 5:30 pm, $550 / $640		SC067 **Testing and Evaluation of E-O Imaging Systems** *(Holst)* 8:30 am to 5:30 pm, $580 / $670	SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $515 / $605
	SC946 ***NEW*** **Super Resolution in Imaging Systems** *(Bagheri, Javidi)* 8:30 am to 5:30 pm, $515 / $605			
	SC944 ***NEW*** **The Radiometry Case Files** *(Grant)* 1:30 to 5:30 pm, $310 / $360			
	SC952 **Applications of Detection Theory** *(Carrano)* 8:30 am to 12:30 pm, $310 / $360			

Course Registration is required.
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Legend for Education Products: Price = SPIE Member / Non-Member SC000 = Course Number WS000 = Workshop Number

Daily Course Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
13 April	14 April	15 April	16 April	17 April
Sensing Technologies and Applications				
SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)* 1:30 to 5:30 pm, $310 / $360	SC945 ***NEW*** **Optical Fiber Sensing Technology: Basic Principles & Applications in Defense and Security** *(Udd, Mendez)* 1:30 to 5:30 pm, $310 / $360	SC948 ***NEW*** **Motes: Self-Organizing Wireless Networked Micro-Sensors** *(Cole)* 8:30 am to 5:30 pm, $515 / $605	SC901 **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $515 / $605	
	SC952 ***NEW*** **Applications of Detection Theory** *(Carrano)* 8:30 am to 12:30 pm, $310 / $360			
Sensor Data and Information Exploitation				
SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 to 5:30 pm, $310 / $360		SC837 **Multivariate Analysis of Imaging and Sensor Data** *(Bajorski)* 8:30 am to 5:30 pm, $515 / $605	SC158 **Fundamentals of Automatic Target Recognition** *(Nasr)* 8:30 am to 5:30 pm, $515 / $605	
			SC174 **Multispectral Image Processing** *(Schowengerdt)* 8:30 am to 5:30 pm, $590 / $680	
			SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* 8:30 am to 5:30 pm, $515 / $605	
			SC901 **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $515 / $605	
Signal, Image, and Neural Net Processing				
SC630 **Digital Signal Processing with Field Programmable Gate Arrays** *(Meyer-Baese)* 1:30 to 5:30 pm, $385 / $435	SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* 8:30 am to 12:30 pm, $310 / $360	SC715 **Independent Component Analysis and Beyond: Blind Signal Processing and its Applications** *(Jung, Girolami)* 8:30 am to 12:30 pm, $310 / $360	SC901 **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $515 / $605	
SC953 ***NEW*** **Signal Processing and Multiscale Analysis in Complex Digital Document Spaces** *(Coifman)* 8:30 am to 12:30 pm, $310 / $360	SC066 **Fundamentals of Electronic Image Processing** *(Weeks)* 8:30 am to 5:30 pm, $575 / $665	SC949 ***NEW*** **Linear and Nonlinear Principal Complement Analysis with Applications in Sensing and Processing** *(Dianat)* 8:30 am to 5:30 pm, $515 / $605		
	SC946 ***NEW*** **Super Resolution in Imaging Systems** *(Bagheri, Javidi)* 8:30 am to 5:30 pm, $465 / $555			
	SC952 ***NEW*** **Applications of Detection Theory** *(Carrano)* 8:30 am to 12:30 pm, $360 / $410			

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Laser Sensors and Systems				
	SC717 **3D Visualization Techniques for Laser Radar** *(Roth)* 8:30 am to 12:30 pm, $310 / $360		SC160 **Precision Stabilization and Laser Pointing Systems** *(Hilkert)* 8:30 am to 5:30 pm, $515 / $605	
	SC784 **Fiber Lasers for Defense Applications: Fibers, Components and System Design Considerations** *(Samson, Torruellas)* 8:30 am to 5:30 pm, $515 / $605			
	SC188 **Laser Beam Propagation for Applications in Laser Communications, Laser Radar, and Active Imaging** *(Phillips, Andrews)* 8:30 am to 5:30 pm, $630 / $720			
	SC167 **Introduction to Laser Radar** *(Kamerman)* 1:30 to 5:30 pm, $515 / $605			
Displays				
		SC159 **Head-Mounted Displays: Design and Applications** *(Melzer, Browne)* 8:30 am to 5:30 pm, $520 / $610		
Information Systems and Networks: Processing, Fusion, and Knowledge Generation				
	SC952 ***NEW*** **Applications of Detection Theory** *(Carrano)* 8:30 am to 12:30 pm, $310 / $360	SC948 ***NEW*** **Motes: Self Organizing Wireless Networked Micro-Sensors** *(Cole)* 8:30 am to 5:30 pm, $515 / $605	SC901 **Sensor Array Signal Processing** *(Rao)* 8:30 am to 5:30 pm, $515 / $605	
Defense, Homeland Security, and Law Enforcement				
SC719 **Chemical & Biological Detection: Overview of Point and Standoff Sensing Technologies** *(Gardner)* 1:30 to 5:30 pm, $310 / $360	SC952 ***NEW*** **Applications of Detection Theory** *(Carrano)* 8:30 am to 12:30 pm, $310 / $360			

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Daily Course Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
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Unmanned, Robotic, and Layered Systems				
SC894 **Introduction to INS and INS-Based Integrated Navigation** *(Soloviev)* 8:30 am to 5:30 pm, $515 / $605	SC952 ***NEW*** **Applications of Detection Theory** *(Carrano)* 8:30 am to 12:30 pm, $310 / $360		SC549 **Incorporating GPS Technology into Commercial and Military Applications** *(Uijt de Haag)* 1:30 to 5:30 pm, $310 / $360	
Optical and Optomechanical Engineering				
SC156 **Basic Optics for Engineers** *(Ducharme)* 8:30 am to 5:30 pm, $550 / $640	SC178 **Introduction to Radiometry and Photometry** *(McCluney)* 8:30 am to 12:30 pm, $420 / $470	SC013 **Precision Mounting of Optical Components** *(Yoder, Jr.)* 8:30 am to 5:30 pm, $600 / $690	SC003 **Practical Optical System Design** - EXPANDED 2-Day Format *(Fischer)* 8:30 am to 5:30 pm, $1010 / $1230	
SC254 **Integrated Opto-Mechanical Analysis** *(Genberg, Doyle)* 8:30 am to 5:30 pm, $560 / $650	SC220 **Optical Alignment Mechanisms** *(Guyer)* 8:30 am to 12:30 pm, $310 / $360	SC659 **Understanding Reflective Optical Design** *(Contreras)* 8:30 am to 5:30 pm, $515 / $605		SC796 **Allowable Stresses in Glass and Engineering Ceramics** *(Pepi)* 8:30 am to 12:30 pm, $310 / $360
	SC221 **Optomechanics and Tolerancing of Instruments** *(Hatheway)* 8:30 am to 5:30 pm, $515 / $605	SC950 ***NEW*** **Advanced Infrared Imaging Radiometry** *(Richards)* 8:30 am to 12:30 pm, $310 / $360		
	SC944 ***NEW*** **The Radiometry Case Files** *(Grant)* 1:30 to 5:30 pm, $310 / $360	SC010 **Introduction to Optical Alignment Techniques** *(Ruda)* 8:30 am to 5:30 pm, $925 / $1145		
Business and Professional Development				
WS951 ***NEW*** **Leading Successful Product Innovation** *(Carrano)* 1:30 to 5:30 pm, $310 / $360	WS846 **Essential Skills for Engineering Project Leaders** *(Hinkle)* 8:30 am to 12:30 pm, $310 / $360			
	WS933 **Complying with the ITAR: A Case Study** *(Scarlott)* 1:30 to 5:30 pm, $310 / $360			

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Program on

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Program on

Laser Sensors and Systems

Program on

Displays

Program on

Space Technologies and Operations

Program on

Unmanned, Robotic, and Layered Systems

Program on

Sensor Data and Information Exploitation

Program on

Signal, Image, and Neural Net Processing

Program on

Information Systems and Networks: Processing, Fusion, and Knowledge Generation

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Daily Conference Schedule

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IR Sensors and Systems				
7298 **Infrared Technology and Applications XXXV** *(Andresen, Fulop, Norton)* p. 33				
7301 *Technologies for* **Synthetic Environments: Hardware-in-the-Loop XIV** *(Buford, Murrer)* p. 46	7299 **Thermosense XXXI** *(Burleigh, Dinwiddie)* p. 41			
	7300 **Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XX** *(Holst)* p. 44			
		7302 **Window and Dome Technologies and Materials XI** *(Tustison)* p. 48		
Defense, Homeland Security, and Law Enforcement				
7303 **Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XIV** *(Harmon, Broach, Holloway)* p. 50				
	7306A **Optics and Photonics in Global Homeland Security V** *(Halvorson, Southern)* p. 60			
	7304 **Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing X** *(Fountain, Gardner)* p. 54			
7306B **Biometric Technology for Human Identification VI** *(Vijaya Kumar, Prabhakar, Ross)* p. 63		7305 **Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense VIII** *(Carapezza)* p. 57		
Imaging and Sensing				
7308 **Radar Sensor Technology XIII** *(Ranney, Doerry)* p. 66			7307 **Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications VI** *(Henry)* p. 64	
	7311 **Terahertz Physics, Devices, and Systems III: Advanced Applications in Industry and Defense** *(Anwar, Dhar, Crowe)* p. 72		7309 **Passive Millimeter-Wave Imaging Technology XII** *(Appleby, Wikner)* p. 68	
	7310 **Non-Intrusive Inspection Technologies II** *(Blackburn)* p. 70			
Sensing Technologies and Applications				
7312 **Advanced Environmental, Chemical, and Biological Sensing Technologies VI** *(Vo-Dinh, Lieberman, Gauglitz)* p. 74		7316 **Fiber Optic Sensors and Applications VI** *(Udd, Du, Wang)* p. 82		
	7315 **Sensing for Agriculture and Food Quality and Safety** *(Kim, Tu, Chao)* p. 80		7313 **Smart Biomedical and Physiological Sensor Technology VI** *(Cullum, Porterfield)* p. 76	
7317 **Ocean Sensing and Monitoring** *(Hou)* p. 85				
7314 **Photonics in the Transportation Industry: Auto to Aerospace II** *(Kazemi, Kress)* p. 78				
Emerging Technologies				
7321 **Bio-Inspired/ Biomimetic Sensor Technologies and Applications** *(Fell, Swaminathan)* p. 93	7320 **Advanced Photon Counting Techniques III** *(Itzler, Campbell)* p. 91			
7319 **Next-Generation Spectroscopic Technologies II** *(Druy, Brown, Crocombe)* p. 90		7318 **Micro- and Nanotechnology Sensors, Systems, and Applications** *(George, Islam, Dutta)* p. 87		
			7322 **Photonic Microdevices/Microstructures for Sensing** *(Xiao, Fan, Wang)* p. 94	

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Laser Sensors and Systems				
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Displays				
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Space Technologies and Operations				
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Unmanned, Robotic, and Layered Systems				
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	7338 **Acquisition, Tracking, Pointing, and Laser Systems Technologies XXIII** *(Chodos, Thompson)* p. 129			
Signal, Image, and Neural Net Processing				
7339 **Enabling Photonics Technologies for Defense, Security, and Aerospace Applications V** *(Hayduk, Delfyett)* p. 130				
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			7342 **Quantum Information and Computation VII** *(Donkor, Pirich, Brandt)* p. 136	

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Information Systems and Networks: Processing, Fusion, and Knowledge Generation				
	7346 **Visual Analytics for Homeland Defense and Security** *(Tolone, Ribarsky)* p. 145	7344 **Data Mining, Intrusion Detection, Information Security and Assurance, and Data Networks Security 2009** *(Dasarathy)* p. 141	7349 **Wireless Sensing and Processing IV** *(Dianat, Zoltowski)* p. 150	
	7347 **Evolutionary and Bio-Inspired Computation: Theory and Applications III** *(O'Donnell, Blowers, Priddy)* p. 146		7345 **Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2009** *(Dasarathy)* p. 143	
	7351 **Mobile Multimedia/Image Processing, Security, and Applications 2009** *(Agaian, Jassim)* p. 153		7352A **Intelligent Sensing, Situation Management, and Impact Assessment** *(Buford, Jakobson)* p. 155	
		7348 **Modeling and Simulation for Military Operations IV** *(Trevisani)* p. 148		
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Infrared Technology and Applications XXXV

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

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Monday 13 April

Opening Remarks

Room: Grand 8A . . . . . Mon. 8:00 to 8:10 am

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

Opening Remarks

Room: Grand 8B . . . . . Mon. 8:00 to 8:10 am

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

Sessions 1,2,3,4 run concurrently with sessions 5,6A,6B,7

SESSION 1

Room: Grand 8A . . . . . Mon. 8:10 to 10:10 am

Infrared at Jet Propulsion Laboratory

Session Chair: **Sarath D. Gunapala,** Jet Propulsion Lab.

8:10 am: **Infrared sensors and instruments for 21 st Century space exploration** *(Invited Paper)*, Paul E. Dimotakis, Jet Propulsion Lab. (United States) . . . . . [7298-01]

8:30 am: **Thermal infrared spectral imager for airborne science applications** *(Invited Paper)*, William R. Johnson, Simon J. Hook, Pantazis Z. Mouroulis, Daniel W. Wilson, Sarath D. Gunapala, Cory J. Hill, Jason M. Mumolo, Vincent J. Realmuto, Bjorn T. Eng, Jet Propulsion Lab. (United States) . . . . . [7298-158]

8:50 am: **Compact infrared imaging spectrometer systems** *(Invited Paper)*, Pantazis Z. Mouroulis, Robert O. Green, Jet Propulsion Lab. (United States) . . . . . [7298-03]

9:10 am: **Superlattice and antimonide-based focal plane arrays** *(Invited Paper)*, Cory J. Hill, Jet Propulsion Lab. (United States) . . . . . [7298-04]

9:30 am: **Novel quantum well, quantum dot, and superlattice heterostructure-based infrared detectors** *(Invited Paper)*, David Z. Ting, Sumith V. Bandara, Cory J. Hill, Sarath D. Gunapala, Alexander Soibel, Jason Mumola, Jean Nguyen, John K. Liu, Sam A. Keo, Jet Propulsion Lab. (United States); Yia-Chung Chang, Univ. of Illinois at Urbana-Champaign (United States); H. C. Liu, C. Y. Song, National Research Council Canada (Canada) . . . . . [7298-05]

9:50 am: **Megapixel dualband QWIP focal plane array** *(Invited Paper)*, Alexander Soibel, Sarath D. Gunapala, Sumith V. Bandara, Cory J. Hill, David Z. Ting, John K. Liu, Jason M. Mumolo, Sam S. Keo, Jet Propulsion Lab. (United States) . . . . . [7298-06]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 5

Room: Grand 8B . . . . . Mon. 8:10 to 11:40 am

Uncooled FPAs and Applications I

Session Chairs: **Stefan T. Baur,** Raytheon Vision Systems; **Jean-Luc Tissot,** ULIS (France)

8:10 am: **17 µm microbolometer FPA technology at BAE Systems,** Richard J. Blackwell, Daniel Lacroix, Tuyet T. Bach, Jonathan Ishii, Sandra L. Hyland, Thomas Dumas, Scott D. Carpenter, Sherman Chan, Balwinder Sujlana, BAE Systems (United States) . . . . . [7298-24]

8:30 am: **High-performance uncooled amorphous silicon XGA IRFPA with 17 µm pixel-pitch**, Jean-Luc Tissot, Michel Vilain, Olivier Legras, Patrick Robert, Christophe Minassian, Sophie Garidel, Sebastien Cortial, ULIS (France); Jean-Jacques Yon, Commissariat à l'Energie Atomique (France) . . . . . [7298-25]

8:50 am: **The architecture and performance of SCD's 17 µm pitch VO_x µ-bolometer detector**, Avraham R. Frenkel, Udi Mizrahi, Leonid Bikov, Avihoo Giladi, Niv Shiloah, Shimon Elkind, Tomer Czyzewski, Igal Kogan, Asaf Amsterdam, SCD - SemiConductor Devices (Israel). . . . . [7298-26]

9:10 am: **Advancement in 17 micron pixel pitch uncooled focal plane arrays**, Chuan C. Li, DRS Infrared Technologies (United States) . . . . . [7298-27]

9:30 am: **Advances in small-pixel, large-format a-Si bolometer arrays**, Charles M. Hanson, Thomas R. Schimert, L-3 Communications Infrared Products (United States) . . . . . [7298-28]

9:50 am: **Uncooled technology transforming the future soldier into a center for surveillance and recognition**, Yoram A. Aron, Noam Cohen, Elbit Systems Electro-Optics ElOp Ltd. (Israel) . . . . . [7298-156]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **Novel readout circuit architecture realizing TEC-less operation for SOI diode uncooled IRFPA**, Takahiro Ohnakado, Masashi Ueno, Yasuaki Ohta, Yasuhiro Kosasayama, Hisatoshi Hata, Takaki Sugino, Takanori Ohno, Keisuke Kama, Masahiro Tsugai, Hiroshi Fukumoto, Mitsubishi Electric Corp. (Japan) . . . . . [7298-31]

11:00 am: **A 160 × 120 pixel uncooled TEC-less infrared radiation focal plane array on a standard ceramic package**, Hideyuki Funaki, Hiroto Honda, Ikuo Fujiwara, Hitoshi Yagi, Koichi Ishii, Keita Sasaki, Toshiba Corp. (Japan) . [7298-32]

11:20 am: **Next-generation PIR security sensors: concept testing and evaluation**, Kevin C. Liddiard, Electro-optic Sensor Design (Australia) . . [7298-33]

Sessions 1,2,3,4 run concurrently with sessions 5,6A,6B,7

SESSION 2

Room: Grand 8A . . . . . Mon. 10:40 am to 12:00 pm

CQWIP, QDWELL, and QWIP FPAs

Session Chairs: **Philippe F. Bois,** Alcatel-Thales III-V Lab. (France); **John W. Devitt,** L-3 Communications Cincinnati Electronics

10:40 am: **C-QWIP focal plane array sensitivity**, Kwong-Kit Choi, Army Research Lab. (United States); David P. Forrai, Darrel W. Endres, L-3 Communications Cincinnati Electronics (United States); Jason Sun, Army Research Lab. (United States); Paul Pinsukanjana, Intelligent Epitaxy Technology, Inc. (United States); John W. Devitt, L-3 Communications Cincinnati Electronics (United States) . . . . . [7298-07]

11:00 am: **Multispectral infrared detection using plasmon-assisted cavities**, Rajeev V. Shenoi, The Univ. of New Mexico (United States); Jessie Rosenberg, California Institute of Technology (United States); Jiayi Shao, Sanjay Krishna, The Univ. of New Mexico (United States); Oskar Painter, California Institute of Technology (United States) . . . . . [7298-08]

11:20 am: **Smart photodetector and focal plane array**, Jarrod Vaillancourt, Xuejun Lu, Univ. of Massachusetts Lowell (United States) . . . . . [7298-09]

11:40 am: **Recent trial results of an LWIR polarimeter**, Barry Connor, Iain Carrie, Thales Optronics Ltd. (United Kingdom) . . . . . [7298-10]

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

SESSION 3

Room: Grand 8A . . . . . Mon. 1:00 to 3:00 pm

QWIP and QDIP with Antimonides

Session Chairs: **Philippe F. Bois,** Alcatel-Thales III-V Lab. (France); **John W. Devitt,** L-3 Communications Cincinnati Electronics

1:00 pm: **Quantum well infrared photodetectors: design using the transfer matrix method**, Ricardo Augusto T. Santos, Fabio Durante P. Alves, Christian Giorgio R. Taranti, Instituto Tecnológico de Aeronautica (Brazil); Gamani Karunasiri, Naval Postgraduate School (United States); Jayr Amorim, Instituto Tecnológico de Aeronautica (Brazil) . . . . . [7298-11]

1:20 pm: **Very longwave infrared (> 14 µm) quantum dot photodetector**, Jarrod Vaillancourt, Xuejun Lu, Univ. of Massachusetts Lowell (United States) . . . . . [7298-12]

1:40 pm: **High-performance 256 × 256 pixel LWIR QDIP**, Mitsuhiro Nagashima, Michiya Kibe, Japan Ministry of Defense (Japan); Minoru Doshida, MOD Technical Research and Development Institute (Japan); Hiroyasu Yamashita, Ryo Suzuki, Yasuhito Uchiyama, Yusuke Matsukura, Fujitsu Labs., Ltd. (Japan); Hironori Nishino, Toshio Fujii, Fujitsu Labs. (Japan); Shinji Miyazaki, Fujitsu Labs., Ltd. (Japan) . . . . . [7298-13]

2:00 pm: **IR imaging at IRnova**, Henk H. Martijn, Carl Asplund, IRnova AB (Sweden); Linda Höglund, Acreo AB (Sweden); Hedda Malm, Sergiy Smuk, IRnova AB (Sweden); Qin Wang, Acreo AB (Sweden) . . . . . [7298-14]

2:20 pm: **QWIP focal plane arrays from MWIR up to VLWIR**, Jean-Alexandre Robo, Eric M. Costard, Jean-Patrick Truffer, Alexandru Nedelcu, Xavier Marcadet, Philippe F. Bois, Alcatel-Thales III-V Lab. (France) . . . . . [7298-15]

2:40 pm: **Progress with antimonide-based detectors at SCD**, Olga Klin, Steve Grossman, Noam Snapi, Maya Brumer, Inna Lukomsky, Michael Yassen, Boris Yofis, Alex Glozman, Joelle Oiknine-Schlesinger, Itay Shtrichman, Eliezer Weiss, Philip C. Klipstein, SCD - SemiConductor Devices (Israel) . . . . . [7298-16]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 6A

Room: Grand 8B . . . . . Mon. 11:40 am to 12:00 pm

IR Optics I

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

11:40 am: **Optical design of an hemispherical, long-wave infrared panomorph lens for total situational awareness**, Simon Thibault, ImmerVision (Canada) . . . . . [7298-34]

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

SESSION 6B

Room: Grand 8B . . . . . Mon. 1:00 to 2:40 pm

IR Optics II

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

1:00 pm: **It's only two lenses in a tube: how complicated can it be?** Christopher R. Bigwood, Andrew P. Wood, Qioptiq Ltd. (United Kingdom) . . . . . [7298-35]

1:20 pm: **Optical design study for the 1-5 µm spectral band**, Miguel P. Snyder, Jay Vizgaitis, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7298-36]

1:40 pm: **Ring around the image, a pocket full of problems**, Troy A. Palmer, Ryan Bemis, StingRay Optics, LLC (United States) . . . . . [7298-37]

2:00 pm: **Demonstration of flexible nanocomposite NIR mirror**, Thad L. Druffel, Optical Dynamics Corp. (United States) . . . . . [7298-38]

2:20 pm: **Black surfaces for infrared, aerospace, and cryogenic applications**, Tomas Kralik, Institute of Scientific Instruments (Czech Republic); Dina Katsir, Acktar Advanced Coatings Ltd. (Israel) . . . . . [7298-39]

Sessions 1,2,3,4 run concurrently with sessions 5,6A,6B,7

SESSION 4

Room: Grand 8A . . . . . Mon. 3:30 to 5:50 pm

Novel Uncooled Technologies

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

3:30 pm: **Parylene-based uncooled thermomechanical detector array**, Onur Ferhanoglu, M. Fatih Toy, Hakan Urey, Koç Univ. (Turkey) . . . . . [7298-17]

3:50 pm: **Optical readout photomechanical imager: from design to implementation**, Matthew Erdtmann, Lei Zhang, Guanghai Jin, Shankar Radhakrishnan, Gregory Simelgor, Jack P. Salerno, Agiltron, Inc. (United States) . . . . . [7298-18]

4:10 pm: **The roadmap for low-price high-performance IR detector based on IR to visible light-up conversion approach**, Valery Garber, Emanual Baskin, Alexander Fayer, Alexander Epstein, Nimrod Shuall, Ahron Saguy, Dekel Veksler, Boris Spektor, David Arbel, Dror Ben-Aharon, Itzhak Parnafes, D.C. Sirica Ltd. (Israel) . . . . . [7298-19]

4:30 pm: **Silicon germanium oxide ($Si_xGe_{1-x}O_y$) infrared material for uncooled infrared detection**, Mahmoud F. Almasri, Qi Cheng, Univ. of Missouri, Columbia (United States) . . . . . [7298-20]

4:50 pm: **Wavelength-selective infrared detectors based on cross-patterned resistive sheets**, Joo-Yun Jung, Jong Yeon Park, Dean P. Neikirk, The Univ. of Texas at Austin (United States) . . . . . [7298-21]

5:10 pm: **Active mode detection with enhanced pyroelectric sensitivity**, Ricardo A. G. Unglaub, Jolanta B. Celinska, Christopher R. McWilliams, Carlos A. Paz de Araujo, Symetrix Corp. (United States); Andrzej M. Pawlak, Scott Jones, Delphi Corp. (United States) . . . . . [7298-22]

5:30 pm: **80 × 60 element thermoelectric infrared focal plane array for high-volume commercial use,** David Kryskowski, Ann Arbor Sensor Systems, LLC (United States) . . . . . [7298-23]

SESSION 7

Room: Grand 8B . . . . . Mon. 2:40 to 5:30 pm

Cryocoolers for IR Focal Plane Arrays

Session Chairs: **Ingo Rühlich,** AIM Infrarot-Module GmbH (Germany); **Alexander M. Veprik,** RICOR-Cryogenic & Vacuum Systems (Israel)

2:40 pm: **Air Liquide pulse tube cryocooler systems for space applications**, Thierry Trollier, Julien Tanchon, Jean-Christophe Rey, Alain Ravex, Air Liquide (France) . . . . . [7298-40]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Update on Thales flexure bearing coolers and drive electronics**, Willem van de Groep, Jeroen C. Mullie, Daniel Willems, Mark Tops, Hans van der Weijden, Tonny Benschop, Thales Cryogenics B.V. (Netherlands) . . . . . [7298-42]

3:50 pm: **High-frequency split Stirling linear cryogenic cooler with shortened cold finger**, Alexander M. Veprik, Semeon Zehter, Herman S. Vilenchik, Nachman Pundak, RICOR-Cryogenic & Vacuum Systems (Israel) . . . . . [7298-43]

4:10 pm: **Six Sigma methods applied to cryogenic coolers assembly line**, Jean Marc Ventre, Michel Germain Lacour, Jean Yves Martin, Jean Marc Cauquil, Thales Cryogénie S.A. (France); Tonny Benschop, Thales Cryogenics B.V. (Netherlands); Rene Griot, Thales Cryogénie S.A. (France) . . . . . [7298-44]

4:30 pm: **Microminiature rotary Stirling cryocooler for compact, lightweight, and low-power thermal imaging systems**, Avishai Filis, Zvi Bar-Haim, Nachman Pundak, RICOR-Cryogenic & Vacuum Systems (Israel) . . . . . [7298-45]

4:50 pm: **Development trends in IR detector coolers**, Markus Mai, Ingo Rühlich, Thomas Wiedmann, Carsten Rosenhagen, AIM Infrarot-Module GmbH (Germany) . . . . . [7298-46]

5:10 pm: **Novel concept for driving linear compressor of micro-miniature split Stirling cryogenic cooler**, Vladimir Maron, Soreq Nuclear Research Ctr. (Israel); Alexander M. Veprik, RICOR-Cryogenic & Vacuum Systems (Israel); Leonid Finkelstein, Itzhak Ziv, Soreq Nuclear Research Ctr. (Israel); Herman S. Vilenchik, Nachman Pundak, RICOR-Cryogenic & Vacuum Systems (Israel) . . . . . [7298-47]

Tuesday 14 April

Sessions 8,9,10,11 run concurrently with sessions 12,13,14,15,16.

INTRODUCTION

Room: Grand 8A . . . . . Tues. 8:00 to 8:10 am

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

SESSION 8

Room: Grand 8A . . . . . Tues. 8:10 to 8:50 am

Infrared in Future Soldier Systems I

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

8:10 am: **Digital image fusion systems: color imaging and low-light targets**, Joseph P. Estrera, L-3 Electro-Optical Systems (United States) . . . . . [7298-48]

8:30 am: **Low-light-level CMOS image sensor for digitally fused night vision systems,** Boyd A. Fowler, Xinqiao Liu, Stephen W. Mims, Janusz Balicki, Wang Li, Hung T. Do, Paul Vu, Fairchild Imaging (United States). . . . . [7298-49]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 9

Room: Grand 8A . . . . . Tues. 10:30 am to 12:10 pm

Infrared in Future Soldier Systems II

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

10:30 am: **FELIN: tailored optronics and systems solutions for dismounted combat**, Anne-Marie A. Milcent, Sagem Defense Securite (France) . . . . [7298-50]

10:50 am: **The handheld multifunctional thermal imager and surveillance instrument of Jena-Optronik within the German project 'IDZ-Infanterist der Zukunft'**, Joerg Heinrich, Jena-Optronik GmbH (Germany). . . . . [7298-51]

11:10 am: **The small arms video sight for the German Army Soldier-of-the-Future Program: lessons learned**, Bernd H. Ledertheil, Carsten Berlips, Carl Zeiss Optronics Wetzlar GmbH (Germany); Marco Ohlmann, Carl Zeiss Optronics GmbH (Germany) . . . . . [7298-52]

11:30 am: **Human factors considerations of IR sensors for the Canadian Integrated Soldier System Project (ISSP)**, John Frim, Linda L. M. Bossi, Defence Research and Development Canada (Canada); David W. Tack, Humansystems Inc. (Canada) . . . . . [7298-53]

11:50 am: **An update on TED, Gun Shot Detection, system development status**, Gil A. Tidhar, Martin Gurovich, Optigo Systems, Ltd. (Israel); Raanan Shlisselberg, Israel Ministry of Defense (Israel) . . . . . [7298-54]

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

SESSION 12

Room: Grand 8B . . . . . Tues. 8:00 to 9:00 am

MCT Advanced Research I

Session Chairs: **Wei Lu,** Shanghai Institute of Technical Physics (China); **Joseph G. Pellegrino,** U.S. Army Night Vision & Electronic Sensors Directorate

8:00 am: **Uniting IR detectors for tactical and space applications: a continuous cycle for reliability**, Xavier Brenière, SOFRADIR (France) . . [7298-69]

8:20 am: **IR-detection modules from SWIR to VLWIR: performance and applications**, Rainer Breiter, Joachim C. Wendler, Holger Lutz, Stefan Rutzinger, Johann Ziegler, AIM Infrarot-Module GmbH (Germany) . . . . . [7298-70]

8:40 am: **Visible to SWIR response of HgCdTe HDVIP detectors,** Arvind I. D'Souza, Ernest Robinson, Maryn G. Stapelbroek, Woon Y. Wong, Mark R. Skokan, Hung-Dah Shih, DRS Sensors & Targeting Systems, Inc. (United States). . . . . [7298-71]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 13

Room: Grand 8B . . . . . Tues. 10:30 am to 12:10 pm

MCT Advanced Research II

Session Chairs: **Hee Chul Lee,** Korea Advanced Institute of Science and Technology (Korea, Republic of); **Paul D. LeVan,** Air Force Research Lab.; **Joseph G. Pellegrino,** U.S. Army Night Vision & Electronic Sensors Directorate

10:30 am: **Large-format HgCdTe focal plane arrays for dual-band long-wavelength infrared detection**, Edward P. G. Smith, Raytheon Co. (United States). . . . . [7298-72]

10:50 am: **Longwave megapixel FPA for commercial and military applications**, Rick Roehl, Arnold L. Adams, Lockheed Martin Santa Barbara Focalplane (United States); John Marciniec, John D. Mullarkey, Paul Lovecchio, BAE Systems (United States) . . . . . [7298-73]

11:10 am: **LW Hawk: a 16 µm pitch full-TV LW IRFPA made from HgCdTe grown by MOVPE**, Leslie G. Hipwood, Chris L. Jones, Chris D. Maxey, Jonathan Fitzmaurice, James P. Price, Mark C. Wilson, Peter Knowles, SELEX GALILEO (United Kingdom). . . . . [7298-74]

11:30 am: **Status of very long infrared-wave focal plane array development at DEFIR**, Olivier Gravrand, Commissariat à l'Energie Atomique (France); Hervé Geoffray, Ctr. National d'Études Spatiales (France); Philippe Chorier, SOFRADIR (France). . . . . [7298-75]

11:50 am: **VLW IRFPAs made from HgCdTe grown by MOVPE**, Leslie G. Hipwood, Chris L. Jones, Chris D. Maxey, Darren Walker, Jonathan Fitzmaurice, Paul Abbott, Nick Shorrocks, Peter Knowles, SELEX GALILEO (United Kingdom). . . . . [7298-76]

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

Sessions 8,9,10,11 run concurrently with sessions 12,13,14,15,16.

SESSION 10

Room: Grand 8A . . . . . .Tues. 1:30 to 3:10 pm

Target Warning Systems

Session Chairs: **Michael T. Eismann,** Air Force Research Lab.; **Ingmar G. Renhorn,** Swedish Defence Research Agency (Sweden); **Gil A. Tidhar,** Optigo Systems, Ltd. (Israel)

1:30 pm: **A wide FOV force protection sensor system for military ground vehicles**, Scott P. Way, Noel Jolivet, John L. Miller, FLIR Systems, Inc. (United States) . . . . . [7298-55]

1:50 pm: **The application of microbolometers in 360-degree ground vehicle situational awareness**, David K. Breakfield, Dan L. Plemons, BAE Systems (United States) . . . . . [7298-56]

2:10 pm: **SAPIR collision alert system as part of IR MWS suite for helicopter fleets**, Shavit Nadav, Louisa Varsano, Saar Oz, Elisra Electronic Systems Ltd. (Israel); Raanan Schlisselberg, Ministry of Defense (Israel) . . . . . [7298-57]

2:30 pm: **Very large-format IR camera technology for submarine panoramic periscope**, John W. Devitt, Phillip Henry, L-3 Communications Cincinnati Electronics (United States); James R. Waterman, Naval Research Lab. (United States); Raghu P. Menon, RemoteReality Corp. (United States) . [7298-59]

2:50 pm: **Performance of SIMAC algorithm suite for tactical missile warning**, Joel B. Montgomery, Christine T. Montgomery, M & M Aviation (United States) . . . . . [7298-60]

Posters/Standby Oral Presentation

Novel, real-time standoff detection of explosives and other substances concealed under clothing, integrated into standard TV images via data fusion, Geoffrey G. Diamond, Intraspect Ltd. (United Kingdom) . . . . . [7298-157]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 11

Room: Grand 8A . . . . . .Tues. 3:40 to 6:00 pm

Type II Superlattice FPAs

Session Chairs: **Manijeh Razeghi,** Northwestern Univ.; **Meimei Z. Tidrow,** U.S. Army Night Vision & Electronic Sensors Directorate

3:40 pm: **Recent success on SLS FPAs and MDA's new direction on the development** *(Invited Paper)*, Meimei Z. Tidrow, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7298-61]

4:00 pm: **Long wavelength InAs/GaSb SLS detectors based on nBn design**, Arezou Khoshakhlagh, Ha sul Kim, Stephen A. Myers, Elena A. Plis, Larry R. Dawson, Sanjay Krishna, The Univ. of New Mexico (United States) . . . . . [7298-62]

4:20 pm: **Background limited performance of long-wavelength infrared focal plane arrays fabricated from Type-II InAs/GaSb M-structure superlattice**, Pierre-Yves Delaunay, Binh-Minh Nguyen, Paritosh Manurkar, Manijeh Razeghi, Northwestern Univ. (United States) . . . . . [7298-63]

4:40 pm: **InAs/GaSb superlattice focal plane array infrared detectors: manufacturing aspects**, Martin Walther, Robert H. Rehm, Johannes Schmitz, Frank Rutz, Joachim Fleissner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Ralf Scheibner, Johann Ziegler, AIM Infrarot-Module GmbH (Germany) . . . . . [7298-64]

5:00 pm: **Type-II InAs/GaSb superlattices for infrared detector applications**, Brett Z. Nosho, Sevag Terterian, Yakov Royter, Rajesh D. Rajavel, HRL Labs., LLC (United States) . . . . . [7298-65]

5:20 pm: **High-performance antimony-based type-II superlattice photodiodes on GaAs substrate** *(Invited Paper)*, Binh-Minh Nguyen, Darin Hoffman, Edward K. Huang, Pierre-Yves Delaunay, Manijeh Razeghi, Northwestern Univ. (United States) . . . . . [7298-66]

5:40 pm: **Optoelectronic characteristics of type-II LWIR InAs/GaSb superlattice n⁺∏p⁺ photodiodes**, Joseph G. Pellegrino, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7298-67]

SESSION 14

Room: Grand 8B . . . . . .Tues. 1:30 to 2:10 pm

MCT Advanced Research III

Session Chairs: **Antoni Rogalski,** Wojskowa Akademia Techniczna (Poland); **Gérard L. Destéfanis,** CEA-LETI (France)

1:30 pm: **Status of p-on-n HgCdTe technologies at DEFIR**, Nicolas Baier, Laurent R. Mollard, Yohan Rothman, Gérard L. Destéfanis, Philippe Ballet, Guillaume Bourgeois, Jean-Paul Zanatta, Michael Tchagaspanian, Commissariat à l'Energie Atomique (France); Christophe Pautet, Paul Fougères, SOFRADIR (France) . . . . . [7298-77]

1:50 pm: **Dual-color products for third-generation IR systems**, Yann Reibel, David Billon-Lanfrey, Philippe M. Tribolet, Franck Ponthenier, Michel M. Zecri, SOFRADIR (France); Jacques P. Baylet, Gérard L. Destéfanis, Commissariat à l'Energie Atomique (France) . . . . . [7298-78]

Posters/Standby Oral Presentation

Extension of spectral range of Peltier cooled photodetectors to 16 µm, Adam Piotrowski, Jozef F. Piotrowski, Jaroslaw Pawluczyk, M. Pędzińska Krzysztof Kłos, VIGO Systems S.A. (Poland) . . . . . [7298-159]

SESSION 15

Room: Grand 8B . . . . . .Tues. 2:10 to 4:40 pm

Uncooled FPAs and Applications II

Session Chairs: **Masafumi Kimata,** Ritsumeikan Univ. (Japan); **Charles M. Hanson,** L-3 Communications Infrared Products

2:10 pm: **Space qualified 512 × 3 pixel uncooled microbolometer FPA**, Timothy D. Pope, Fabien Dupont, Sonia Garcia-Blanco, Fraser Williamson, Francois J. Châteauneuf, Hubert Jerominek, INO (Canada); Ngo-Phong Linh, Canadian Space Agency (Canada) . . . . . [7298-79]

2:30 pm: **Modular infrared 640 × 480 pixel camera core for rapid device integration**, Loïc Le Noc, Alain Bergeron, Bruno Tremblay, François Lagacé, Luc Mercier, François Duchesne, Hubert Jerominek, INO (Canada) . . . . [7298-80]

2:50 pm: **Hybrid thin-film ferroelectric detector with pixel level ADC**, Joseph R. Acquaviva, Arif Ahmed, William Jan, Chien Hung Wu, Joshua Ziff, Bridge Semiconductor Corp. (United States) . . . . . [7298-81]

Coffee Break . . . . . 3:10 to 3:40 pm

3:40 pm: **Fast low-density IR imager of VPD PbSe**, Germán Vergara, Víctor Villamayor, Raúl Gutiérrez, Luís Jorge Gómez, María del Carmen Torquemada, María Teresa Rodrigo, Fernando José Sánchez, Marina Verdú, Julio Plaza del Olmo, Rosa María Almazán, Alfredo Heras, Mario Álvarez, Irene Catalán, Purificación Rodríguez, David Fernández, Ctr. de Investigación y Desarrollo de la Armada (Spain); Francesc Serra-Graells, Lluís A. Terés, Josep Maria Margarit, Ctr. Nacional de Microelectrónica (Spain) . . . . . [7298-82]

4:00 pm: **Vacuum packaging technology for mass production of uncooled IRFPAs**, Takuya Ito, Takayuki Tokuda, Masafumi Kimata, Ritsumeikan Univ. (Japan); Hideyuki Abe, Ayumi Industry Co., Ltd. (Japan); Naotaka Tokashiki, Miyoshi Electronics Corp. (Japan) . . . . . [7298-83]

4:20 pm: **Uncooled amorphous silicon TEC-less 1/4 VGA IRFPA with 25 µm 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) . . . . . [7298-84]

SESSION 16

Room: Grand 8B . . . . . .Tues. 4:40 to 6:00 pm

IR Optics: Filters

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

4:40 pm: **MEMS-based tunable filters for compact IR spectral imaging**, William J. Gunning III, Teledyne Scientific Co. (United States); Stefan C. Lauxtermann, Hakan Durmas, Min Xu, Teledyne Imaging Sensors (United States); Philip Stupar, Robert Borwick, Teledyne Scientific Co. (United States); Donald E. Cooper, Teledyne Imaging Sensors (United States); Paul H. Kobrin, Teledyne Scientific Co. (United States); Miikka Kangas, Teledyne Imaging Sensors (United States); Jeffrey F. DeNatale, Teledyne Scientific Co. (United States); William E. Tennant, Teledyne Imaging Sensors (United States) . . . . . [7298-85]

5:00 pm: **Environmental performance of dual-band antireflection coatings**, Thomas D. Rahmlow, Jr., Jeanne E. Lazo-Wasem, Rugate Technologies, Inc. (United States); Scott Wilkinson, Corning NetOptix (United States); Flemming Tinker, Flemming Tinker, LLC (United States) . . . . . [7298-87]

5:20 pm: **High-performance MWIR dual-bandpass filter for thermal imaging**, Karen D. Hendrix, Adam Bergeron, David L. Favot, JDSU (United States) . . . . . [7298-88]

5:40 pm: **A multispectral optical system (1.55 µm and 8-12 µm) of GASIR ®1: design and coating aspects**, Dusan Zadravec, Vectronix AG (Switzerland); John W. Franks, Kenneth A. Rogers, Alec F. Hendry, Umicore Coating Services (United Kingdom); Patrick Drach, Vectronix AG (Switzerland) . . . . . [7298-155]

Wednesday 15 April

Introduction to MCT 50th Anniversary Sessions

Room: Grand 8A • Wed. 8:00 to 8:10 am

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

SESSION 17

Room: Grand 8A . . . . . Wed. 8:10 am to 12:05 pm

MCT 50th Anniversary I

Session Chairs: **Wolfgang A. Cabanski,** AIM Infrarot-Module GmbH (Germany); **R. Kennedy McEwen,** SELEX GALILEO (United Kingdom); **Philippe M. Tribolet,** SOFRADIR (France); **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate

8:10 am: **Recollections of MCT work in the UK at Malvern and Southampton** *(Invited Paper)*, Tom Elliott, Consultant (United Kingdom) . . . . . [7298-89]

9:05 am: **50 years of successful MCT research and production in France** *(Invited Paper)*, Philippe Bensussan, SOFRADIR (France); Gérard L. Destéfanis, Commissariat à l'Energie Atomique (France); Michel Sirieix, Sagem Defense Securite (France); Philippe M. Tribolet, SOFRADIR (France) . . . . . [7298-90]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **HgCdTe technology in Germany: the past, the present, and the future** *(Invited Paper)*, Wolfgang A. Cabanski, Johann Ziegler, AIM Infrarot-Module GmbH (Germany) . . . . . [7298-91]

11:15 am: **Russian development of HgCdTe technology: 50 years** *(Invited Paper)*, Konstantin O. Boltar, Igor D. Burlakov, Vladimir P. Ponomarenko, Anatoly M. Filachov, Orion Research and Production Association (Russian Federation) . . . . . [7298-92]

11:45 am: **HgTe-based photodetectors in Poland** *(Invited Paper)*, Antoni Rogalski, Wojskowa Akademia Techniczna (Poland) . . . . . [7298-93]

Lunch/Exhibition Break . . . . . 12:05 to 1:30 pm

SESSION 18

Room: Grand 8A . . . . . Wed. 1:30 to 5:30 pm

MCT 50th Anniversary II

Session Chairs: **Stefan T. Baur,** Raytheon Vision Systems; **Myron J. Scholten,** DRS Sensors & Targeting Systems, Inc.; **Kadri Vural,** Teledyne Imaging Sensors; **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate

1:30 pm: **The development of a 0.1 eV bandgap semiconductor at the Honeywell Research Center (1959–1985)** *(Invited Paper)*, Joe Schmit, Paul W. Kruse, Ernie L. Stelzer, Consultant (United States) . . . . . [7298-94]

2:00 pm: **History of HgCdTe infrared detectors at BAE Systems** *(Invited Paper)*, Marion B. Reine, BAE Systems (United States) . . . . . [7298-95]

2:45 pm: **HgCdTe at Texas Instruments and beyond** *(Invited Paper)*, Michael A. Kinch, DRS Sensors & Targeting Systems, Inc. (United States) . . . . . [7298-96]

Coffee Break . . . . . 3:30 to 4:00 pm

4:00 pm: **Historical perspectives on HgCdTe material and device development at Raytheon Vision Systems** *(Invited Paper)*, Gerry Garwood, Peter R. Bratt, Tse Tung, William A. Radford, David R. Rhiger, Scott M. Johnson, Murray H. Kalisher, Raytheon Vision Systems (United States) . . . . . [7298-97]

4:45 pm: **HgCdTe at Teledyne** *(Invited Paper)*, William E. Tennant, Jose M. Arias, Jagmohan Bajaj, Teledyne Imaging Sensors (United States) . . . . . [7298-98]

Thursday 16 April

SESSION 19

Room: Grand 8A . . . . . Thurs. 8:00 to 11:20 am

MCT 50th Anniversary III

Session Chairs: **Peter N. Dennis,** QinetiQ Ltd. (United Kingdom); **Stuart B. Horn,** Defense Advanced Research Projects Agency; **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate

8:00 am: **30 years of HgCdTe technology in Israel** *(Invited Paper)*, Eliezer Weiss, SCD - SemiConductor Devices (Israel) . . . . . [7298-99]

8:20 am: **Development history of HgCdTe infrared detectors in Japan** *(Invited Paper)*, Hironori Nishino, Fujitsu Labs. (Japan); Naoki Oda, NEC Corp. (Japan) . . . . . [7298-100]

8:40 am: **HgCdTe technologies in South Korea** *(Invited Paper)*, Sooho Bae, Han Jung, i3system Corp. (Korea, Republic of); Seung-Man Park, Hoseo Univ. (Korea, Republic of); Hee Chul Lee, Korea Advanced Institute of Science and Technology (Korea, Republic of) . . . . . [7298-101]

9:00 am: **The development of HgCdTe infrared detector technology in China** *(Invited Paper)*, Wei Lu, Li He, Xiaoshuang Chen, Lei Ding, Shengli Sun, Shanghai Institute of Technical Physics (China); Jian Tang, Jun Hong Su, Kunming Institute of Physics (China) . . . . . [7298-102]

9:20 am: **HgCdTe technology in Australia** *(Invited Paper)*, John M. Dell, Lorenzo Faraone, The Univ. of Western Australia (Australia) . . . . . [7298-103]

9:40 am: **Mercury cadmium telluride IR detector development in India: status and issues** *(Invited Paper)*, Ram N. Singh, Retired (India) . . . . . [7298-104]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **HgCdTe development at Universities and US Government Laboratories** *(Invited Paper, Presentation Only)*, Philip Perconti, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7298-151]

Government Panel Discussion on the Impact of HgCdTe

Room: Grand 8A . . . . . Thurs. 11:20 am to 12:00 pm

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

Participants: **A. Fenner Milton,** U.S. Army Night Vision & Electronic Sensors Directorate; **James R. Waterman,** Naval Research Lab.; **Lynette E. Brown,** Air Force Research Lab; **Meimei Tidrow,** Missile Defense Agency

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

SESSION 20

Room: Grand 8A . . . . . Thurs. 1:00 to 6:10 pm

Short Wave IR and Applications

Session Chair: **Martin H. Ettenberg,** Goodrich SUI, Inc.

1:00 pm: **3D range-gated imaging at infrared wavelengths with superresolution depth mapping**, Martin Laurenzis, Frank Christnacher, Nicolas Metzger, French-German Research Institute of Saint-Louis (France); Ingo Zielenski, Wehrtechnische Dienststelle für Waffen und Munition (Germany) . . . . . [7298-105]

1:20 pm: **New high-gain detectors for active imaging**, Frederic P. Pistone, Philippe M. Tribolet, Michel M. Zecri, Xavier Lefoul, SOFRADIR (France); Gérard L. Destéfanis, Johan Rothman, Commissariat à l'Energie Atomique (France) . . . . . [7298-106]

1:40 pm: **HgCdTe APD-FPA performance at DEFIR**, Johan Rothman, Laurent R. Mollard, Eric De Borniol, Commissariat à l'Energie Atomique (France); Nicolas Baier, Commissarait à l'Energie Atomique (France); Fabrice Guellec, Philippe Ballet, Gérard L. Destéfanis, Commissariat à l'Energie Atomique (France); Xavier Lefoul, Philip Triboler, SOFRADIR (France) . . . . . [7298-107]

2:00 pm: **Theoretical analysis and comparison of SWIR active imaging detectors**, Stephane Demiguel, Sagem Defense Securite (France) . . . . [7298-108]

2:20 pm: **InAlAs avalanche photodiode with type-II absorber for detection beyond 2 µm**, Yu Ling Goh, Daniel S. G. Ong, Matthew J. Steer, Shi Yong, Jo Shien Ng, Chee Hing Tan, John P. R. David, The Univ. of Sheffield (United Kingdom) . . . . . [7298-109]

2:40 pm: **Performance and modeling of the HgCdTe e-APD for active systems applications**, Jeffrey D. Beck, Richard E. Scritchfield, DRS Sensors & Targeting Systems, Inc. (United States) . . . . . [7298-110]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **A new CMOS SiGeC avalanche photo-diode pixel for IR sensing**, Carlos Augusto, Pedro C. Diniz, Lynn Forester, Quantum Semiconductor LLC (United States) . . . . . [7298-111]

3:50 pm: **The development of extremely low-noise InAs electron APDs for SWIR active or passive imaging**, Andrew R. J. Marshall, Chee Hing Tan, Mathew J. Steer, John P. R. David, The Univ. of Sheffield (United Kingdom) . . . . . [7298-112]

4:10 pm: **Active infrared imaging technology for maritime applications** *(Invited Paper, Presentation Only)*, James R. Waterman, Naval Research Lab. (United States) . . . . . [7298-113]

4:30 pm: **An uncooled 1280 × 1024 InGaAs focal plane array for small platform, shortwave infrared imaging**, Michael J. Evans, Jesse Battaglia, Michael A. Blessinger, Marlon D. Enriquez, Martin H. Ettenberg, Joseph Groppe, Mark Lin, Joseph Passe, Mark Stern, Thomas M. Sudol, Goodrich SUI, Inc. (United States) . . . . . [7298-114]

4:50 pm: **Development of low dark current SiGe-detector arrays for visible-NIR imaging sensor**, Ashok K. Sood, Robert A. Richwine, Yash R. Puri, Magnolia Optical Technologies, Inc. (United States); Gary E. Bulman, Rama Venkatasubramanian, RTI International (United States); Stuart B. Horn, Defense Advanced Research Projects Agency (United States); Ray S. Balcerak, Ray M. Balcerak, LLC (United States); Arvind I. D'Souza, DRS Sensors & Targeting Systems, Inc. (United States); Thomas Bramhall, U.S. Army (United States) . . . . . [7298-115]

5:10 pm: **Large format 1280 × 1024 short-wave infrared (SWIR) focal plane array (FPA) combining extremely low noise with high-dynamic range**, David Acton, Michael D. Jack, Todd E. Sessler, Raytheon Vision Systems (United States) . . . . . [7298-116]

5:30 pm: **Low dark current InGaAs detector arrays for night vision and astronomy**, Michael H. MacDougal, Jon C. Geske, Chad S. Wang, Shirong Liao, Aerius Photonics, LLC (United States) . . . . . [7298-117]

5:50 pm: **Properties of short-wavelength infrared InGaAs and HgCdTe P +n photodiodes for low-light level imaging,** Roger E. DeWames, Roy T. Littleton, Curtis Billman, Joseph G. Pellegrino, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Stuart B. Horn, Defense Advanced Research Projects Agency (United States); Ray S. Balcerak, Systems Planning (United States) . . . . . [7298-118]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

A design of an uncooled thermal imaging system to block image blurring using an optimum detector warm shield, Jun Ho Jeong, Samsung Advanced Institute of Technology (Korea, Republic of) . . . . . [7298-135]

GaSb substrates with extended IR wavelength for advanced space-based applications, Lisa P. Allen, Patrick Flint, Gordon Dallas, Daniel Bakken, Kevin Blanchat, Galaxy Compound Semiconductors, Inc. (United States); Gail J. Brown, Air Force Research Lab. (United States); Shiva R. Vangala, William D. Goodhue, Univ. of Massachusetts Lowell (United States) . . . [7298-136]

TATP and TNT detection by mid-infrared transmission spectroscopy, Johannes Herbst, Juergen Hildenbrand, Armin Lambrecht, Fraunhofer Institute for Physical Measurements (Germany) . . . . . [7298-137]

A new chip layout for pyroelectric single-element detectors with high D* and very low microphonics, Volkmar Norkus, Gerald U. Gerlach, Technische Univ. Dresden (Germany); Reinhard Köhler, DIAS Infrared GmbH (Germany) . [7298-141]

Thin nickel oxide film for microbolometer, Dong-Soo Kim, Il Woong Kwon, Yong Soo Lee, Hee Chul Lee, Korea Advanced Institute of Science and Technology (Korea, Republic of) . . . . . [7298-142]

Implementation of real-time nonuniformity correction with multiple NUC tables using FPGA in an uncooled imaging system, Gyong Jin Oh, Lyang-June Kim, Sue-Ho Sheen, Gyou-Phyo Koo, Sang-Hun Jin, LIG Nex1 Co., Ltd. (Korea, Republic of); Jong-Ho Lee, Agency for Defense Development (Korea, Republic of) . . . . . [7298-143]

Liquid explosive detection from outside of the bottle by IR, Hideo Itozaki, Yuji Yamauchi, Osaka Univ. (Japan) . . . . . [7298-145]

6:00 pm: **20,000-hour reliability tests for the CLSS one-watt linear cryocooler**, M. Squires, R. D. Nelson, Carleton Life Support Systems Inc. (United States) . . . . . [7298-147]

A low-noise readout circuit in 0.35 µm CMOS for low-cost, uncooled FPA infrared network camera, Atila Alvandpour, Christer Jansson, Linköpings Univ. (Sweden); Frank Niklaus, Faun AB (Sweden); Per Fredriksson, Behzhad Mesgazadeh, M. Reza Sadeghifar, Linköpings Univ. (Sweden) . . . . . [7298-149]

PicoWatt infrared power measurement using an absolute cryogenic radiometer, Stephen M. Carr, Solomon I. Woods, Timothy M. Jung, Jung Research and Development (United States); Adriaan C. Carter, Raju U. Datla, National Institute of Standards and Technology (United States) . . . . . [7298-150]

A bias heating cancellation method for resistive uncooled microbolometer detectors, Alp Oguz, Murat Tepegoz, Tayfun Akin, Middle East Technical Univ. (Turkey) . . . . . [7298-152]

A column-based two-stage analog-to-digital converter for uncooled microbolometer arrays, Alperen Toprak, Murat Tepegoz, Tayfun Akin, Middle East Technical Univ. (Turkey) . . . . . [7298-153]

Morphology issues of HgCdTe samples grown by MOCVD, Pawel Madejczyk, Wojskowa Akademia Techniczna (Poland); A. Madejczyk, Krzysztof Kłos, VIGO Systems S.A. (Poland); Waldemar Gawron, Antoni Rogalski, Jaroslaw Rutkowski, Wojskowa Akademia Techniczna (Poland) . . . . . [7298-154]

POSTERS-THURSDAY

Room: Cyrstal M . . . . . Thurs. 6:00 to 7:30 pm

Posters/Standby Oral Presentations

Novel, real-time standoff detection of explosives and other substances concealed under clothing, integrated into standard TV images via data fusion, Geoffrey G. Diamond, Intraspect Ltd. (United Kingdom) . . . . . [7298-157]

Extension of spectral range of Peltier cooled photodetectors to 16 µm, Adam Piotrowski, Jozef F. Piotrowski, Jaroslaw Pawluczyk, M. Pędzińsika Krzysztof Kłos, VIGO Systems S.A. (Poland) . . . . . [7298-159]

Friday 17 April

SESSION 21

Room: Grand 8A . . . . . Fri. 8:00 to 11:30 am

Selected Technology Presentations

Session Chairs: **John Lester Miller,** FLIR Systems, Inc.; **Simon Thibault,** ImmerVision (Canada); **Bjørn F. Andresen,** Elbit Systems Electro-Optics ElOp Ltd. (Israel)

8:00 am: **Characterization of a digital-pixel focal plane array**, Matthew G. Brown, MIT Lincoln Lab. (United States). . . . . [7298-119]

8:20 am: **Ultra-low power ADC on chip for high-performance IR detector**, Michel M. Zecri, Gilbert Decaens, SOFRADIR (France) . . . . . [7298-121]

8:40 am: **Field reliability of Ricor microcoolers**, Nachman Pundak, RICOR-Cryogenic & Vacuum Systems (Israel) . . . . . [7298-122]

9:00 am: **Low-cost, high-performance molded IR optics**, Jing Zhao, Vincent DiFilippo, Agiltron, Inc. (United States) . . . . . [7298-123]

9:20 am: **High-resolution 1280 × 1024, 15 µm pitch compact InSb IR detector**, Ofer Nesher, Igor Pivnik, Elad Ilan, Zippi Calalhorra, Alina Koifman, Itai Hirsh, SCD - SemiConductor Devices (Israel) . . . . . [7298-124]

9:40 am: **Infrared frequency selective surfaces for sensor applications**, David W. Peters, Lori I. Basilio, Alvaro A. Cruz-Cabrera, G. Ronald Hadley, William A. Johnson, Joel R. Wendt, Shanalyn A. Kemme, Sandia National Labs. (United States); Tony R. Carter, Sandia Staffing Alliance (United States); Sally Samora, LMATA Government Services, LLC (United States). . . . . [7298-125]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Localized signal-to-noise ratio of man and vehicle size targets**, Joseph P. Estrera, L-3 Electro-Optical Systems (United States) . . . . . [7298-126]

10:50 am: **Low-noise, fast frame-rate InGaAs 320 × 256 FPA for hyperspectral applications**, Jan P. Vermeiren, Urbain Van Bogget, XenICs NV (Belgium); Guido Van Horebeek, XenICs NV (Belgium) and Cmosis (Belgium); Jonas L. Bentell, Peet Verbeke, Thierry Colin, XenICs NV (Belgium) . . . [7298-127]

11:10 am: **Anomaly detection and classification of objects in hyperspectral scene data**, Niclas Wadströmer, Ingmar G. Renhorn, Jörgen Ahlberg, Swedish Defence Research Agency (Sweden) . . . . . [7298-128]

Lunch Break . . . . . 11:30 am to 1:00 pm

SESSION 22

Room: Grand 8A . . . . . Fri. 1:00 to 3:00 pm

Selected Application Presentations

Session Chairs: **Simon Thibault,** ImmerVision (Canada); **John Lester Miller,** FLIR Systems, Inc.; **Bjørn F. Andresen,** Elbit Systems Electro-Optics ElOp Ltd. (Israel)

1:00 pm: **Extracting wildfire characteristics using hyperspectral, lidar, and thermal IR remote-sensing systems**, Christos E. Koulas, Univ. of Victoria (Canada) and Global Remote Sensing (Canada). . . . . [7298-129]

1:20 pm: **Stationary early warning system for bird strike prevention in aviation**, Holger Vogel, Mario O. Muenzberg, Harry Schlemmer, Hubertus Haan, Carl Zeiss Optronics GmbH (Germany); Paul Baader, Klaus Herden, Baader Konzept GmbH (Germany) . . . . . [7298-148]

1:40 pm: **An optimal approach for the fusion of information in a dual-band infrared imaging system**, Teresa L. Pace, Drew Manville, Gene Cloud, John Lofgren, James Pittman, DRS Technologies, Inc. (United States). [7298-130]

2:00 pm: **Design and analysis of dual-camera dual-band infrared imaging system**, Clinton L. Edwards, Leo R. Gauthier, Jr., Daniel T. Prendergast, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7298-131]

2:20 pm: **Spherical detection systems for detection and tracking of IR heat signatures** *(Presentation Only)*, Ryan D. Riel, Adam Calihman, Lucid Dimensions (United States). . . . . [7298-132]

2:40 pm: **Infrared-based object tracking**, Jon Gervais, Austin L. Youngblood, Walter H. Delashmit, Univ. of North Texas (United States). . . . . [7298-133]

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Thermosense XXXI

Conference Chairs: **Douglas D. Burleigh,** La Jolla Cove Consulting; **Ralph B. Dinwiddie,** Oak Ridge National Lab.

Program Committee: **Nicolas P. Avdelidis,** National Technical Univ. of Athens (Greece); **Jeff R. Brown,** Hope College; **Pierre G. Bremond,** Cedip Infrared Systems (France); **Antonio Colantonio,** Public Works and Government Services Canada (Canada); **Fred P. Colbert,** Colbert Infrared Services; **K. Elliott Cramer,** NASA Langley Research Ctr.; **Viki L. DeMars,** Professional Thermographers Association; **Ermanno G. Grinzato,** Consiglio Nazionale delle Ricerche (Italy); **Sheng-Jen Hsieh,** Texas A&M Univ.; **Herbert Kaplan,** Honeyhill Technical Co.; **Timo T. Kauppinen,** VTT (Finland); **Kathryn M. Lee,** United Space Alliance, LLC; **Dennis H. LeMieux,** Siemens Corporate Research; **Robert P. Madding,** FLIR Systems, Inc.; **Xavier P. V. Maldague,** Univ. Laval (Canada); **Jonathan J. Miles,** James Madison Univ.; **Gary L. Orlove,** FLIR Systems, Inc.; **G. Raymond Peacock,** Temperatures.com, Inc.; **Piotr Pregowski,** Pregowski Infrared Services (Poland); **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.; **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc.; **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russia); **Lisa West Åkerblom,** FLIR Systems AB (Sweden)

Steering Committee Emeritus Members: **Sven-Åke Ljungberg,** Univ. of Gävle (Sweden); **John R. Snell,** Snell Infrared

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 13 April

Vendor Presentations and Reception

Monday 13 April · 5:00 to 8:00 pm · Crystal J2 Ballroom

Chairs: **G. Raymond Peacock,** Temperatures.com, Inc.; **Herbert Kaplan,** Honeyhill Technology Co.

This event features 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 2009 DSS Exhibition?

This Special Session was started four 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 on-site.

Your company must be an exhibitor at DSS09 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 Herbert Kaplan: hkaplan@earthlink.net

This vendor session is held in conjunction with the Thermosense conference, 7299.

Confirmed Presentations:

SemiConductor Devices (SCD)
(Booth 829)
Hercules, a 1280 x 1024 elements, 15µm pitch, InSb 2D MWIR IDCA FPA
Presenter: **Fabian Schapiro,** Marketing Manager

Sensors Unlimited, Inc., part of Goodrich Corporation
(Booth 3213)
What You Should Ask Before Investing in a Shortwave Infrared (SWIR) Lens
Presenter: **Marc Hansen,** Applications Engineer

Photon Engineering LLC
(Booth 112)
Using Software to Reduce Ghost Images in IR systems
Presenter: **Michael Gauvin,** VP sales

ABB Group - Analytical Business
(Booth 917)
A New FT-IR Hyperspectral Imager
Presenter: TBA

Sofradir EC, Inc.
(Booths 611, 616)
Advanced Technology in Thermal Imaging
Presenter: **Art Stout,** Vice President

Lockheed Martin Santa Barbara Focalplane
(Booth 911)
High Speed, High Definition, MWIR Sensors
Presenter: **Dr. Arn Adams**

Additional Presentations

Additional speakers and titles to a maximum of 12 presentations are expected by meeting time. They will be announced then.

Tuesday 14 April

SESSION 1

Room: Grand 12 . . . . . .Tues. 8:00 to 9:00 am

Calibration and Radiometric Measurements

Session Chairs: **G. Raymond Peacock,** Temperatures.com, Inc.; **Robert P. Madding,** FLIR Systems, Inc.; **Ralph B. Dinwiddie,** Oak Ridge National Lab.

8:00 am: **Characterization of thermal imagers under various ambient conditions**, Riho Vendt, Priit Jaanson, Viktor Vabson, Toomas Kübarsepp, Metrosert AS (Estonia); Mart Noorma, Tartu Ülikool (Estonia) . . . . . [7299-01]

8:20 am: **Improving scene-based nonuniformity correction for infrared images using frequency domain processing**, Jonah C. McBride, Magnus S. Snorrason, Charles River Analytics, Inc. (United States) . . . . [7299-02]

8:40 am: **High-heat flux sensor for infrared thermography determination of heat-transfer coefficient of liquid metal-cooled target's wall,** Jacek A. Patorski, Paul Scherrer Institut (Switzerland); Malko Gindrat, Sulzer Metco AG (Switzerland). . . . . [7299-03]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 2

Room: Grand 12 . . . . . .Tues. 10:30 to 11:10 am

Biological and Medical Applications

Session Chairs: **Morteza Safai,** The Boeing Co.; **Gary L. Orlove,** FLIR Systems, Inc.; **Ralph B. Dinwiddie,** Oak Ridge National Lab.

10:30 am: **Infrared imaging to quantify the effects of nicotine-induced vasoconstriction in humans**, Siegfried Brunner, Christian Kargel, Univ. der Bundeswehr München (Germany). . . . . [7299-04]

10:50 am: **Face detection in thermal imagery using an Open Source Computer Vision Library**, Sarun Sumriddetchkajorn, Armote Somboonkaew, National Electronics and Computer Technology Ctr. (Thailand) . . . . . [7299-05]

SESSION 3

Room: Grand 12 . . . . . Tues. 11:10 am to 12:10 pm

Buildings and Environmental Applications I

Session Chairs: **Timo T. Kauppinen,** VTT (Finland); **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc.; **Nicolas P. Avdelidis,** National Technical Univ. of Athens (Greece)

11:10 am: **Minimum equipment specifications and personnel certification requirements for infrared thermographic inspections of building envelopes**, Antonio Colantonio, Public Works and Government Services Canada (Canada); Gregory McIntosh, Snell Infrared Canada (Canada) . . . . . [7299-06]

11:30 am: **The use of thermography in energy performance of buildings-directive (EPBD) applications**, Timo T. Kauppinen, VTT (Finland) . . . . . [7299-07]

11:50 am: **Radiometric modeling of mechanical draft cooling towers to assist in the extraction of their absolute temperature from remote thermal imagery**, Matthew Montanaro, Carl Salvaggio, David W. Messinger, Scott D. Brown, Rochester Institute of Technology (United States); Alfred J. Garrett, James S. Bollinger, Savannah River National Lab. (United States) . . . . . [7299-08]

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

SESSION 4

Room: Grand 12 . . . . . .Tues. 1:30 to 2:50 pm

Buildings and Environmental Applications II

Session Chairs: **Timo T. Kauppinen,** VTT (Finland); **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc.; **Nicolas P. Avdelidis,** National Technical Univ. of Athens (Greece)

1:30 pm: **Measurement of wind speed from cooling lake thermal imagery**, Alfred J. Garrett, Savannah River National Lab. (United States) and Rochester Institute of Technology (United States); Eugene P. Shine, Richard C. Tuckfield, Eliel Villa-Aleman, Robert J. Kurzeja, Malcolm M. Pendergast, Timothy B. Brown, Savannah River National Lab. (United States) . . . . . [7299-09]

1:50 pm: **Use of remote sensing data to enhance the performance of a hydrodynamic simulation of a partially frozen cooling lake utilized in power plant efficiency studies**, May V. Arsenovic, Carl Salvaggio, Edward C. Hensel, Rochester Institute of Technology (United States); Alfred J. Garrett, Savannah River National Lab. (United States) and Rochester Institute of Technology (United States). . . . . [7299-10]

2:10 pm: **Seismic risk evaluation aided by IR thermography**, Ermanno G. Grinzato, Consiglio Nazionale delle Ricerche (Italy) . . . . . [7299-11]

2:30 pm: **Thermal inertas contrast detection of subsurface structures**, Nancy K. DelGrande, Geo-Temp Corp. (United States) . . . . . [7299-42]

SESSION 5

Room: Grand 12 . . . . . .Tues. 2:50 to 6:20 pm

Industrial Applications and Research Topics

Session Chairs: **Kathryn M. Lee,** United Space Alliance, LLC; **Herbert Kaplan,** Honeyhill Technical Co.; **Jonathan J. Miles,** James Madison Univ.

2:50 pm: **Electronic hidden solder-joint geometry characterization**, Sheng-Jen Hsieh, Texas A&M Univ. (United States). . . . . [7299-12]

3:10 pm: **Heating medium absorption and emission as factors of thermographic investigations of petrochemical furnaces**, Piotr Pregowski, Pregowski Infrared Services (Poland); Grzegorz Goleniewski, Wojciech Komosa, Waldemar A. Korytkowski, PKN ORLEN S.A. (Poland); Slawomir Zwolenik, neoVISION (Poland). . . . . [7299-14]

Coffee Break . . . . . 3:30 to 4:00 pm

4:00 pm: **Characterization of uncertainties when measuring metal cutting temperatures using infrared radiation thermography**, Eric Whitenton, National Institute of Standards and Technology (United States) . . . . . [7299-15]

4:20 pm: **The use of microscopes and telescopes in thermography**, Ralph B. Dinwiddie, Oak Ridge National Lab. (United States) . . . . . [7299-16]

4:40 pm: **Target recognition: fusing LWIR and EO imagery for detection of humans in a scene**, Renee L. Woodyard, Julie A. Skipper, Wright State Univ. (United States); Daniel W. Repperger, Air Force Research Lab. (United States). . . . . [7299-17]

5:00 pm: **NIR applications in electronics and medical technology**, Leino Mirka, Huhtanen Jukka, Lähdeniemi Matti, Soini Antti, Satakunta Univ. of Applied Sciences (Finland) . . . . . [7299-18]

5:20 pm: **A Virtual International Association of Thermographers**, G. Raymond Peacock, Temperatures.com, Inc. (United States) . . . . . [7299-41]

5:40 pm: **Rapid detection of sugar content and pH in red wines based on projection pursuit regression**, Fang G. Wu, Zhejiang Univ. (China). . . . [7299-19]

6:00 pm: **Application of wavelet threshold denoising model to infrared spectral signal processing**, Fang G. Wu, Zhejiang Univ. (China) . . . . . [7299-20]

Wednesday 15 April

SESSION 6

Room: Grand 12 . . . . . Wed. 8:00 to 8:40 am

Materials Evaluation

Session Chairs: **Takahide Sakagami,** Osaka Univ. (Japan);
Ermanno G. Grinzato, Consiglio Nazionale delle Ricerche (Italy)

8:00 am: **Thermograms analysis for process physics visualization, using 3D temperature profiles** *(Presentation Only)*, Mohammed A. Omar, Yi Zhou, Clemson Univ. (United States) . . . . . [7299-21]

8:20 am: **Influence of a growing oxide layer on band-emissivities used for optical termperature measurements**, Wolfgang Bauer, Alexander Moldenhauer, Univ. Duisburg-Essen (Germany) . . . . . [7299-40]

SESSION 7

Room: Grand 12 . . . . . Wed. 8:40 am to 12:20 pm

IR NDT I: Theory

Session Chairs: **Douglas D. Burleigh,** La Jolla Cove Consulting;
K. Elliott Cramer, NASA Langley Research Ctr.;
Steven M. Shepard, Thermal Wave Imaging, Inc.

8:40 am: **Load-induced debonding of FRP composites applied to reinforced concrete**, Joel Blok, Jeff R. Brown, Hope College (United States) . . . . . [7299-24]

9:00 am: **Application of air-coupled acoustic thermography (ACAT) for inspection of honeycomb structures**, Joseph N. Zalameda, Army Research Lab. (United States); William P. Winfree, NASA Langley Research Ctr. (United States); Charles G. Pergantis, David Flanagan, Daniel DeSchepper, Army Research Lab. (United States). . . . . [7299-25]

9:20 am: **Advances in frequency modulated thermal wave imaging for noncontact subsurface sensing**, Ravibabu Mulaveesala, Venkata Subba Rao Ghali, Nataraj Jonnalagadda, Indian Institute of Information Technology (India); Suneet Tuli, Indian Institute of Technology Delhi (India) . . . . . [7299-26]

9:40 am: **Measurement limits in active thermography** *(Invited Paper)*, Steven M. Shepard, Yulin Hou, James R. Lhota, Tasdiq Ahmed, Thermal Wave Imaging, Inc. (United States) . . . . . [7299-27]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **Enhanced contrast detection of subsurface defects by pulsed infrared thermography based on the fourth order statistic moment: kurtosis**, Francisco J. Madruga, Univ. de Cantabria (Spain); Clemente Ibarra-Castanedo, Univ. Laval (Canada); Olga M. Conde, Univ. de Cantabria (Spain); Xavier P. V. Maldague, Univ. Laval (Canada); José M. López-Higuera, Univ. de Cantabria (Spain). . . . . [7299-28]

11:00 am: **Nondestructive testing by superresolution infrared thermography**, Takahide Sakagami, Shiro Kubo, Tomohiro Matsumoto, Osaka Univ. (Japan); Daisuke Sato, Constec Engineering Co., Ltd. (Japan) . . . . . [7299-36]

11:20 am: **Heat-stimulus correction for pulsed-infrared thermography**, Hernan D. Benitez Restrepo, Pontificia Univ. Javeriana, Cali (Colombia); Abdelhakim Bendada, Clemente Ibarra-Castanedo, Xavier P. V. Maldague, Univ. Laval (Canada). . . . . [7299-31]

11:40 am: **Thermography as a non-invasive and automated NDE approach for composites assessment**, Nicolas P. Avdelidis, Maria Koui, National Technical Univ. of Athens (Greece) . . . . . [7299-23]

12:00 pm: **Autonomous infrared thermography based inspection of glass-reinforced plastic (GRP) wind turbine blades (WTBS)**, Charalampos Schizas, Panagiotis Chatzakos, Alexandros Lagonikas, Dimitrios Korres, Nikolaos Avdelidis, Vasilios Spais, Kostas Chryssagis, ZENON S.A. (Greece). . . . . [7299-30]

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

SESSION 8

Room: Grand 12 . . . . . Wed. 1:30 to 4:30 pm

IR NDT II: Applications

Session Chairs: **Douglas D. Burleigh,** La Jolla Cove Consulting;
Jeff R. Brown, Hope College;
K. Elliott Cramer, NASA Langley Research Ctr.

1:30 pm: **Thermographical investigations of inductively heated metallic surfaces**, Beate Oswald-Tranta, Mario Sorger, Montan Univ. Leoben (Austria) . . . . . [7299-32]

1:50 pm: **Thermographic detection of near-surface flaws in reinforced carbon-carbon panels** *(Invited Paper)*, William P. Winfree, Patricia A. Howell, NASA Langley Research Ctr. (United States) . . . . . [7299-33]

2:20 pm: **Development of thermographic inspection routine exploiting phase transition of water for moisture detection in aircraft structures**, Eetta Saarimäki, VTT Technical Research Ctr. of Finland (Finland); Peter Ylinen, Finnish Air Force (Finland). . . . . [7299-34]

2:40 pm: **Application of infrared imaging for quality inspection in resistance spot welds**, Wanchuck Woo, Hsin Wang, Zhili Feng, Hanbing Xu, Charles Chin, Oak Ridge National Lab. (United States). . . . . [7299-35]

3:00 pm: **Thermographic evaluation of artworks**, Steven M. Shepard, Thermal Wave Imaging, Inc. (United States); Jim Coddington, The Museum of Modern Art (United States); Yulin Hou, James R. Lhota, Tasdiq Ahmed, Thermal Wave Imaging, Inc. (United States). . . . . [7299-37]

Coffee Break . . . . . 3:20 to 3:50 pm

3:50 pm: **Applying infrared thermography to marine surveying**, John N. Allinson II, J.N. Allinson Associates, Inc. (United States) . . . . . [7299-38]

4:10 pm: **Euclidean distance algorithm for defect recognition in infrared thermographic nondestructive testing**, Xingwang Guo, Qidalatu Wang, BeiHang Univ. (China) . . . . . [7299-39]

4:30 pm: **Characterizing defects in pulsed thermal NDT** *(Manuscript Only)*, V. P. Vavilov, Tomsk Polytechnic Univ. (Russian Federation). . . . . [7299-29]

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

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

Program Committee: **Piet Bijl,** TNO Human Factors (Netherlands); **Ronald G. Driggers,** Naval Research Lab.; **David P. Forrai,** L-3 Communications Cincinnati Electronics, Inc.; **Keith A. Krapels,** U.S. Army Night Vision & Electronic Sensors Directorate; **Terrence S. Lomheim,** The Aerospace Corp.; **Alan Irwin,** Santa Barbara Infrared, Inc.; **Luanne P. Obert,** U.S. Army RDECOM CERDEC NVESD; **Hector M. Reyes,** Raytheon Network Centric Systems; **Endre Repasi,** FGAN-FOM (Germany); **Joseph P. Reynolds,** U.S. Army RDECOM CERDEC NVESD; **Ronald B. Sartain,** Army Research Lab.; **Michael A. Soel,** FLIR Systems, Inc.; **Curtis M. Webb,** Northrop Grumman Corp.

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Grand 11 . . . . . .Tues. 1:00 to 3:05 pm

Modeling I

Session Chairs: **Joseph P. Reynolds,** U.S. Army Night Vision & Electronic Sensors Directorate; **Piet Bijl,** TNO Human Factors (Netherlands)

1:00 pm: **Progress in infrared persistent surveillance sensors** *(Keynote Presentation) (Presentation Only)*, Ronald G. Driggers, Naval Research Lab. (United States). . . . . [7300-01]

1:45 pm: **Optical characteristics of small surface targets, measured in the False Bay, South Africa, June 2007**, Arie N. de Jong, TNO Defense, Security and Safety (Netherlands) . . . . . [7300-02]

2:05 pm: **Range performance impact of noise for thermal system modeling**, Jonathan D. Fanning, Todd W. Du Bosq, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7300-03]

2:25 pm: **Passive IR sensor performance analysis using Mathcad® modeling**, William H. Wan, Lockheed Martin Coherent Technologies (United States)[7300-04]

2:45 pm: **Visual acuity and contrast sensitivity with compressed motion video**, Piet Bijl, Sjoerd C. de Vries, TNO Defense, Security and Safety (Netherlands) . . . . . [7300-05]

Coffee Break . . . . . 3:05 to 3:35 pm

SESSION 2

Room: Grand 11 . . . . . .Tues. 3:35 to 4:55 pm

Modeling II

Session Chairs: **Keith A. Krapels,** U.S. Army Night Vision & Electronic Sensors Directorate; **Terrence S. Lomheim,** The Aerospace Corp.; **Ronald G. Driggers,** Naval Research Lab.

3:35 pm: **Perception testing: a key component in modeling and simulation at NVESD**, Tana Maurer, Oanh-Tho Nguyen, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Evelyn J. Boettcher, DCS Corp. (United States); Jim M. Thomas, EOIR Technologies, Inc. (United States) . . . . . [7300-06]

3:55 pm: **Empirical modeling and results of NIR clutter for tactical missile warning**, Joel B. Montgomery, Christine T. Montgomery, M & M Aviation (United States) . . . . . [7300-07]

4:15 pm: **Modeling of video compression effects on target acquisition performance**, Jae H. Cha, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Bradley L. Preece, EOIR Technologies, Inc. (United States); Richard L. Espinola, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7300-09]

4:35 pm: **Status of NVESD imager performance models,** Brian P. Teaney, Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7300-40]

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

Experimental method for observation prediction based on the decision matrix, through day/night equipments in NIR and LWIR spectral ranges, Octavia Violeta C. Borcan, Catalin A. Spulber, Pro Optica S.A. (Romania) . . . . . [7300-38]

Evaluation of the different configurations of infrared-type gimbaled cameras in the sense of blur, Bulent Ozkan, Alper Akmese, Altug Ucar, TÜBITAK Sage (Turkey) . . . . . [7300-39]

Wednesday 15 April

SESSION 3

Room: Grand 11 . . . . . Wed. 8:30 to 9:50 am

Modeling III

Session Chairs: **Luanne P. Obert,** U.S. Army Night Vision & Electronic Sensors Directorate; **Hector M. Reyes,** Raytheon Co.

8:30 am: **Superresolution for flash LADAR data**, Shuowen Hu, Susan Young, Army Research Lab. (United States); Tsai Hong, National Institute of Standards and Technology (United States); Joseph P. Reynolds, Keith A. Krapels, Brian S. Miller, Jim M. Thomas, Oanh-Tho Nguyen, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7300-10]

8:50 am: **Sensor performance as a function of sampling (d) and optical blur (Fλ)**, Piet Bijl, Maarten A. Hogervorst, TNO Defense, Security and Safety (Netherlands) . . . . . [7300-11]

9:10 am: **Validating model predictions of MRT measurements on thermal imaging systems**, Stephen D. Burks, Kenneth Garner, Stephen Miller, Brian P. Teaney, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7300-12]

9:30 am: **Comparison of perception results with a proposed model for detection of a stationary target from a moving platform**, Melvin H. Friedman, Joseph P. Reynolds, Robin Kang, U.S. Night Vision and Electronic Sensors Directorate (United States); Richard H. Vollmerhausen, Consultant (United States); David L. Wilson, U.S. Night Vision and Electronic Sensors Directorate (United States). . . . . [7300-14]

Coffee Break . . . . . 9:50 to 10:30 am

SESSION 4

Room: Grand 11 . . . . . Wed. 10:30 to 11:50 am

Modeling IV

Session Chairs: **Ronald B. Sartain,** Army Research Lab.;
David P. Forrai, L-3 Communications Cincinnati Electronics;
Ronald G. Driggers, Naval Research Lab.

10:30 am: **Quantitative performance evaluation of image enhancement techniques on low-light level cameras**, Judith Dijk, TNO Defense, Security and Safety (Netherlands); Piet Bijl, TNO Defence, Security and Safety (Netherlands) . . . . . [7300-15]

10:50 am: **Limitations of contrast enhancement for infrared target identification**, Todd W. Du Bosq, Jonathan D. Fanning, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7300-16]

11:10 am: **Multispectral EO/IR sensor model for evaluating UV, visible, SWIR, MWIR and LWIR system performance**, Ashok K. Sood, Robert A. Richwine, Yash R. Puri, Magnolia Optical Technologies, Inc. (United States); Nibir K. Dhar, Dennis L. Polla, Defense Advanced Research Projects Agency (United States); Priyalal S. Wijewarnasuriya, Army Research Lab. (United States) . . . . . [7300-17]

11:30 am: **Recognition and identification of ground targets from airborne platforms**, Joshua M. Doe, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Evelyn J. Boettcher, DCS Corp. (United States); Brian S. Miller, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7300-18]

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

SESSION 5

Room: Grand 11 . . . . . Wed. 1:30 to 2:30 pm

Targets, Backgrounds, and Atmospherics I

Session Chairs: **Endre Repasi,** Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany);
Michael A. Soel, FLIR Systems, Inc.

1:30 pm: **Validation of the thermal code of RadTherm-IR, IR-Workbench, and F-TOM**, Frédéric Schwenger, Peter Grossmann, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany); Alain Malaplate, Consultant (France) . . . . . [7300-19]

1:50 pm: **The coupling of MATISSE and the SE-WORKBENCH: a new solution for simulating efficiently the atmospheric radiative transfer and the sea surface radiation**, Thierry Cathala, OKTAL Synthetic Environment (France) . . . . . [7300-21]

2:10 pm: **MATISSE-v1.5 and MATISSE-v2.0: new developments and comparison with MIRAMER measurements**, Bernard M. Rosier, Pierre Simoneau, Karine Caillault, Sandrine Fauqueux, Thierry Huet, Luc Labarre, Claire Malherbe, ONERA (France) . . . . . [7300-22]

SESSION 6

Room: Grand 11 . . . . . Wed. 2:30 to 4:20 pm

Targets, Backgrounds, and Atmospherics II

Session Chairs: **Endre Repasi,** Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany);
Michael A. Soel, FLIR Systems, Inc.

2:30 pm: **Measurement and analysis of optical surface properties for input to ShipIR**, David A. Vaitekunas, W. R. Davis Engineering, Ltd. (Canada); James Jafolla, Paul McKenna, Martin Szczesniak, Surface Optics Corp. (United States) . . . . . [7300-23]

2:50 pm: **CART III: improved camouflage assessment using moving target indication**, Thomas Müller, Markus Müller, Fraunhofer-Institut für Informations- und Datenverarbeitung (Germany); Thomas Honke, Wehrtechnische Dienststelle für Schutz und Sondertechnik (Germany) . . . . . [7300-24]

Coffee Break . . . . . 3:10 to 3:40 pm

3:40 pm: **Analysis of a structure-based image similarity measure using homogeneity regions**, Eric P. Lam, Thales-Raytheon Systems Co. LLC (United States) . . . . . [7300-25]

4:00 pm: **Signal modeling of turbulence-distorted imagery**, Susan Young, Army Research Lab. (United States) . . . . . [7300-26]

Thursday 16 April

SESSION 7

Room: Grand 11 . . . . . Thurs. 8:00 to 10:00 am

Systems and Testing I

Session Chairs: **Alan Irwin,** Santa Barbara Infrared, Inc.;
Curtis M. Webb, Northrop Grumman Electronic Systems

8:00 am: **Comparison of emissivity evaluation methods for IR sources**, Stephen Scopatz, Jason A. Mazzetta, Miguel Medina, John Sgheiza, Electro Optical Industries, Inc. (United States) . . . . . [7300-27]

8:20 am: **Improving MTF measurements of undersampled optical systems**, Joseph D. Laveigne, Santa Barbara Infrared, Inc. (United States); Stephen D. Burks, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7300-28]

8:40 am: **Infrared search and track and imaging system: testing in the laboratory and during flight**, Luigi E. Guzzetti, Livio Busnelli, SELEX GALILEO (Italy) . . . . . [7300-29]

9:00 am: **LWIR and MWIR wavefront sensing with quadri-wave lateral shearing interferometry**, Sabrina Velghe, Djamel Brahmi, William Boucher, Benoit F. Wattellier, PHASICS SA (France); Nicolas Guérineau, Riad Haïdar, Jérôme Primot, ONERA (France) . . . . . [7300-30]

9:20 am: **A new fast infrared imaging spectroradiometer**, Claude B. Roy, Louis M. Moreau, Frederic Doyon, Luc E. Levesques, ABB Inc. (Canada) . . . . . [7300-31]

9:40 am: **Performance, calibration method, and examples of measurements of a mid-infrared interferometric hyperspectral imager**, Dario Cabib, CI Systems (Israel) Ltd. (Israel) . . . . . [7300-32]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 8

Room: Grand 11 . . . . . Thurs. 10:30 am to 12:10 pm

Systems and Testing II

Session Chairs: **Alan Irwin,** Santa Barbara Infrared, Inc.;
Curtis M. Webb, Northrop Grumman Electronic Systems

10:30 am: **Performance of a controllable time dependent and dualband emission infrared source to test missile warning systems in the field**, Dario Cabib, CI Systems (Israel) Ltd. (Israel) . . . . . [7300-33]

10:50 am: **MKV carrier vehicle sensor calibration**, Joseph Tansock, Scott M. Hansen, Utah State Univ. (United States); Jason Williams, Bryan Sisko, Kajal Pancholi, Missile Defense Agency (United States); Aaron Plotnik, Massachusetts Institute of Technology (United States); Jon Albritton, Missile Defense Agency (United States); Michael S. Margulis, Micah P. Kalscheur, Dan P. Welsh, Lockheed Martin Space Systems Co. (United States); Deon Dixon, Utah State Univ. (United States); Steven Brown, Missile Defense Agency (United States); Katharine Ip, Lockheed Martin Space Systems Co. (United States); Karl Burk, Mark E. Greenman, James Q. Peterson, Alan Bird, David Marchant, Dean Ferguson, Brent Haslem, Utah State Univ. (United States); William Shaw, BAE Systems (United States) . . . . . [7300-34]

11:10 am: **Large-area blackbody emissivity variation with observation angle**, Paul W. Nugent, Joseph A. Shaw, Montana State Univ. (United States) . [7300-35]

11:30 am: **A study of the radiometric calibration of spectral bands in the mid-wave infrared spectral range (MWIR, 1.5-5µm)**, Thomas Svensson, Ingmar G. Renhorn, Swedish Defence Research Agency (Sweden); Patrik Broberg, Luleå Univ. of Technology (Sweden) . . . . . [7300-36]

11:50 am: **A new passive polarimetric imaging system collecting polarization signatures in the visible and infrared bands**, Daniel A. Lavigne, Defence Research and Development Canada (Canada); Mélanie Breton, AEREX avionique inc. (Canada); Georges R. Fournier, Mario Pichette, Defence Research and Development Canada (Canada); Vincent Rivet, AEREX avionique inc. (Canada) . . . . . [7300-37]

Monday 13 April 2009 • Proceedings of SPIE Vol. 7301

Technologies for Synthetic Environments: Hardware-in-the-Loop XIV

Conference Chairs: **James A. Buford, Jr.,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Robert Lee Murrer, Jr.,** Millennium Engineering and Integration Co.

Program Committee: **Mary A. Amick,** U.S. Air Force; **James A. Annos,** U.S. Navy; **David Brett Beasley,** Optical Sciences Corp.; **Dennis H. Bunfield,** Davidson Technologies Inc.; **Charles F. Coker,** Air Force Research Lab.; **David S. Cosby,** U.S. Army Research, Development and Engineering Ctr.; **Naresh C. Das,** Army Research Lab.; **Shawn M. Goodrich,** U.S. Air Force; **Alexander G. Hayes,** MIT Lincoln Lab.; **W. Larry Herald,** MacAulay Brown Inc.; **John M. Lannon,** RTI International; **Heard S. Lowry,** Aerospace Testing Alliance; **Scott B. Mobley,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Randy A. Nicholson,** Aerospace Testing Alliance; **Robert M. Patchan,** The Johns Hopkins Univ. Applied Physics Lab.; **Ronald J. Rapp,** Air Force Research Lab.; **Jonathan C. Reeves,** U.S. Air Force; **Donald R. Snyder,** Air Force Research Lab.; **Steven L. Solomon,** Acumen Scientific; **Owen M. Williams,** Defence Science and Technology Organisation (Australia); **Brian K. Woode,** Naval Air Warfare Ctr.

Monday 13 April

SESSION 1

Room: Grand 12 . . . . . Mon. 8:30 to 9:30 am

Flight Motion Simulators

Session Chairs: **James A. Annos,** U.S. Navy; **Jonathan C. Reeves,** U.S. Air Force; **Mary A. Amick,** U.S. Air Force

8:30 am: **Gimbal stability requirements for target image enhancement**, Robert W. Mitchell, Ideal Aerosmith, Inc. (United States) . . . . . [7301-01]

8:50 am: **Making flight motion tables invisible**, Louis A. DeMore, Acutronic USA, Inc. (United States) and Point Park Univ. (United States) . . . . . [7301-02]

9:10 am: **General characteristics of motion simulators used in the performance tests of infrared camera systems**, Bulent Ozkan, Alper Akmese, TÜBITAK Sage (Turkey). . . . . [7301-03]

SESSION 2

Room: Grand 12 . . . . . Mon. 9:30 to 11:10 am

HWIL Facilities and Test

Session Chairs: **Scott B. Mobley,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Brian K. Woode,** Naval Air Warfare Ctr.; **Alexander G. Hayes,** MIT Lincoln Lab.

9:30 am: **Support technologies involved in the development and implementation of radiometric systems for sensor calibration, characterization, and HWIL testing at AEDC**, Heard S. Lowry, Mary F. Breeden, Dustin Crider, Sidney L. Steely, Randy A. Nicholson, Aerospace Testing Alliance (United States). . . . . [7301-04]

9:50 am: **Automated characterization test suite for the evaluation of PC-based real-time simulation systems**, John E. Terry, Jr., U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States); Jay Crosby, Shawn Jones, Optical Sciences Corp. (United States). . . . . [7301-05]

Coffee Break . . . . . 10:10 to 10:30 am

10:30 am: **Common HWIL framework development**, Hajin J. Kim, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States); Stephen Moss, AEgis Technologies Group, Inc. (United States) . . . . . [7301-06]

10:50 am: **The infrared and semi-active laser simulation capabilities at the AMSTAR Production Bay HWIL facility**, Cindy L. Talbot, Steve Wilkerson, Optical Sciences Corp. (United States). . . . . [7301-07]

SESSION 3

Room: Grand 12 . . . . . Mon. 11:10 am to 12:10 pm

Real-Time Scene Generation I

Session Chairs: **Charles F. Coker,** Air Force Research Lab.; **David S. Cosby,** U.S. Army Research, Development and Engineering Ctr.; **Robert M. Patchan,** The Johns Hopkins Univ. Applied Physics Lab.

11:10 am: **Comparison of GPU and FPGA hardware for HWIL scene generation and image processing**, Craig R. Eales, Leszek Swierkowski, Defence Science and Technology Organisation (Australia). . . . . [7301-08]

11:30 am: **Boat, wake, and wave real-time simulation**, Leszek Swierkowski, Efthimios Gouthas, Chad L. Christie, Owen M. Williams, Defence Science and Technology Organisation (Australia) . . . . . [7301-09]

11:50 am: **Real-time volumetric rendering techniques for high-altitude wake and plume scene generation**, Dennis H. Bunfield, Darian E. Trimble, Davidson Technologies Inc. (United States); Gary H. Ballard, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States) . . . . . [7301-10]

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

SESSION 4

Room: Grand 12 . . . . . Mon. 1:30 to 2:10 pm

Real-Time Scene Generation II

Session Chairs: **John M. Lannon,** RTI International; **W. Larry Herald,** MacAulay Brown Inc.; **Dennis H. Bunfield,** Davidson Technologies Inc.

1:30 pm: **Correcting optical distortion using post-render convolutions**, Thomas Fronckowiak, Jr., Torch Technologies LLC (United States) . . . . [7301-11]

1:50 pm: **Digital tapped delay lines for HWIL testing of matched filter radar receivers**, Richard F. Olson, William J. Braselton, Richard D. Mohlere, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States). . . . . [7301-12]

SESSION 5

Room: Grand 12 . . . . . Mon. 2:10 to 4:40 pm

IR Projectors

Session Chairs: **David Brett Beasley,** Optical Sciences Corp.; **Ronald J. Rapp,** Air Force Research Lab.; **Donald R. Snyder,** Air Force Research Lab.

2:10 pm: **Two-band DMD-based infrared scene simulator**, Julia R. Dupuis, David J. Mansur, Robert M. Vaillancourt, Thomas Evans, David L. Carlson, Elizabeth Schundler, OPTRA, Inc. (United States) . . . . . [7301-13]

2:30 pm: **Performance data from the Mirage HD infrared scene projector system with 1536x768 wide-format resistive array**, Joseph D. Laveigne, Kevin Sparkman, Jim Oleson, Santa Barbara Infrared, Inc. (United States). . . . . [7301-14]

2:50 pm: **Development of high-temperature resistor infrared emitter and emitter array**, Kaiyan Zhang, K Lab Corp. (United States) . . . . . [7301-15]

Coffee Break . . . . . 3:10 to 3:40 pm

3:40 pm: **Liquid crystal on silicon spatial light modulator for infrared scene generation**, Jay E. Stockley, Kipp A. Bauchert, Anna M. Linnenberger, Steve A. Serati, Boulder Nonlinear Systems, Inc. (United States); Cisca Vuong, U.S. Army STRICOM (United States) . . . . . [7301-16]

4:00 pm: **Effects of indium mole fraction on LWIR light-emitting device performance**, Naresh C. Das, Army Research Lab. (United States); Frederick J. Towner, Richard P. Leavitt, Maxion Technologies, Inc. (United States). . . . . [7301-17]

4:20 pm: **Membrane-mirror-on-VLSI infrared scene projector**, Travis L. Simpkins, Cardinal Warde, Optron Systems, Inc. (United States). . . . . [7301-18]

SESSION 6

Room: Grand 12 . . . . . Mon. 4:40 to 5:40 pm

Projector Calibration

Session Chairs: **Owen M. Williams,** Defence Science and Technology Organisation (Australia); **Naresh C. Das,** Army Research Lab.; **Heard S. Lowry,** Aerospace Testing Alliance

4:40 pm: **Spectral calibration of a visible projector**, Mark H. Bowden, David B. Beasley, Optical Sciences Corp. (United States); David S. Cosby, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States). . . . . [7301-19]

5:00 pm: **Rise-time enhancement techniques for resistive array infrared scene projectors**, Joseph D. Laveigne, Greg Franks, Santa Barbara Infrared, Inc. (United States). . . . . [7301-20]

5:20 pm: **Resistor-array infrared projector nonuniformity correction: search for performance improvement IV**, Leszek Swierkowski, Robert A. Joyce, Owen M. Williams, Defence Science and Technology Organisation (Australia). . . . . [7301-21]

Wednesday-Thursday 15-16 April 2009 • Proceedings of SPIE Vol. 7302

Window and Dome Technologies and Materials XI

Conference Chair: **Randal W. Tustison,** Raytheon Co.

Program Committee: **Ishwar D. Aggarwal,** Naval Research Lab.; **Joel Askinazi,** Goodrich Corp.; **Richard Gentilman,** Raytheon Co.; **Daniel C. Harris,** NaNaval Air Systems Command; **Brian K. Jones,** U.S. Army Research, Development and Engineering Command; **James C. Kirsch,** U.S. Army Research, Development and Engineering Command; **Robert J. Ondercin,** Air Force Research Lab.; **Adrienne E. Selz,** Air Force Research Lab.; **Roger M. Sullivan,** Naval Air Systems Command; **Michael E. Thomas,** The Johns Hopkins Univ. Applied Physics Lab.; **Brian J. Zelinski,** Raytheon Missile Systems

Wednesday 15 April

SESSION 1

Room: Grand 9-10. . . . . Wed. 8:30 to 9:50 am

Sapphire and Alumina

Session Chair: **Daniel C. Harris,** Naval Air Systems Command

8:30 am: **Evolution of the sapphire industry: the origins of Rubicon technology and Gavish**, Daniel C. Harris, Naval Air Systems Command (United States). . . . . [7302-01]

8:50 am: **Characteristics of thick (>12 mm) EFG sapphire sheet for IR window applications**, John W. Locher, Christopher D. Jones, Jeffrey B. Rioux, Herbert E. Bates, Saint-Gobain Crystals (United States) . . . . . [7302-02]

9:10 am: **Hydrogen effect on the properties of sapphire**, Radon Mogilevsky, Liudmila G. Sharafutdinova, Emerging Material Technologies, Inc. (United States); Sergiy G. Nedilko, Kyiv National Taras Shevchenko Univ. (Ukraine); V. Gavrilov, JSC Technocrystal (Ukraine); D. Verbilo, Frantsevich Institute for Problems of Materials Science (Ukraine); Scott D. Mittl, Insaco Inc. (United States) . . [7302-03]

9:30 am: **Polycrystalline alumina for aerodynamic IR domes and windows**, Mark V. Parish, Marina R. Pascucci, CeraNova Corp. (United States) . . . [7302-04]

Coffee Break . . . . . 9:50 to 10:20 am

SESSION 2

Room: Grand 9-10. . . . . Wed. 10:20 am to 12:00 pm

Multifunctional Windows and Domes: Evolving Optical Challenges

Session Chair: **Robert J. Ondercin,** Air Force Research Lab.

10:20 am: **Large-area ALON windows for reconnaissance and transparent armor applications**, Lee M. Goldman, Surmet Corp. (United States); Richard H. Twedt, Surmet Precision Optics (United States); Robyn Foti, Mark Smith, Suri A. Sastri, Surmet Corp. (United States). . . . . [7302-06]

10:40 am: **Dual IR/RF windows for laser communications**, Lee M. Goldman, Surmet Corp. (United States); Richard H. Twedt, Surmet Precision Optics (United States); Jayson Zigman, Surmet Corp. (United States); Robert J. Ondercin, Air Force Research Lab. (United States) . . . . . [7302-07]

11:00 am: **Joining transparent ceramics**, Amir Shechter, Ehud Galun, Elbit Systems Electro-Optics El-Op Ltd. (Israel) . . . . . [7302-08]

11:20 am: **Processing method and process modeling of large aperture transparent magnesium aluminate spinel domes**, Jian H. Yu, Brandon McWilliams, Steven M. Kilczewski, Gary A. Gilde, James Snads, Army Research Lab. (United States). . . . . [7302-09]

11:40 am: **Bonding force determination at AFB® interfaces of single-crystal sapphire composites**, Huai-Chuan Lee, Helmuth E. Meissner, Xiaodong Mu, Onyx Optics Inc. (United States). . . . . [7302-10]

Lunch/Exhibition Break . . . . . 12:00 to 1:40 pm

SESSION 3

Room: Grand 9-10. . . . . Wed. 1:40 to 3:40 pm

Spinel Windows and Domes

Session Chair: **Joel Askinazi,** Goodrich Corp.

1:40 pm: **Evaluation of commercially available bulk Mg and Al oxides and hydroxides for the production of transparent $MgAl_2O_4$**, Anthony C. Sutorik, Gary A. Gilde, Steven M. Kilczewski, Army Research Lab. (United States). . . . . [7302-11]

2:00 pm: **Observations during the fabrication of spinel optics**, Joseph R. Bashe, Douglas L. Hibbard, Exotic Electro-Optics, Inc. (United States). . . . . [7302-12]

2:20 pm: **Progress in manufacturing transparent spinel domes**, Evans A. LaRoche, Keith Rozenberg, Jeff Kutsch, Technology Assessment and Transfer (United States). . . . . [7302-13]

2:40 pm: **Advances in spinel ceramic technology for large windows and domes**, Juan L. Sepulveda, Raouf O. Loutfy, Sekyung Chang, Materials and Electrochemical Research Corp. (United States); Nick Traggis, Precision Photonics Corp. (United States) . . . . . [7302-14]

3:00 pm: **Recent developments in transparent polycrystalline spinel**, Ishwar D. Aggarwal, Shyam S. Bayya, Guillermo R. Villalobos, Woohong Kim, Jasbinder S. Sanghera, Naval Research Lab. (United States) . . . . . [7302-15]

3:20 pm: **High-strength transparent spinel with fine, unimodal grain size**, Sean M. Sweeney, Milivoj K. Brun, Timothy J. Yosenick, Anteneh Kebbede, Mohan Manoharan, GE Global Research (United States); Lisa P. Franks, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States). . . . . [7302-16]

Coffee Break . . . . . 3:40 to 4:10 pm

SESSION 4

Room: Grand 9-10. . . . . Wed. 4:10 to 5:30 pm

Coatings and Surface Treatments

Session Chair: **Richard Gentilman,** Raytheon Co.

4:10 pm: **High growth-rate deposition of highly oriented polycrystalline diamond film**, Chao Liu, Valdosta Optics Lab., Inc. (United States) . . . . [7302-17]

4:30 pm: **Evaluating environmental survivability of optical coatings**, Shay Joseph, Doron Yadlovker, Orna Marcovitch, Hedva Zipin, Rafael Advanced Defense Systems Ltd. (Israel) . . . . . [7302-18]

4:50 pm: **Erosion study of antireflecting microstructures in sapphire**, Douglas S. Hobbs, TelAztec LLC (United States) . . . . . [7302-20]

5:10 pm: **Application of physical gradient index (Motheye) structures to ALON windows as a durable AR treatment**, Neeta Agarwal, Lee M. Goldman, Suri A. Sastri, Surmet Corp. (United States); Robert J. Ondercin, Air Force Research Lab. (United States); Paul H. Kobrin, Teledyne Scientific & Imaging, LLC (United States). . . . . [7302-21]

Thursday 16 April

SESSION 5

Room: Grand 9-10. . . . . Thurs. 8:00 to 9:20 am

Germanium and Zinc Sulfide Optical Materials

Session Chair: **Adrienne E. Selz,** Air Force Research Lab.

8:00 am: **A historical view of germanium as an infrared window material**, Roger M. Sullivan, Office of Naval Research (United States) . . . . . [7302-22]

8:20 am: **Variability in CVD ZnS: assessment of legacy and international CVD ZnS materials**, John S. McCloy, Pacific Northwest National Lab. (United States) and Raytheon Co. (United States); Ralph Korenstein, Raytheon Co. (United States). . . . . [7302-24]

8:40 am: **The effect of metal in the formation of multispectral ZnS**, Ralph Korenstein, Raytheon Co. (United States); John S. McCloy, Pacific Northwest National Lab. (United States). . . . . [7302-25]

9:00 am: **Varying electro-kinetic interactions to achieve predictable smooth surfaces on zinc sulfide**, Jessica E. DeGroote, Jamie Perdue, David Myers, John J. Oliver, Optimax Systems, Inc. (United States) . . . . . [7302-26]

SESSION 6

Room: Grand 9-10. . . . . Thurs. 9:20 to 11:30 am

Metrology

Session Chair: **Ishwar D. Aggarwal,** Naval Research Lab.

9:20 am: **Instrumentation for characterizing a new class of optical domes**, Amit K. Lal, Joshua Jo, Eddie Scott, Stephen A. Kupiec, James D. Trolinger, MetroLaser, Inc. (United States) . . . . . [7302-27]

9:40 am: **Round robin testing of the OptiDomes**, Michael Martucci, Richard Plympton, Jessica E. DeGroote, Optimax Systems . . . . . ., Inc. (United States). . . . . [7302-28]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Measurement results for time-delayed source interferometers for windows, hemispherical domes, and tangent ogives**, William P. Kuhn, Opt-E (United States); Hector P. Durazo, Robert S. LeCompte, Breault Research Organization, Inc. (United States); Matthew B. Dubin, The Univ. of Arizona (United States). . . . . [7302-29]

10:50 am: **An innovative noncontact surface measurement solution for asphere, deep parabolic, and ogive radome geometries**, Scott DeFisher, Optipro Systems (United States). . . . . [7302-30]

11:10 am: **Metrology of freeform conformal optics using scanning low-coherence dual-wavelength interferometry**, Damon W. Diehl, Christopher J. Ditchman, Christopher T. Cotton, Bryan D. Statt, ASE Optics, Inc. (United States). . . . . [7302-31]

Lunch/Exhibition Break . . . . . 11:30 am to 1:20 pm

SESSION 7

Room: Grand 9-10. . . . . Thurs. 1:20 to 4:10 pm

Characterization and Finishing

Session Chair: **Roger M. Sullivan,** Naval Air Systems Command

1:20 pm: **Recent developments in finishing of deep concave, aspheric, and plano surfaces utilizing the UltraForm 5-axis computer controlled system**, Scott Bambrick, Michael J. Bechtold, Scott DeFisher, David Mohring, Joseph P. Meisenzahl, OptiPro Systems (United States) . . . . . [7302-33]

1:40 pm: **Technologies for precision manufacture of current and future windows and domes**, Aric B. Shorey, Robert W. Hallock, QED Technologies, Inc. (United States). . . . . [7302-34]

2:00 pm: **Semi-empirical scattering model for chemical vapor deposited ZnS**, John S. McCloy, Pacific Northwest National Lab. (United States) and Raytheon Co. (United States) . . . . . [7302-35]

2:20 pm: **Predicted and measured EMI shielding effectiveness of a metallic mesh coating on a sapphire window over a broad frequency range**, Keith T. Jacoby, Matthew W. Pieratt, Exotic Electro-Optics, Inc. (United States); Jennifer I. Halman, Keith A. Ramsey, Battelle Memorial Institute (United States). . . . . [7302-36]

2:40 pm: **Predicted and measured transmission and diffraction by a metallic mesh coating**, Jennifer I. Halman, Keith A. Ramsey, Battelle Memorial Institute (United States); Michael D. Thomas, Andrew J. Griffin, Spica Technologies, Inc. (United States). . . . . [7302-37]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Birefringence and grain-size effects on in-line transmission in polycrystalline magnesium fluoride**, Tzu-Chien Wen, Dinesh K. Shetty, The Univ. of Utah (United States). . . . . [7302-38]

3:50 pm: **Biaxial flexural strength of fused silica glass: Weibull statistical analysis of recent UDRI data**, Claude A. Klein, C.A.K. Analytics, Inc. (United States). . . . . [7302-39]

SESSION 8

Room: Grand 9-10. . . . . Thurs. 4:10 to 5:30 pm

Novel Materials

Session Chair: **Michael E. Thomas,** The Johns Hopkins Univ. Applied Physics Lab.

4:10 pm: **Low-thermal expansion infrared glass ceramics**, Philip Lam, L2 Tech, Inc. (United States) . . . . . [7302-40]

4:30 pm: **Optical properties of polycrystalline Nd:YAG for different levels of Nd doping**, Ryan M. Springer, Naval Air Systems Command (United States) and The Johns Hopkins Univ. (United States); Michael E. Thomas, The Johns Hopkins Univ. Applied Physics Lab. (United States); Frank A. Narducci, Naval Air Systems Command (United States). . . . . [7302-42]

4:50 pm: **Ceramic laser material development progress and future prospects**, Jean C. Huie Imholt, Raytheon Co. (United States) . . . . . [7302-43]

5:10 pm: **Advanced parylene technology for sensor, optical windows, and display applications,** Rakesh Kumar, Specialty Coating Systems (United States). . . . . [7302-44]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

Design and implementation of a new time-delayed source and alignment considerations for a tangent ogive interferometer, Hector P. Durazo, Breault Research Organization, Inc. (United States); William P. Kuhn, Opt-E (United States); Robert S. LeCompte, Breault Research Organization, Inc. (United States); Matthew B. Dubin, The Univ. of Arizona (United States). . . . . [7302-45]

Light scattering of highly oriented polycrystalline diamond film, Chao Liu, Wei Qiu, Valdosta Optics Lab., Inc. (United States); Helmuth E. Meissner, Xiaodong Mu, Onyx Optics Inc. (United States) . . . . . [7302-46]

Monday-Friday 13-17 April 2009 • Proceedings of SPIE Vol. 7303

Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XIV

Conference Chairs: **Russell S. Harmon,** U.S. Army Research Office; **J. Thomas Broach,** U.S. Army Night Vision & Electronic Sensors Directorate; **John H. Holloway, Jr.,** Naval Surface Warfare Ctr., Panama City

Program Committee: **Leslie M. Collins,** Duke Univ.; **Yogadhish Das,** Defence Research and Development Canada (Canada); **Robert M. Deas,** Defence Science and Technology Lab. (United Kingdom); **Gerald J. Dobeck,** Naval Surface Warfare Ctr.; **Paul D. Gader,** Univ. of Florida; **John E. McFee,** Defence Research and Development Canada (Canada); **James M. Sabatier,** The Univ. of Mississippi; **Motoyuki Sato IV,** Tohoku Univ. (Japan); **Miranda A. Schatten,** U.S. Army RDECOM CERDEC NVESD; **Waymond R. Scott, Jr.,** Georgia Institute of Technology; **Richard C. Weaver,** U.S. Army RDECOM CERDEC NVESD

Monday 13 April

SESSION 1

Room: Grand 6 . . . . . Mon. 8:30 to 10:10 am

Explosives Detection and Environmental Effects I

Session Chairs: **Jan M. H. Hendrickx,** New Mexico Institute of Mining and Technology; **Russell S. Harmon,** U.S. Army Research Office

8:30 am: **Detection and dispersal of explosives by ants**, John E. McFee, Defence Research and Development Canada (Canada); Steve Achal, ITRES Research Ltd. (Canada); Anthony A. Faust, Eldon Puckrin, Defence Research and Development Canada (Canada); Andrew House, Damon Reynolds, ITRES Research Ltd. (Canada); Bill McDougall, Adam Asquini, Defence Research and Development Canada (Canada) . . . . . [7303-01]

8:50 am: **Mass spectrometry analysis of hexamethylene triperoxide diamine (HMTD) by its decomposition products**, Alvaro J. Peña-Quevedo, Samuel P. Hernández-Rivera, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-02]

9:10 am: **Near-surface transport of TNT and DNT in soils under fluctuating atmospheric conditions**, Ingrid Y. Padilla, Juan P. Gutierrez, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-03]

9:30 am: **Interrelation between atmospheric conditions and detection of explosive relative compounds near soil-atmospheric surfaces in unsaturated soil**, Angel A. Anaya, Ingrid Y. Padilla, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-04]

9:50 am: **Climate effect on the fate, transport, and detection of explosive signatures in a sandy soil field lysimeter**, Edwin J. Colon, Ingrid Y. Padilla, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-05]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Grand 6 . . . . . Mon. 10:40 am to 12:00 pm

Explosives Detection and Environmental Effects II

Session Chairs: **John E. McFee,** Defence Research and Development Canada (Canada); **Samuel P. Hernández-Rivera,** Univ. de Puerto Rico Mayagüez

10:40 am: **Transport and distribution of TNT and DNT in the presence of surface vegetation with** *Fimbrystilis Cymosa*, Sangchul Hwang, Ingrid Y. Padilla, Irimar Feliciano, Juan Falcon, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-06]

11:00 am: **Environmental effects on the fate and transport of explosives-related compounds in heterogeneous 3D clayey soil's system**, Rafael E. Rivera, Ingrid Y. Padilla, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-07]

11:20 am: **Modeling of the transport of explosive related compounds in soil**, Maik Irrazábal-Aguilera, Julio G. Briano, Samuel P. Hernandez-Rivera, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-08]

11:40 am: **Concentration distribution of DNT and TNT around an improvised explosive device in an urban environment**, Lillian M. Rivera Mercado, Ingrid Y. Padilla, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7303-09]

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

SESSION 3

Room: Grand 6 . . . . . Mon. 1:30 to 3:30 pm

Sensing and Detection in the Marine Environment

Session Chairs: **Gerald J. Dobeck,** Naval Surface Warfare Ctr.; **John H. Holloway, Jr.,** Naval Surface Warfare Ctr., Panama City

1:30 pm: **Image preparation for enhancement of recorded underwater video**, Harold R. Suiter, Naval Surface Warfare Ctr. (United States); Mark F. Wolff, Arete Associates (United States) . . . . . [7303-10]

1:50 pm: **Recent ATR and fusion algorithm improvements for side scan and multiband sonar imagery**, Tom Aridgides, Manuel F. Fernández, Lockheed Martin Maritime Systems & Sensors (United States) . . . . . [7303-11]

2:10 pm: **Near and far EMI-field analyses in a conducting environment to enhance underwater UXO detection**, Fridon Shubitidze, Dartmouth College (United States); Benjamin Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Irma Shamatava, Sky Research, Inc. (United States); Juan P. Fernández, Dartmouth College (United States); Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States) . . . [7303-12]

2:30 pm: **Underwater UXO discrimination studies: adapting EMI forward models to marine environments**, Fridon Shubitidze, Dartmouth College (United States); Benjamin Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Irma Shamatava, Sky Research, Inc. (United States); Juan P. Fernández, Dartmouth College (United States); Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States) . . . . . [7303-13]

2:50 pm: **Application of Fisher fusion techniques to improve the individual performance of sonar computer-aided detection/computer-aided classification (CAD/CAC) algorithms**, Charles M. Ciany, William C. Zurawski, Raytheon Co. (United States) . . . . . [7303-14]

3:10 pm: **Adaptive large-scale clutter removal from imagery with application to high-resolution sonar**, Gerald J. Dobeck, Naval Surface Warfare Ctr. (United States) . . . . . [7303-15]

Coffee Break . . . . . 3:30 to 4:00 pm

SESSION 4

Room: Grand 6 . . . . . Mon. 4:00 to 5:20 pm

Acoustic Sensing

Session Chairs: **James M. Sabatier,** The Univ. of Mississippi; **Steven S. Bishop,** U.S. Army Night Vision & Electronic Sensors Directorate

4:00 pm: **Standoff detection of obscured vehicle with laser Doppler vibrometer**, Vyacheslav Aranchuk, Alexander E. Ekimov, James M. Sabatier, The Univ. of Mississippi (United States) . . . . . [7303-16]

4:20 pm: **Demultiplexing multiple-beam laser Doppler vibrometry for continuous scanning**, Richard D. Burgett, QinetiQ North America, Technology Solutions Group (United States); Vyacheslav Aranchuk, James M. Sabatier, The Univ. of Mississippi (United States) . . . . . [7303-17]

4:40 pm: **Synthetic aperture acoustic measurements of stationary suspended cinderblock and surrogate substitutes**, Steven S. Bishop, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Teresa J. Woods, The Catholic Univ. of America (United States); Mehrdad Soumekh, Consultant (United States); Joseph F. Vignola, John A. Judge, The Catholic Univ. of America (United States) . . . . . [7303-18]

5:00 pm: **Orthogonal sensor suite and the signal-processing algorithm for human detection and discrimination**, Alexander E. Ekimov, James M. Sabatier, The Univ. of Mississippi (United States) . . . . . [7303-19]

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 5

Room: Grand 6 . . . . . .Tues. 10:30 to 11:50 am

EMI Sensing I

Session Chairs: **Leonard R. Pasion,** The Univ. of British Columbia (Canada); **J. Thomas Broach,** U.S. Army Night Vision & Electronic Sensors Directorate

10:30 am: **Metal detector depth-estimation algorithms**, Jay A. Marble, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . [7303-20]

10:50 am: **APG UXO discrimination studies using advanced EMI models and TEMTADS data**, Fridon Shubitidze, Dartmouth College (United States); Benjamin Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Juan P. Fernández, Dartmouth College (United States); Irma Shamatava, Sky Research, Inc. (United States); Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States). . . . . [7303-21]

11:10 am: **The physically complete models applied to BUD time-domain EMI data**, Irma Shamatava, Sky Research, Inc. (United States); Fridon Shubitidze, Dartmouth College (United States); Benjamin Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Juan P. Fernández, Dartmouth College (United States); Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States) . . . . . [7303-22]

11:30 am: **The physically complete EMI models applied to the ESTCP Camp Sibert Pilot Study EM-63 data**, Irma Shamatava, Sky Research, Inc. (United States); Fridon Shubitidze, Dartmouth College (United States); Benjamin Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Juan P. Fernández, Dartmouth College (United States); Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States) . . . [7303-23]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 6

Room: Grand 6 . . . . . .Tues. 1:20 to 3:00 pm

EMI Sensing II

Session Chairs: **Leonard R. Pasion,** The Univ. of British Columbia (Canada); **J. Thomas Broach,** U.S. Army Night Vision & Electronic Sensors Directorate

1:20 pm: **Classification of items in a walk-through metal detector using time series of eigenvalues of the polarizability tensor**, Jarmo Kauppila, Tampere Univ. of Technology (Finland); Timo K. Ala-Kleemola, Against Intuition Inc. (Finland); Juho V. Vihonen, Juha Jylhä, Marja H. Ruotsalainen, Tampere Univ. of Technology (Finland); Ari Järvi, Rapiscan Systems, Inc. (Finland); Ari Visa, Tampere Univ. of Technology (Finland). . . . . [7303-24]

1:40 pm: **Investigating the effects of soils with complex magnetic susceptibility on EMI measurements using numerical modelling of Maxwell's equations**, Kevin Kingdon, Sky Research, Inc. (Canada); Leonard R. Pasion, Sky Research, Inc. (Canada) and The Univ. of British Columbia (Canada); Douglas W. Oldenburg, The Univ. of British Columbia (Canada) . . . . . [7303-25]

2:00 pm: **Transient electromagnetic inversion for multiple targets**, Lin-Ping Song, The Univ. of British Columbia (Canada); Leonard R. Pasion, The Univ. of British Columbia (Canada) and Sky Research Inc. (Canada); Douglas W. Oldenburg, The Univ. of British Columbia (Canada); Stephen Billings, Sky Research, Inc. (Canada) . . . . . [7303-26]

2:20 pm: **Clutter suppression in EMI data by upward continuation**, Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States); Fridon Shubitidze, Dartmouth College (United States); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Juan P. Fernández, Dartmouth College (United States); Irma Shamatava, U.S. Army Engineer Research and Development Ctr. (United States). . . . . [7303-27]

2:40 pm: **Detection of multiple subsurface metallic targets using EMI data**, Tomasz M. Grzegorczyk, Delpsi, LLC (United States); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Fridon Shubitidze, Juan P. Fernández, Irma Shamatava, Dartmouth College (United States); Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States). . . . . [7303-28]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 7

Room: Grand 6 . . . . . .Tues. 3:30 to 4:50 pm

EMI Sensing III

Session Chairs: **Fridon Shubitidze,** Dartmouth College; **Benjamin E. Barrowes,** U.S. Army Engineer Research and Development Ctr.

3:30 pm: **Location estimation using a broadband electromagnetic induction array**, Waymond R. Scott, Jr., Ali Cafer Gurbuz, James H. McClellan, Georgia Institute of Technology (United States) . . . . . [7303-29]

3:50 pm: **Man-portable vector EMI instrument data characterization in dry and aqueous environments**, Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (United States); Fridon Shubitidze, Juan P. Fernández, Irma Shamatava, Dartmouth College (United States); Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States). . . . . [7303-30]

4:10 pm: **A vector handheld frequency-domain sensor for UXO identification**, Juan P. Fernández, Dartmouth College (United States); Benjamin Barrowes, Kevin A. ONeill, U.S. Army Engineer Research and Development Ctr. (United States); Irma Shamatava, Fridon Shubitidze, Dartmouth College (United States). . . . . [7303-31]

4:30 pm: **Automated, nonmetallic, five-axis measurement facility for testing and development of electromagnetic induction sensors for landmine detection**, Gregg D. Larson, Waymond R. Scott, Jr., Georgia Institute of Technology (United States) . . . . . [7303-32]

Wednesday 15 April

SESSION 8

Room: Grand 6 . . . . . Wed. 8:00 to 10:00 am

Environmental Effects on Sensing Technologies

Session Chairs: **Jan Igel,** Leibniz Institute for Applied Geosciences (Germany); **Holger Preetz,** Leibniz Institute for Applied Geosciences (Germany)

8:00 am: **Magnetic signatures of topsoil due to burning**, Gunther Kletetschka, NASA Goddard Space Flight Ctr. (United States). . . . . [7303-33]

8:20 am: **A synthesis of current knowledge and future directions for soil magnetism research**, Jacqueline A. Hannam, Cranfield Univ. (United Kingdom); Remke L. Van Dam, Michigan State Univ. (United States); Russell S. Harmon, U.S. Army Research Office (United States). . . . . [7303-34]

8:40 am: **Calibration of RADARSAT-2 surface soil moisture estimates**, Jan M. H. Hendrickx, New Mexico Institute of Mining and Technology (United States); Bernard Rabus, MacDonald, Dettwiler and Associates Ltd. (Canada); Diana C. Romero, New Mexico Institute of Mining and Technology (United States); Hans W. Wehn, MacDonald, Dettwiler and Associates Ltd. (Canada); Bruce J. Harrison, Sung-ho Hong, Brian Borchers, New Mexico Institute of Mining and Technology (United States); Jim Slater, National Geospatial-Intelligence Agency (United States) . . . . . [7303-35]

9:00 am: **Improvement of hydrologic model soil moisture predictions using SEBAL evapotranspiration estimates**, Jan M. H. Hendrickx, Sung-ho Hong, New Mexico Institute of Mining and Technology (United States); Fred L. Ogden, Nawa R. Pradham, Univ. of Wyoming (United States) . . . . . [7303-36]

9:20 am: **Small-scale variability of electromagnetic soil properties and their influence on landmine detection: how to measure, how to analyze, and how to interpret?**, Jan Igel, Holger Preetz, Leibniz Institute for Applied Geosciences (Germany) . . . . . [7303-37]

9:40 am: **Classification of soil susceptibility and prediction of metal detector performance: case study of Angola**, Holger Preetz, Leibniz Institute for Applied Geosciences (Germany); Sven Altfelder, Volker Hennings, Federal Institute for Geosciences and Natural Resources (Germany); Jan Igel, Leibniz Institute for Applied Geosciences (Germany). . . . . [7303-38]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 9

Room: Grand 6 . . . . . Wed. 10:30 am to 12:10 pm

Optical Sensing I

Session Chairs: **Horacio A. Abbate,** Univ. de Buenos Aires (Argentina); **Neelam Gupta,** Army Research Lab.

10:30 am: **Longwave infrared hyperspectral imager based on a diffractive optic lens**, Neelam Gupta, Army Research Lab. (United States) . . . . . [7303-39]

10:50 am: **Dualband thermal imagery for the detection of mines and explosive objects**, Jason J. Lepley, Mark E. Bray, SELEX GALILEO (United Kingdom). . . . . [7303-40]

11:10 am: **Spectral and spatial analysis of false alarms in background data**, Abhishek Sanaka, Shivakar Vulli, Sanjeev Agarwal, Missouri Univ. of Science and Technology (United States); Richard Ess, Anh H. Trang, U.S. Army (United States). . . . . [7303-41]

11:30 am: **Landmine detection using IR image segmentation by means of fractal dimension analysis**, Horacio A. Abbate, Juliana Gambini, Univ. de Buenos Aires (Argentina); Claudio Delrieux, Univ. Nacional del Sur (Argentina); Eduardo H. Castro, Univ. de Buenos Aires (Argentina). . . . . [7303-42]

11:50 am: **Collection and evaluation of false alarm signatures in background data**, Sanjeev Agarwal, Shivakar Vulli, Missouri Univ. of Science and Technology (United States); Neil J. Malloy, Multisensor Science LLC (United States); Elizabeth M. Lord, Josh R. Fairley, Bruce M. Sabol, Wesley Johnson, U.S. Army Corps of Engineers (United States); Richard Ess, U.S. Army (United States); Anh H. Trang, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7303-43]

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

SESSION 10

Room: Grand 6 . . . . . Wed. 1:40 to 3:00 pm

Multi-Sensor Systems and Field Tests

Session Chairs: **Motoyuki Sato IV,** Tohoku Univ. (Japan); **Miranda A. Schatten,** U.S. Army Night Vision & Electronic Sensors Directorate

1:40 pm: **Buried object depth estimation**, Mehmet Sezgin, TÜBITAK Marmara Research Ctr. (Turkey). . . . . [7303-44]

2:00 pm: **Multifrequency metal detector performance in highly mineralized soils**, Laurence Stamatescu, Gregory P. Harmer, Oliver Nesper, Dorin Bordean, Yuriy Tkachenko, Minelab Electronics Pty Ltd. (Australia) . . . . . [7303-45]

2:20 pm: **ALIS evaluation tests in Croatia**, Motoyuki Sato IV, Tohoku Univ. (Japan). . . . . [7303-46]

2:40 pm: **Overseas testing of a multisensor landmine detection system: results and lessons learned**, Joe G. Keranen, Applied Research Associates, Inc. (United States); Zeke J. Topolosky, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7303-47]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 11

Room: Grand 6 . . . . . Wed. 3:30 to 5:30 pm

Optical Sensing II

Session Chairs: **Patrick J. Treado,** ChemImage Corp.; **Peter Howard,** U.S. Army Night Vision & Electronic Sensors Directorate

3:30 pm: **Evaluating detection performance of a LIBS/Raman/SWIR fusion sensor**, Patrick J. Treado, Matthew Nelson, Charles W. Gardner, Robert Schweitzer, ChemImage Corp. (United States); Martin C. Richardson, College of Optics & Photonics, Univ. of Central Florida (United States). . [7303-49]

3:50 pm: **Laser-induced breakdown spectroscopy (LIBS) for detection of ammonium nitrate in soils**, Daniel Díaz, Univ. Nacional de Colombia, Medellín (Colombia); David W. Hahn, Univ. of Florida (United States); Alejandro Molina, Univ. Nacional de Colombia, Medellín (Colombia) . . . . . [7303-50]

4:10 pm: **LIBS discrimination of landmine casings**, Russell S. Harmon, U.S. Army Research Office (United States); Jennifer L. Gottfried, Army Research Lab. (United States); Aaron La Pointe, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7303-51]

4:30 pm: **Laser-induced breakdown spectroscopy based deminers probe**, James P. Hauck, Mark Walker, Scientific Applications & Research Associates, Inc. (United States). . . . . [7303-52]

4:50 pm: **New laser range facility at UCF in Florida**, Martin C. Richardson, College of Optics & Photonics, Univ. of Central Florida (United States). . [7303-53]

5:10 pm: **A graphical user interface for real-time spectroscopy: data collection, feature extraction, model development, and real-time testing**, Peter A. Torrione, Kenneth D. Morton, Chris Lunsford, Leslie M. Collins, Signal Innovations Group, Inc. (United States) . . . . . [7303-54]

Thursday 16 April

SESSION 12

Room: Grand 6 . . . . . Thurs. 8:00 to 10:00 am

The Autonomous Mine Detection System

Session Chairs: **Mark C. Locke,** U.S. Army Night Vision & Electronic Sensors Directorate; **Richard C. Weaver,** U.S. Army Night Vision & Electronic Sensors Directorate

8:00 am: **Assessment of the autonomous mine detection system (AMDS)**, Isaac S. Chappell, Institute for Defense Analyses (United States); Mark C. Locke, U.S. Army Night Vision & Electronic Sensors Directorate (United States) [7303-55]

8:20 am: **Autonomous mine detection system (AMDS) threat marking payload module**, Kevin Brown, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7303-56]

8:40 am: **Autonomous mine detection system (AMDS) mission robotics**, Adam Mulliken, Institute for Defense Analyses (United States); David J. Bruemmer, Idaho National Lab. (United States); Herman Herman, Carnegie Mellon Univ. (United States) . . . . . [7303-57]

9:00 am: **Autonomous mine detection system (AMDS) mine detection payload module**, Matt Aeillo, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7303-58]

9:20 am: **Autonomous mine detection system (AMDS) neutralization payload module**, Richard Vanaman, U.S. Army Armament Research, Development and Engineering Ctr. (United States); Mark C. Locke, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7303-59]

9:40 am: **Autonomous mine detection system (AMDS) explosives detection payload module**, David Hicks, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7303-60]

Coffee Break . . . . . 10:00 to 10:50 am

SESSION 13

Room: Grand 6 . . . . . Thurs. 10:50 am to 12:10 pm

Optical Sensing III

Session Chairs: **James J. Staszewski,** Carnegie Mellon Univ.; **Angela M. Puetz,** Naval Postgraduate School

10:50 am: **Characterization of signature information for visual landmine detection**, James J. Staszewski, Carnegie Mellon Univ. (United States); Alan D. Davison, Army Research Lab. (United States) . . . . . [7303-61]

11:10 am: **Optical cues for landmine detection**, Charles A. Hibbitts, The Johns Hopkins Univ. (United States); James J. Staszewski, Carnegie Mellon Univ. (United States); Vincent Sha, CVI (United States); James Rooney, Andrew Cempa, Lincoln Univ. of Missouri (United States); Alan D. Davison, Army Research Lab. (United States). . . . . [7303-62]

11:30 am: **Fluorescent imprinted polymers for detection of explosive nitro-aromatic compounds**, Richard C. Stringer, Shubhra Gangopadhyay, Sheila A. Grant, Univ. of Missouri, Columbia (United States) . . . . . [7303-63]

11:50 am: **Initial results using an LCD polarization imaging camera**, Richard C. Olsen, Angela M. Puetz, Phillip Smith, Naval Postgraduate School (United States). . . . . [7303-64]

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

SESSION 14

Room: Grand 6 . . . . . Thurs. 1:40 to 4:30 pm

Sensing Potpourri

Session Chairs: **Hans-Georg Meyer,** IPHT Jena (Germany); **Jay A. Marble,** U.S. Army Night Vision & Electronic Sensors Directorate

1:40 pm: **Preliminary results of multifrequency (C, Ku, and Ka-band of frequencies), polarimetric measurements of snow, bare, and vegetated soil reflective and emissive characteristics angular dependences**, Astghik K. Hambaryan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia) . . . [7303-65]

2:00 pm: **Magnetic STAR technology for real-time localization and classification of unexploded ordnance and buried mines**, Roy F. Wiegert, Kwang Lee, Naval Surface Warfare Ctr. (United States) . . . . . [7303-66]

2:20 pm: **Standoff subterranean high-definition impedance imaging**, Al Wexler, Quantic Electroscan Inc. (Canada) . . . . . [7303-67]

2:40 pm: **Measurements of snow, bare, and vegetated soil microwave reflective and emissive characteristics angular dependences at 5.6GHz**, Artashes K. Arakelyan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia) . . . . . [7303-68]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Detection of buried magnetic objects by a SQUID Gradiometer system**, Hans-Georg Meyer, Sven Linzen, Ronny Stolz, Sebastian Hauspurg, Andreas Chwala, Marco Schulz, Volkmar Schultze, IPHT Jena (Germany); Nikolai Bondarenko, Supracon AG (Germany); Konrad Hartung, Michael Schneider, Wolfgang Fried, Friedrich-Schiller-Univ. Jena (Germany) . . . . . [7303-69]

3:50 pm: **Synthesis and comparison of several silicon-based fluorinated phenol polymers as QCM sensor coating for DMMP detection**, Zhidong Wang, Xiaosong Du, Univ. of Electronic Science and Technology of China (China); Yangdong Jiang, Univ. of Electronic Science and Technology of China (Colombia) . . . . . [7303-70]

4:10 pm: **Mine detection using THz time domain spectroscopy**, Hakan Altan, Sinan K. Bilikmen, Middle East Technical Univ. (Turkey) . . . . . [7303-71]

Friday 17 April

SESSION 15

Room: Grand 6 . . . . . Fri. 8:00 to 10:00 am

Signal Processing and Statistical Classification I

Session Chairs: **Leslie M. Collins,** Duke Univ.; **James M. Keller,** Univ. of Missouri, Columbia

8:00 am: **Real-time Gaussian Markov random field-based ground tracking for ground penetrating radar data**, Kyle Bradbury, Peter A. Torrione, Leslie M. Collins, Duke Univ. (United States) . . . . . [7303-72]

8:20 am: **Adaptive edge histogram descriptor for landmine detection using GPR**, Hichem Frigui, Aleksey S. Fadeev, Andrew Karem, Univ. of Louisville (United States); Paul D. Gader, Univ. of Florida (United States) . . . . . [7303-73]

8:40 am: **Syntactic landmine detection and classification**, Kenneth J. Hintz, David Hwang, Nathalia Peixoto, George Mason Univ. (United States) . . . [7303-74]

9:00 am: **Landmine detection using mixture of discrete hidden Markov models**, Hichem Frigui, Anis Hamdi, Oualid Missaoui, Univ. of Louisville (United States); Paul D. Gader, Univ. of Florida (United States) . . . . . [7303-75]

9:20 am: **Wideband EMI pre-screening for landmine detection**, Joseph N. Wilson, Ganesan Ramachandran, Paul D. Gader, Brandon Smock, Univ. of Florida (United States); Waymond R. Scott, Jr., Georgia Institute of Technology (United States) . . . . . [7303-76]

9:40 am: **Fast physics-based mine detection algorithms for wide-band electromagnetic induction sensors**, Ganesan Ramachandran, Paul D. Gader, Joseph N. Wilson, Univ. of Florida (United States) . . . . . [7303-77]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 16

Room: Grand 6 . . . . . Fri. 10:30 am to 12:10 pm

Signal Processing and Statistical Classification II

Session Chairs: **Hichem Frigui,** Univ. of Louisville; **Paul D. Gader,** Univ. of Florida

10:30 am: **Sensor management using a new framework for observation modeling**, Mark P. Kolba, Leslie M. Collins, Duke Univ. (United States) . [7303-78]

10:50 am: **Context-dependent feature selection for landmine detection with ground-penetrating radar**, Christopher R. Ratto, Peter A. Torrione, Leslie M. Collins, Duke Univ. (United States) . . . . . [7303-79]

11:10 am: **Context-dependent fusion for landmine detection with multisensor systems**, Hichem Frigui, Ahmed Chamseddine, Univ. of Louisville (United States); Paul D. Gader, Univ. of Florida (United States) . . . . . [7303-80]

11:30 am: **Sensor data fusion for spectroscopy based detection of explosives**, Pratik V. Shah, Abhijeet Singh, Sanjeev Agarwal, Sahra Sedigh, Missouri Univ. of Science and Technology (United States); Alan Ford, Robert D. Waterbury, Alaka'i Consulting & Engineering, Inc. (United States) . . . . . [7303-81]

11:50 am: **Sensor-fused detection of explosive hazards**, Timothy C. Havens, James M. Keller, Dominic K. C. Ho, Kevin E. Stone, Univ. of Missouri, Columbia (United States) . . . . . [7303-82]

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

SESSION 17

Room: Grand 6 . . . . . Fri. 1:40 to 3:00 pm

Signal Processing and Statistical Classification III

Session Chairs: **Peter A. Torrione,** Duke Univ.; **Anh H. Trang,** U.S. Army Night Vision & Electronic Sensors Directorate

1:40 pm: **Simultaneously exploiting spectral similarity and spatial distribution for patterned minefield detection**, Anh H. Trang, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Sanjeev Agarwal, Missouri Univ. of Science and Technology (United States); Thomas Broach, Thomas W. Smith, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . [7303-83]

2:00 pm: **Automatic cuing of human-in-the-loop detection system**, James M. Keller, Kevin E. Stone, Dominic K. C. Ho, Mihail Popescu, Univ. of Missouri, Columbia (United States) . . . . . [7303-84]

2:20 pm: **On improving subspace spectral feature technique for the detection of weak scattering plastic antitank landmines**, Dominic K. C. Ho, Univ. of Missouri, Columbia (United States); Paul D. Gader, Joe Wilson, Univ. of Florida (United States); Hichem Frigui, Univ. of Louisville (United States) . . . . . [7303-85]

2:40 pm: **Two-dimensional template matching method for buried object discrimination in GPR data**, Mehmet Sezgin, TÜBITAK Marmara Research Ctr. (Turkey) . . . . . [7303-86]

Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing X

Conference Chairs: **Augustus Way Fountain III,** U.S. Army Edgewood Chemical Biological Ctr.; **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.; **Harry Ing,** Bubble Technology Industries, Inc. (Canada); **Matthew T. Griffin,** General Dynamics Armament and Technical Products; **Robert Mayo,** U.S. Dept. of Energy, Office of Nonproliferation Research & Development; **Harold R. McHugh,** U.S. Dept. of Energy, Special Technologies Lab.; **Paul M. Pellegrino,** Army Research Lab.; **Michael Peters,** Intelagard; **Michael W. Petryk,** Defence Research and Development Canada (Canada); **Cynthia R. Swim,** U.S. Army Edgewood Chemical Biological Ctr.; **Ken Yasuda,** U.S. Army Night Vision & Electronic Sensors Directorate

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Grand 7A . . . . . .Tues. 10:30 to 11:50 am

Biological Sensing I

Session Chair: **Patrick J. Gardner,** Western Carolina Univ.

10:30 am: **Pathogenic ecology: where have all the pathogens gone? Anthrax: a classic case**, Johnathan Kiel, Air Force Research Lab. (United States). . . . . [7304-01]

10:50 am: **Bacteria mixture analysis with Raman chemical imaging microscopy**, A. Peter Snyder, Jason A. Guicheteau, Steven D. Christesen, Darren K. Emge, Janet L. Jensen, Rabih E. Jabbour, Ashish Tripathi, U.S. Army Edgewood Chemical Biological Ctr. (United States). . . . . [7304-02]

11:10 am: **Development of a bionanoprobe sensing concept employing molecular recognition and multifunctional transduction**, Dimitra N. Stratis-Cullum, Army Research Lab. (United States); Nicole Whitten, Univ. of Maryland, Baltimore County (United States) and Army Research Lab. (United States); Mikella E. Hankus, Army Research Lab. (United States); Brian M. Cullum, Univ. of Maryland, Baltimore County (United States); Paul M. Pellegrino, Army Research Lab. (United States). . . . . [7304-03]

11:30 am: **Oxygen flux as an indicator of physiological stress in aquatic organisms: a real-time biomonitoring system of water quality**, Brian C. Sanchez, Gowri Yale, Rameez Chatni, Marshall D. Porterfield, Hugo G. Ochoa-Acuña, Maria S. Sepulveda, Purdue Univ. (United States). . . . . [7304-04]

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

SESSION 2

Room: Grand 7A . . . . . .Tues. 1:30 to 3:30 pm

Biological Sensing II

Session Chair: **Patrick J. Gardner,** Western Carolina Univ.

1:30 pm: **Fast detection and identification of bacteria in potable water**, Alois Friedberger, Ulrich Reidt, Christoph Heller, Andreas Helwig, Gerhard Müller, EADS Deutschland GmbH (Germany). . . . . [7304-05]

1:50 pm: **Infrared signatures of Bacillus bacteria: clear IR distinctions between sporulated and vegetative cells with chemical assignments**, Timothy J. Johnson, Yin-Fong Su, Nancy B. Valentine, Helen W. Kreuzer, Karen L. Wahl, Joel Forrester, Pacific Northwest National Lab. (United States); Stephen D. Williams, Appalachian State Univ. (United States). . . . . [7304-06]

2:10 pm: **History of biological aerosol standoff detection at the Applied Physics Laboratory**, Michael E. Thomas, Christopher C. Carter, Harvey W. Ko, Camille A. Schumacher, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7304-07]

2:30 pm: **Optical properties and cross sections of biological aerosols**, Michael E. Thomas, Karen M. Siegrist, Daniel V. Hahn, Alison Carr, Diane Limsui, Christopher C. Carter, Nathan T. Boggs, Joan Jackman, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7304-08]

2:50 pm: **LIDAR measurements of biological warfare simulants**, David M. Brown, Evan P. Thrush, Karen M. Siegrist, Michael E. Thomas, Alison Carr, Nathan T. Boggs, The Johns Hopkins Univ. Applied Physics Lab. (United States). . . . . [7304-09]

3:10 pm: **The chemical biological distributed early warning system**, Joshua Broadwater, Alison Carr, Todd M. Neighoff, Diane Limsui, Artemas Herzog, Chad Hawthorne, Jeffrey Barton, Lee Harris, Chris Carter, The Johns Hopkins Univ. Applied Physics Lab. (United States). . . . . [7304-10]

Coffee Break . . . . . 3:30 to 4:00 pm

SESSION 3

Room: Grand 7A . . . . . .Tues. 4:00 to 5:40 pm

Biological Sensing III

Session Chair: **Jerome J. Braun,** MIT Lincoln Lab.

4:00 pm: **Humidity dependent refractive index model for bacterial spores**, Karen M. Siegrist, Alison Carr, Diane Limsui, Nathan T. Boggs, Michael E. Thomas, Christopher C. Carter, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7304-12]

4:20 pm: **Wide-area surveillance for detection and tracking of chemical and biological clouds**, Todd M. Neighoff, Sean Happel, Steven Conard, John Gomes, The Johns Hopkins Univ. Applied Physics Lab. (United States). . . . . [7304-13]

4:40 pm: **Detection and classification of atmospheric aerosols using multi-wavelength LWIR lidar**, Russell E. Warren, EO-Stat, Inc. (United States); Richard G. Vanderbeek, U.S. Army Edgewood Chemical Biological Ctr. (United States); Jeffrey Ahl, JLA Technology (United States) . . . . . [7304-14]

5:00 pm: **Standoff fluorescence lifetime imaging system for remote sensing of chemical and biological agents**, Edgar A. Mendoza, Redondo Optics, Inc. (United States). . . . . [7304-15]

5:20 pm: **Lab-on-a-chip PCR in continuous flow: an ultrafast analytical tool for B-agents**, Claudia Gärtner, Nadine Hlawatsch, Richard Klemm, Microfluidic ChipShop GmbH (Germany); Thomas Clemens, CLEMENS GmbH (Germany) . . . . . [7304-17]

Wednesday 15 April

SESSION 4

Room: Grand 7A . . . . . Wed. 8:00 to 10:00 am

Chemical Sensing I

Session Chair: **Cynthia R. Swim,**
U.S. Army Edgewood Chemical Biological Ctr.

8:00 am: **Modeling the atmospheric chemistry of TICs**, Michael V. Henley, Air Force Research Lab. (United States) . . . . . [7304-18]

8:20 am: **Range test validation cloud tracking system**, William J. Marinelli, Physical Sciences Inc. (United States) . . . . . [7304-19]

8:40 am: **Imaging Fourier transform spectrometry (IFTS) of chemical plumes**, Kenneth C. Bradley, Kevin C. Gross, Glen P. Perram, Air Force Institute of Technology (United States) . . . . . [7304-20]

9:00 am: **Development of a MEMS-scale photo-acoustic chemical sensor for trace vapor detection**, Ellen L. Holthoff, Paul M. Pellegrino, Army Research Lab. (United States) . . . . . [7304-21]

9:20 am: **A new generation of dual-input beam spectroradiometer for the standoff detection of chemicals**, Louis M. Moreau, Frederic Grandmont, Christian A. Vallieres, Claude B. Roy, ABB Inc. (Canada); Eldon Puckrin, Jean-Marc Thériault, Defence Research and Development Canada Valcartier (Canada) . . . . . [7304-22]

9:40 am: **The noncontact detection of a nerve agent simulant on U.S. Military CARC**, Michael W. Petryk, Defence Research and Development Canada (Canada) . . . . . [7304-23]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 5

Room: Grand 7A . . . . . Wed. 10:30 am to 12:10 pm

Chemical Sensing II

Session Chair: **Michael W. Petryk,** Defence Research and Development Canada (Canada)

10:30 am: **Dwell-time considerations for large area cold plasma decontamination**, Gregory A. Konesky, K-Plasma Ltd. (United States) . [7304-24]

10:50 am: **Chemical biological (CB) defense technology solution for tactical CB threat detection by active/passive CB electromagnetic radiation (photons), 8-12µm wavelength and elecro optics**, Ravi P. Lall, U.S. Army Edgewood Chemical Biological Ctr. (United States) . . . . . [7304-25]

11:10 am: **Imaging open-path Fourier transform infrared spectrometer for 3D cloud profiling**, Julia R. Dupuis, David J. Mansur, Robert M. Vaillancourt, Elizabeth Schundler, Thomas Evans, OPTRA, Inc. (United States); Lori A. Todd, Kathleen M. Mottus, The Univ. of North Carolina at Chapel Hill (United States) . . . . . [7304-26]

11:30 am: **Optimization of sensor resolution for standoff chemical detection**, Alison Carr, Joshua Broadwater, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7304-27]

11:50 am: **Multiwalled carbon nanotubes modified with ferrocene-amino acid derivatives as electrochemical sensors for chemical warfare agent mimics**, Yizh Xiao, The Univ. of Western Ontario (Canada); Michael W. Petryk, Defence Research and Development Canada (Canada); Heinz-Bernhard Kraatz, The Univ. of Western Ontario (Canada) . . . . . [7304-28]

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

SESSION 6

Room: Grand 7A . . . . . Wed. 1:40 to 3:00 pm

Chemical Sensing III

Session Chair: **Paul M. Pellegrino,** Army Research Lab.

1:40 pm: **A compact low-power detector for chemical alarms**, Douglas R. Adkins, Patrick R. Lewis, Defiant Technologies, Inc. (United States) . . . . . [7304-29]

2:00 pm: **Sensing with midinfrared frequency combs: a novel modality for ultrasensitive detection of hazardous materials**, Konstantin L. Vodopyanov, Stanford Univ. (United States) . . . . . [7304-30]

2:20 pm: **Picosecond multiphoton STIRAP detection of gas phase species: a test with sodium**, J. Bruce Johnson, Susan D. Allen, Daniel R. Britton, Joey Burdin, James Hicks, Kevin Lyon, W. Dean Murry, Arkansas State Univ. (United States) . . . . . [7304-31]

2:40 pm: **Spectroscopic material determination via LIBS and CRDS**, Steven T. Griffin, The Univ. of Memphis (United States) . . . . . [7304-32]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 7

Room: Grand 7A . . . . . Wed. 3:30 to 5:50 pm

Current Industrial Trends in CBRNE Sensing

Session Chair: **Matthew T. Griffin,**
General Dynamics Armament and Technical Products

3:30 pm: **CBRN mobile laboratories in Italy**, Giorgio Mari, Istituto Superiore per la Prevenzione e la Sicurezza del Lavoro (Italy); Claudio Garibaldi, Vigili del Fuoco (Italy); Corrado Lancia, BIOTRACE MicroSafe Srl (Italy); Giampaolo Giraudi, Mariarosa Bellino, Italian Army 7° NBC Regiment (Italy); Michele Pazienza, ... [7304-33]

3:50 pm: **Hand-held, highly reliable, selective, direct, and reagentless detection**, Melik C. Demirel, The Pennsylvania State Univ. (United States) . . . . . [7304-34]

4:10 pm: **AIRIS standoff multispectral sensor**, William J. Marinelli, Physical Sciences Inc. (United States) . . . . . [7304-35]

4:30 pm: **Performance status of a small robot-mounted or hand-held, solar-blind, standoff chemical, biological, and explosives (CBE) sensor**, William F. Hug, Photon Systems, Inc. (United States); Rohit Bhartia, Jet Propulsion Lab. (United States); Ray D. Reid, Photon Systems, Inc. (United States); Arthur L. Lane, Jet Propulsion Lab. (United States) . . . . . [7304-36]

4:50 pm: **Ultraviolet degradation study of photomultiplier tubes at SURF III**, Lindsay Hum, Naval Surface Warfare Ctr. Corona Div. (United States); Ping-Shine Shaw, Zhigang Li, Keith R. Lykke, National Institute of Standards and Technology (United States) . . . . . [7304-37]

5:10 pm: **Integrated amplification and passivation nanolayers for ultra-high-sensitivity photodetector arrays: application for LIBS and Raman spectroscopy**, Jie Yao, B&W Tek, Inc. (United States); Patrick J. Gardner, Western Carolina Univ. (United States) . . . . . [7304-38]

5:30 pm: **Hand-held chemical identification using Fourier transform infrared spectroscopy**, Chris Brown, Ahura Scientific, Inc. (United States) . . . . . [7304-39]

Thursday 16 April

SESSION 8

Room: Grand 7A . . . . . Thurs. 8:00 to 10:00 am

Explosives Sensing I

Session Chair: **Augustus Way Fountain III,**
U.S. Army Edgewood Chemical Biological Ctr.

8:00 am: **Optimal dynamic detection of explosives**, David S. Moore, Los Alamos National Lab. (United States); Herschel A. Rabitz, Princeton Univ. (United States) . . . . . [7304-40]

8:20 am: **Remote detection of explosives with multispectral imaging**, Harvey C. Schau, Meridian Systems LLC (United States) . . . . . [7304-41]

8:40 am: **Synthesis, characterization, and spectroscopic signatures of urea nitrate and nitrourea**, Stanley M. Caulder, John H. Wilkinson, Farhad Forohar, Christopher T. Konek, Naval Surface Warfare Ctr. (United States) . . . . . [7304-42]

9:00 am: **High-speed midwave infrared hyperspectral imaging using Fourier-transform spectrometer technology for characterization of rapid combustion events**, Kevin C. Gross, Air Force Institute of Technology (United States); Vincent Farley, Jean-Philippe Gagnon, Philippe Lagueux, Telops (Canada); Glen P. Perram, Air Force Institute of Technology (United States); Martin Chamberland, Telops (Canada) . . . . . [7304-43]

9:20 am: **Remote sensing of explosives-contaminated surfaces**, John D. Bruno, Maxion Technologies, Inc. (United States) . . . . . [7304-44]

9:40 am: **Standoff detection of trace explosives by infrared photo-thermal imaging**, Christopher A. Kendziora, Naval Research Lab. (United States); Robert Furstenberg, Naval Research Lab. (United States) and National Research Council (United States); Michael R. Papantonakis, Stanley V. Stepnowski, Naval Research Lab. (United States); Matthew Rake, Jennifer L. Stepnowski, Nova Research, Inc. (United States); R. Andrew McGill, Naval Research Lab. (United States) . . . . . [7304-45]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 9

Room: Grand 7A . . . . . Thurs. 10:30 to 11:50 am

Explosives Sensing II

Session Chair: **Augustus Way Fountain III,**
U.S. Army Edgewood Chemical Biological Ctr.

10:30 am: **Optical detection of explosives: spectral signatures for the explosive bouquet**, Scott W. Reeve, William A. Burns, Tabetha Osborn, Sindhu Kaimal, Josh Green, Jason L. Causey, Arkansas State Univ. (United States) . . . . . [7304-46]

10:50 am: **Smart dust infrared sensors for standoff explosives detection**, Alexey E. Kovalev, Matthew G. Bray, Theresa S. Mayer, Douglas H. Werner, The Pennsylvania State Univ. (United States) . . . . . [7304-47]

11:10 am: **Results of a UV TEPS-Raman energetic detection system (TREDS) for standoff detection**, Robert D. Waterbury, Edwin L. Dottery, Alan Ford, Jeremy D. Rose, Alaka'i Consulting & Engineering, Inc. (United States) . [7304-48]

11:30 am: **Standoff detection of harardous materials using a novel dual-laser pulse technique: theory and experiments**, Alan Ford, Alaka'i Consulting & Engineering, Inc. (United States); Paul M. Pellegrino, Army Research Lab. (United States); Edwin L. Dottery, Jeremy D. Rose, Robert D. Waterbury, Alaka'i Consulting & Engineering, Inc. (United States) . . . . . [7304-49]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 10

Room: Grand 7A . . . . . Thurs. 1:20 to 3:00 pm

Explosives Sensing III

Session Chair: **Ken Yasuda,**
U.S. Army Night Vision & Electronic Sensors Directorate

1:20 pm: **Atmosphere issues in detection of explosives and organic residues**, Christopher G. Brown, Matthieu Baudelet, Candice Bridge, Matthew K. Fisher, Michael Sigman, Martin C. Richardson, College of Optics & Photonics, Univ. of Central Florida (United States); Paul J. Dagdigian, The Johns Hopkins Univ. (United States) . . . . . [7304-50]

1:40 pm: **HME powder detection using space sampling and electrochemical sensors**, Avi A. Cagan, Arizona State Univ. (United States); Joseph Wang, Karel Cizek, Univ. of California, San Diego (United States); Donglai Lu, Jeffrey LaBelle, Arizona State Univ. (United States) . . . . . [7304-51]

2:00 pm: **An hybrid sensing device for explosive detection**, Erica Forzani, Alvaro Diaz Aguilar, Mattheu Leright, Donglai Lu, Avi A. Cagan, Nongjian Tao, Arizona State Univ. (United States) . . . . . [7304-52]

2:20 pm: **Molecular signal as a signature for detection of energetic materials in filament-induced breakdown spectroscopy**, Matthieu Baudelet, Matthew Weidman, Matthew K. Fisher, Christopher G. Brown, Michael Sigman, Martin C. Richardson, College of Optics & Photonics, Univ. of Central Florida (United States); Paul J. Dagdigian, The Johns Hopkins Univ. (United States) . . . . . [7304-53]

2:40 pm: **Detection and classification of explosive compounds utilizing laser ion mobility spectrometry**, Andreas Langmeier, Wiebke Heep, Carola Oberhuettinger, Helmut Oberpriller, Matthias Kessler, Johann Goebel, Gerhard Müller, EADS Deutschland GmbH (Germany) . . . . . [7304-54]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 11

Room: Grand 7A . . . . . Thurs. 3:30 to 5:50 pm

Radiological and Nuclear Sensing

Session Chair: **Harold R. McHugh,**
U.S. Dept. of Energy, Special Technologies Lab.

3:30 pm: **Current trends in radiation and nuclear sensing**, Harold R. McHugh, U.S. Dept. of Energy (United States); William M. Quam, National Security Technologies, LLC (United States) . . . . . [7304-55]

3:50 pm: **Current status of AWE investigations into stand-off detection of special nuclear material**, John O'Malley, Atomic Weapons Establishment (United Kingdom) . . . . . [7304-56]

4:10 pm: **MCNPX simulations to support the development of active interrogation techniques for the detection of SNM**, Mark C. Owen, Gemma Weston, Amandeep Thandi, Atomic Weapons Establishment (United Kingdom) . . . . . [7304-58]

4:30 pm: **Secure facilities for nuclear warheads**, Ashraf El Sayed Mohamed, Brno Univ. of Technology (Egypt) . . . . . [7304-59]

4:50 pm: **Novel scintillators based on metal organic frameworks**, F. Patrick Doty, Ronald J. T. Houk, R. K. Bhakta, Ida M. B. Nielsen, Gyorgy Vizkelethy, Mark D. Allendorf, Sandia National Labs. (United States) . . . . . [7304-60]

5:10 pm: **Lead-iodide-based nanoscintillators for detection of ionizing radiation**, Nathan J. Withers, Brian A. Akins, Antonio C. Rivera, John B. Plumley, Gennady A. Smolyakov, Marek Osinski, The Univ. of New Mexico (United States) . . . . . [7304-61]

5:30 pm: **Gamma-ray detection by optical visualization of secondary electron clouds,** Ranjit D. Pradhan, Michael Gertsenshteyn, Yunping Yang, Victor Grubsky, Wondwosen Mengesha, Volodymyr Romanov, Igor Mariyenko, Gennady Medvedkin, Physical Optics Corp. (United States); Ihor Berezhnyy, Science and Engineering Services, Inc. (United States); Tomasz P. Jannson, Physical Optics Corp. (United States) . . . . . [7304-63]

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

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.; **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.; **Pradeep K. Khosla,** Carnegie Mellon Univ.; **Michael A. Kolodny,** Army Research Lab.; **Paul F. Morgan,** U.S. Special Operations Command; **Tien Pham,** Army Research Lab.; **Dennis J. Reimer,** National Memorial Institute for the Prevention of Terrorism; **Glenn T. Shwaery,** Univ. of New Hampshire; **Nino Srour,** Army Research Lab.

Wednesday 15 April

SESSION 1

Room: Grand 5 . . . . . Wed. 8:30 to 9:10 am

Keynote Session

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

8:30 am: **Cyber Security: challenges and opportunities** *(Keynote Presentation)*, Pradeep K. Khosla, Carnegie Mellon Univ. (United States) . . . . . [7305-01]

SESSION 2

Room: Grand 5 . . . . . Wed. 9:10 to 10:30 am

Infrastructure Protection and Cyber Security

Session Chairs: **Pradeep K. Khosla,** Carnegie Mellon Univ.; **Edward M. Carapezza,** Univ. of Connecticut and DARPA

9:10 am: **Risk management communication system between a local government and residents using several network systems and terminal devices**, Takashi Ohyama, Hiroyuki Enomoto, Yuichiro Takei, Yuji Maeda, Nippon Telegraph and Telephone Corp. (Japan) . . . . . [7305-02]

9:30 am: **Tracking illegal small-arms traffic across U.S. borders through the implementation of firearm microstamping to small arms and small arms exports**, Todd E. Lizotte, Orest P. Ohar, Hitachi Via Mechanics (USA), Inc. (United States) . . . . . [7305-03]

9:50 am: **Design of real-time multipoint temperature monitoring based on FBG array in electric power system**, Zhiwei Zeng, Hongbin Huang, Shun'er Chen, Weiping Liu, Yang Ran, Jinan Univ. (China) . . . . . [7305-04]

10:10 am: **Firearm microstamping technology: a tool for counterinsurgency intelligence gathering**, Todd E. Lizotte, Orest P. Ohar, Hitachi Via Mechanics (USA), Inc. (United States) . . . . . [7305-05]

Coffee Break . . . . . 10:30 to 11:00 am

SESSION 3

Room: Grand 5 . . . . . Wed. 11:00 am to 12:00 pm

Autonomous Air, Underwater, and Ground Vehicles

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

11:00 am: **Heuristic reduction of gyro drift in gyro-based vehicle tracking**, Johann Borenstein, Lauro V. Ojeda, Univ. of Michigan (United States) . . [7305-06]

11:20 am: **UXO detection, characterization using cognitive robotic systems**, Amir H. Shirkhodaie, Saed Amer, Tennessee State Univ. (United States) . . . . . [7305-07]

11:40 am: **C2SM: a mobile system for detecting and 3D mapping of chemical, radiological, and nuclear contamination**, Piotr Jasiobedzki, Ho-Kong Ng, Michel Bondy, MacDonald, Dettwiler and Associates Ltd. (Canada); Carl H. McDiarmid, Royal Canadian Mounted Police (Canada) . . . . . [7305-08]

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

SESSION 4

Room: Grand 5 . . . . . Wed. 1:30 to 3:10 pm

Security and Surveillance Systems I

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

1:30 pm: **Distributed sensor concepts for perimeter surveillance and vehicle classification**, Tamara Rogers, Tennessee State Univ. (United States); Atindra K. Mitra, Air Force Research Lab. (United States); Fred Johnson, Tennessee State Univ. (United States); Chico Foxx, North Carolina A&T State Univ. (United States); Sean Young, LaMar Westbrook, Air Force Research Lab. (United States); Tony Marrs, VIASPACE Security, Inc. (United States); Thomas L. Lewis, Air Force Research Lab. (United States); M. Saleh Zein-Sabatto, Amir H. Shirkhodaie, Fenghui Yao, Mohan Malkani, Tennessee State Univ. (United States); James D. Leonard, Jr., Cheutaunia Johnson, Air Force Research Lab. (United States) . . . . . [7305-09]

1:50 pm: **Application of heterogeneous multiple camera system with panoramic capabilities in a harbor environment**, Henk A. Lensen, Piet B. W. Schwering, Sebastiaan P. van den Broek, Dirk-Jan J. de Lange, Rob A. W. Kemp, TNO Defense, Security and Safety (Netherlands) . . . . [7305-10]

2:10 pm: **Helicopter acoustic alerting system for high-security facilities**, Robert L. Steadman, Scott Hansen, Chris Park, Dennis Power, Textron Systems Corp. (United States) . . . . . [7305-11]

2:30 pm: **Real-time 360° imaging system for situational awareness**, Michael K. Rose, Jesse D. Chamberlain, Daniel L. LaValley, Kollmorgen Electro-Optical (United States) . . . . . [7305-12]

2:50 pm: **Multi-phenomenological sensors and networks for coastal surveillance**, Edward M. Carapezza, Univ. of Connecticut and DARPA (United States) . . . . . [7305-13]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 5

Room: Grand 5 . . . . . Wed. 3:40 to 6:00 pm

Security and Surveillance Systems II

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

3:40 pm: **Wide-area optical target detection**, Geoffrey M. Miller, PVP Advanced EO Systems, Inc. (United States) . . . . . [7305-14]

4:00 pm: **SMARTracIn: a concept for spoof resistant tracking of vessels and detection of adverse intentions**, Sten F. Andler, Univ. of Skövde (Sweden); Mikael Fredlin, Saab Microwave Systems AB (Sweden); Per M. Gustavsson, George Mason Univ. (United States); Joeri van Laere, Univ. of Skövde (Sweden); Pontus Svenson, Swedish Defence Research Agency (Sweden) . . . . . [7305-15]

4:20 pm: **Extended range surveillance in visible light**, Jim Lougheed, David Green, General Dynamics Canada Ltd. (Canada) . . . . . [7305-16]

4:40 pm: **People and vehicle tracking using low-cost sensors**, Thomas J. Plummer, Anson Kennedy, McQ, Inc. (United States). . . . . [7305-17]

5:00 pm: **Multitarget tracking in complex visual environment**, Yafeng Yin, Hong Man, Haibo He, Stevens Institute of Technology (United States); Sachi V. Desai, U.S. Army Research, Development and Engineering Command (United States). . . . . [7305-18]

5:20 pm: **Presistant ocean surveillance (POS) technologies for homeland security applications**, Linda J. Frizzell-Makowski, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7305-19]

5:40 pm: **Rapidly deployable ASV system for coastal monitoring**, David C. Sparks, SeaLandAire Technologies, Inc. (United States). . . . . [7305-20]

Thursday 16 April

SESSION 6

Room: Grand 5 . . . . . Thurs. 8:30 to 11:40 am

Unattended Sensors and Sensor Networks

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

Session with 7333-Unattended Ground, Sea, and Air Sensor Technologies and Applications XI.

8:30 am: **Status of UGS technology on U.S. Borders**, John H. McQuiddy, McQ, Inc. (United States) . . . . . [7305-21]

8:50 am: **Binary sensor system in homeland security and military applications**, Tomasz P. Jannson, Thomas C. Forrester, Kang S. Lee, Eric Gans, Victor Grubsky, Edward Patton, Kevin Walter, Physical Optics Corp. (United States). . . . . [7305-22]

9:10 am: **System-on-chip-centric unattended embedded sensors in homeland security and defense applications**, Tomasz P. Jannson, Thomas C. Forrester, Kevin Degrood, Kevin Walter, Physical Optics Corp. (United States). . . . . [7305-23]

9:30 am: **Expanding the role of unattended ground sensor to multitiered systems**, David R. Garrison II, Paul E. Voglewede, David Garigen, Harris Corp. (United States). . . . . [7305-24]

9:50 am: **Classifying humans of interest utilizing active ultrasonic transducer**, Shafik A. Quoraishee, Sachi V. Desai, U.S. Army Research, Development and Engineering Command (United States); Amir Morcos, U.S. Army Armament Research, Development and Engineering Ctr. (United States) . . . . . [7305-25]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **Power-resource management and low-power remote wireless RF electronics**, Tomasz P. Jannson, Thomas C. Forrester, Kevin Degrood, Robert Kremer, Kang S. Lee, Eric Gans, Kevin Walter, Physical Optics Corp. (United States). . . . . [7305-26]

11:00 am: **Acoustic threatening sound detection and recognition system**, Hongmei Deng, Kun Sun, Roger Xu, Intelligent Automation, Inc. (United States). . . . . [7305-27]

11:20 am: **Novel radar-based unattended ground sensor (UGS) for DHS border monitoring applications**, , ... [7305-28]

Lunch/Exhibition Break . . . . . 11:40 am to 1:00 pm

SESSION 7

Room: Grand 5 . . . . . Thurs. 1:00 to 3:00 pm

Command, Control, Communications, and Intelligence (C3I)

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

Joint Session with 7333-Unattended Ground, Sea, and Air Sensor Technologies and Applications XI.

1:00 pm: **Modeling of decision-making for Navy Command and Control System through extended mark flow graph and fuzzy logic**, Roger I. Valencia Reyes, Servicios Industriales de la Marina S.A. (Peru) and Univ. de Sao Paulo (Brazil); Paulo E. Miyagi, Escola Politecnica da Univ. de Sao Paulo (Brazil); Alvaro Talavera Lopez, Pontifícia Univ. Católica do Rio de Janeiro (Brazil) . . . . . [7305-29]

1:20 pm: **Assured communications and combat resiliency: the relationship between effective national communications and combat efficiency**, Glenn O. Allgood, Teja Kuruganti, James Nutaro, Oak Ridge National Lab. (United States); Jay Saffold, Research Network Inc. (United States) . . . . [7305-30]

1:40 pm: **An extreme-events laboratory to provide network-centric collaborative situation assessment and decision making**, Brian J. Panulla, Loretta D. More, Wade R. Shumaker, Michael D. Jones, Robert Hooper, Jeffrey M. Vernon, Stanley G. Aungst, The Pennsylvania State Univ. (United States). . . . . [7305-31]

2:00 pm: **Dynamically relayed wireless networks for disaster response**, Wenxuan Guo, Xinming Huang, Worcester Polytechnic Institute (United States). . . . . [7305-32]

2:20 pm: **A Department of Homeland Security program for countering explosives attacks at large public events and mass transit facilities**, Christa K. Knudson, Pacific Northwest National Lab. (United States); Michael C. Kemp, Iconal Technology Ltd. (United Kingdom); Nicholas J. Lombardo, Pacific Northwest National Lab. (United States) . [7305-33]

2:40 pm: **Content-addressable environments for public safety**, Scott A. Valcourt, Pushpa Datla, Univ. of New Hampshire (United States). . . . . [7305-34]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 8

Room: Grand 5 . . . . . Thurs. 3:30 to 5:30 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

Joint Session with 7333-Unattended Ground, Sea, and Air Sensor Technologies and Applications XI.

3:30 pm: **Weapon identification using hierarchical classification of acoustic signatures**, Saad M. Khan, Ajay Divakaran, Harpreet S. Sawhney, Sarnoff Corp. (United States). . . . . [7305-35]

3:50 pm: **Bayesian detection of acoustic muzzle blasts**, Kenneth D. Morton, Leslie M. Collins, Duke Univ. (United States) . . . . . [7305-36]

4:10 pm: **Field-based gunfire location systems**, Charles A. Uzes, Marine Physics & Technology Co. (United States) and Douglas Machines, Inc. (United States). . . . . [7305-37]

4:30 pm: **Back-end algorithms that enhance the functionality of a biomimetic acoustic gunfire direction-finding system**, Yirong Pu, Sarah Kelsall, Allyn E. Hubbard, Boston Univ. (United States) . . . . . [7305-38]

4:50 pm: **Detection and classification of objects using acoustic excitations**, Pawan Setlur, Moeness G. Amin, Villanova Univ. (United States); Abdelhak Zoubir, Technische Univ. Darmstadt (Germany) . . . . . [7305-39]

5:10 pm: **Efficient algorithms for the dynamic resource allocation problem of counter-RAM systems**, Markus Graswald, Hendrik Rothe, Helmut-Schmidt Univ. (Germany) . . . . . [7305-40]

Friday 17 April

SESSION 9

Room: Grand 5 . . . . . Fri. 8:20 to 9:30 am

Container Inspection and Through-the-Wall Sensor Systems

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

8:20 am: **An adaptive background estimation technique for enhancing target detection in through-the-wall-radar imaging applications** *(Invited Paper)*, Habib Estephan, Moeness G. Amin, Villanova Univ. (United States) . . . . [7305-41]

8:50 am: **Active millimeter-wave all-electronic through-wall imager**, Wilson A. Caba, College of Optics & Photonics, Univ. of Central Florida (United States); David Muh, Daniel Dillery, Northrop Grumman Information Technology (United States); Guy Zummo, Glenn D. Boreman, College of Optics & Photonics, Univ. of Central Florida (United States) . . . . . [7305-42]

9:10 am: **Aviation security cargo inspection queuing simulation model for material flow and accountability**, Glenn O. Allgood, Mohammed O. Husseini, Terri A. Rose, Oak Ridge National Lab. (United States) . . . . . [7305-43]

SESSION 10

Room: Grand 5 . . . . . Fri. 9:30 to 10:10 am

Laser and Radar Systems

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

9:30 am: **42.8 Gb/s ASK Homodyne receiver using standard DFB lasers**, Donald A. Becker, Daniel Mohr, Shubhashish Datta, Christoph Wree, Suhas Bhandare, Abhay M. Joshi, Discovery Semiconductors, Inc. (United States) . . . . . [7305-44]

9:50 am: **High-resolution over-the-horizon radars using time reversal**, Eung G. Paek, Joon Y. Choe, Naval Research Lab. (United States). . . . . [7305-45]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 11

Room: Grand 5 . . . . . Fri. 10:40 am to 12:00 pm

Novel Technologies for Homeland Defense and Security

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

10:40 am: **Speech endpoint detection with non-language speech sounds for generic speech processing applications**, Matthew R. McClain, Brian Romanowski, 21st Century Technologies, Inc. (United States). . . . [7305-46]

11:00 am: **An enhanced transform domain communication system (ETDCS) with narrow-band interference (NBI) avoidance capability**, Dapeng O. Wu, Univ. of Florida (United States) . . . . . [7305-47]

11:20 am: **Modulation classification-based compressed sensing for communication signals**, Qin Jiang, Roy M. Matic, HRL Labs., LLC (United States) . . . . . [7305-48]

11:40 am: **A novel 3-DOF cable-driven wind tunnel mechanism and its position analysis**, Yu Yao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . . . [7305-49]

Tuesday-Thursday 14-16 April 2009 • Part of Proceedings of SPIE Vol. 7306

Optics and Photonics in Global Homeland Security V

Conference Chairs: **Craig S. Halvorson,** Lawrence Livermore National Lab.; **Šárka O. Southern,** Gaia Medical Institute

Program Committee: **Cindy Bruckner-Lea,** Pacific Northwest National Lab.; **Daniel A. Capostagno,** Consultant; **Anthony F. Colucci,** GE Global Research; **Michael J. DeWeert,** BAE Systems; **Konrad Faulstich,** ESE GmbH (Germany); **Refael Gatt,** Global Security Devices (Israel); **Jeffrey S. Gordon,** GE Global Research; **Peter Kiesel,** Palo Alto Research Ctr., Inc.; **Lisa Brown,** Western Washington Univ.; **Dan J. Kroll,** Hach Co., Inc.; **Han Q. Le,** Univ. of Houston; **Daniel Lehrfeld,** ; **Igor L. Medintz,** Naval Research Lab.; **Chung-Hye Read,** National Geospatial-Intelligence Agency; **Steven A. Ripp,** The Univ. of Tennessee; **Theodore T. Saito,** Lawrence Livermore National Lab.; **Kim E. Sapsford,** U.S. Food and Drug Administration; **Gary M. Shiffman,** L-3 Communications Global Security & Engineering Solutions; **Ashok K. Sood,** Magnolia Optical Technologies, Inc.

Tuesday 14 April

SESSION 1

Room: Crystal G1 . . . . . .Tues. 8:10 to 8:30 am

Government Initatives in Homeland Security

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

8:10 am: **Homeland Security R&D budgets**, Craig S. Halvorson, Lawrence Livermore National Lab. (United States) . . . . . [7306A-01]

SESSION 2

Room: Crystal G1 . . . . . .Tues. 8:30 to 8:50 am

Global Health Security I

Session Chair: **Šárka O. Southern,** Gaia Medical Institute

8:30 am: **Wind-field measurements for the mitigation of airborne health threats in a complex urban environment,** Mark F. Arend, David Santoro, Sameh Abdelazim, Fred Moshary, Samir A. Ahmed, City College/CUNY (United States). . . . . [7306A-02]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 3

Room: Crystal G1 . . . . . Tues. 10:40 am to 12:10 pm

Global Health Security II

Session Chair: **Šárka O. Southern,** Gaia Medical Institute

10:40 am: **Optical biosensors and a perspective on the future** *(Invited Paper)*, Frances S. Ligler, Naval Research Lab. (United States) . . . . . [7306A-03]

11:10 am: **Science and technology objectives in military healthcare: the ONR perspective**, Igor Vodyanoy, Office of Naval Research (United States). [7306A-04]

11:30 am: **Technology challenges of forward-deployed military clinical laboratories**, Todd A. Ritter, Idaho Technology Inc. (United States) . . . [7306A-05]

11:50 am: **A systems-level approach to developing biological and chemical sensor requirements**, Nerayo Teclemariam, Nathaniel J. Gleason, Todd H. West, Donna M. Edwards, Ann Yoshimura, Liston Purvis, Greg Foltz, Sandia National Labs. (United States). . . . . [7306A-06]

Lunch/Exhibition Break . . . . . 12:10 to 1:20 pm

SESSION 4

Room: Crystal G1 . . . . . .Tues. 1:20 to 4:50 pm

Global Health Security III

Session Chair: **Šárka O. Southern,** Gaia Medical Institute

1:20 pm: **Salivary diagnostics: a new solution for an old problem, breast cancer detection**, Charles F. Streckfus, Univ. of Texas Dental Branch at Houston (United States). . . . . [7306A-07]

1:40 pm: **Non-invasive biological monitoring using exhaled breath or saliva analysis**, Karla D. Thrall, Charles A. Timchalk, Yuehe Lin, Pacific Northwest National Lab. (United States). . . . . [7306A-08]

2:00 pm: **Molecular sensing of physiological stress: new technology for early detection of health threats**, Šárka O. Southern, Gaia Medical Institute (United States). . . . . [7306A-09]

2:20 pm: **Saliva-based system for health and toxicology monitoring**, David B. Fenner, Amy E. Stevens, David I. Rosen, Anthony A. Ferrante, Steven J. Davis, Physical Sciences Inc. (United States) . . . . . [7306A-10]

2:40 pm: **Broad-spectrum identification and discrimination between biothreat agents and near-neighbor species**, Baochuan Lin, Anthony Malanoski, Naval Research Lab. (United States); Tomasz A. Leski, Nina C. Long, Carolyn E. Meador, Nova Research, Inc. (United States); Zheng Wang, Brian Barrows, David A. Stenger, Naval Research Lab. (United States); Sofi Ibrahim, U.S. Army Medical Research Institute of Infectious Diseases (United States). . . . . [7306A-12]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Biophotonic imaging: lighting the way for chem/bio detection**, Steven A. Ripp, The Univ. of Tennessee (United States) . . . . . [7306A-13]

3:50 pm: **Porphyrin-embedded organosilicas for detection and decontamination**, Brandy J. Johnson, Brian J. Melde, Paul T. Charles, Anthony P. Malanoski, Michael A. Dinderman, Naval Research Lab. (United States). . . . . [7306A-14]

4:10 pm: **Supramolecular analytical chemistry: a new tool for fingerprinting complex analytes in real-life settings**, Chance Rainwater, Eric V. Anslyn, The Univ. of Texas at Austin (United States) . . . . . [7306A-15]

4:30 pm: **New biosensors for food safety screening solutions**, Maureen A. Dyer, Jennifer A. Oberholtzer, David C. Mulligan, William P. Hanson, Hanson Technologies, Inc. (United States). . . . . [7306A-17]

Wednesday 15 April

SESSION 5

Room: Crystal G1 . . . . . Wed. 8:00 to 11:30 am

Global Health Security IV

Session Chair: **Šárka O. Southern,** Gaia Medical Institute

8:00 am: **Handheld and portable test systems for immunodiagnostics and nucleic acid detection**, Konrad Faulstich, Klaus Haberstroh, Roman Gruler, Michael Eberhard, Thomas Wiest, Dirk Lentzsch, ESE GmbH (Germany) . . . . . [7306A-18]

8:20 am: **Bead-based assays for biodetection: from flow-cytometry to microfluidics**, Richard M. Ozanich, Kate Antolick, Cindy Bruckner-Lea, Kyle J. Bunch, Brian Dockendorff, Jay W. Grate, Cynthia Warner, Marvin G. Warner, Pacific Northwest National Lab. (United States) . . . . [7306A-19]

8:40 am: **Portable, instantaneous, and ultrasensitive detection of micro-organisms based on interferometry and lab-on-a-chip nanotechnology**, Aurel Ymeti, Ostendum (Netherlands) . . . . . [7306A-20]

9:00 am: **Piezo-optical point-of-care immunoassay**, Steve A. Ross, Vivacta Ltd. (United Kingdom) . . . . . [7306A-21]

9:20 am: **TIRF-EC technology for rapid and accurate diagnostics and discovery of synthetic receptors**, Alexander N. Asanov, Tirf Technologies Inc. (United States) . . . . . [7306A-22]

9:40 am: **eSensor®: an electrochemical detection-based DNA microarray technology enabling sample-to-answer molecular diagnostics**, Robin H. Liu, Osmetech Molecular Diagnostics (United States) . . . . . [7306A-23]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **The filmarray: state-of-the-art pathogen detection and identification**, Todd A. Ritter, Idaho Technology Inc. (United States) . . [7306A-24]

10:50 am: **=Utility of monitoring insulin-like growth factor-I during military operational stress: measurement, military relevance, and future directions**, Bradley C. Nindl, U.S. Army Research Institute of Environmental Medicine (United States) . . . . . [7306A-26]

11:10 am: **LTCC microfluidic devices for microelectrochemical detection in picoliter volumes**, Zoraida P. Aguilar, Ocean Nanotech LLC (United States); Prabhu Arumugam, Vegrandis (United States); Ingrid Fritsch, Univ. of Arkansas (United States) . . . . . [7306A-27]

Lunch/Exhibition Break . . . . . 11:30 am to 1:00 pm

SESSION 6

Room: Crystal G1 . . . . . Wed. 1:00 to 3:10 pm

Protecting Air Transportation from Missiles

Session Chair: **Daniel Lehrfeld,** Photonic Products Group, Inc.

1:00 pm: **DHS Counter-MANPADS Programs** *(Invited Paper, Presentation Only)*, Kerry D. Wilson, U.S. Dept. of Homeland Security (United States) . . . . [7306A-28]

1:30 pm: **Northrop Grumman Guardian™ pod commercial program results**, David Denton, Northrop Grumman Electronic Systems (United States) . . . . . [7306A-29]

1:50 pm: **JETEYE in flight** *(Presentation Only)*, Laurie Nuzzo, BAE Systems (United States) . . . . . [7306A-30]

2:10 pm: **Project Chloe: evaluation of an innovative approach to commercial aircraft protection, concept and demonstration** *(Presentation Only)*, David Denton, Northrop Grumman Electronic Systems (United States) . [7306A-31]

2:30 pm: **Recent progress on the Raytheon Vigilent Eagle Counter-MANPADS system** *(Presentation Only)*, Jeffrey L. Vollin, Raytheon Missile Systems (United States) . . . . . [7306A-32]

2:50 pm: **Test and evaluation of a next-generation laser pointer/tracker for IRCM**, Stuart N. Chapman, SELEX GALILEO (United Kingdom) . . . . . [7306A-33]

Coffee Break . . . . . 3:10 to 3:30 pm

SESSION 7

Room: Crystal G1 . . . . . Wed. 3:30 to 6:40 pm

Explosives Detection

Session Chair: **Refael Gatt,** Global Security Devices (Israel)

3:30 pm: **Trace explosives detection: an overciew from R&D to T&E** *(Invited Paper)*, Richard T. Lareau, U.S. Dept. of Homeland Security (United States) . . . . . [7306A-69]

4:00 pm: **The importance of operational testing on explosive detection systems**, Tom Jensen, National Safe Skies Alliance (United States) . . . [7306A-35]

4:20 pm: **Detection of liquid and homemade explosives**, Michael P. Ellenbogen, Richard R. Bijjani, Reveal Imaging Technologies, Inc. (United States) . . . . . [7306A-36]

4:40 pm: **Stand-off detection of organic samples using filament-induced breakdown spectroscopy**, James Martin, Matthieu Baudelet, Matthew Weidman, Matthew K. Fisher, Candice Bridge, Christopher G. Brown, Michael Sigman, Martin C. Richardson, College of Optics & Photonics, Univ. of Central Florida (United States); Paul J. Dagdigian, The Johns Hopkins Univ. (United States) . . . . . [7306A-37]

5:00 pm: **Fiber Bragg grating-based harsh environmental sensing platform and its potential applications in industries, defense, and security**, Hua Xia, GE Global Research (United States) . . . . . [7306A-38]

5:20 pm: **Detection of security relevant substances within the cooperative project SAFE XUV**, Elisabeth Schramm, Helmholtz Zentrum München, GmbH (Germany); Thomas Heindl, Technische Univ. München (Germany); Jasper Hoelzer, Helmholtz Zentrum München, GmbH (Germany); Alexander McNeish, Smiths Heimann GmbH (Germany); Michael Puetz, Bundeskriminalamt (Germany); Hermann Ries, Patricia Schall, Smiths Heimann GmbH (Germany); Rasmus Schulte-Ladbeck, Bundeskriminalamt (Germany); Rainer H. Schultze, Optimare GmbH (Germany); Martin Sklorz, Univ. Rostock (Germany); Gerd Spieker, Coherent GmbH (Germany); Roman Trebbe, Bundeskriminalamt (Germany); Andreas Ulrich, Technische Univ. München (Germany); Jochen Wieser, Coherent GmbH (Germany); Ralf Zimmermann, Univ. Rostock (Germany) and Helmholtz Zentrum München, GmbH (Germany) . . . . . [7306A-39]

5:40 pm: **Integrating technology and biology: technologically enhancing the human element**, Joram Bobasch, ICTS Europe Holding B.V. (Germany) . . . . . [7306A-40]

6:00 pm: **The ethical dimension of terahertz and millimeter-wave imaging technologies: security, privacy, and acceptability**, Regina Ammicht Quinn, Benjamin Rampp, Tuebingen Univ. (Germany) . . . . . [7306A-42]

6:20 pm: **Automatic detection of concealed weapons and explosives**, Refael Gatt, Global Security Devices (United States) . . . . . [7306A-43]

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Thursday 16 April

SESSION 8

Room: Crystal G1 . . . . . Thurs. 8:00 to 9:50 am

Radiation Detection

Session Chair: **Jeffrey S. Gordon,** GE Global Research

8:00 am: **3D multispectral x-ray screening system**, Max Robinson, Kromek (United Kingdom). . . . . [7306A-44]

8:20 am: **GE intelligent personal radiation locator system**, Brian D. Yanoff, Yanfeng Du, Walter V. Dixon III, Naresh K. Rao, Wen Li, Jeffrey S. Gordon, GE Global Research (United States) . . . . . [7306A-45]

8:40 am: **Lanthanide-halide-based nanoscintillators for portable radiological detectors** *(Invited Paper)*, Marek Osinski, Krishnaprasad Sankar, Nathan J. Withers, John B. Plumley, Antonio C. Rivera, Brian A. Akins, Gennady A. Smolyakov, The Univ. of New Mexico (United States) . . . . [7306A-46]

9:10 am: **Recent developments in optical fibers and how defense, security, and sensing can benefit**, Elise Regnier, Ekaterina Burov, Alain Pastouret, Draka Comteq France (France); Gerard Kuyt, Frans Gooijer, Draka Comteq Fibre B.V. (Netherlands); Aurelien Bergonzo, Draka Comteq France (France); Arnie Berkers, Draka Comteq Fibre B.V. (Netherlands); Philippe Signoret, Laurent Trousellier, Univ. Montpellier II (France); Olaf L. Storaasli, Draka Communications Optical Fiber (United States); Pascale Nouchi, Draka Comteq France (France) . . . . . [7306A-47]

9:30 am: **Detector considerations relevant to x-ray diffraction imaging for security screening applications**, Geoffrey Harding, GE Global Research (Germany); Helmut Strecker, Philips Research (Germany); Jeffrey S. Gordon, GE Global Research (United States) . . . . . [7306A-48]

Coffee Break . . . . . 9:50 to 10:20 am

SESSION 9

Room: Crystal G1 . . . . . Thurs. 10:20 am to 12:00 pm

Water Security

10:20 am: **Morphotypic analysis and classification of bacteria and bacterial colonies using laser light-scattering, pattern recognition, and machine-learning system**, Bartek Rajwa, Bulent Bayraktar, Valery Patsekin, Murugesan Venkatapathi, Padmapriya P. Banada, Euiwon Bae, Karleigh Huff, E. Daniel Hirleman, Jr., Arun K. Bhunia, J. Paul Robinson, Purdue Univ. (United States) . . . . . [7306A-49]

10:40 am: **Morphological characterization of waterborne pathogens**, Venkat V. Devarakonda, Sivakumar Manickavasagam, BlazeTech Corp. (United States) . . . . . [7306A-50]

11:00 am: **DNA enzyme-based detection of metals in water**, David G. Kellner, Yi Lu, DzymeTech, Inc. (United States) . . . . . [7306A-51]

11:20 am: **Prediction of contaminant fate and transport in potable water systems using H_2OFate**, Venkat V. Devarakonda, Sivakumar Manickavasagam, BlazeTech Corp. (United States); Vicki VanBlaricum, Mark D. Ginsberg, U.S. Army Corps of Engineers (United States) . . . . . [7306A-52]

11:40 am: **Water security**, Dan J. Kroll, Hach Co., Inc. (United States) [7306A-53]

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

SESSION 10

Room: Crystal G1 . . . . . Thurs. 1:00 to 2:30 pm

Border Technology

Session Chairs: **Han Q. Le,** Univ. of Houston; **Gary M. Shiffman,** L-3 Communications Global Security & Engineering Solutions

1:00 pm: **Borders, immigration, and maritime security: an update on the Centers of Excellence** *(Invited Paper)*, Jeanne Lin, U.S. Dept. of Homeland Security (United States) . . . . . [7306A-54]

1:30 pm: **Advances in IR thermal imaging for border defense**, John W. Devitt, L-3 Communications Cincinnati Electronics (United States) . . . . . [7306A-55]

1:50 pm: **Heuristic reduction of gyro drift in IMU-based personnel tracking systems**, Johann Borenstein, Lauro V. Ojeda, Surat Kwanmuang, Univ. of Michigan (United States) . . . . . [7306A-56]

2:10 pm: **Markov chain rank fusion for multibiometric authentication**, MD. Maruf Monwar, Univ. of Calgary (Canada) . . . . . [7306A-57]

SESSION 11

Room: Crystal G1 . . . . . Thurs. 2:30 to 6:10 pm

Maritime Security Technologies

Session Chairs: **Michael J. DeWeert,** BAE Systems; **Chung-Hye Read,** National Geospatial-Intelligence Agency

2:30 pm: **Comprehensive maritime awareness joint capabilities technology demonstration**, Christopher Dwyer, Naval Research Lab. (United States) . . . . . [7306A-58]

2:50 pm: **Inspecting the inside of underwater hull**, Vladivoj Valkovic, Davorin Sudac, Institut Ruder Boškovic (Croatia); Dario Matika, Institute for Researches and Development of Defense Systems (Croatia). . . . . [7306A-59]

Coffee Break . . . . . 3:10 to 3:30 pm

3:30 pm: **Environmental security of the port and harbors-sediments**, Jasmina Obhodas, Institute Ruder Boskovic (Croatia); Vladivoj Valkovic, A.C.T. (Croatia); Dario Matika, Institute for Researches and Development of Defense Systems (Croatia) . . . . . [7306A-60]

3:50 pm: **User-defined operational picture for public private information in maritime missions**, Per M. Gustavsson, Saab Microwave Systems AB (Sweden); Mikael Edqvist, Anna Isacson, Nils Kjellgren, Finn Wallman, 4C Strategies AB (Sweden); Johan Ölander, Saab Training Systems AB (Sweden) . . . . . [7306A-61]

4:10 pm: **Automated intelligent video surveillance system for ships**, Hai Wei, Hieu T. Nguyen, Prakash Ramu, Chaitanya Raju, Xiaoqing Liu, Jacob Yadegar, UtopiaCompression Corp. (United States) . . . . . [7306A-62]

4:30 pm: **Automated passive acoustic underwater intruder detection**, Barry Bunin II, Alexander Sedunov, Laurent Fillinger, Alexander M. Sutin, Stevens Institute of Technology (United States) . . . . . [7306A-63]

4:50 pm: **Passive acoustic tracking and classification of vessels in the Hudson River estuary**, Alexander M. Sutin, Heui-Seol Roh, Stevens Institute of Technology (United States); Vladimir Zhdanov, Consultant (United States); Barry Bunin II, Stevens Institute of Technology (United States) . . . . . [7306A-64]

5:10 pm: **Hybrid lidar radar receiver for underwater imaging applications**, Madhavi Seetamraju, Rajan S. Gurjar, Michael R. Squillante, Radiation Monitoring Devices, Inc. (United States); Jeffery P. Derderian, Dipole Engineering, Inc. (United States) . . . . . [7306A-65]

5:30 pm: **A multisensor approach for monitoring river chemical tank barge emissions**, David J. Williams, Eben D. Thoma, U.S. Environmental Protection Agency (United States) . . . . . [7306A-66]

5:50 pm: **Automatic target detection in side-scan sonar data,** Rebecca T. Quintal, John S. Byrne, Paul S. Dysart, SAIC (United States) . . . . . [7306A-67]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

Ultrasonically levitated drops as microreactors for universal portable analysis, Mark D. Ginsberg, U.S. Army Corps of Engineers (United States); Alexander Scheeline, Zakiah Pierre, Chris R. Field, Univ. of Illinois at Urbana-Champaign (United States) . . . . . [7306A-68]

Optical-microfluidics for disease diagnosis, Jeong-Yeol Yoon, Brian C. Heinze, The Univ. of Arizona (United States) . . . . . [7306A-16]

Monday 13 April 2009 • Part of Proceedings of SPIE Vol. 7306

Biometric Technology for Human Identification VI

Monday 13 April

SESSION 12

Room: Grand 5 . . . . . Mon. 9:00 to 10:00 am

Face

9:00 am: **Image quality based adaptive illumination normalisation for face recognition**, Harin Sellahewa, Sabah A. Jassim, Univ. of Buckingham (United Kingdom). . . . . [7306B-69]

9:20 am: **Feature selection optimized by discrete particle swarm optimization for face recognition**, Yanjun Yan, Ganapathi Kamath, Lisa A. Osadciw, Syracuse Univ. (United States) . . . . . [7306B-70]

9:40 am: **Design and analysis of fuzzy extractors for faces**, Yagiz Sutcu, Polytechnic Institute of NYU (United States); Qiming Li, A*STAR Institute for Infocomm Research (Singapore); Nasir D. Memon, Polytechnic Institute of NYU (United States). . . . . [7306B-71]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 13

Room: Grand 5 . . . . . Mon. 10:30 to 11:15 am

Invited Session:

10:30 am: **Recent research results in iris biometrics** *(Invited Paper)*, Kevin W. Bowyer, Univ. of Notre Dame (United States) . . . . . [7306B-72]

SESSION 14

Room: Grand 5 . . . . . Mon. 11:15 am to 12:35 pm

Ear and Iris

11:15 am: **Ensemble training to improve 2D ear recognition**, Christopher Middendorff, Kevin W. Bowyer, Univ. of Notre Dame (United States). . . . . [7306B-73]

11:35 am: **Ear localization using hierarchical clustering**, Surya Prakash, Umarani Jayaraman, Phalguni Gupta, Indian Institute of Technology Kanpur (India). . . . . [7306B-74]

11:55 am: **Fast and robust probabilistic inference of iris mask**, Yunghui Li, Marios Savvides, Carnegie Mellon Univ. (United States) . . . . . [7306B-75]

12:15 pm: **Optical requirements with turbulence corrections for long-range biometrics**, Junoh Choi, Grant H. Soehnel, Brett E. Bagwell, Kevin R. Dixon, David V. Wick, Sandia National Labs. (United States) . . . . . [7306B-84]

Lunch Break . . . . . 12:35 to 1:45 pm

SESSION 15

Room: Grand 5 . . . . . Mon. 1:45 to 2:45 pm

Heart

1:45 pm: **Laser Doppler vibrometry measures of physiological function: evaluation of biometric capabilities**, Mei Chen, Joseph A. O'Sullivan, Washington Univ. in St. Louis (United States); Naveen Singla, Exegy Inc. (United States); Erik J. Sirevaag, John W. Rohrbaugh, Washington Univ. in St. Louis (United States). . . . . [7306B-76]

2:05 pm: **Laser Doppler vibrometry measurements of the carotid pulse: biometrics using hidden Markov models**, Alan D. Kaplan, Joseph A. O'Sullivan, Erik J. Sirevaag, John W. Rohrbaugh, Washington Univ. in St. Louis (United States). . . . . [7306B-77]

2:25 pm: **A model-based approach to human identification using ECG**, John M. Irvine, Mark Homer, Natasha Markuson, Suzanne Wendelken, Draper Labs. (United States) . . . . . [7306B-78]

SESSION 16

Room: Grand 5 . . . . . Mon. 2:45 to 3:30 pm

Invited Session

2:45 pm: **Recent advances in signature biometrics** *(Invited Paper)*, Javier Ortega-Garcia, Univ. Autónoma de Madrid (Spain) . . . . . [7306B-79]

Coffee Break . . . . . 3:30 to 4:00 pm

SESSION 17

Room: Grand 5 . . . . . Mon. 4:00 to 5:20 pm

Fingerprint, Gait, and Signature

4:00 pm: **Fingerprints scanner using digital interference holography**, Mariana C. Potcoava, Myung K. Kim, Univ. of South Florida (United States). . . . . [7306B-80]

4:20 pm: **Time-frequency classifiers for human gait recognition**, Bijan G. Mobasseri, Moeness G. Amin, Lyonnet Bastien, Villanova Univ. (United States). . . . . [7306B-81]

4:40 pm: **Synthetic generation of handwritten signatures based on spectral analysis**, Javier Galbally-Herrero, Julian Fierrez, Marcos Martinez-Diaz, Javier Ortega-Garcia, Univ. Autónoma de Madrid (Spain) . . . . . [7306B-82]

5:00 pm: **An efficient floating-point to fixed-point conversion process for biometric algorithm on DaVinci DSP architecture**, Ira Konvalinka, Azhar Quddus, Daniel Asraf, Bioscrypt Inc. (Canada). . . . . [7306B-83]

Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications VI

Conference Chair: **Daniel J. Henry,** Goodrich ISR Systems, Barrington

Thursday 16 April

SESSION 1

Room: Crystal C . . . . . Thurs. 8:30 to 11:40 am

2D and Multispectral/Hyperspectral Sensors

Session Chair: **Daniel J. Henry,** Goodrich ISR Systems

8:30 am: **Optical registration array for imaging polarimeters**, Dane J. Phillips, Greg A. Finney, Anne-Marie Dorsett, Digital Fusion Inc. (United States) . . . . . [7307-01]

8:50 am: **A 5.5 megapixel high-performance low-light military video camera**, Gerald B. Heim, Brian L. Biesterfeld, Jon M. Burkepile, Ball Aerospace & Technologies Corp. (United States); Wayne W. Frame, Consultant (United States); Joshua J. Harris, Jordan F. Shimonek, Phillips M. Smith, Minming Wu, Ball Aerospace & Technologies Corp. (United States) . . . . . [7307-02]

9:10 am: **Holographic convex grating hyperspectral imagers**, Yiqun Ji, Yuheng Chen, Quan Liu, Weimin Shen, Soochow Univ. (China) . . . . . [7307-03]

9:30 am: **Imaging and radiometric performance simulation for a new high-performance dual-band airborne reconnaissance camera**, Jinhee Yu, Dong-Ok Ryu, Yonsei Univ. (Korea, Republic of); Jee-Yeon Yoon, LIG Nex1 Co., Ltd. (Korea, Republic of); Sug-Whan Kim, Yonsei Univ. (Korea, Republic of); Jun-Ho Lee, Kongju National Univ. (Korea, Republic of); Myung-Jin Shin, LIG Nex1 Co., Ltd. (Korea, Republic of) . . . . . [7307-04]

9:50 am: **Monolithic InGaAs detector arrays for uncooled high-sensitivity SWIR sensing**, Peter E. Dixon, Navneet G. Masaun, Michael J. Evans, Marlon D. Enriquez, John A. Trezza, Martin H. Ettenberg, Goodrich Corp. (United States) . . . . . [7307-05]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **Profile video**, Paul E. Voglewede, Geoff Amey, Jeffrey M. Zampieron, Harris Corp. (United States) . . . . . [7307-07]

11:00 am: **UAV sensor platforms utilizing pressurized structure technology**, Harris Edge, Army Research Lab. (United States) . . . . . [7307-08]

11:20 am: **Design of an airframe agnostic roll-on/roll-off (AA-RORO) sensor platform**, Zenovy S. Wowczuk, J. Jerome Holton, Adam J. Harrison, ARES Systems Group, LLC (United States); Bruce Sparks, Oculus Development, LLC (United States) . . . . . [7307-09]

Lunch/Exhibition Break . . . . . 11:40 am to 1:30 pm

SESSION 2

Room: Crystal C . . . . . Thurs. 1:30 to 3:30 pm

3D/SAR Sensors

Session Chair: **Daniel J. Henry,** Goodrich ISR Systems

1:30 pm: **3D structure extraction for flying platforms with IR cameras**, Michael Holicki, Nikolaus Schweyer, Jürgen Zoz, MBDA Germany (Germany) . . . . . [7307-10]

1:50 pm: **An ultra-compact laser terrain mapper for deployment onboard unmanned aerial vehicles**, Marwan Hussein, Jeffrey W. Tripp, Brian Hill, Optech, Inc. (Canada) . . . . . [7307-11]

2:10 pm: **Real-time dense stereo system with rectification for autonomous navigation and mapping**, Darren Myatt, Jeremy Rogers, Waterfall Solutions Ltd. (United Kingdom) . . . . . [7307-12]

2:30 pm: **Bistatic synthetic aperture radar imaging for arbitrary trajectories in the presence of noise and clutter**, Can-Evren Yarman, WesternGeco-Schlumberger (United States); Birsen Yazici, John P. Swoboda, Rensselaer Polytechnic Institute (United States) . . . . . [7307-13]

2:50 pm: **True amplitude BiSAR image reconstruction via backprojection and image domain scaling**, Can-Evren Yarman, WesternGeco-Schlumberger (United States); Birsen Yazici, Rensselaer Polytechnic Institute (United States) . . . . . [7307-14]

3:10 pm: **Wide field-of-view target tracking sensor**, David D. Li, Jianwen J. Yang, New Span Opto-Technology Inc. (United States); Michael R. Wang, Univ. of Miami (United States) and New Span Opto-Technology Inc. (United States) . . . . . [7307-15]

Coffee Break . . . . . 3:30 to 4:00 pm

SESSION 3

Room: Crystal C . . . . . Thurs. 4:00 to 5:00 pm

Motion Processing

Session Chair: **Daniel J. Henry,** Goodrich ISR Systems

4:00 pm: **Video National Imagery Interpretability Rating Scale criteria survey results**, Darrell L. Young, Raytheon Intelligence & Information Systems (United States); Tariq Bakir, Harris Corp. (United States); Frederick V. Petitti, Raytheon Intelligence & Information Systems (United States); Michelle Brennan, Moriarty and Associates, Inc. (United States); James H. Yen, National Institute of Standards and Technology (United States) . . . . . [7307-17]

4:20 pm: **Perceptual evaluation of motion imagery: interpretability comparison of high-definition formats**, Charles P. Fenimore, John W. Roberts, James H. Yen, Hassan Sahibzada, National Institute of Standards and Technology (United States) . . . . . [7307-18]

4:40 pm: **Moving object detection and tracking from airborne surveillance platforms,** Zhihai He, Univ. of Missouri, Columbia (United States) . . . . . [7307-19]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

Vehicle detection in static aerial imagery, Feng Han, Hui Cheng, Harpreet S. Sawhney, Rakesh Kumar, Saad M. Khan, Sarnoff Corp. (United States) . . . . . [7307-23]

GPS-assisted visual tracking of multiple interacting targets, Saad M. Khan, Hui Cheng, Rakesh Kumar, Harpreet S. Sawhney, Sarnoff Corp. (United States) . . . . . [7307-28]

Friday 17 April

SESSION 4

Room: Crystal C . . . . . Fri. 8:30 to 9:50 am

Detection and Tracking

Session Chair: **Daniel J. Henry,** Goodrich ISR Systems

8:30 am: **Tracking multiple-sized objects in low-resolution and noisy images**, Moulay A. Akhloufi, Ctr. of Robotics and Vision (Canada) . . . . . [7307-20]

8:50 am: **Improved target tracking in aerial video using particle filtering**, Zhanfeng Yue, Pramod L. Narasimha, Pankaj Topiwala, FastVDO Inc. (United States) . . . . . [7307-21]

9:10 am: **Vehicle detection and tracking from low frame rate aerial video**, Jiangjian Xiao, Hui Cheng, Sarnoff Corp. (United States) . . . . . [7307-22]

9:30 am: **Automated UAV-based mapping for airborne reconnaissance and video exploitation**, Stephen Se, Pezhman Firoozfam, Norman Goldstein, Linda Wu, Melanie Dutkiewicz, MacDonald, Dettwiler and Associates Ltd. (Canada) . . . . . [7307-24]

Coffee Break . . . . . 9:50 to 10:20 am

SESSION 5

Room: Crystal C . . . . . Fri. 10:20 to 11:40 am

Processing and Exploitation

Session Chair: **Daniel J. Henry,** Goodrich ISR Systems

10:20 am: **Automatic task assignment for mixed aircraft formations**, Jason F. Ralph, The Univ. of Liverpool (United Kingdom); Kenneth L. Edwards, QinetiQ Ltd. (United Kingdom); Daniel Jones, The Univ. of Liverpool (United Kingdom) . . . . . [7307-25]

10:40 am: **Using linear color profiles for vehicle and road detection in UAV images**, Joshua Candamo, Dmitry B. Goldgof, Rangachar Kasturi, Univ. of South Florida (United States) . . . . . [7307-26]

11:00 am: **Shadow removal from textured images**, Qiang He, Mississippi Valley State Univ. (United States); Henry C. H. Chu, Univ. of Louisiana at Lafayette (United States) . . . . . [7307-27]

11:20 am: **Real-time airborne data management system**, Richard Lourette, Roddy Shuler, Bernard Brower, Matthew Pellechia, S. Danny Rajan, ITT Corp. (United States) . . . . . [7307-29]

Radar Sensor Technology XIII

Conference Chairs: **Kenneth I. Ranney,** Army Research Lab.; **Armin W. Doerry,** Sandia National Labs.

Program Committee: **Sean Buckley,** The Univ. of Texas at Austin; **Joseph C. Deroba,** U.S. Army CERDEC Intelligence and Information Warfare Directorate; **Doreen M. Dyck,** Defence Research and Development Canada (Canada); **John E. Gray,** Naval Surface Warfare Ctr.; **Todd A. Kastle,** Air Force Research Lab.; **Seong-Hwoon Kim,** General Atomics; **James L. Kurtz,** Univ. of Florida; **Jenshan Lin,** Univ. of Florida; **David G. Long,** Brigham Young Univ.; **Canh Ly,** Army Research Lab.; **Anthony Martone,** Army Research Lab.; **Kamran Mesghali,** ITT Electronic Systems; **Atindra K. Mitra,** Air Force Research Lab.; **George J. Moussally,** Mirage Systems; **Lam H. Nguyen,** Army Research Lab.; **Thomas Pizzillo,** Army Research Lab.; **R. Keith Raney,** The Johns Hopkins Univ.; **Meppalli K. Shandas,** dB Control; **Jerry L. Silvious,** Army Research Lab.; **Helmut H. S. Suess,** DLR Standort Oberpfaffenhofen (Germany); **Lars M. Wells,** Sandia National Labs.

Monday 13 April

SESSION 1

Room: Crystal K . . . . . Mon. 8:30 to 10:10 am

Radar Systems I

Session Chair: **James L. Kurtz,** Univ. of Florida

8:30 am: **Hybrid polarity SAR architecture**, R. Keith Raney, The Johns Hopkins Univ. (United States) . . . . . [7308-01]

8:50 am: **The dual-use potential of the TerraSAR-X mission**, Helmut H. S. Suess, Stefan Buckreuss, DLR Standort Oberpfaffenhofen (Germany) . . . . . [7308-02]

9:10 am: **Fast ISAR image generation through localization of persistent scattering centers**, Harald Anglberger, Rainer H. Speck, Timo M. Kempf, Helmut H. S. Suess, DLR Standort Oberpfaffenhofen (Germany). . . . . [7308-03]

9:30 am: **Lite-weight SAR/MTI for small UAV applications**, John C. Kirk, Jr., Goleta Star, LLC (United States) . . . . . [7308-04]

9:50 am: **An airborne interferometric SAR system for high-performance 3D mapping**, Martin Lange, Intermap Technologies GmbH (Germany); Paul Gill, Intermap Technologies Corp. (Canada) . . . . . [7308-05]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Crystal K . . . . . Mon. 10:40 am to 12:00 pm

Radar Systems II

Session Chair: **R. Keith Raney,** The Johns Hopkins Univ.

10:40 am: **A small manned aircraft as a testbed for radar sensor development**, Matthew C. Edwards, Evan C. Zaugg, David G. Long, Brigham Young Univ. (United States); Alex Margulis, ARTEMIS, Inc. (United States) . . . . . [7308-06]

11:00 am: **Active millimeter-wave imaging using raster scanner**, Axel Hülsmann, Andreas Liebelt, Axel Tessmann, Arnulf Leuther, Michael Schlechtweg, Oliver Ambacher, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) . . . . . [7308-07]

11:20 am: **Performance evaluation of a monopulse radar in rotorcraft brownout landing aid application**, Guoqing Liu, Ken Yang, Brian Sykora, Imad Salha, BAE Systems (United States) . . . . . [7308-08]

11:40 am: **Millimeter-wave radar for vital signs sensing**, Douglas T. Petkie, Carla Benton, Erik Bryan, Wright State Univ. (United States) . . . . . [7308-09]

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

SESSION 3

Room: Crystal K . . . . . Mon. 1:30 to 2:50 pm

Imaging Radar Applications and Phenomenology

Session Chair: **Atindra K. Mitra,** Air Force Research Lab.

1:30 pm: **SAR vibrometry using fractional Fourier transform processing**, Qi Wang, Majeed M. Hayat, Balu Santhanam, The Univ. of New Mexico (United States); Tom D. Atwood, Sandia National Labs. (United States) . . . . . [7308-10]

1:50 pm: **Characterization of the effects of atmospheric lensing in SAR images**, Michael E. Lawrence, Charles T. Hansen, Raytheon Co. (United States) . . . . . [7308-12]

2:10 pm: **Holographic surveillance radar**, Gordon K. A. Oswald, Cambridge Consultants Ltd. (United Kingdom) and Univ. of Maine (United States) . . [7308-13]

2:30 pm: **Stokes matrix eigenvectors of fully polarimetric SAR data**, Jorge V. Geaga, Consultant (United States) . . . . . [7308-14]

Coffee Break . . . . . 2:50 to 3:30 pm

SESSION 4

Room: Crystal K . . . . . Mon. 3:30 to 5:30 pm

IED, Landmine, and Concealed Threat Sensing

Session Chair: **Canh Ly,** Army Research Lab.

3:30 pm: **Route following SAR mode for optimized IED reconnaissance**, Darren R. Moe, General Atomics Aeronautical Systems, Inc. (United States) . . . . . [7308-15]

3:50 pm: **An affordable modular radar for landmine and IED detection**, Paul D. Curtis, David J. Daniels, Jon Dittmer, Nigel Hunt, Blair Graham, ERA Technology Ltd. (United Kingdom) . . . . . [7308-16]

4:10 pm: **Proposed design of a search radar for thin wire detection**, Jay A. Marble, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7308-17]

4:30 pm: **Radar-based concealed threat detector**, Jerry Hausner, Electro Science Technologies (United States). . . . . [7308-18]

4:50 pm: **3D wavefront image formation for NIITEK GPR**, Tuan T. Ton, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . [7308-19]

5:10 pm: **Detection of shallow buried nonmetallic landmine and estimation of its depth at microwave X-band frequency**, Kailash C. Tiwari, Dharmenra Singh, Manoj K. Arora, Indian Institute of Technology Roorkee (India) . . . . . [7308-20]

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 5

Room: Crystal K . . . . . Tues. 10:30 am to 12:10 pm

Radar Components

Session Chair: **Meppalli K. Shandas,** dB Control

10:30 am: **High-power transmitters for radar applications**, Meppalli K. Shandas, dB Control (United States) . . . . . [7308-21]

10:50 am: **Performance analysis of ultra-wideband antennas for microradar applications**, Amir H. Shirkhodaie, Maysam Sarfaraz, Tennessee State Univ. (United States) . . . . . [7308-22]

11:10 am: **Multitone radar design using software radio components**, Atindra K. Mitra, Air Force Research Lab. (United States) . . . . . [7308-23]

11:30 am: **True RF correlation receiver**, Ming-Chiang Li, Consultant (United States) . . . . . [7308-24]

11:50 am: **Low-profile and high-efficiency probe feed patch antenna array at S-band using an air dielectric for radar applications**, Canh Ly, Army Research Lab. (United States) . . . . . [7308-25]

Lunch/Exhibition Break . . . . . 12:10 to 1:50 pm

SESSION 6

Room: Crystal K . . . . . .Tues. 1:50 to 3:10 pm

Sense Through the Wall I

Session Chair: **Lam H. Nguyen,** Army Research Lab.

1:50 pm: **Detection of multiple slow-moving targets located behind walls**, Anthony Martone, Kenneth I. Ranney, Roberto Innocenti, Army Research Lab. (United States) . . . . . [7308-27]

2:10 pm: **Optimal waveform design for through-the-wall radar imaging**, Fauzia Ahmad, Moeness G. Amin, Villanova Univ. (United States) . . . . . [7308-28]

2:30 pm: **Behind-the-wall target identification (BWTI)**, Yeo-Sun Yoon, Moeness G. Amin, Villanova Univ. (United States) . . . . . [7308-29]

2:50 pm: **A hardware architecture for time reversal of short impulses based on frequency domain approach**, Shaoshu Sha, Varun Shenoy, Mingyu Lu, Sungyong Jung, The Univ. of Texas at Arlington (United States); Kyoungwon Min, SungChul Lee, Korea Electronics Technology Institute (Korea, Republic of) . . . . . [7308-30]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 7

Room: Crystal K . . . . . .Tues. 3:40 to 5:00 pm

Sense Through the Wall II

Session Chair: **Anthony Martone,** Army Research Lab.

3:40 pm: **Signal and image processing techniques for the Army Research Lab ultra-wideband synchronous impulse reconstruction (UWB SIRE) radar**, Lam H. Nguyen, Army Research Lab. (United States) . . . . . [7308-31]

4:00 pm: **Radar detection of moving objects around corners**, Ain Sume, Stefan L. Nilsson, Swedish Defence Research Agency (Sweden) . . . . . [7308-32]

4:20 pm: **Polarization coherency through various scattering mechanisms**, Kevin Walker, Glafkos Stratis, Salvatore Bellofiore, Steven Stoltz, Joseph C. Kloiber, Raytheon Missile Systems (United States) . . . . . [7308-33]

4:40 pm: **Micro-Doppler phenomenology of humans at UHF and Ku-band for biometric characterization**, Jerry L. Silvious, John Clark, Thomas Pizzillo, David Tahmoush, Army Research Lab. (United States) . . . . . [7308-34]

SESSION 7A

Room: Crystal K . . . . . .Tues. 5:00 to 6:00 pm

Fifty years of noise radar

The concept of noise radar was pioneered 50 years ago by Billy Horton of the former Diamond Ordnance Fuze Laboratory (renamed Harry Diamond Laboratories and then combined with other entities to form what is now the Army Research Laboratory) in Washington, D.C., USA. Horton recognized that one way to eliminate range and Doppler ambiguities was to use random noise as the modulating function and perform range determination by cross-correlating the return signal with a time-delayed replica of the transmit waveform. The talk will provide a historical account of noise radar from 1959 to 2009, describe notable results from worldwide R&D activities in noise radar, and predict possible developments over the next 50 years. Our efforts to track down Mr. Horton made us aware of some sad news. An obituary in the Washington Post on May 3, 2003, read in part: "Billy Mitchusson Horton, 84, an inventor and Army Department civilian who worked for the Harry Diamond Laboratories from 1953 to 1974 and became its technical director, died of a respiratory ailment April 28 at a hospice in Cleveland." However, his legacy lives on.

5:00 pm: **Fifty years of noise radar: the legacy of Billy Horton** *(Presentation Only),* Ram M. Narayanan, The Pennsylvania State Univ. (United States); Konstantin A. Lukin, Usikov Institute of Radiophysics and Electronics (Ukraine) . . . . . [7308-52]

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

Intelligent target recognition using micro-Doppler radar signatures, Thayananthan Thayaparan, Defence Research and Development Canada (Canada) . . . . . [7308-44]

CFAR detection and extraction of maneuvering air target in strong sea-clutter via time-frequency-based s-method, Thayananthan Thayaparan, Defence Research and Development Canada (Canada); Ljubisa Stankovic, Milos Darkovic, Univ. of Montenegro (Montenegro) . . . . . [7308-45]

Characterization of camouflage structures by means of different mmw-imaging procedures, Christian T. Inaebnit, armasuisse (Switzerland); Uwe Aulenbacher, IBSS (Germany). . . . . [7308-46]

Analysis of two different types of 3D ultra-wideband antennas, Maysam Sarfaraz, Amir H. Shirkhodaie, Tennessee State Univ. (United States). . . . . [7308-47]

A fusion study of a Range-Doppler imager with an infrared sensor for ground-to-ground surveillance, Yves M. de Villers, Defence Research and Development Canada Valcartier (Canada) . . . . . [7308-48]

Target detection using a pulsed linear frequency modulated noise waveform, Mark A. Govoni, U.S. Army Research, Development and Engineering Command (United States); Hongbin Li, Stevens Institute of Technology (United States). . . . . [7308-49]

Real-time imaging implementation of the Army Research Laboratory synchronous impulse reconstruction radar on a graphics processing unit architecture, Song Jun Park, Lam H. Nguyen, Dale R. Shires, Brian Henz, Army Research Lab. (United States). . . . . [7308-50]

Particle swarm optimization and uncertainty in Dempster-Shafer fusion, Kenneth I. Ranney, Nasser M. Nasrabadi, Army Research Lab. (United States). . . . . [7308-51]

3D SAR image formation for underground targets using ultra-wideband (UWB) radar, Lam H. Nguyen, Traian Dogaru, Roberto Innocenti, Army Research Lab. (United States). . . . . [7308-53]

Wednesday 15 April

SESSION 8

Room: Crystal K . . . . . Wed. 8:30 to 10:10 am

Radar Algorithms and Processing

Session Chair: **Jerry L. Silvious,** Army Research Lab.

8:30 am: **Radar measurement as an operator problem**, John E. Gray, Allen D. Parks, Naval Surface Warfare Ctr. (United States) . . . . . [7308-35]

8:50 am: **Performance trade-offs for two radar types used for ground surveillance in security applications**, Walker Butler, ICx Technologies, Inc. (United States). . . . . [7308-36]

9:10 am: **Filtering of weather radar imagery using steerable Gaussian smoothers**, Dimitrios Charalampidis, Anirudh Paduru, The Univ. of New Orleans (United States). . . . . [7308-37]

9:30 am: **Position-adaptive scatterer localization for radar imaging applications**, Sean Young, Atindra K. Mitra, Thomas Morton, Air Force Research Lab. (United States); Raul Ordonez, Univ. of Dayton (United States) . . . . [7308-38]

9:50 am: **Highly resolved turntable ISAR signature extraction for ATR**, Timo M. Kempf, Markus Peichl, Stephan Dill, Helmut H. S. Suess, DLR Standort Oberpfaffenhofen (Germany). . . . . [7308-39]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 9

Room: Crystal K . . . . . Wed. 10:40 to 11:40 am

Radar Phenomenology

Session Chair: **Seong-Hwoon Kim,** General Atomics

10:40 am: **Properties of a train of identical pulses overlaid with a phase coding**, Dmitry Chebanov, LaGuardia Community College, CUNY (United States). . . . . [7308-40]

11:00 am: **Ka-band short pulse combined scatterometer-radiometer system and the results of its preliminary application for snow, bare, and vegetated soil remote sensing from low-altitude measuring platforms**, Artashes K. Arakelyan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia) . . . . . [7308-42]

11:20 am: **Ku-band combined scatterometer-radiometer system and the results of preliminary polarimetric measurements of snow, bare, and vegetated soil, waved water surface microwave reflection and emission**, Artashes K. Arakelyan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia) . . . . . [7308-43]

Passive Millimeter-Wave Imaging Technology XII

Conference Chairs: **Roger Appleby,** QinetiQ Ltd. (United Kingdom); **David A. Wikner,** Army Research Lab.

Program Committee: **Christopher A. Martin,** Trex Enterprises Corp.; **Erich N. Grossman,** National Institute of Standards and Technology; **Arttu R. Luukanen,** VTT Technical Research Ctr. of Finland (Finland)

Thursday 16 April

SESSION 1

Room: Crystal J1. . . . . Thurs. 8:20 to 10:00 am

Phenomenology

Session Chair: **David A. Wikner,** Army Research Lab.

8:20 am: **Passive millimeter-wave cross polarization imaging and phenomenology**, E. Lee Stein, Jr., Univ. of Delaware (United States); Christopher A. Schuetz, Richard D. Martin, Phase Sensitive Innovations, Inc. (United States); Jesse P. Samluk, John P. Wilson, Daniel G. Mackrides, Dennis W. Prather, Univ. of Delaware (United States) . . . . . [7309-01]

8:40 am: **Direct detection polarimetric radiometer (DDPR)**, George G. Koenig, Gary Koh, U.S. Army Engineer Research and Development Ctr. (United States); Charles C. Ryerson, U.S. Army Corps of Engineers (United States). . . . . [7309-02]

9:00 am: **Comparison of passive millimetre-wave and IR imagery in a nautical environment**, Peter Coward, QinetiQ Ltd. (United Kingdom). . . . . [7309-03]

9:20 am: **Performance modeling of a passive interferometric millimeter-wave sensor**, Eddie L. Jacobs, The Univ. of Memphis (United States) . . . . . [7309-04]

9:40 am: **Subpixel visibility in passive millimeter-wave systems**, Albert N. Pergande, Lockheed Martin Missiles and Fire Control (United States). . . . . [7309-05]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 2

Room: Crystal J1. . . . . Thurs. 10:30 to 11:50 am

Systems

Session Chair: **Christopher A. Martin,** Trex Enterprises Corp.

10:30 am: **Passive millimeter-wave imaging polarimeter system**, Christopher M. Persons, Digital Fusion Inc. (United States); Christopher A. Martin, Trex Enterprises Corp. (United States); Michael W. Jones, Digital Fusion Inc. (United States); Vladimir G. Kolinko, John A. Lovberg, Trex Enterprises Corp. (United States). . . . . [7309-06]

10:50 am: **Design and performance of a distributed aperture millimeter-wave imaging system using optical upconversion**, Richard D. Martin, Christopher A. Schuetz, Phase Sensitive Innovations, Inc. (United States); Caihua Chen, Univ. of Delaware (United States); Thomas E. Dillon, Phase Sensitive Innovations, Inc. (United States); Jesse P. Samluk, E. Lee Stein, Jr., Univ. of Delaware (United States); Mark Mirotnik, Catholic Univ. (United States); Dennis W. Prather, Univ. of Delaware (United States) . . . . . [7309-07]

11:10 am: **Demonstration of a passive low-noise millimeter-wave detector array for imaging**, David A. Wikner, Army Research Lab. (United States); Erich N. Grossman, National Institute of Standards and Technology (United States). . . . . [7309-08]

11:30 am: **Evaluation of a passive millimetre-wave imager for wire detection in degraded visual conditions**, Roger Appleby, QinetiQ Ltd. (United Kingdom); Jack N. Sanders-Reed, Boeing-SVS, Inc. (United States) . . . . . [7309-09]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 3

Room: Crystal J1. . . . . Thurs. 1:20 to 4:30 pm

Security

Session Chairs: **Arttu R. Luukanen,** VTT Technical Research Ctr. of Finland (Finland); **Erich N. Grossman,** National Institute of Standards and Technology

1:20 pm: **Design of a high-resolution passive millimeter wavelength camera for security applications**, Jonathan J. Drewes, Orlando Optics, Inc. (United States); Robert Daly, Brijot Imaging Systems, Inc. (United States). . . . . [7309-10]

1:40 pm: **Results and experiences from the NATO Common Shield - DAT#7 experiment: Defence Against Terrorism**, Markus Peichl, Stephan Dill, Matthias Jirousek, Helmut H. S. Suess, DLR Standort Oberpfaffenhofen (Germany) . . . . . [7309-11]

2:00 pm: **Suicide bomber detection**, Naomi E. Alexander, Carlos Callejero, Alfa Imaging S.A. (Spain); Franco Fiore, NATO C3 Agency (Netherlands); Ignacio Gómez, Alfa Imaging S.A. (Spain); Ramon Gonzalo, Univ. Pública de Navarra (Spain); Alvaro Enriquez de Luna, Spanish Navy Research and Development Ctr. (Spain); Iñigo Ederra, Inés Palacios, Univ. Pública de Navarra (Spain) . . . . . [7309-12]

2:20 pm: **Safe VISITOR: visible, infrared, and terahertz object recognition for security screening application**, Torsten May, Gabriel Zieger, Solveig Anders, Viatcheslav Zakosarenko, Hans-Georg Meyer, IPHT Jena (Germany); Marco Schubert, Michael Starkloff, Supracon AG (Germany); Mario Roessler, Günter Thorwirth, Ulf Krause, Jena-Optronik GmbH (Germany). . . . . [7309-13]

2:40 pm: **Stand-off passive THz imaging at 8-meter stand-off distance: results from a 64-channel real-time imager**, Arttu R. Luukanen, VTT Technical Research Ctr. of Finland (Finland). . . . . [7309-14]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Dual-surface dielectric depth detector for holographic millimeter-wave security scanners**, Douglas L. McMakin, Paul E. Keller, David M. Sheen, Thomas E. Hall, Pacific Northwest National Lab. (United States). . . . . [7309-15]

3:50 pm: **A swept millimetre-wave technique for the detection of concealed weapons and thin layers of dielectric material with or without fragmentation**, Nicholas J. Bowring, David A. Andrews, Nacer Rezgui, Sarah Smith, Stuart W. Harmer, Manchester Metropolitan Univ. (United Kingdom); Elizabeth Guest, Leeds Metropolitan Univ. (United Kingdom); Matthew Southgate, Manchester Metropolitan Univ. (United Kingdom) . . . . . [7309-16]

4:10 pm: **Active wideband 350-GHz imaging system for concealed-weapon detection**, David M. Sheen, Thomas E. Hall, Ronald H. Severtsen, Douglas L. McMakin, Brian K. Hatchell, Patrick L. J. Valdez, Pacific Northwest National Lab. (United States). . . . . [7309-17]

SESSION 4

Room: Crystal J1. . . . . Thurs. 4:30 to 5:50 pm

Device Technology

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

4:30 pm: **Experimental characterization of mm-wave detection by a micro-array of Golay cells**, Douglas Denison, Michael E. Knotts, Georgia Tech Research Institute (United States); Vladimir Tsukruk, Michael E. McConney, Georgia Institute of Technology (United States) . . . . . [7309-18]

4:50 pm: **Design and analysis of a spatially selective mirror for submillimeter-wave imaging**, Orges Furxhi, Eddie L. Jacobs, The Univ. of Memphis (United States). . . . . [7309-19]

5:10 pm: **Development of high-speed modulator for W-band mmW imaging system**, Peng Yao, Julien Macario, Christopher A. Schuctz, Rownak Shireen, Shouyuan Shi, Dennis W. Prather, Univ. of Delaware (United States) . . . [7309-20]

5:30 pm: **Mm- and THz-waves detector on the base of narrow-gap semiconductors,** Fedir F. Sizov, Valentyn M. Dobrovolskii, Vyacheslav V. Zabudsky, V.E. Lashkaryov Institute of Semiconductor Physics (Ukraine); Jurij Y. Kamenev, Usikov Institute of Radiophysics and Electronics (Ukraine); Natalia I. Momot, Joanna V. Gumenjuk-Sichevska, V.E. Lashkaryov Institute of Semiconductor Physics (Ukraine) . . . . . [7309-21]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

3D resolving R and B functions in ultra-resolution and targeting problems for space objects, Evgeni N. Terentiev, Lomonosov Moscow State Univ. (Russian Federation); Nikolai E. Terentiev, Quest Software (Russian Federation). . [7309-22]

The multibeam microwave lens for system of microwave imaging, Denis Shuravlev, Belarusian State Univ. of Informatics and Radioelectronics (Belarus). . . . . [7309-23]

Non-Intrusive Inspection Technologies II

Conference Chair: **Brandon W. Blackburn,** Raytheon Co.

Program Committee: **David L. Chichester,** Idaho National Lab.; **Paul Hausladen,** Oak Ridge National Lab.; **Alan Hunt,** Idaho State Univ.; **Dwight L. Williams,** Massachusetts Institute of Technology; **Joseph W. Schumer,** Naval Research Lab.

Tuesday 14 April

SESSION 1

Room: Grand 5 . . . . . Tues. 8:00 to 9:00 am

Remote Sensing

Session Chair: **Joseph W. Schumer,** Naval Research Lab.

8:00 am: **Optical and engineering development of the spatial heterodyne interferometer for emergent line discrimination spectroscopy (SHIELDS)**, Steven R. Watchorn, Scientific Solutions, Inc. (United States); John E. Anderson, U.S. Army Engineer Research and Development Ctr. (United States); Christopher E. Sioris, Environment Canada (Canada); John Noto, Scientific Solutions, Inc. (United States) . . . . . [7310-01]

8:20 am: **The SORDS trimodal imager**, Michael V. Hynes, Maurice Toolin, Bernard Harris, John McElroy, Raytheon Co. (United States); Mark Wallace, Larry J. Schultz, David Palmer, Los Alamos National Lab. (United States); Daniel Wakeford, Bubble Technology Industries, Inc. (Canada); Richard C. Lanza, Massachusetts Institute of Technology (United States); Michael Sqillante, Radiation Monitoring Devices, Inc. (United States); Anthony Kourepenis, The Charles Stark Draper Lab., Inc. (United States) . . . . . [7310-02]

8:40 am: **A solid-state hyperspectral imager for real-time standoff explosives detection using shortwave infrared imaging,** Bora M. Onat, Gary E. Carver, Mark A. Itzler, Princeton Lightwave, Inc. (United States) . . . . . [7310-03]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 2

Room: Grand 5 . . . . . Tues. 10:30 am to 12:10 pm

Inspection Hardware and Materials

Session Chair: **Paul Hausladen,** Oak Ridge National Lab.

10:30 am: **Preliminary design and experiments of portable and autonomous x-ray equipment for fast and accurate materials identification by dual-energy radioscopy and tomography techniques**, Mihai Iovea, Gabriela Mateiasi, ACCENT PRO 2000 s.r.l. (Romania); Octavian Duliu, Univ. of Bucharest (Romania); Alexandru Caescu, Madalina Mangu, ACCENT PRO 2000 s.r.l. (Romania) . . . . . [7310-04]

10:50 am: **3-1-1 Plus scanner**, Max Robinson, Kromek (United Kingdom) . . . . . [7310-05]

11:10 am: **LuAG:Pr, LuAG:La, and LuAP:Ce thin film scintillators**, Yuriy V. Zorenko, Ivan Franko National Univ. of L'viv (Ukraine) . . . . . [7310-06]

11:30 am: **$Lu_3Al_5O_{12}$-based materials for high 2D-resolution scintillation detectors**, Martin Nikl, Jiri A. Mares, Institute of Physics of the AS CR, v.v.i. (Czech Republic); Petr Prusa, Institute of Physics of the AS CR, v.v.i. (Czech Republic) and Czech Technical Univ. in Prague (Czech Republic); Jan Tous, Karel Blazek, Crytur Ltd. (Czech Republic); Anna G. Vedda, Univ. degli Studi di Milano-Bicocca (Italy); Yuriy V. Zorenko, Vitali Gorbenko, Ivan Franko National Univ. of L'viv (Ukraine) . . . . . [7310-07]

11:50 am: **Comparison of $Bi_4Ge_3O_{12}$ and NaI for detecting photo-induced delayed gamma rays**, Edna S. Cardenas, Edward T. E. Reedy, Heather A. Seipel, Idaho State Univ. (United States) and Idaho Accelerator Ctr. (United States); Alan Hunt, Idaho Accelerator Ctr. (United States) and Idaho State Univ. (United States); Bruce H. Failor, L-3 Pulse Sciences (United States) . . . . [7310-08]

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

SESSION 3

Room: Grand 5 . . . . . Tues. 1:40 to 5:30 pm

Inspection Methodologies and CONOPS

Session Chair: **David L. Chichester,** Idaho National Lab.

1:40 pm: **Noninvasive threat liquid identification system**, Max Robinson, Kromek (United Kingdom) . . . . . [7310-09]

2:00 pm: **Real-time muon tomography imaging simulation and fast threat target identification**, Holger M. Jaenisch, Licht Strahl Engineering Inc. (United States) and Alabama A&M Univ. (United States); James W. Handley, Alabama A&M Univ. (United States) and Licht Strahl Engineering Inc. (United States) . . . . . [7310-10]

2:20 pm: **A quantitative measure for information content in antenna array radiation patterns**, Karan D. Mohan, Mohammad A. Khan, Amin N. Dharamsi, Old Dominion Univ. (United States) . . . . . [7310-11]

2:40 pm: **The SORDS trimodal imager detector arrays**, Daniel Wakeford, Bubble Technology Industries, Inc. (Canada); Michael V. Hynes, Maurice Toolin, Bernard Harris, John McElroy, Raytheon Co. (United States); Mark Wallace, Larry J. Schultz, David Palmer, Los Alamos National Lab. (United States); Richard C. Lanza, Massachusetts Institute of Technology (United States); Michael R. Squillante, Radiation Monitoring Devices, Inc. (United States); Anthony Kourepenis, The Charles Stark Draper Lab., Inc. (United States) . . . . . [7310-12]

3:00 pm: **Detecting nuclear material with a neutron time-of-flight spectrometer**, Mathew T. Kinlaw, Idaho National Lab. (United States); Scott J. Thompson, Alan Hunt, Idaho Accelerator Ctr. (United States); James L. Jones, Idaho National Lab. (United States) . . . . . [7310-13]

Coffee Break . . . . . 3:20 to 3:50 pm

3:50 pm: **The SORDS trimodal imager: image reconstruction algorithms**, Larry J. Schultz, Mark Wallace, Mark C. Galassi, Andrew S. Hoover, Michal Mocko, David Palmer, Shawn Tornga, Los Alamos National Lab. (United States); Michael V. Hynes, Maurice Toolin, Bernard Harris, John McElroy, Raytheon Co. (United States); Daniel Wakeford, Bubble Technology Industries, Inc. (Canada); Richard C. Lanza, Massachusetts Institute of Technology (United States); Berthold K. P. Horn, MIT Artificial Intelligence Lab. (United States); Michael R. Squillante, James F. Christian, Radiation Monitoring Devices, Inc. (United States); Anthony Kourepenis, The Charles Stark Draper Lab., Inc. (United States); David K. Wehe, Univ. of Michigan (United States) . . . . . [7310-14]

4:10 pm: **Active inspection delayed neutron signatures for application to special nuclear material forensics**, Heather A. Seipel, Edward T. E. Reedy, Edna S. Cardenas, Idaho State Univ. (United States) and Idaho Accelerator Ctr. (United States); Bruce H. Failor, L-3 Pulse Sciences (United States); Alan Hunt, Idaho Accelerator Ctr. (United States) and Idaho State Univ. (United States) . . . . . [7310-15]

4:30 pm: **Discrete gamma rays from photofission for use in nuclear forensics applications**, Edward T. E. Reedy, Heather A. Seipel, Idaho State Univ. (United States) and Idaho Accelerator Ctr. (United States); Edna S. Cardenas, Idaho State Univ. (United States); Bruce H. Failor, L-3 Pulse Sciences (United States); Alan Hunt, Idaho Accelerator Ctr. (United States) and Idaho State Univ. (United States) . . . . . [7310-16]

4:50 pm: **Illicit drug detection using energy dispersive x-ray diffraction**, Emily J. Cook, Univ. College London (United Kingdom); Silvia Pani, Univ. of Surrey (United Kingdom); Jennifer A. Griffiths, Univ. College London (United Kingdom); Leah George, Home Office Scientific Development Branch (United Kingdom); Julie A. Horrocks, Queen Mary Univ. of London (United Kingdom); Robert D. Speller, Univ. College London (United Kingdom) . . . . . [7310-17]

5:10 pm: **Stand-off detection of fast neutrons from a fission source,** P. E. Vanier, I. Dioszegi, C. Salwen, Brookhaven National Lab. (United States); L. Forman, Ion Focus Technology (United States) . . . . . [7310-18]

POSTERS-TUESDAY

Room: Palms Foyer . . . . . .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.

Improvements in an imaging gamma ray camera, Paul S. Linsay, James F. Christian, Robert Vinci, Hadong Kim, Leonard Cirignano, Frank Robertson, Gerald Entine, Michael R. Squillante, Radiation Monitoring Devices, Inc. (United States) . . . . . [7310-20]

Portable and autonomous x-ray dual-energy radioscopy and tomography equipment for in-situ explosives detection, Mihai Iovea, Gabriela Mateiasi, Marian Neagu, Madalina Mangu, ACCENT PRO 2000 s.r.l. (Romania) . . [7310-21]

Make time for the Exhibition

Tuesday 14 April . . . . . 10:00 am to 6:00 pm
Wednesday 15 April . . . . . 10:00 am to 5:00 pm
Thursday 16 April . . . . . 10:00 am to 2:00 pm

See pp. 16–20 for exhibition details.

Terahertz Physics, Devices, and Systems III: Advanced Applications in Industry and Defense

Conference Chairs: **Mehdi Anwar,** Univ. of Connecticut; **Nibir K. Dhar,** Army Research Lab.; **Thomas W. Crowe,** Virginia Diodes, Inc.

Program Committee: **Alexander G. Davies,** Univ. of Leeds (United Kingdom); **Gottfried H. Döhler,** Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); **Achyut K. Dutta,** Banpil Photonics, Inc.; **M. Saif Islam,** Univ. of California, Davis; **Hiroshi Ito,** NTT Photonics Labs. (Japan); **Peter U. Jepsen,** Danmarks Tekniske Univ. (Denmark); **James Kolodzey,** Univ. of Delaware; **Edmund H. Linfield,** Univ. of Leeds (United Kingdom); **Amir H. Majedi,** Univ. of Waterloo (Canada); **Tariq Manzur,** Naval Undersea Warfare Ctr.; **Taiichi Otsuji,** Tohoku Univ. (Japan); **Azizur B. Rahman,** The City Univ. (United Kingdom); **Victor Ryzhii,** Univ. of Aizu (Japan); **Richard A. Soref,** Air Force Research Lab.; **Simon Verghese,** MIT Lincoln Lab.; **Richard T. Webster,** Hanscom Air Force Base; **K. Sigfrid Yngvesson,** Univ. of Massachusetts, Amherst; **Weili Zhang,** Oklahoma State Univ.

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Crystal M . . . . . Tues. 10:20 am to 12:05 pm

THz Spectroscopy

Session Chairs: **Nibir K. Dhar,** Army Research Lab.; **Thomas W. Crowe,** Virginia Diodes, Inc.

10:20 am: **Terahertz quantum cascade lasers: physics, design, and applications** *(Keynote Presentation)*, Federico Capasso, Harvard Univ. (United States) . . . . . [7311-01]

11:00 am: **Noninvasive mail inspection system with terahertz radiation** *(Invited Paper)*, Hiromichi Hoshina, Yoshiaki Sasaki, Aya Hayashi, Chiko Otani, The Institute of Physical and Chemical Research (RIKEN) (Japan); Kodo Kawase, Nagoya Univ. (Japan) . . . . . [7311-02]

11:20 am: **Development of a THz heterodyne receiver with quantum cascade laser and hot electron bolometer mixer for standoff detection of explosive material**, Heiko Richter, Alexei D. Semenov, Heinz-Wilhelm Hübers, Sergey Pavlov, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Lukas Mahler, Alessandro Tredicucci, Scuola Normale Superiore di Pisa (Italy); Harvey E. Beere, David A. Ritchie, Univ. of Cambridge (United Kingdom); Michele Ortolani, Istituto di Fotonica e Nanotecnologie del CNR (Italy); Ulrich Schade, BESSY GmbH (Germany); Konstantin S. Ilin, Michael Siegel, Univ. Karlsruhe (Germany) . . . . . [7311-03]

11:35 am: **Terahertz standoff identification: influence of environment and sample properties**, Joachim Jonuscheit, Michael Herrmann, Sabine Wohnsiedler, René Beigang, Fraunhofer-Institut für Physik Messtechnik (Germany) . . [7311-04]

11:50 am: **Terahertz frequency generation by frequency mixing in semiconductor optical amplifiers**, Eric J. Donkor, Univ. of Connecticut (United States) . . . . . [7311-05]

Lunch/Exhibition Break . . . . . 12:05 to 1:35 pm

SESSION 2

Room: Crystal M . . . . . Tues. 1:35 to 3:00 pm

Advanced Concepts in THz I

Session Chairs: **Amir H. Majedi,** Univ. of Waterloo (Canada); **Mehdi Anwar,** Univ. of Connecticut; **Thomas W. Crowe,** Virginia Diodes, Inc.

1:35 pm: **Tutorial: terahertz electronics** *(Invited Paper)*, Michael S. Shur, Rensselaer Polytechnic Institute (United States) . . . . . [7311-06]

2:15 pm: **Bi-material MEMS detector arrays for THz imaging**, Dragoslav Grbovic, Gamani Karunasiri, Naval Postgraduate School (United States) . . . . . [7311-07]

2:30 pm: **The potential of wide band-gap semiconductor materials in laser-induced semiconductor switches**, Dane J. Phillips, Digital Fusion Inc. (United States); Haojun Luo, John F. Muth, North Carolina State Univ. (United States); John V. Foreman, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States); Eric R. Smith, Digital Fusion Inc. (United States); Patrick Wellenius, North Carolina State Univ. (United States); Henry O. Everitt, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States) . . . . . [7311-08]

2:45 pm: **Generation of wide terahertz radiation using bulk and quasi-phase-matched GaAs crystal**, Baolong Yu, Naibing Ma, Min-Yi Shih, Alexander V. Parfenov, Physical Optics Corp. (United States) . . . . . [7311-09]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 3

Room: Crystal M . . . . . Tues. 3:30 to 5:05 pm

Advanced Concepts in THz II

Session Chairs: **Tariq Manzur,** Naval Undersea Warfare Ctr.; **Azizur B. Rahman,** The City Univ. (United Kingdom)

3:30 pm: **THz plasmonic modes in metal-clad planar multilayer waveguides** *(Invited Paper)*, Behnood G. Ghamsari, Amir H. Majedi, Univ. of Waterloo (Canada) . . . . . [7311-10]

3:50 pm: **Development of optical antenna-coupled Si CMOS-based detector at 30 THz**, JeongSun S. Moon, HRL Labs., LLC (United States); Kyung-Ah Son, Goutam Chattopadhyay, David Z. Ting, Jet Propulsion Lab. (United States) . . . . . [7311-11]

4:05 pm: **Resonant terahertz absorption by plasmons in grating-gate GaN HEMT structures**, Andrey V. Muravjov, Nezih Pala, Dmitry B. Veksler, Michael S. Shur, Rensselaer Polytechnic Institute (United States); Xuhong Hu, Remis Gaska, Sensor Electronic Technology, Inc. (United States); Himanshu Saxena, Robert E. Peale, Univ. of Central Florida (United States) . . . . . [7311-12]

4:20 pm: **Correcting the secondary focus of Fresnel zone plate antennas**, James C. Wiltse, Georgia Institute of Technology (United States) . . . . . [7311-13]

4:35 pm: **Rapid prototyping for fabrication of GHz-THz bandgap structures**, Michael E. Gehm, Ziran Wu, Hao Xin, The Univ. of Arizona (United States) . . . . . [7311-14]

4:50 pm: **Application of a high-temperature superconducting detector to terahertz imaging,** Andrew D. Hellicar, Jia Du, Stephen Hanham, Li Li, Commonwealth Scientific and Industrial Research Organisation (Australia) . . . . . [7311-15]

POSTERS-TUESDAY

Room: Palms Foyer . . . . . .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.

Terahertz reflectance spectra of pure explosive materials at normal and oblique incidence, Michele Ortolani, Istituto di Fotonica e Nanotecnologie del CNR (Italy) and BESSY GmbH (Germany); Ulrich Schade, BESSY GmbH (Germany); Jongseok Lee, BESSY GmbH (Germany) and ERATO-MF (Japan); Heinz-Wilhelm Hübers, Heiko Richter, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [7311-29]

About efficiency of identification of materials using spectrum dynamics of medium response under the action of THz radiation, Vyacheslav A. Trofimov, Svetlana A. Varentsova, Lomonosov Moscow State Univ. (Russian Federation) . . . . . [7311-30]

Monte Carlo simulation of terahertz step well quantum cascade laser structures, Will Freeman, Naval Air Warfare Ctr. (United States); Gamani Karunasiri, Naval Postgraduate School (United States) . . . . . [7311-32]

Binary mask scanning for THz imaging, Dan C. Popescu, Andrew D. Hellicar, Li Li, Yue Li, Grahame C. Rosolen, Greg Hislop, Commonwealth Scientific and Industrial Research Organisation (Australia) . . . . . [7311-33]

Demonstration of enhanced emission and time delay beam steering using photoconductive terahertz source with multiple spot feed, Michael E. Knotts, Georgia Tech Research Institute (United States) . . . . . [7311-34]

Wednesday 15 April

SESSION 4

Room: Crystal M . . . . . Wed. 8:15 to 10:05 am

THz Detection

Session Chairs: **Mehdi Anwar,** Univ. of Connecticut;
Tariq Manzur, Naval Undersea Warfare Ctr.

8:15 am: **Progress on efficient generation and applications of quasi-single-cycle and widely tunable monochromatic terahertz pulses** *(Keynote Presentation)*, Yujie J. Ding, Lehigh Univ. (United States) . . . . . [7311-16]

8:45 am: **Tunable THz plasmon resonances in InGaAs/InP HEMT: prospects for imaging spectrometer** *(Invited Paper)*, Robert E. Peale, Himanshu Saxena, Univ. of Central Florida (United States); Walter R. Buchwald, Air Force Research Lab. (United States); Greg C. Dyer, S. James Allen, Jr., Univ. of California, Santa Barbara (United States) . . . . . [7311-17]

9:05 am: **An algorithm for the detection of handguns in terahertz images**, Andrew J. Lingg, Brian D. Rigling, Wright State Univ. (United States) . . . [7311-18]

9:20 am: **Fundamental investigations of explosives using THz spectroscopy**, John H. Wilkinson, Christopher T. Konek, Joseph P. Hooper, Stanley M. Caulder, Naval Surface Warfare Ctr. (United States) . . . . . [7311-20]

9:35 am: **Uncooled detector, optics, and prototype camera development for THz imaging**, Timothy D. Pope, Georges S. Baldenberger, Sonia Verrault, Michel Doucet, INO (Canada) . . . . . [7311-21]

9:50 am: **Terahertz scattering behavior of various broadband absorbers**, Chiayun Wu, Andrew Gatesman, Thomas Goyette, Lucille DeRoeck, Robert Giles, Univ. of Massachusetts, Lowell (United States); William Nixon, U.S. Army National Ground Intelligence Ctr. (United States) . . . . . [7311-22]

Coffee Break . . . . . 10:05 to 10:35 am

SESSION 5

Room: Crystal M . . . . . Wed. 10:35 am to 12:10 pm

THz Imaging

Session Chairs: **Tariq Manzur,** Naval Undersea Warfare Ctr.;
Nibir K. Dhar, Army Research Lab.

10:35 am: **All-solid-state terahertz sources and receivers** *(Invited Paper)*, Thomas W. Crowe, Jeffrey L. Hesler, Virginia Diodes, Inc. (United States)[7311-23]

10:55 am: **Active THz imaging system with improved frame rate**, Wolff von Spiegel, Christian am Weg, Bernd Hils, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany); Torsten Löffler, Loeffler Technology GmbH (Germany); Ralf Henneberger, Ralph Zimmermann, Radiometer Physics GmbH (Germany); Hartmut G. Roskos, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany) . . . . . [7311-24]

11:10 am: **Hollow core fibres for THz applications**, Luca Vincetti, Univ. degli Studi di Modena e Reggio Emilia (Italy); Annamaria Cucinotta, Stefano Selleri, Univ. degli Studi di Parma (Italy) . . . . . [7311-25]

11:25 am: **First demonstration of a vehicle-mounted 250GHz real-time passive imager**, Chris M. Mann, ThruVision Ltd. (United Kingdom) . . . . [7311-26]

11:40 am: **Uncooled MEMS-based detector arrays for THz imaging applications**, J. Allen Cox, Honeywell Solid State Electronics Ctr. (United States); Robert Osiander, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7311-27]

11:55 am: **On the modification and characterization of infrared thermal detectors for real-time imaging with narrowband terahertz sources**, Barry N. Behnken, U.S. Air Force (United States); Gamani Karunasiri, Naval Postgraduate School (United States) . . . . . [7311-28]

Monday-Tuesday 13-14 April 2009 • Proceedings of SPIE Vol. 7312

Advanced Environmental, Chemical, and Biological Sensing Technologies VI

Monday 13 April

SESSION 1

Room: Crystal B . . . . . Mon. 8:30 to 10:10 am

Biosensor Technologies I

Session Chair: **Tuan Vo-Dinh,** Duke Univ.

8:30 am: **Enzyme-based biosensors for direct detection of organophosphate neurotoxins**, Alex Simonian, Auburn Univ. (United States) . . . . . [7312-01]

8:50 am: **System for rapid detection of antibiotic resistance of airborne pathogens**, M. Fortin, I. Noiseux, M. L. Vernon, INO (Canada); C. Laflamme, G. Fillion, Laval Hospital (Canada); C. Duchaine, Laval Hospital (Canada) and Univ. Laval (Canada); J. Ho, Defence Research Establishment Suffield (Canada) . . . . . [7312-02]

9:10 am: **Ultra-high-sensitivity nanoplasmonic resonance energy transfer spectroscopic biomolecular imaging**, G. Logan Liu, Univ. of Illinois at Urbana-Champaign (United States) . . . . . [7312-03]

9:30 am: **Fiber optics SERS-based plasmonics nanobiosensing in single living cells**, J. Scaffidi, M. Gregas, V. Seewaldt, T. Vo-Dinh, Duke Univ. (United States) . . . . . [7312-38]

9:50 am: **Direct detection of biomarkers, nanoparticles, bacteria, and virus in blood and other biological samples**, Michael J. Heller, Univ. of California, San Diego (United States) . . . . . [7312-05]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Crystal B . . . . . Mon. 10:40 am to 12:00 pm

Biosensor Technologies II

Session Chair: **Tuan Vo-Dinh,** Duke Univ.

10:40 am: **Recent progress in active cable chemical sensing of toxic materials**, M. Beshay, S. Garon, H. Mukamal, R. A. Lieberman, Intelligent Optical Systems, Inc. (United States) . . . . . [7312-39]

11:00 am: **The performance of a multisensor detection system based on phage-coated magnetoelastic biosensors in a mixed microbial population**, Shichu Huang, Hong Yang, Ramji S. Lakshmanan, Suiqiong Li, Michael L. Johnson, I-Hsuan Chen, James M. Barbaree, Valery A. Petrenko, Bryan A. Chin, Auburn Univ. (United States) . . . . . [7312-07]

11:20 am: **Nanowire microchip biosensor for chem-bio detection**, A. Dhawan, H. Wang, M. Gerhold, Tuan Vo-Dinh, Duke Univ. (United States) . . . . . [7312-08]

11:40 am: **A fiber optic microarray for the detection of pathogenic microorganisms**, Jason R. E. Shepard, Univ. at Albany (United States). [7312-09]

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

SESSION 3

Room: Crystal B . . . . . Mon. 1:30 to 3:10 pm

Chemical Sensor Technologies

Session Chair: **Tuan Vo-Dinh,** Duke Univ.

1:30 pm: **An integrated chemical sensor for downhole CO_2 monitoring in carbon sequestration**, Ning Liu, Yang Li, Liangxiong Li, Reid Grigg, Robert Lee, New Mexico Institute of Mining and Technology (United States) . . . . . [7312-10]

1:50 pm: **Modified ZSM-5 zeolite film-integrated fiber optic sensors for ammonia detection**, Xiling Tang, Zhong Tang, Seok-Jhin Kim, Junhang Dong, Univ. of Cincinnati (United States). . . . . [7312-11]

2:10 pm: **Toward in-situ detection of PAHs trace in seawater using SERS-active sensors**, Olivier Péron, Emmanuel Rinnert, Michel Lehaitre, Florent Colas, Chantal Compère, French Research Institute for Exploitation of the Sea (France) . . . . . [7312-12]

2:30 pm: **System level integration of microfabricated chemical sensing platforms**, Erica Forzani, Anant Rai, Rui Wang, Rodrigo Iglesias, Francis Tsow, Nongjian Tao, Arizona State Univ. (United States) . . . . . [7312-13]

2:50 pm: **Digital array gas radiometer (DAGR): a sensitive and reliable trace gas detection concept**, Larry L. Gordley, Martin J. McHugh, Robert E. Thompson, GATS, Inc. (United States) . . . . . [7312-14]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 4

Room: Crystal B . . . . . Mon. 3:40 to 6:00 pm

Spectroscopic Sensing Systems

Session Chair: **Heinz-Detlef Kronfeldt,** Technische Univ. Berlin (Germany)

3:40 pm: **Microsystem light source at 671 nm for shifted excitation Raman difference spectroscopy**, Martin Maiwald, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); Heinar G. Schmidt, Technische Univ. Berlin (Germany); Bernd Sumpf, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany); Götz Erbert, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany) . . . . . [7312-15]

4:00 pm: **Hand-held Raman sensor head for in-situ characterization of meat quality applying a microsystem 671 nm diode laser**, Heinar G. Schmidt, Kay Sowoidnich, Technische Univ. Berlin (Germany); Martin Maiwald, Bernd Sumpf, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany) . . . . . [7312-16]

4:20 pm: **Metal-coated Si nanograss as highly sensitive SERS sensors**, Jing Tang, Fung-Suong Ou, Huei-Pei Kuo, Hewlett-Packard Labs. (United States); William F. Stickle, Hewlett-Packard Co. (United States); Shih-Yuan Wang, Wei Wu, Zhiyong Li, R. Stanley Williams, Hewlett-Packard Labs. (United States). . . . . [7312-17]

4:40 pm: **Quality control of retreated waste resulting from electrical cables recycling by hyperspectral imaging**, Giuseppe Bonifazi, Silvia Serranti, Paolo Bevilacqua, Univ. degli Studi di Roma, La Sapienza (Italy). . . . . [7312-18]

5:00 pm: **Influence of atmosphere and laser parameters on LIBS detection and analysis of explosives and organic thin films**, Matthieu Baudelet, Christopher G. Brown, Candice Bridge, Matthew Weidman, Matthew K. Fisher, College of Optics & Photonics, Univ. of Central Florida (United States); Michael Sigman, Univ. of Central Florida (United States); Martin C. Richardson, College of Optics & Photonics, Univ. of Central Florida (United States); Paul J. Dagdigian, The Johns Hopkins Univ. (United States) . . . . . [7312-19]

5:20 pm: **Nanofluidic biochips for use in the direct THz spectroscopic detection and identification of biological species**, Edgar A. Mendoza, Redondo Optics, Inc. (United States) . . . . . [7312-20]

5:40 pm: **Detection of flame-retardant additives in polymers and polymer blends with NIR spectral imaging**, Raimund Leitner, Carinthian Tech Research AG (Austria) . . . . . [7312-21]

Tuesday 14 April

SESSION 5

Room: Crystal B . . . . . .Tues. 8:10 to 8:50 am

Nanoparticle-based Sensing Systems

Session Chair: **Robert A. Lieberman,** Intelligent Optical Systems, Inc.

8:10 am: **Gold nanoparticle assays: toward single molecule unamplified DNA detection**, Remco Verdoold, Dorothee Wasserberg, Felicia Ungureanu, Jan Halamek, Rob Kooyman, Univ. Twente (Netherlands) . . . . . [7312-22]

8:30 am: **Bacterial SERS sensing using aperiodic metal nanoparticle arrays,** Ashwin Gopinath, Sylvanus Y. Lee, Svetlana V. Boriskina, Luca Dal Negro, Boston Univ. (United States) . . . . . [7312-23]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 6

Room: Crystal B . . . . . .Tues. 10:30 to 11:50 am

Chemical Sensor Systems

Session Chair: **Edgar A. Mendoza,** Redondo Optics, Inc.

10:30 am: **Portable open-path chemical sensor using a quantum cascade laser**, Paul A. Corrigan, Maung Lwin, Reuven Huntley, Amandeep Chhabra, Fred Moshary, Barry M. Gross, Samir A. Ahmed, City College, CUNY (United States). . . . . [7312-24]

10:50 am: **Fabrication and characterization of high-sensitive Love wave devices**, Jia Hu, Xiaosong Du, Guangzhong Xie, Ping Sun, Yadong Jiang, Univ. of Electronic Science and Technology of China (China) . . . . . [7312-25]

11:10 am: **Compact photoacoustic chemical sensor**, David Wells, Maxion Technologies, Inc. (United States). . . . . [7312-26]

11:30 am: **Fast detection of toxic industrial compounds by laser ion mobility spectrometry**, Carola Oberhuettinger, Andreas Langmeier, Helmut Oberpriller, Matthias Kessler, Johann Goebel, Gerhard Müller, EADS Deutschland GmbH (Germany) . . . . . [7312-27]

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

SESSION 7

Room: Crystal B . . . . . .Tues. 1:30 to 3:10 pm

Sensing Applications I

Session Chair: **Lothar U. Kempen,** Intelligent Optical Systems, Inc.

1:30 pm: **Satellite-observed sensitivity of weather condition for predicting malaria vector distribution in Bandarban district, Bangladesh**, Mohammad Nizamuddin, Atiqur Rahman, Leonid M. Roytman, City College, CUNY (United States); Felix N. Kogan, Alfred M. Powell, Jr., National Oceanic and Atmospheric Administration (United States) . . . . . [7312-28]

1:50 pm: **Optical autocovariance direct detection lidar for simultaneous wind, aerosol, and chemistry profiling from ground, air, and space platforms**, Christian J. Grund, James Howell, Robert Pierce, Michelle Stephens, Ball Aerospace & Technologies Corp. (United States). . . . . [7312-37]

2:10 pm: **Oil spill detection**, Wei-Chuan Shih, Ballard Andrews, Schlumberger-Doll Research Ctr. (United States). . . . . [7312-30]

2:30 pm: **Fluorescent detection of dipicolinic acid using synthesis surface imprinted ligand**, El Mostafa Sadoqi, Anne O'Kafor, St. John's Univ. (United States); Sunil Kumar, Kalle Levon, Polytechnic Univ. (United States). . . . [7312-31]

2:50 pm: **Detecting insect infestation with poly3-hexylthiophene-2,5-diyl thin film sensor**, Kanchana A. Weerakoon, Suiqiong Li, Hungjen J. Shu, Bryan A. Chin, Auburn Univ. (United States). . . . . [7312-32]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 8

Room: Crystal B . . . . . .Tues. 3:40 to 5:00 pm

Sensing Applications II

Session Chair: **Robert A. Lieberman,** Intelligent Optical Systems, Inc.

3:40 pm: **Artificial neural network (ANN) based land cover types classification using ASTER data**, Guoyin Cai, Institute of Remote Sensing Applications (China). . . . . [7312-33]

4:00 pm: **Absorption laser-induced breakdown spectroscopy**, Hani E. Elsayed-Ali, Olodia A. Nassef, Old Dominion Univ. (United States). . . . . [7312-34]

4:20 pm: **Studies of minerals, organic and biogenic materials through time-resolved Raman spectroscopy**, Christopher Garcia, Old Dominion Univ. (United States); M. Nurul Abedin, Syed Ismail, NASA Langley Research Ctr. (United States); Shiv K. Sharma, Anupam K. Misra, Univ. of Hawai'i (United States); Hani E. Elsayed-Ali, Old Dominion Univ. (United States) . . . . . [7312-35]

4:40 pm: **Research of soil moisture retrieval in arid region on the watershed scale**, Qing Zhang, Xiuwan Chen, Peking Univ. (China) . . . . . [7312-36]

Smart Biomedical and Physiological Sensor Technology VI

Conference Chairs: **Brian M. Cullum,** Univ. of Maryland, Baltimore County; **D. Marshall Porterfield,** Purdue Univ.

Program Committee: **Karl S. Booksh,** Univ. of Delaware; **Marie-Christine Daniel,** Univ. of Maryland, Baltimore County; **Sheila A. Grant,** Univ. of Missouri, Columbia; **David A. Heaps,** AstraZeneca; **Ilko K. Ilev,** U.S. Food and Drug Administration; **Chang-Soo Kim,** Missouri Univ. of Science and Technology; **Joel Mobley,** The Univ. of Mississippi; **W. Todd Monroe,** Louisiana State Univ.; **Joshua Pfefer,** U.S. Food and Drug Administration; **Shiv K. Sharma,** Univ. of Hawai'i at Manoa; **Liju Yang,** North Carolina Central Univ.; **Jeong-Yeol Yoon,** The Univ. of Arizona; **Anhong Zhou,** Utah State Univ.

Thursday 16 April

SESSION 1

Room: Crystal D . . . . . Thurs. 8:30 to 10:10 am

Nanoscience in Biomedicine

Session Chairs: **Marie-Christine Daniel,** Univ. of Maryland, Baltimore County; **Jeong-Yeol Yoon,** The Univ. of Arizona

8:30 am: **Nanoscale structure-activity relationships in the treatment of disease** *(Invited Paper)*, Daniel Feldheim, Univ. of Colorado at Boulder (United States) . . . . . [7313-01]

8:50 am: **Probing the interaction of human plasma proteins and nanoparticles** *(Invited Paper)*, Silvia H. Lacerda, National Institute of Standards and Technology (United States) . . . . . [7313-02]

9:10 am: **Multifunctional nanocarriers based on dendronized gold nanoparticles**, Marie-Christine Daniel, Margaret Grow, Maria Bednarek, Cesar Baeta, Univ. of Maryland, Baltimore County (United States) . . . . . [7313-03]

9:30 am: **Spectral and fluorescence imaging of immune system and tissue response to an immunogenic agent**, Se-woon Choe, Abhinav Acharya, Benjamin Keselowsky, Brian S. Sorg, Univ. of Florida (United States) . . . [7313-04]

9:50 am: **Protein nanoarray made by size-dependent self-assembly for detection of mouse immunoglobulin G and octamer-4**, Phat L. Tran, Tremaine B. Powell, Keesung Kim, Jeong-Yeol Yoon, The Univ. of Arizona (United States) . . . . . [7313-05]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Crystal D . . . . . Thurs. 10:40 am to 12:20 pm

Novel Biosensing Platforms and Materials I

Session Chairs: **Chang-Soo Kim,** Missouri Univ. of Science and Technology; **Anhong Zhou,** Utah State Univ.

10:40 am: **Important considerations in development of reference-free optical biosensors**, Mohammad R. Chatni, Gang Li, D. Marshall Porterfield, Purdue Univ. (United States) . . . . . [7313-06]

11:00 am: **An integrated fluidic system for photometric dissolved oxygen measurements**, Jongwon Park, Chang-Soo Kim, Missouri Univ. of Science and Technology (United States) . . . . . [7313-07]

11:20 am: **Fluidic biosensors with integrated photografted hydrogel sensing elements**, Zhan Gao, Youyou Zheng, David B. Henthorn, Chang-soo Kim, Missouri Univ. of Science and Technology (United States) . . . . . [7313-08]

11:40 am: **Photopatternable hydrogel materials for reversible optical glucose sensors**, Christian M. Pick, Chang-Soo Kim, David B. Henthorn, Missouri Univ. of Science and Technology (United States) . . . . . [7313-09]

12:00 pm: **SmartHEALTH: a microfluidic multisensor platform for POC cancer diagnostics**, Cornelia Carstens, Holger Becker, Claudia Gärtner, Microfluidic ChipShop GmbH (Germany) . . . . . [7313-10]

Lunch/Exhibition Break . . . . . 12:20 to 1:50 pm

SESSION 3

Room: Crystal D . . . . . Thurs. 1:50 to 3:50 pm

Novel Biosensing Platforms and Materials II

Session Chairs: **Karl S. Booksh,** Univ. of Delaware; **Shiv K. Sharma,** Univ. of Hawai'i at Manoa

1:50 pm: **Optimization of multilayer surface-enhanced Raman scattering (SERS) immuno-nanosensors via self-assembled monolayer spacers**, Charles K. Klutse, Honggang Li, Brian M. Cullum, Univ. of Maryland, Baltimore County (United States) . . . . . [7313-11]

2:10 pm: **Surface plasmon resonance biosensing toward real biological sample analysis** *(Invited Paper)*, Jean-Francois Masson, Olivier Bolduc, Univ. de Montréal (Canada) . . . . . [7313-12]

2:30 pm: **Tunable fiber optic imaging bundle SERS substrates**, John B. Kiser, Mikella E. Hankus, Brian M. Cullum, Univ. of Maryland, Baltimore County (United States) . . . . . [7313-13]

2:50 pm: **New microcavity substrates for enhancing Raman signals of microscopic samples**, Shiv K. Sharma, Anupam K. Misra, Lori Kamemoto, Ava Dykes, Tayro Acosta, Univ. of Hawai'i (United States) . . . . . [7313-14]

3:10 pm: **Interaction of gold nanoparticles with Hb and BSA**, Poorani G. Gananathan, Sivabalan Shanmugam, Aruna Prakasa Rao, Singaravelu Ganesan, Anna Univ. (India) . . . . . [7313-15]

3:30 pm: **Novel configuration coupling surface plasmon resonance and electrokinetic separations for quantitative monitoring of biomolecules,** Karl S. Booksh, Michael R. Malone, Univ. of Delaware (United States) . . [7313-16]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

A multimodal technique for the quantification of dynamic stress, Vishal Saxena, Univ. of Southern California (United States) and AppWave (United States) . . . . . [7313-26]

A commercial MOSFET-based biosensor with a gold extended gate electrode, Hong-Kun Lyu, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Young-Sam Choi, Jang-Kyoo Shin, Kyungpook National Univ. (Korea, Republic of); Jae-Hyun Kim, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of) . . . . . [7313-27]

Friday 17 April

SESSION 4

Room: Crystal D . . . . . Fri. 8:30 to 9:50 am

Viral and Pathogen Sensing

Session Chairs: **Sheila A. Grant,** Univ. of Missouri, Columbia;
Ilko K. Ilev, U.S. Food and Drug Administration

8:30 am: **Electrospun sol-gel fibers for fluorescence-based sensing**, Jasenka Memisevic, Lela Riley, Sheila A. Grant, Univ. of Missouri, Columbia (United States). . . . . [7313-17]

8:50 am: **Detection of avian influenza A H_3N_2 antigens in mirochannel and droplet microfluidics**, Jeong-Yeol Yoon, The Univ. of Arizona (United States). . . . . [7313-18]

9:10 am: **SERS-based immuno-microwell arrays for multiplexed detection of food-borne pathogenic bacteria**, Jian Sun, Mikella E. Hankus, Brian M. Cullum, Univ. of Maryland, Baltimore County (United States) . . . . . [7313-19]

9:30 am: **Magnetic-field tuning of the frequency and sensitivity response of a magnetoelastic biosensor**, Wen Shen, Leslie Mathison, Bryan A. Chin, Auburn Univ. (United States). . . . . [7313-20]

Coffee Break . . . . . 9:50 to 10:30 am

SESSION 5

Room: Crystal D . . . . . Fri. 10:30 am to 12:10 pm

Biomedical Sensing at the Clinic and Field

Session Chairs: **Joel Mobley,** The Univ. of Mississippi;
Brian M. Cullum, Univ. of Maryland, Baltimore County

10:30 am: **Differentiating pediatric epileptic cortical lesions from normal cortex by using time-dependent diffuse reflectance spectroscopy in vivo**, Sanghoon Oh, Miami Children's Hospital (United States) and Florida International Univ. (United States); Bradley Fernald, Florida International Univ. (United States); Sanjiv Bhatia, John Ragheb, David Sandberg, Miami Children's Hospital (United States) and Univ. of Miami (United States); Mahlon D. Johnson, Univ. of Rochester Medical Ctr. (United States); Wei-Chiang Lin, Miami Children's Hospital (United States) and Florida International Univ. (United States). . . . . [7313-21]

10:50 am: **Observation of the human body thermoregulation and extraction of its vein signature using NIR and MWIR imaging**, Nabila Bouzida, Abdelhakim Bendada, Xavier P. V. Maldague, Univ. Laval (Canada) . . . . . [7313-22]

11:10 am: **Development of variable-depth HIFU (high-intensity focused ultrasound) applicators for image-guided remote hemostasis**, Joel Mobley, Jason L. Raymond, David S. Woolworth, Charles C. Church, The Univ. of Mississippi (United States); Peter J. Kaczkowski, Univ. of Washington (United States). . . . . [7313-23]

11:30 am: **Detecting electric-field disturbances for passive through-wall movement and proximity sensing**, Sam Beardsmore-Rust, Philip Watson, Robert J. Prance, Christopher J. Harland, Helen Prance, Peter Stiffell, Univ. of Sussex (United Kingdom) . . . . . [7313-24]

11:50 am: **An end-to-end solution for monitoring health status of first responders**, Jacob Yadegar, Zvi Topol, Anurag Ganguli, UtopiaCompression Corp. (United States); William J. Kaiser, Univ. of California, Los Angeles (United States); Massoud Agahi, Cedars-Sinai Medical Ctr. (United States) . . . . [7313-25]

Photonics in the Transportation Industry: Auto to Aerospace II

Conference Chairs: **Alex A. Kazemi,** The Boeing Co.; **Bernard C. Kress,** Univ. Louis Pasteur (France)

Program Committee: **Frank Abdi,** AlphaSTAR Corp.; **Ayman Abouraddy,** CREOL, The College of Optics and Photonics, Univ. of Central Florida; **Hamid Aghvami,** King's College London (United Kingdom); **Thomas D. P. Allsop,** Aston Univ. (United Kingdom); **Pierre Ambs,** Univ. de Haute Alsace (France); **Ayoub Chakari,** Univ. Louis Pasteur (France); **Eric Y. Chan,** The Boeing Co.; **Catherine Ciardiello,** OFS; **Marc Comet,** Institut Franco-Allemand de Recherches de Saint-Louis (France); **Brian Culshaw,** Univ. of Strathclyde (United Kingdom); **Dan Silviu Curticapean,** Fachhochschule Offenburg (Germany); **Mahendra S. Dassanayake,** Ford Co.; **Richard M. De La Rue,** Univ. of Glasgow (United Kingdom); **Thomas Dietsch,** BMW AG (Germany); **Basil Garabet,** EM4, Inc.; **Harold Hager,** The Boeing Co.; **Beth C. Haskell,** PerkinElmer Optoelectronics; **Kenneth M. Hays,** The Boeing Co.; **Zuyuan He,** The Univ. of Tokyo (Japan); **Vic Hejmadi,** Universal Semiconductor, Inc.; **Richard T. Howard,** NASA Marshall Space Flight Ctr.; **Jeffrey H. Hunt,** The Boeing Co.; **Nicolas Javahiraly,** Univ. Louis Pasteur (France); **Lothar U. Kempen,** Intelligent Optical Systems, Inc.; **Peter Kiesel,** Palo Alto Research Ctr., Inc.; **Georg Kodl,** LEONI AG (Germany); **David A. Krohn,** Light Wave Venture Consulting, LLC; **Jack Latchinian,** Zygo Corp.; **Patrick P. Meyrueis,** Univ. Louis Pasteur (France); **Jean-Pierre Moeglin,** Institut Franco-Allemand de Recherches de Saint-Louis (France); **Mohammad Mojahedi,** Univ. of Toronto (Canada); **Herbert O. Moser,** National Univ. of Singapore (Singapore); **Nezih Mrad,** Defence Research and Development Canada (Canada); **Juock S. Namkung,** Naval Air Warfare Ctr.; **Allen S. Panahi,** Accro USA LLC; **Saeed Rehman,** FiberLogix Ltd. (United Kingdom); **Ahmad Safaai-Jazi,** Virginia Polytechnic Institute and State Univ.; **Stephen Sagan,** BAE Systems; **Martin Schell,** Fraunhofer-Institut für Nachrichtentechnik-Heinrich-Herz (Germany); **Michel Sirieix,** Sagem Defense Securite (France); **Massood Tabib-Azar,** Case Western Reserve Univ.; **Simon Thibault,** ImmerVision (Canada); **Tuan Vo-Dinh,** Duke Univ.

Monday 13 April

SESSION 1

Room: Crystal D . . . . . Mon. 8:30 to 10:20 am

Sensors in Transportation/Aerospace Applications I

Session Chair: **Alex A. Kazemi,** The Boeing Co.

8:30 am: **Resonator fiber optic gyroscope with digital serrodyne scheme using a digital controller**, Xijing Wang, Zuyuan He, Kazuo Hotate, The Univ. of Tokyo (Japan) . . . . . [7314-01]

8:50 am: **Wireless ZigBee strian gage sensor system for structural health monitoring**, Frank Abdi, AlphaSTAR Corp. (United States) . . . . . [7314-02]

9:10 am: **Health monitoring system and evaluation of Army composite bridge**, Frank Abdi, AlphaSTAR Corp. (United States) . . . . . [7314-03]

9:30 am: **Design, study, and achievement of a fiber optic amplitude modulation sensor for angular position detection: application to an automotive steering sytem**, Nicolas Javahiraly, Cedric Perrotton, Ayoub Chakari, Patrick P. Meyrueis, Univ. Louis Pasteur (France) . . . . . [7314-04]

9:50 am: **Fiber optic emerging technologies for detection of hydrogen in space applications** *(Invited Paper)*, Alex A. Kazemi, The Boeing Co. (United States). . . . . [7314-05]

Coffee Break . . . . . 10:20 to 10:50 am

SESSION 2

Room: Crystal D . . . . . Mon. 10:50 am to 12:10 pm

Sensors in Transportation/Aerospace Applications II

Session Chair: **Tuan Vo-Dinh,** Duke Univ.

10:50 am: **Fiber optic sensor applications in transportation infrastructure protection**, David A. Krohn, Light Wave Venture Consulting, LLC (United States); Paul Nicholls, SensorTran (United Kingdom) . . . . . [7314-06]

11:10 am: **Optimizing the optical components choice for performances improvement of multimode fiber gyroscope**, Hocine Medjadba, Lab. of Electronics and Optoelectronics Systems (Algeria); Sylvain Lecler, Photonics Systems Lab. (France); Lotfy Mokhtar Simohamed, Lab. of Electronics and Optoelectronics Systems (Algeria); Ayoub Chakari, Nicolas Javahiraly, Photonics Systems Lab. (France). . . . . [7314-07]

11:30 am: **Multitask single lens for automotive vision applications**, Simon Thibault, Patrice Roulet, Mathieu Villegas, ImmerVision (Canada) [7314-08]

11:50 am: **Fiber optic cryogenic liquid level detection system for space applications**, Alex A. Kazemi, The Boeing Co. (United States) . . . . . [7314-09]

Lunch Break . . . . . 12:10 to 1:20 pm

SESSION 3

Room: Crystal D . . . . . Mon. 1:20 to 3:00 pm

Sensors in Transportation/Aerospace Applications III

Session Chair: **Bernard C. Kress,** Univ. Louis Pasteur (France)

1:20 pm: **Distributed network of integrated 3D sensors for transportation security applications**, Vic Hejmadi, Alex Hong, Universal Semiconductor, Inc. (United States). . . . . [7314-10]

1:40 pm: **Optical sensors for spacecraft relative navigation**, Richard T. Howard, NASA Marshall Space Flight Ctr. (United States) . . . [7314-11]

2:00 pm: **Fiber optic-based oxygen leak detection system for military and commercial aircrafts inerting fuel tanks**, Allen S. Panahi, Accro USA LLC (United States). . . . . [7314-12]

2:20 pm: **Optical engine initiation: multiple compartment applications**, Jeffrey H. Hunt, The Boeing Co. (United States). . . . . [7314-13]

2:40 pm: **The exploitation of thin film coatings for fibre sensors for the application of chemical sensing**, Thomas D. P. Allsop, Aston Univ. (United Kingdom); Ron Neal, Univ. of Plymouth (United Kingdom); Saeed Rehman, STR Fiber Technologies (United Kingdom); Robert R. J. Maier, James S. Barton, Heriot-Watt Univ. (United Kingdom); David J. Webb, Aston Univ. (United Kingdom); Julian D. C. Jones, Heriot-Watt Univ. (United Kingdom); Ian Bennion, Aston Univ. (United Kingdom). . . . . [7314-22]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 4

Room: Crystal D . . . . . Mon. 3:30 to 5:00 pm

Micro/Nanophotonics in Transportation

Session Chair: **Michel Sirieix,** Sagem Defense Securite (France)

3:30 pm: **Micro/nanomanufactured THz electromagnetic metamaterials as a base for applications in transportation**, Herbert O. Moser, National Univ. of Singapore (Singapore). . . . . [7314-15]

3:50 pm: **Multimaterial photosensitive fiber constructs enable large-area optical sensing and imaging**, Ayman Abouraddy, College of Optics & Photonics, Univ. of Central Florida (United States); Yoel Fink, Massachusetts Institute of Technology (United States) . . . . . [7314-16]

4:10 pm: **Low-cost mass replicable plastic HUD combiner element** *(Invited Paper)*, Bernard C. Kress, Univ. Louis Pasteur (France); Pierre St. Hilaire, AVR Inc. (United States); Victorien Raulot, Patrick P. Meyrueis, Univ. Louis Pasteur (France) . . . . . [7314-17]

4:40 pm: **Low-cost high data rate white LED (WLED) transceiver development**, Eric Y. Chan, Dennis G. Koshinz, William P. Krug, Harold Hager, The Boeing Co. (United States). . . . . [7314-18]

SESSION 5

Room: Crystal D . . . . . Mon. 5:00 to 6:00 pm

Photonics in Data Transmission for Transportation

Session Chair: **Eric Y. Chan,** The Boeing Co.

5:00 pm: **Space-based laser cross-link systems used in satellite communications**, Allen S. Panahi, Accro USA LLC (United States); Alex A. Kazemi, The Boeing Co. (United States). . . . . [7314-19]

5:20 pm: **Virtual diffractive consoles for transportation**, Renaud R. Kiefer, Bernard C. Kress, Joseph-Joël Fontaine, Univ. Louis Pasteur (France) . . [7314-20]

5:40 pm: **Performance and qualification gaps between commercial and space-based high-power diode laser modules**, Alex Rosiewicz, EM4 Inc. (United States). . . . . [7314-21]

Tuesday 14 April

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

Nanothermites for space and defence applications, Marc Comet, Denis Spitzer, Jean-Pierre Moeglin, Institut Franco-Allemand de Recherches de Saint-Louis (France) . . . . . [7314-23]

Sensing for Agriculture and Food Quality and Safety

Conference Chairs: **Moon S. Kim,** USDA Agricultural Research Service; **Shu-I Tu,** USDA Agricultural Research Service; **Kaunglin Chao,** USDA Agricultural Research Service

Program Committee: **Arjun Bangalor,** ChemImage Corp.; **Arun K. Bhunia,** Purdue Univ.; **Suming Chen,** National Taiwan Univ. (Taiwan); **Stephen R. Delwiche,** USDA Agricultural Research Service; **Ki-Bok Kim,** Korea Research Institute of Standards and Science (South Korea); **Naoshi Kondo,** Kyoto Univ. (South Korea); **Kurt C. Lawrence,** USDA Agricultural Research Service; **Kang-Jin Lee,** Rural Development Administration (South Korea); **Alan M. Lefcourt,** USDA Agricultural Research Service; **Renfu Lu,** USDA Agricultural Research Service; **Bosoon Park,** USDA Agricultural Research Service; **Yankun Peng,** China Agricultural Univ. (China); **Yang Tao,** Univ. of Maryland, College Park; **Gang Yao,** Univ. of Missouri, Columbia; **Yibin Ying,** Zhejiang Univ. (China)

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Crystal D . . . . . Tues. 10:30 am to 12:10 pm

Biosensors and Pathogen Detection

Session Chair: **Shu-I Tu,** USDA Agricultural Research Service

10:30 am: **Detecting Escherichia coli strains using magnetically loaded fluorescence labeled polymeric nanoparticles**, F. Yeşm Ekinci, Yeditepe Univ. (Turkey); Filiz Sayar, Ayfer Çaliş, Erhan Piskin, Hacettepe Üniv. (Turkey). [7315-01]

10:50 am: **Phage-based magnetoelastic biosensor for the detection of Salmonella typhimurium**, Suiqiong Li, Ramji S. Lakshmanan, Rajesh Guntupalli, Shichu Huang, Z. Y. Cheng, Valery A. Petrenko, James M. Barbaree, Vitaly Vodyanoy, Bryan A. Chin, Auburn Univ. (United States). . . . . [7315-02]

11:10 am: **Conducting polymer-based DNA biosensor for the detection of Bacillus cereus group species**, Vijayalakshmi Velusamy, Khalil I. Arshak, Olga Korostynska, Kamila Oliwa, Catherine Adley, Univ. of Limerick (Ireland) . . . . . [7315-03]

11:30 am: **Portable integrated capillary-electrophoresis system using disposable polymer chips with capacitively coupled contactless conductivity detection for on-site analysis of foodstuff**, Claudia Gärtner, Richard Klemm, Holger Becker, Microfluidic ChipShop GmbH (Germany). . . . . [7315-04]

11:50 am: **Environmental effects on the production of Shiga-like toxins by E. coli O157:H7 as revealed by sandwiched immuno chemiluminescence detection**, Shu-I Tu, Joseph Uknalis, Yiping He, USDA Agricultural Research Service (United States) . . . . . [7315-05]

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

SESSION 2

Room: Crystal D . . . . . Tues. 1:40 to 3:10 pm

Laser and Raman Applications

Session Chair: **Arun K. Bhunia,** Purdue Univ.

1:40 pm: **Recent advances in chemical imaging technology for the detection of contaminants for food safety and security** *(Invited Paper)*, Ryan Priore, Oksana Olkhovyk, David Tuschel, Patrick J. Treado, ChemImage Corp. (United States); Moon S. Kim, Kaunglin Chao, USDA Agricultural Research Service (United States) . . . . . [7315-06]

2:10 pm: **Microsystem technology based diode lasers and Raman sensors for in-situ food quality control**, Bernd Sumpf, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); Heinar G. Schmidt, Technische Univ. Berlin (Germany); Martin Maiwald, Andre Müller, Götz Erbert, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany); Günther Tränkle, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany) . . . . . [7315-07]

2:30 pm: **In-situ characterization of meat aging with diode-laser Raman spectroscopy**, Heinar G. Schmidt, Jenny Blum, Kay Sowoidnich, Technische Univ. Berlin (Germany); Bernd Sumpf, Ferdinand-Braun-Institut für Höchstfrequenztechnik (Germany); Fredi Schwägele, Max Rubner-Institut (Germany); Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany) . . . . . [7315-08]

2:50 pm: **Prediction of the light scattering patterns from bacteria colonies by a time-resolved reaction-diffusion model and the scalar diffraction theory**, Euiwon Bae, Nan Bai, Amornrat Aroonnual, Arun K. Bhunia, J. Paul Robinson, E. Daniel Hirleman, Jr., Purdue Univ. (United States) . . . . . [7315-09]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 3

Room: Crystal D . . . . . Tues. 3:40 to 5:20 pm

Optical Sensing I

Session Chair: **Gang Yao,** Univ. of Missouri, Columbia

3:40 pm: **Proactive detection of bones on a poultry processing line**, Wayne D. Daley, John M. Stewart, Georgia Tech Research Institute (United States). . . . . [7315-10]

4:00 pm: **Using a 3D profiler and infrared camera to monitor oven loading in fully cooked meat operations**, John M. Stewart, Aklilu Georges, Georgia Tech Research Institute (United States). . . . . [7315-11]

4:20 pm: **Nondestructive real-time monitoring of fiber formation in meat analogs**, Janaka C. Ranasinghesagara, Fu-Hung Hsieh, Harold Huff, Gang Yao, Univ. of Missouri, Columbia (United States) . . . . . [7315-12]

4:40 pm: **Uninformation variable elimination and successive projections algorithm in midinfrared spectral wavenumber selection**, Di Wu, Fang Cao, Zili Zhou, Shuijuan Feng, Yong He, Zhejiang Univ. (China). . . . . [7315-13]

5:00 pm: **Identification of Thai Hom Mali rice using a refractometer,** Sarun Sumriddetchkajorn, National Electronics and Computer Technology Ctr. (Thailand); Kajpanya Suwansukho, King Mongkut's Institute of Technology Lakrabang (Thailand). . . . . [7315-14]

POSTERS-TUESDAY

Room: Palms Foyer . . . . . Tues. 6:00 to 7:30 pm

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Use of vegetation health data for estimation of Aus rice yield in Bangladesh, Atiqur Rahman, City College, CUNY (United States); Humayun Kabir, New York State Dept. of Transportation (United States); Mohammad Nizamuddin, Leonid M. Roytman, City College, CUNY (United States); Mitchell D. Goldberg, National Oceanic and Atmospheric Administration (United States) . . . . . [7315-33]

Development of a portable electronic nose for freshness measurement of stored meat, Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of) . . . . . [7315-36]

Development of a real-time system of monitoring the bacterial growth and registering the forward-scattering pattern, Nan Bai, Euiwon Bae, Amornrat Aroonnual, Arun K. Bhunia, J. Paul Robinson, E. Daniel Hirleman, Jr., Purdue Univ. (United States) . . . . . [7315-37]

Dimensionality reduction of hyperspectral images using kernel ICA, Asif Khan, Intaek Kim, Myongji Univ. (Korea, Republic of); Seong G. Kong, Temple Univ. (United States) . . . . . [7315-41]

Textural feature extraction and optimization in wavelet sub-bands to identify raisin varieties, Di Wu, Fang Cao, Zhejiang Univ. (China); Zili Zhou, Zhejiang Professional Technology Institute of Mechanical and Electrical Engineering (China); Yong He, Zhejiang Univ. (China) . . . . . [7315-42]

Detection of antigen-antibody reaction by Love wave SAW device and comparison with SPR biosensor, Ki-Bok Kim, Sangdae Lee, Yong-Il Kim, Dong-Jin Yoon, Bongyoung Ahn, Korea Research Institute of Standards and Science (Korea, Republic of) . . . . . [7315-43]

Wednesday 15 April

SESSION 4

Room: Crystal D . . . . . Wed. 8:20 to 10:00 am

Hyperspectral Imaging for Food Quality

Session Chair: **Stephen R. Delwiche,** USDA Agricultural Research Service

8:20 am: **Algorithm development for detection of mechanical injury on white mushrooms (Agaricus bisporus) using hyperspectral imaging**, Aoife A. Gowen, Colm P. O'Donnell, Univ. College Dublin (Ireland) . . . . . [7315-15]

8:40 am: **Classical and hyperspectral machine vision logics applied to hazelnut quality assessment**, Giuseppe Bonifazi, Laura D'aniello, Aldo Gargiulo, Silvia Serranti, Univ. degli Studi di Roma, La Sapienza (Italy) . . . . . [7315-16]

9:00 am: **Analysis of hyperspectral scattering characteristics for predicting apple fruit firmness and soluble solids content**, Renfu Lu, Min Huang, USDA Agricultural Research Service (United States); Jianwei Qin, Univ. of Florida (United States) . . . . . [7315-17]

9:20 am: **Online high-speed NIR diffuse-reflectance imaging spectroscopy in food quality monitoring**, Richard Driver, Kevin M. DiDona, Headwall Photonics Inc. (United States) . . . . . [7315-18]

9:40 am: **Near-infrared hyperspectral imaging of damaged wheat kernels**, Stephen R. Delwiche, USDA Agricultural Research Service (United States); I-Chang Yang, National Taiwan Univ. (Taiwan); Moon S. Kim, USDA Agricultural Research Service (United States) . . . . . [7315-19]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 5

Room: Crystal D . . . . . Wed. 10:30 am to 12:00 pm

Hyperspectral Imaging Applications

Session Chair: **Renfu Lu,** USDA Agricultural Research Service

10:30 am: **Quantification and threshold detection in real-time hyperspectral imaging** *(Invited Paper)*, Richard Driver, Headwall Photonics Inc. (United States) . . . . . [7315-20]

11:00 am: **Hyperspectral machine vision procedures applied to compost characterisation**, Giuseppe Bonifazi, Silvia Serranti, Univ. degli Studi di Roma, La Sapienza (Italy) . . . . . [7315-21]

11:20 am: **Feature level fusion for hyperspectral images**, Chengzhe Xu, Intaek Kim, Myongji Univ. (Korea, Republic of); Seong G. Kong, Temple Univ. (United States) . . . . . [7315-22]

11:40 am: **Effects of harvest time on citrus canker detection using hyperspectral reflectance imaging**, Jianwei Qin, Thomas F. Burks, Xuhui Zhao, Mark A. Ritenour, Univ. of Florida (United States); Gordon W. Bonn, Florida Dept. of Agriculture and Consumer Services (United States) . . . . . [7315-23]

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

SESSION 6

Room: Crystal D . . . . . Wed. 1:30 to 3:00 pm

Hyperspectral Imaging for Food Safety

Session Chair: **Aoife A. Gowen,** Univ. College Dublin (Ireland)

1:30 pm: **Hyperspectral imaging platform for food quality and safety inspection** *(Invited Paper)*, Moon S. Kim, Diane E. Chan, Won Jun, Kaunglin Chao, Alan M. Lefcourt, Stephen R. Delwiche, USDA Agricultural Research Service (United States); Kang-Jin Lee, Rural Development Administration (Korea, Republic of) . . . . . [7315-24]

2:00 pm: **Prediction of the microbial spoilage of beef based on hyperspectral scattering profiles**, Yankun Peng, Jing Zhang, Jianhu Wu, China Agricultural Univ. (China) . . . . . [7315-25]

2:20 pm: **Automatic detection of aflatoxin contaminated corn kernels using dual-band imagery**, Ambrose E. Ononye, Haibo Yao, Zuzana Hruska, Russell Kincaid, Institute for Technology Development (United States); Robert L. Brown, Thomas E. Cleveland, USDA Agricultural Research Service (United States) . . . . . [7315-26]

2:40 pm: **Application of hyperspectral fluorescence imaging for identification of microbial biofilms on food processing surfaces**, Won Jun, Moon S. Kim, USDA Agricultural Research Service (United States); Kangjin Lee, National Institute of Agricultural Engineering (Korea, Republic of); Kaunglin Chao, Alan M. Lefcourt, USDA Agricultural Research Service (United States) . . [7315-27]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 7

Room: Crystal D . . . . . Wed. 3:30 to 4:50 pm

Optical Sensing II

Session Chair: **Kaunglin Chao,** USDA Agricultural Research Service

3:30 pm: **Spatial mapping using infrared reflectance spectroscopy of potentially mineralisable nitrogen and the relationship to crop production**, Daniel V. Murphy, Mahdi Osman, Craig A. Russell, Sigit Darmawanto, Frances C. Hoyle, John M. Dell, The Univ. of Western Australia (Australia) . . . . . [7315-28]

3:50 pm: **Dynamic multispectral imaging remote sensor with spectral zooming**, Bing Chen, Univ. of Miami (United States); Jianwen J. Yang, New Span Opto-Technology Inc. (United States); Michael R. Wang, Univ. of Miami (United States) . . . . . [7315-29]

4:10 pm: **Multispectral imaging for predicting soluble solids content and pH of grapes**, Fang Cao, Di Wu, Zhejiang Univ. (China); Zili Zhou, Zhejiang Professional Technology Institute of Mechanical and Electrical Engineering (China); Yong He, Zhejiang Univ. (China) . . . . . [7315-31]

4:30 pm: **Combination of simple chemical and spectroscopic methods for the identification of Thai Hom Mali rice**, Kajpanya Suwansukho, King Mongkut's Institute of Technology Lakrabang (Thailand); Sarun Sumriddetchkajorn, National Electronics and Computer Technology Ctr. (Thailand) . . . . . [7315-32]

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Fiber Optic Sensors and Applications VI

Wednesday 15 April

SESSION 1

Room: Grand 7B . . . . . Wed. 8:30 am to 12:20 pm

Distributed Sensors, Raman, and Brillouin Sensing

Session Chairs: **Anbo Wang,** Virginia Polytechnic Institute and State Univ.; **Alexis Mendez,** MCH Engineering LLC

8:30 am: **Long-distance fiber optic sensing solutions for pipeline leakage, intrusion, and ground movement detection** *(Invited Paper)*, Marc Nikles, Omnisens S.A. (Switzerland) . . . . . [7316-01]

9:00 am: **Feasibility study of the automated detection and localization of underground tunnel excavation using Brillouin optical time domain reflectometer**, Assaf Klar, Raphael Linker, Technion-Israel Institute of Technology (Israel) . . . . . [7316-02]

9:20 am: **Elimination of rain-induced nuisance alarms in distributed fiber optic perimeter intrusion detection systems**, Seedahmed Mahmoud, Jim Katsifolis, Future Fibre Technologies Pty Ltd. (Australia) . . . . . [7316-03]

9:40 am: **Distributed temperature sensing via Brillouin-tailored optical fiber**, Peter D. Dragic, Neolight Technologies LLC (United States) . . . . . [7316-04]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Fiber optic distributed sensing applications in defense, security, and energy** *(Invited Paper)*, Mikko Jaaskelainen, SensorTran (United States) . . . . . [7316-05]

11:00 am: **Tailoring of the Brillouin gain profile for fiber-based sensor systems and networks**, Peter D. Dragic, Neolight Technologies LLC (United States) . . . . . [7316-06]

11:20 am: **Raman sensing of fuel gases using a reflective coating capillary optical fiber**, Steven D. Woodruff, National Energy Technology Lab. (United States); Michael P. Buric, Kevin P. Chen, Joel Falk, National Energy Technology Lab. (United States) and Univ. of Pittsburgh (United States); Ricardo Velez, National Energy Technology Lab. (United States). . . . . [7316-07]

11:40 am: **Multipoint temperature compensated fiber optic oxygen leak detection system for monitoring aircraft fuel tanks**, Edgar A. Mendoza, Redondo Optics, Inc. (United States) . . . . . [7316-08]

12:00 pm: **Distributed strain and temperature sensing in plastic optical fiber using Rayleigh scatter**, Steven T. Kreger, Dawn K. Gifford, Alexander K. Sang, Luna Innovations Inc. (United States) . . . . . [7316-09]

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

SESSION 2

Room: Grand 7B . . . . . Wed. 1:30 to 3:00 pm

Fiber Grating Sensors I

Session Chairs: **Jerry J. Benterou,** Lawrence Livermore National Lab.; **Stephen J. Mihailov,** Communications Research Ctr. Canada (Canada)

1:30 pm: **Through-the-jacket inscription of fiber Bragg gratings using femtosecond infrared radiation for sensor applications** *(Invited Paper)*, Stephen J. Mihailov, Dan Grobnic, Christopher W. Smelser, Robert B. Walker, Communications Research Ctr. Canada (Canada) . . . . . [7316-10]

2:00 pm: **Radiation sensitivity of Bragg gratings written with femtosecond IR lasers**, Stefan K. Hoeffgen, Henning Henschel, Jochen Kuhnhenn, Udo Weinand, Fraunhofer-Institut für Naturwissenschaftlich-Technische Trendanalysen (Germany); Stephen J. Mihailov, Dan Grobnic, Communications Research Ctr. Canada (Canada) . . . . . [7316-11]

2:20 pm: **Bragg gratings written in multimode borosilicate fibers using ultrafast infrared radiation and a phase mask**, Dan Grobnic, Stephen J. Mihailov, Christopher W. Smelser, Communications Research Ctr. Canada (Canada). . . . . [7316-12]

2:40 pm: **Ultrafast fiber grating sensor system to measure the velocity and position of a blast wave**, Eric Udd, Columbia Gorge Research (United States); Jerry J. Benterou, Lawrence Livermore National Lab. (United States) . . . [7316-13]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 3

Room: Grand 7B . . . . . Wed. 3:30 to 6:00 pm

Fiber Grating Sensors II

Session Chairs: **Eric Udd,** Columbia Gorge Research; **Paul Lefebvre,** LxDATA (Canada)

3:30 pm: **Fiber optic strain and wing shape sensing on a modified Predator-B unmanned aerial vehicle** *(Invited Paper)*, W. Lance Richards, Allen R. Parker, Jr., William L. Ko, Anthony Piazza, NASA Dryden Flight Research Ctr. (United States) . . . . . [7316-14]

4:00 pm: **Bragg grating-based optical waveguide organic compound sensor**, Xiaoli Dai, Stephen J. Mihailov, Chantal Blanchetiere, Communications Research Ctr. Canada (Canada) . . . . . [7316-15]

4:20 pm: **High-sensitivity pressure sensor based on fiber Bragg grating and metal bellows**, Dongcao Song, Jilin Zou, Zhanxiong Wei, Stevens Institute of Technology (United States); Shangming Yang, Yantai Univ. (China); Hong-Liang Cui, Stevens Institute of Technology (United States) . . . . . [7316-16]

4:40 pm: **Highly sensitive biochemical sensor utilizing Bragg grating in submicron Si/SiO_2 waveguides**, Saurabh M. Tripathi, Arun Kumar, Indian Institute of Technology Delhi (India); Jean-Pierre Meunier, Emmanuel Marin, Univ. Jean Monnet Saint-Etienne (France) . . . . . [7316-17]

5:00 pm: **Analysis of temperature and strain changes profiles by using fiber Bragg grating sensors**, M. Etezad, M. Kahrizi, Khashayar Khorasani, Concordia Univ. (Canada) . . . . . [7316-18]

5:20 pm: **Miniature cost-effective single-channel and multichannel fiber Bragg grating sensor interrogator (FBG-Transceiver™) system**, Edgar A. Mendoza, Redondo Optics, Inc. (United States) . . . . . [7316-19]

5:40 pm: **High reliability FBG interrogation analyzers for stimulous infrastructure projects**, William Yang, BaySpec, Inc. (United States) . . [7316-50]

Thursday 16 April

SESSION 4

Room: Grand 7B . . . . . Thurs. 8:00 to 9:30 am

Analysis of Light and Effects on Sensors

Session Chairs: **Robert P. Dahlgren,** Univ. of California, Santa Cruz; **Jeff Bush,** Optiphase, Inc.

8:00 am: **Fluoride fibers: state of the art** *(Invited Paper)*, Mohammed Saad, IRphotonics Inc. (Canada) . . . . . [7316-49]

8:30 am: **Advances in hyperspectral imaging technologies for multichannel fiber sensing**, Jay Zakrzewski, Kevin M. Didona, Headwall Photonics Inc. (United States) . . . . . [7316-20]

8:50 am: **Leveraging scattering for polarization analysis**, Thomas W. Kohlgraf-Owens, Aristide C. Dogariu, College of Optics & Photonics, Univ. of Central Florida (United States) . . . . . [7316-21]

9:10 am: **A model for an omnidirectional radiometer**, Melissa E. Jansen, Leo R. Gauthier, Jr., Nathan W. Rolander, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7316-22]

SESSION 5

Room: Grand 7B . . . . . Thurs. 9:30 am to 12:30 pm

Interferometric Sensors

Session Chairs: **Jeff Bush,** Optiphase, Inc.; **Robert P. Dahlgren,** Univ. of California, Santa Cruz

9:30 am: **A personal tour of the fiber optic Sagnac interferometer** *(Invited Paper)*, Eric Udd, Columbia Gorge Research (United States) . . . [7316-23]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Swept laser interferometric interrogation**, Jeff Bush, Optiphase, Inc. (United States); Walid Atia, Axsun Technologies Inc. (United States) . . . . [7316-24]

10:50 am: **Temperature-independent strain sensor based on a core-offset multimode fiber interferometer**, Bo Dong, Wilfrid Laurier Univ. (Canada); Da-Peng Zhou, Univ. of Waterloo (Canada); Li Wei, Wilfrid Laurier Univ. (Canada); Wing-Ki Liu, Univ. of Waterloo (Canada); John W. Y. Lit, Wilfrid Laurier Univ. (Canada) . . . . . [7316-25]

11:10 am: **Low-cost lateral force sensor based on a core-offset multimode fiber interferometer with intensity based interrogation technique**, Da-Peng Zhou, Univ. of Waterloo (Canada); Bo Dong, Li Wei, Wilfrid Laurier Univ. (Canada); Wing-Ki Liu, Univ. of Waterloo (Canada); John W. Y. Lit, Wilfrid Laurier Univ. (Canada) . . . . . [7316-26]

11:30 am: **Proposed precise relative rotation sensing using slow light**, Yun-Dong Zhang, Nan Wang, Hao Wang, He Tian, Jin Fang Wang, Ping Yuan, Harbin Institute of Technology (China) . . . . . [7316-27]

11:50 am: **Application of fiber optic gyroscope in fiber optic sensors**, Vardhani P. Chunduru, Osmania Univ. College for Women (India) . . . . . [7316-46]

12:10 pm: **Narrow linewidth low phase noise planar external cavity laser for optical sensing**, Mazin Alalusi, Paul Brasil, Redfern Integrated Optics Inc. (United States); Sanggeon Lee, Steve Li, Axel Mehnert, Peter Mols, Lew Stolpner, Redfern Integrated Optics, Inc. (United States) . . . . . [7316-51]

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

SESSION 6

Room: Grand 7B . . . . . Thurs. 1:30 to 3:30 pm

Temperature and Pressure Measurements and High-Temperature Sensors

Session Chairs: **Gary Pickrell,** Virginia Polytechnic Institute and State Univ.; **Anbo Wang,** Virginia Polytechnic Institute and State Univ.

1:30 pm: **Sapphire direct bonding as a platform for pressure sensing at extreme high temperatures**, Evan M. Lally, Yong Xu, Anbo Wang, Virginia Polytechnic Institute and State Univ. (United States) . . . . . [7316-28]

1:50 pm: **Reliability of optical fibers in a cryogenic environment**, Eric A. Lindholm, Andrei A. Stolov, Robert S. Dyer, Brian Slyman, David Burgess, OFS Specialty Photonics Div. (United States) . . . . . [7316-29]

2:10 pm: **Evaluation of the performance of a novel low-cost macrobend fiber-based temperature sensor**, Ginu Rajan, Dublin Institute of Technology (Ireland); Jinesh Mathew, Cochin Univ. of Science & Technology (India); Yuliya V. Semenova, Gerald T. Farrell, Dublin Institute of Technology (Ireland) . . . . . [7316-30]

2:30 pm: **A high-sensitivity temperature sensor based on a macrobending single-mode fiber**, Pengfei Wang, Gerald T. Farrell, Yuliya V. Semenova, Dublin Institute of Technology (Ireland) . . . . . [7316-31]

2:50 pm: **Light guide technology: using light to enhance safety**, William S. Lerner, Consultant (United States) . . . . . [7316-32]

3:10 pm: **An integrated high-pressure, pressure temperature, and skin friction sensor**, Alexander K. Sang, Clark Boyd, Luna Innovations Inc. (United States) . . . . . [7316-33]

Coffee Break . . . . . 3:30 to 4:00 pm

SESSION 7

Room: Grand 7B . . . . . Thurs. 4:00 to 5:40 pm

Electromagnetic Radiation and Particle Sensors

Session Chairs: **Gary Pickrell,** Virginia Polytechnic Institute and State Univ.; **Anbo Wang,** Virginia Polytechnic Institute and State Univ.

4:00 pm: **Compact super-wideband optical antenna**, Wen C. Wang, Richard Forber, IPITEK, Inc. (United States); Kenneth Bui, U.S. Army Communications-Electronics Command (United States) . . . . . [7316-34]

4:20 pm: **Reliability testing of low-drive voltage electro-optic polymer devices**, Raluca Dinu, Dan Jin, Lumera Corp. (United States) . . . . . [7316-35]

4:40 pm: **Ce-doped SiO_2 optical fibers for remote radiation sensing and measurement**, Norberto Chiodini, Anna G. Vedda, Mauro Fasoli, Federico Moretti, Univ. degli Studi di Milano-Bicocca (Italy); Marie Claire Cantone, Ivan Veronese, Univ. degli Studi di Milano (Italy); Giampiero Tosi, Istituto Europeo di Oncologia (Italy); Marco Brambilla, Barbara Cannillo, Eleonora Mones, Azienda Ospedaliera Maggiore della Carità (Italy); Gilberto Brambilla, Univ. of Southampton (United Kingdom) . . . . . [7316-36]

5:00 pm: **Vulnerability of rare-earth-doped fibers for space missions: origins of radiation-induced attenuation**, Youcef Ouerdane, Univ. Jean Monnet Saint-Etienne (France); Sylvain Girard, CEA DAM Ile de France (France); Blandine Tortech, Univ. Jean Monnet Saint-Etienne (France); Thierry Robin, iXFiber SAS (France); Claude Marcandella, CEA DAM Ile de France (France); Aziz Boukenter, Univ. Jean Monnet Saint-Etienne (France); Benoît Cadier, iXFiber SAS (France); Jean-Pierre Meunier, Univ. Jean Monnet Saint-Etienne (France); Patrice Crochet, iXFiber SAS (France) . . . . . [7316-37]

5:20 pm: **Characterization of a triboluminescent optical sensor for detecting particles,** Angela Gauthier, Dulaney High School (United States) and The John Hopkins Univ. Applied Physics Lab. (United States); Melissa E. Jansen, John Meyer, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . [7316-38]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

All-fiber multimode interference refractometer sensor, J. Enrique Antonio-Lopez, Daniel Lopez-Cortes, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); M. A. Basurto-Pensado, Univ. Autónoma del Estado de Morelos (Mexico); Daniel A. May-Arrioja, J. Javier Sanchez-Mondragon, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico) . . . . . [7316-47]

Effect of extrinsic perturbation by transverse pressure, bending, and tension birefringence, Chandrakant M. Jadhao, G.S. College of Khamgaon (India); Deepak S. Dhote, Brijlal Biyani Science College of Amravati (India). . . . . [7316-48]

Friday 17 April

SESSION 8

Room: Grand 7B . . . . . Fri. 8:30 to 10:30 am

Photonic Crystal Fibers and Sensors

Session Chair: **Henry H. Du,** Stevens Institute of Technology

8:30 am: **Multichannel surface-enhanced Raman scattering probe based on photonic crystal fiber**, He Yan, Jie Liu, Zhonghuan Zhang, Mingshan Li, Tsinghua Univ. (China); Lantian Hou, Yanshan Univ. (China); Changxi Yang, Tsinghua Univ. (China). . . . . [7316-39]

8:50 am: **High-sensitivity photonic crystal fiber interferometer for chemical vapors detection**, Joel Villatoro, Rajan Jha, Institut de Ciències Fotòniques (Spain); Vladimir P. Minkovich, Ctr. de Investigaciones en Óptica (Mexico); Mark Kreuzer, Gonçal Badenes, Institut de Ciències Fotòniques (Spain); Valerio Pruneri, Institut de Ciències Fotòniques (Spain) and ICREA-Institució Catalana de Recerca i Estudis Avançats (Spain) . . . . . [7316-40]

9:10 am: **Photonic crystal fiber modal interferometers for accurate refractometry**, Joel Villatoro, Rajan Jha, Gonçal Badenes, Institut de Ciències Fotòniques (Spain). . . . . [7316-41]

9:30 am: **Photonic bandgap fiber with immobilized Ag nanoparticles in the core-hole channel for SERS-based measurements of aqueous solutions**, Yun Han, Maung K. Khaing Oo, Svetlana A. Sukhishvili, Henry H. Du, Stevens Institute of Technology (United States) . . . . . [7316-42]

9:50 am: **Design of photonic crystal fiber long-period grating refractive index sensor**, Jiri Kanka, Institute of Photonics and Electronics (Czech Republic); Yinian Zhu, Zonghu He, Henry H. Du, Stevens Institute of Technology (United States). . . . . [7316-43]

10:10 am: **Tunable properties of liquid crystal-filled photonic crystal fibers**, Sunish J. Mathews, Yuliya V. Semenova, Ginu Rajan, Gerald T. Farrell, Dublin Institute of Technology (Ireland) . . . . . [7316-44]

Coffee Break . . . . . 10:30 to 11:00 am

FIBER OPTIC SENSORS PANEL

Industry, Lab, and University Cooperation

Fri. 11:00 am to 12:00 pm · Room: Grand 7B

Panel Members: **Eric Udd,** Columbia Gorge Research; **Johan Vlekken,** Fibre Optic Sensors and Sensing Systems (Belgium); **Alexis Mendez,** MCH Engineering LLC; **Henry H. Du,** Stevens Institute of Technology; **Anbo Wang,** Virginia Polytechnic Institute and State Univ.

This one-hour panel discussion and workshop will be directed toward a discussion of business and development issues associated with commercialization and deployment of fiber optic sensor technology. Considerable success has been achieved in certain areas such as civil structures and there have been successes in oil and gas, wind power, aerospace, and the medical field. It is also apparent that there is a great deal more to do and that the deployments that have been made represent the early stages of the introduction of this new technology. Questions and participation by the audience will be encouraged.

Ocean Sensing and Monitoring

Conference Chair: **Weilin (Will) Hou,** Naval Research Lab.

Conference Co-Chair: **Robert A. Arnone,** Naval Research Lab.

Program Committee: **Kendall L. Carder,** SRI International; **Georges R. Fournier,** Defence R&D Canada/Valcartier (Canada); **Michael P. Strand,** Naval Surface Warfare Ctr.; **Alan D. Weidemann,** Naval Research Lab.

Monday 13 April

OPENING REMARKS

Room: Crystal E. . . . . Mon. 1:30 to 1:35 pm

Session Chairs: **Weilin (Will) Hou,** Naval Research Lab.;
Robert A. Arnone, Naval Research Lab.

SESSION 1

Room: Crystal E. . . . . Mon. 1:35 to 3:15 pm

Ocean Sensing and Forecasting

Session Chairs: **Joan S. Cleveland,** Office of Naval Research;
Kendall L. Carder, SRI International

1:35 pm: **Progress in multidisciplinary sensing of the 4-dimensional ocean** *(Invited Paper)*, Tommy D. Dickey, Univ. of California, Santa Barbara (United States). . . . . [7317-01]

2:05 pm: **New capabilities for defining the coastal 3D ecosystems based on uncertainty of physical-bio-optical relationships** *(Invited Paper)*, Robert A. Arnone, Naval Research Lab. (United States); Brandon Casey, Sherwin D. Ladner, Planning Systems Inc. (United States); Peter Flynn, Dong-Shang Ko, Igor Shulman, Naval Research Lab. (United States); Kevin L. Mahoney, Naval Oceanographic Office (United States). . . . . [7317-02]

2:35 pm: **Forecasting the ocean optical properties using satellite optics and circulation models**, Brandon Casey, Planning Systems, Inc. (United States); Robert A. Arnone, Dong-Shang Ko, Igor Shulman, Peter Flynn, Naval Research Lab. (United States); Sherwin D. Ladner, Planning Systems, Inc. (United States); Sergio Derada, Naval Research Lab. (United States) . . . . . [7317-03]

2:55 pm: **Defining the uncertainty of electro-optical identification system performance estimates using a 3D optical environment derived from satellite**, Sherwin D. Ladner, Brandon Casey, Planning Systems Inc. (United States); Robert A. Arnone, Alan D. Weidemann, Deric J. Gray, Naval Research Lab. (United States); Kevin L. Mahoney, Naval Oceanographic Office (United States); Thomas Giddings, Joe Shirron, Metron, Inc. (United States); Igor Shulman, Naval Research Lab. (United States) . . . . . [7317-04]

Coffee Break . . . . . 3:15 to 3:45 pm

SESSION 2

Room: Crystal E. . . . . Mon. 3:45 to 5:15 pm

Sensing Platforms

Session Chairs: **Kendall L. Carder,** SRI International;
Joan S. Cleveland, Office of Naval Research

3:45 pm: **RIMPAC 08: Naval Oceanographic Office glider operations**, Kevin L. Mahoney, Bruce Bricker, Danielle Bryant, Marc C. Torres, Naval Oceanographic Office (United States); Thomas Giddings, Metron, Inc. (United States); Kenneth P. Grembowicz, Naval Oceanographic Office (United States) . . . . . [7317-05]

4:05 pm: **Using Webb gliders to maintain a sustained ocean presence** *(Invited Paper)*, Oscar Schofield, Rutgers Univ. (United States) . . . . . [7317-06]

4:35 pm: **Design and construction of an unmanned underwater vehicle prototype**, Arturo E. Cadena, Jr., Escuela Superior Politécnica del Litoral (Ecuador) . . . . . [7317-07]

4:55 pm: **Autonomous buoy platform for visual maritime surveillance: design and initial deployment**, Sergiy Fefilatyev, Dmitry B. Goldgof, Chad Lembke, Univ. of South Florida (United States) . . . . . [7317-08]

Tuesday 14 April

SESSION 3

Room: Crystal E. . . . . Tues. 8:10 to 8:50 am

Ocean Sensing I

Session Chairs: **Weilin (Will) Hou,** Naval Research Lab.;
Alan D. Weidemann, Naval Research Lab.

8:10 am: **Wave slope measurement by imaging polarimetry**, David B. Chenault, J. Larry Pezzaniti, Polaris Sensor Technologies, Inc. (United States); Howard J. Schultz, Univ. of Massachusetts, Amherst (United States). . . . . [7317-19]

8:30 am: **Tracking of storm fronts in weather radar imagery,** Dimitrios Charalampidis, Anirudh Paduru, Univ. of New Orleans (United States) . . [7317-10]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 4

Room: Crystal E. . . . . Tues. 10:30 am to 12:00 pm

Underwater Imaging

Session Chairs: **Alan D. Weidemann,** Naval Research Lab.;
Weilin (Will) Hou, Naval Research Lab.

10:30 am: **Time-dependent underwater optical propagation measurements using modulated light fields** *(Invited Paper)*, Linda J. Mullen, Alan Laux, Brandon Cochenour, Naval Air Warfare Ctr. (United States) . . . . . [7317-11]

11:00 am: **Improved LLS imaging performance in scattering-dominant waters**, Fraser R. Dalgleish, Frank M. Caimi, Walter B. Britton, Carl F. Andren, Florida Atlantic Univ. (United States). . . . . [7317-12]

11:20 am: **Analysis of optical 3D imaging based upon time-of-flight techniques**, Michael P. Strand, Naval Surface Warfare Ctr. (United States). . . . . [7317-13]

11:40 am: **Underwater optical communications with a modulating retro-reflector**, Brandon Cochenour, Linda J. Mullen, Naval Air Warfare Ctr. (United States); William S. Rabinovich, Rita Mahon, Naval Research Lab. (United States). . . . . [7317-14]

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

SESSION 5

Room: Crystal E. . . . . .Tues. 1:30 to 2:50 pm

Visibility and Remote Sensing

Session Chairs: **Robert A. Arnone,** Naval Research Lab.; **Michael P. Strand,** Naval Surface Warfare Ctr.

1:30 pm: **Polarization characteristics of coastal waters and their impact on in-water visibility**, Alberto Tonizzo, Jing Zhou, Alexander Gilerson, City College, CUNY (United States); Michael S. Twardowski, WET Labs, Inc. (United States); Deric J. Gray, Alan D. Weidemann, Robert A. Arnone, Naval Research Lab. (United States); Barry M. Gross, Fred Moshary, Samir A. Ahmed, City College, CUNY (United States) . . . . . [7317-15]

1:50 pm: **Diver visibility: why one cannot see as far**, Weilin (Will) Hou, Alan D. Weidemann, Deric J. Gray, Naval Research Lab. (United States) . . . . . [7317-16]

2:10 pm: **Optical detection of marine mammals**, Jon S. Schoonmaker, Yuliya Podobna, Cynthia D. Boucher, Tami M. Wells, Daniel Oakley, Advanced Coherent Technologies LLC (United States). . . . . [7317-17]

2:30 pm: **Determination of river depth using Quickbird imagery**, Paul E. Lyon, Naval Research Lab. (United States). . . . . [7317-18]

Coffee Break . . . . . 2:50 to 3:20 pm

SESSION 6

Room: Crystal E. . . . . .Tues. 3:20 to 4:20 pm

Ocean Sensing II

Session Chairs: **Michael P. Strand,** Naval Surface Warfare Ctr.; **Joan S. Cleveland,** Office of Naval Research

3:20 pm: **Multiscale modeling of sea clutter to facilitate detection of low observable targets within sea clutter**, Jing Hu, Univ. of Florida (United States); Wen-wen Tung, Purdue Univ. (United States); Jianbo Gao, Univ. of Florida (United States); Erik P. Blasch, Air Force Research Lab. (United States); Genshe Chen, DCM Research Resources, LLC (United States). . . . . [7317-20]

3:40 pm: **C-band polarimetric combined radar-radiometer system and the results of measurement of waved water surface microwave reflective and emissive characteristics angular dependences**, Astghik K. Hambaryan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia). . . . . [7317-21]

4:00 pm: **Preliminary results of multifrequency (at C, Ku, and Ka-band of frequencies) polarimetric spatio-temporally collocated measurements of waved water surface microwave reflective and emissive characteristics angular dependences,** Artashes K. Arakelyan, ECOSERV Remote Observation Ctr. Co. Ltd. (Armenia). . . . . [7317-22]

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

Feasibility study for monitoring of off-shore pipelines using BOTDA system, Il-Bum Kwon, Guohua Jin, Dae-Cheol Seo, Chi-Yeop Kim, Nam-Kwon Lee, Korea Research Institute of Standards and Science (Korea, Republic of) . . . . . [7317-23]

Micro- and Nanotechnology Sensors, Systems, and Applications

Conference Chairs: **Thomas George,** ViaLogy PLC; **M. Saif Islam,** Univ. of California, Davis; **Achyut K. Dutta,** Banpil Photonics, Inc.

Program Committee: **Hatice Altug,** Boston Univ.; **Mehdi Anwar,** Univ. of Connecticut; **Orlando Auciello,** Argonne National Lab.; **Debjyoti Banerjee,** Texas A&M Univ.; **Steve Blair,** The Univ. of Utah; **Scott D. Collins,** Univ. of Maine; **Yi Cui,** Stanford Univ.; **Cristina Davis,** Univ. of California, Davis; **Ernest J. Garcia,** Sandia National Labs.; **Stephanie A. Getty,** NASA Goddard Space Flight Ctr.; **Sonia Grego,** RTI International; **David A. Horsley,** Univ. of California, Davis; **Ahalapitiya Hewage Jayatissa,** Univ. of Toledo; **Anupama B. Kaul,** Jet Propulsion Lab.; **Nobuhiko P. Kobayashi,** Univ. of California, Santa Cruz; **Andrei A. Kolmakov,** Southern Illinois Univ., Carbondale; **Mary J. Li,** NASA Goddard Space Flight Ctr.; **Harish M. Manohara,** Jet Propulsion Lab.; **Gilberto Medeiros-Ribeiro,** Lab. Nacional de Luz Sincrotron (Brazil); **Patrick I. Oden,** Texas Instruments Inc.; **Robert Olah,** Banpil Photonics, Inc.; **Mashiur Rahman,** Marshall Univ.; **Ashok K. Sood,** Magnolia Optical Technologies, Inc.; **Hideyuki Sotobayashi,** Aoyama Gakuin Univ. (Japan); **A. Alec Talin,** Sandia National Labs.; **Thomas G. Thundat,** Oak Ridge National Lab.; **David V. Wick,** Sandia National Labs.; **Shih-Yuan Wang,** Hewlett-Packard Labs.; **Zhonglin L. Wang,** Georgia Institute of Technology; **Priyalal S. Wijewarnasuriya,** Army Research Lab.; **Eui-Hyeok Yang,** Stevens Institute of Technology

Wednesday 15 April

SESSION 1

Room: Boston . . . . . Wed. 8:00 am to 12:00 pm

Micro-Nanophotonics

Session Chairs: **M. Saif Islam,** Univ. of California, Davis; **Slava V. Rotkin,** Lehigh Univ.

8:00 am: **Advances in micro-nano technologies for imaging sensors** *(Keynote Presentation)*, Nibir K. Dhar, DARPA-MTO (United States) . . . . . [7318-01]

8:40 am: **Exploring assembly at the nanoscale** *(Invited Paper)*, Federico Rosei, Univ. du Québec (Canada) . . . . . [7318-02]

9:10 am: **EO/IR sensors development using zinc oxide and carbon nanostructures**, Ashok K. Sood, Robert A. Richwine, Yash R. Puri, Magnolia Optical Technologies, Inc. (United States); Dennis L. Polla, Nibir K. Dhar, Defense Advanced Research Projects Agency (United States); Zhonglin L. Wang, Georgia Institute of Technology (United States); Priyalal S. Wijewarnasuriya, Army Research Lab. (United States); Neil Goldsman, Univ. of Maryland, College Park (United States); Martin B. Soprano, U.S. Army (United States) . . . . . [7318-03]

9:30 am: **Heterogeneous 3D integration of multispectral photonic sensor with highly oriented micro/nanopillars of semiconductors** *(Invited Paper)*, M. Saif Islam, Univ. of California, Davis (United States) . . . . . [7318-04]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Nanotube MEMS: developing extreme nanoscale devices** *(Invited Paper)*, Slava V. Rotkin, Lehigh Univ. (United States) . . . . . [7318-05]

11:00 am: **Combining plasmonics and MEMS/NEMS for higher performance sensor systems** *(Invited Paper)*, Aykutlu Dana, Bilkent Univ. (Turkey) . . [7318-06]

11:30 am: **Chemical detection using flexible metal-organic frameworks** *(Invited Paper)*, Mark D. Allendorf, Ronald J. T. Houk, A. Alec Talin, Sandia National Labs. (United States); Leanne Andruszkiewicz, Peter J. Hesketh, Georgia Institute of Technology (United States) . . . . . [7318-07]

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

SESSION 2

Room: Boston . . . . . Wed. 1:30 to 3:10 pm

Nanofabrication Techniques

Session Chair: **Debjyoti Banerjee,** Texas A&M Univ.

1:30 pm: **Using dip pen techniques for synthesis of nanostructures**, Rohit Gargate, Debjyoti Banerjee, Abhay Patil, Texas A&M Univ. (United States) . . . . . [7318-08]

1:50 pm: **Desktop nanofabrication with Dip Pen Nanolithography®**, Jason R. Haaheim, Omkar A. Nafday, Jae-Won Jang, Paul L. Stiles, Tom Levesque, NanoInk, Inc. (United States) . . . . . [7318-09]

2:10 pm: **Aligned nanotubes in 3D nanoscale architectures formed using high-throughput manufacturable processes for electronics and sensing applications**, Anupama B. Kaul, Krikor Megerian, Paul A. von Allmen, Richard L. Baron, Jet Propulsion Lab. (United States) . . . . . [7318-10]

2:30 pm: **Characterization of InP nanowires grown on non-single-crystal platforms**, Drew J. Lohn, Takehiro Onishi, Nobuhiko P. Kobayashi, Univ. of California, Santa Cruz (United States) . . . . . [7318-11]

2:50 pm: **Surface-enhanced Raman scattering performance of rough metallic nanowire-based devices**, Stergios J. Papadakis, Joan A. Hoffmann, The Johns Hopkins Univ. Applied Physics Lab. (United States); JiaHai Wang, Pawan Tiyagi, David H. Gracias, The Johns Hopkins Univ. (United States) . . . . . [7318-12]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 3

Room: Boston . . . . . Wed. 3:40 to 5:50 pm

BioMEMS and Microfluidics

Session Chair: **Stephanie A. Getty,** NASA Goddard Space Flight Ctr.

3:40 pm: **Microfluidic point-of-care diagnostics for resource-poor environments** *(Invited Paper)*, Samuel Sia, Columbia Univ. (United States) . . . . . [7318-13]

4:10 pm: **Digital magnetic microtags for multiplex bio-assays**, Thanos Mitrelias, Univ. of Cambridge (United Kingdom) . . . . . [7318-14]

4:30 pm: **Using of SAMs technology for label-free detection of pathogenic micro-organisms**, Erhan Piskin, Hacettepe Üniv. (Turkey) . . . . . [7318-15]

4:50 pm: **Size-dependent droplet actuation in digital microfluidic systems**, Biddut Bhattacharjee, Homayoun Najjaran, The Univ. of British Columbia (Canada) . . . . . [7318-16]

5:10 pm: **Engineering nanopatterned surfaces for real-time colorimetric detection of biochemical agents**, Ashwin Gopinath, Gary F. Walsh, Sylvanus Y. Lee, Svetlana V. Boriskina, Luca Dal Negro, Boston Univ. (United States); Jason Amsden, David L. Kaplan, Fiorenzo G. Omenetto, Tufts Univ. (United States) . . . . . [7318-17]

5:30 pm: **Visual and tactile display of MEMS microhand for surgical applications**, Shanchieh J. Yang, Yen-Wen Lu, Adam Weissman, Michael A. Pepen, Rochester Institute of Technology (United States) . . . . . [7318-18]

Thursday 16 April

SESSION 4

Room: Boston . . . . . Thurs. 8:00 am to 12:00 pm

Micro-Autonomous Systems and Technology (MAST)

Session Chair: **Harish M. Manohara,** Jet Propulsion Lab.

8:00 am: **Overview of the ARL MAST Program** *(Invited Paper)*, Joseph N. Mait, Army Research Lab. (United States) . . . . . [7318-19]

8:30 am: **Development of micromechanics for micro-autonomous systems (ARL-MAST Program)** *(Invited Paper)*, James S. Humbert, Univ. of Maryland, College Park (United States) . . . . . [7318-20]

9:00 am: **An overview of research in advanced microelectronics for micro-autonomous platforms** *(Invited Paper)*, Kamal Sarabandi, Univ. of Michigan (United States) . . . . . [7318-21]

9:30 am: **A simulation environment for modeling and development of algorithms for ensembles of mobile microsystems** *(Invited Paper)*, Vijay Kumar, Jonathan Fink, Univ. of Pennsylvania (United States); Thomas R. Collins, Georgia Institute of Technology (United States); Yasamin Mostofi, The Univ. of New Mexico (United States); Brian M. Sadler, Army Research Lab. (United States) . . . . . [7318-22]

10:00 am: **Physiology of microsystems** *(Invited Paper)*, Mark Falco, BAE Systems (United States); Harish M. Manohara, Jet Propulsion Lab. (United States); Daniel W. Beekman, Army Research Lab. (United States) . . . . . [7318-23]

Coffee Break . . . . . 10:30 to 11:00 am

11:00 am: **Design of high-energy power sources for micro-autonomous systems**, Sri R. Narayan, Thomas I. Valdez, Jet Propulsion Lab. (United States). . . . . [7318-24]

11:20 am: **Robust landing with measuring only time-to-collision**, Yoshiaki Kuwata, Larry H. Matthies, Jet Propulsion Lab. (United States). . . . . [7318-25]

11:40 am: **Design and fabrication of microflap actuators for steering of micro air vehicles**, George C. Zimbru, Woo Ho Lee, Dan O. Popa, The Univ. of Texas at Arlington (United States) . . . . . [7318-26]

Lunch/Exhibition Break . . . . . 12:00 to 1:50 pm

SESSION 5

Room: Boston . . . . . Thurs. 1:50 to 5:00 pm

Complex MEMS and Nanosystems

Session Chair: **Anupama B. Kaul,** Jet Propulsion Lab.

1:50 pm: **MEMS and nanotechnologies from devices to systems: DARPA's perspectives** *(Keynote Presentation)*, Amit Lal, Defense Advanced Research Projects Agency (United States) . . . . . [7318-27]

2:30 pm: **Deformable MEMS mirrors in secure optical communication system**, Leah Ziph-Schatzberg, Boston Univ. (United States); Thomas G. Bifano, Boston Univ. (United States) and Boston Micromachines Corp. (United States); Jason B. Stewart, Steven A. Cornelissen, Boston Micromachines Corp. (United States); Zvi Bleier, PLX Inc. (United States) . . . . . [7318-28]

2:50 pm: **Hewlett Packard's inkjet MEMS technology: past, present, and future** *(Invited Paper)*, Sam G. Angelos, Jr., Susan K. Richards, James W. Stasiak, Hewlett-Packard Co. (United States) . . . . . [7318-29]

Coffee Break . . . . . 3:20 to 3:50 pm

3:50 pm: **Studies on the iteration methods for estimating the pull-in parameters of electrostatic actuators**, Sudarshan R. Nelatury, The Pennsylvania State Univ. (United States); Oladipo Onipede, Jr., Penn State Erie, The Behrend College (United States); Robert Gray, Penn State Harrisburg (United States). . . . . [7318-30]

4:10 pm: **A generalized electrostatic micro-mirror (GEM) model for a two-axis convex piecewise linear-shaped MEMS mirror**, Clinton L. Edwards, The Johns Hopkins Univ. Applied Physics Lab. (United States); M. Lee Edwards, Consultant (United States). . . . . [7318-31]

4:30 pm: **Nanotechnology enabled sensors and wireless sensing networks** *(Invited Paper),* Ray Tsui, Islamshah Amlani, Sal Mastroianni, Motorola, Inc. (United States); Alvaro Diaz Aguilar, Erica Forzani, Nongjian Tao, Arizona State Univ. (United States) . . . . . [7318-32]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

Digital implementations for integrated microfluidic sensing, Ali Ahmadi, Jackie Nichols, Mina Hoorfar, Homayoun Najjaran, Jonathan F. Holzman, The Univ. of British Columbia (Canada) . . . . . [7318-48]

Six degree-of-freedom MEMS motion sensor using a single proof mass, Mark Boysel, Virtus Advanced Sensors (United States). . . . . [7318-49]

Antibody functionalized magnetic nanowires for cell purification and selective manipulation, Ning Gao, Xiaochuan Yang, Yao-Tsan Tsai, Geh Meh Chu, Hongjun Wang, Eui-Hyeok Yang, Stevens Institute of Technology (United States). . . . . [7318-50]

Single-layer SiGe infrared wide-band micro-emitter arrays by MEMS technology, Volodymyr K. Malyutenko, Oleg Y. Malyutenko, Institute of Semiconductor Physics (Ukraine); Vladimir N. Leonov, Chris A. Van Hoof, IMEC (Belgium) . . . . . [7318-51]

A simple technique to increase the quality factor of micro-mechanical resonators, Ross G. Turnbull, Univ. of Oxford (United Kingdom); Mike C. L. Ward, Carl J. Anthony, The Univ. of Birmingham (United Kingdom); Stephen Collins, Univ. of Oxford (United Kingdom) . . . . . [7318-53]

Microfabrication of nanowires-based GMR biomedical sensor, Ramya Bellamkonda, Mangilal Agarwal, Raja S. Mannam, Daniel Carbo, James Palmer, Mark DeCoster, Despina Davis, Louisiana Tech Univ. (United States) . . . [7318-54]

Detailed droplet routing and complexity characterization on a microfluidic biochip, Rachael A. L'Orsa, Biddut Bhattacharjee, Jonathan F. Holzman, Mina Hoorfar, Homayoun Najjaran, The Univ. of British Columbia (Canada) . . [7318-55]

Nanosensor design for hydrogen detection, Peng Zhang, Abihilash Vincent, Sudipta Seal, Hyoung Cho, Univ. of Central Florida (United States) . . . . [7318-56]

Fabrication of vertically standing metal nanowire arrays on silicon substrates using anodized aluminum oxide (AAO) and polycarbonate (PC) membrane, Seongjin Jang, Souran Manoochehri, Eui-Hyeok Yang, Stevens Institute of Technology (United States) . . . . . [7318-57]

Friday 17 April

SESSION 6

Room: Boston . . . . . Fri. 8:00 to 10:30 am

Nanoelectronics: Fabrication, Assembly, and Characterization

Session Chair: **Eui-Hyeok Yang,** Stevens Institute of Technology

8:00 am: **Nanomaterials and nanostructures research for integrated adaptive multimodal sensing** *(Keynote Presentation)*, Kitt C. Reinhardt, Air Force Office of Scientific Research (United States). . . . . [7318-33]

8:40 am: **Electro-optical characterization of individual multiwall carbon nanotube quantum dots**, Nan Ai, Yao-Tsan Tsai, Stevens Institute of Technology (United States); Daniel S. Choi, Univ. of Idaho (United States); Eui-Hyeok Yang, Stefan Strauf, Stevens Institute of Technology (United States) . . . . . [7318-34]

9:00 am: **Nanopatterning of microsensor arrays for pH monitoring**, Olga Korostynska, Khalil I. Arshak, Arousian Arshak, Edric Gill, Univ. of Limerick (Ireland) . . . . . [7318-35]

9:20 am: **Nanostructured surfaces for anti-biofouling/anti-microbial applications**, Chang-Hwan Choi, Stevens Institute of Technology (United States); Chang-Jin Kim, Univ. of California, Los Angeles (United States) . . . . . [7318-36]

9:40 am: **Nanosurfaces for nanosensing**, Edward Gillman, Alexander S. Raspopin, David Costello, Senspex (United States) . . . . . [7318-37]

10:00 am: **Carbon-based nanodevices for sensors, actuators, and electronics** *(Invited Paper)*, Eui-Hyeok Yang, Stefan Strauf, Frank T. Fisher, Stevens Institute of Technology (United States); Daniel S. Choi, Univ. of Idaho (United States). . . . . [7318-38]

Coffee Break . . . . . 10:30 to 11:00 am

SESSION 7

Room: Boston . . . . . Fri. 11:00 am to 12:00 pm

Nanotechnology for Space Applications

Session Chair: **Stephanie A. Getty,** NASA Goddard Space Flight Ctr.

11:00 am: **Fully printed phased-array antenna for space communications**, Maggie Y. Chen, Omega Optics, Inc. (United States); Xuejun Lu, Univ. of Massachusetts, Lowell (United States); Harish Subbaraman, Ray T. Chen, The Univ. of Texas at Austin (United States) . . . . . [7318-58]

11:20 am: **Fabrication of a nanoscale electric-field sensor**, Yun T. Zheng, Todd T. King, Daniel S. Stewart, Stephanie A. Getty, NASA Goddard Space Flight Ctr. (United States). . . . . [7318-41]

11:40 am: **Integration of a carbon nanotube field emission electron gun for a miniaturized time-of-flight mass spectrometer** *(Invited Paper)*, Stephanie A. Getty, Mary J. Li, Nicholas P. Costen, Larry A. Hess, Todd T. King, Patrick A. Roman, William Brinckerhoff, Paul R. Mahaffy, NASA Goddard Space Flight Ctr. (United States). . . . . [7318-42]

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

SESSION 8

Room: Boston . . . . . Fri. 1:30 to 4:00 pm

Diamond MEMS/NEMS

Session Chair: **Orlando Auciello,** Argonne National Lab.

1:30 pm: **Ultra-nanocrystalline diamond for MEMS and NEMS: opportunities and challenges** *(Invited Paper)*, Anirudha V. Sumant, Argonne National Lab. (United States) . . . . . [7318-43]

2:00 pm: **Tribological issues critical to MEMS and NEMS performance: studies of ultra-nanocrystalline diamond with other MEMS materials** *(Invited Paper)*, Robert W. Carpick, Vivekananda P. Adiga, Univ. of Pennsylvania (United States) . . . . . [7318-44]

2:30 pm: **Diamond MEMS: wafer scale processing, devices, and technology insertion** *(Invited Paper)*, John Carlisle, Argonne National Lab. (United States) . . . . . [7318-45]

3:00 pm: **MEMS-based spatial light modulators: recent developments and future directions** *(Invited Paper)*, Daniel Lopez, Argonne National Lab. (United States) . . . . . [7318-46]

3:30 pm: **Fundamentals and application of materials integration for low-power piezoelectrically actuated ultra-nanocrystalline diamond MEMS/NEMS** *(Invited Paper)*, Orlando Auciello, Argonne National Lab. (United States) . . . . . [7318-47]

Make time for the Exhibition

Tuesday 14 April . . . . . 10:00 am to 6:00 pm
Wednesday 15 April . . . . . 10:00 am to 5:00 pm
Thursday 16 April . . . . . 10:00 am to 2:00 pm

See pp. 16–20 for exhibition details.

Monday 13 April 2009 • Proceedings of SPIE Vol. 7319

Next-Generation Spectroscopic Technologies II

Conference Chairs: **Mark A. Druy,** Physical Sciences Inc.; **Christopher D. Brown,** Ahura Scientific, Inc.; **Richard A. Crocombe,** Thermo Fisher Scientific, Inc.

Program Committee: **Michael B. Frish,** Physical Sciences Inc.; **Fred Haibach,** Polychromix, Inc.; **Martin Kraft,** Carinthian Tech Research AG (Austria); **Curtis A. Marcott,** Light Light Solutions, LLC; **Jay Zakrzewski,** Headwall Photonics Inc.

Monday 13 April

SESSION 1

Room: Boston . . . . . Mon. 8:30 to 11:40 am

Imaging Spectroscopy

Session Chair: **Mark A. Druy,** Physical Sciences Inc.

8:30 am: **Molecular imaging by confocal Raman mapping: enabling technologies for speed, multivariate analysis, and convenience**, Fran Adar, Andrew Whitley, HORIBA Jobin Yvon Inc. (United States) . . . . . [7319-01]

8:50 am: **Design and characterization of a hyperspectral chromotomographic imaging system for battlespace defense**, Randall L. Bostick, Kevin C. Gross, Glen P. Perram, Air Force Institute of Technology (United States) . . . . . [7319-02]

9:10 am: **IR focal plane arrays for spectroscopic applications**, Arnold L. Adams, Amy E. Smith, Larry J. Hahn, Mark A. Goodnough, Lockheed Martin Corp. (United States) . . . . . [7319-03]

9:30 am: **Rapid, calibrated, high-resolution, spectral imaging using tunable laser source**, Lam K. Nguyen, Eli K. Margalith, OPOTEK, Inc. (United States) . . . . . [7319-04]

9:50 am: **Applications of spectral imaging using a tunable laser source**, David C. Oertel, Jeffrey T. Grothaus, The Procter & Gamble Co. (United States); Curtis A. Marcott, Light Light Solutions, LLC (United States) . . . . . [7319-05]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **Advanced pushbroom hyperspectral LWIR imagers**, Hannu Holma, Risto Jaskari, Jarmo Lehtomaa, Harri Karjalainen, Timo Hyvärinen, Specim Spectral Imaging Ltd. (Finland) . . . . . [7319-06]

11:00 am: **Performance and applications of a hypertemporal, hyperspectral Fourier-transform infrared spectroradiometer**, Bruce H. King, Thomas A. Ellis, Thomas E. Old, ATK Mission Research (United States) . . . . . [7319-07]

11:20 am: **Novel hyperspectral prediction method and apparatus**, Gabor J. Kemeny, Natalie A. Crothers, Gard A. Groth, Middleton Research (United States); Ralf Marbach, VTT Optical Instruments (Finland) . . . . . [7319-08]

Lunch Break . . . . . 11:40 am to 1:15 pm

SESSION 2

Room: Boston . . . . . Mon. 1:15 to 2:55 pm

Miniature and Portable Spectrometers

Session Chair: **Christopher D. Brown,** Ahura Scientific, Inc.

1:15 pm: **Adaptive spectroscopy for rapid chemical identification**, Dineshbabu V. Dinakarababu, Michael E. Gehm, The Univ. of Arizona (United States) . . . . . [7319-10]

1:35 pm: **Simultaneous higher harmonic detection: optimal experimental techniques in wavelength modulation spectroscopy**, Mohammad A. Khan, Amin N. Dharamsi, Karan D. Mohan, Old Dominion Univ. (United States) . . . . . [7319-11]

1:55 pm: **Portable Raman detection instrument for rapid bio-agent detection and identification**, W. Scott Sutherland, Marie Lesaicherre, Sankaran Kumar, Loganathan Doraisamy, Serge Bobroff, Walter Freeman, Joseph Napoli, GE Security (United States); Michael C. Burrell, Frank J. Mondello, Tracy L. Paxon, GE Global Research (United States) . . . . . [7319-12]

2:15 pm: **Coded-aperture DUV spectrometer for stand-off Raman spectroscopy**, Nathan A. Hagen, David J. Brady, Duke Univ. (United States) . . . . . [7319-13]

2:35 pm: **Advances in portable FTIR spectrometers for the field: the HazmatID Ranger**, Dustin Levy, Smiths Detection (United States) . . . . . [7319-14]

Coffee Break . . . . . 2:55 to 3:25 pm

SESSION 3

Room: Boston . . . . . Mon. 3:25 to 5:45 pm

MEMS-based Spectrometers

Session Chair: **Richard A. Crocombe,** Thermo Fisher Scientific Inc.

3:25 pm: **Recent advances in compact broadly tunable external-cavity quantum cascade lasers**, Eric B. Takeuchi, Miles J. Weida, David Arnone, Michael B. Pushkarsky, Timothy Day, Daylight Solutions, Inc. (United States) . . . . . [7319-20]

3:45 pm: **Diffractive MEMS components, systems, and applications**, Heinrich Grueger, Thomas Egloff, Tino Puegner, Michael Scholles, Harald Schenk, Hubert K. Lakner, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) . . . . . [7319-15]

4:05 pm: **Large stroke translatory MOEMS actuators for optical path length modulation in miniaturized FTIR spectrometers**, Thilo Sandner, Fraunhofer-Institut für Photonische Mikrosysteme (Germany); Andreas Kenda, Carinthian Tech Research AG (Austria); Christian Drabe, Harald Schenk, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) . . . . . [7319-16]

4:25 pm: **Improved MOEMS-based ultra-rapid Fourier transform infrared spectrometer**, Andreas Tortschanoff, Andreas Kenda, Martin Kraft, Werner Scherf, Carinthian Tech Research AG (Austria); Thilo Sandner, Harald Schenk, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) . . . . . [7319-17]

4:45 pm: **High-resolution miniature FTIR spectrometer enabled by a large linear travel MEMS pop-up mirror**, Erik R. Deutsch, David Reyes, Jinhong Kim, Block Engineering, LLC (United States) . . . . . [7319-18]

5:05 pm: **MEMS-based Fabry-Perot microspectrometers for agriculture**, John M. Dell, Jason S. Milne, Jarek Antoszewski, Adrian J. Keating, Leo Schuler, Lorenzo Faraone, The Univ. of Western Australia (Australia) . . . . . [7319-19]

5:25 pm: **Compact ruggedized NIR spectrometer based on volume phase gratings**, William Yang, BaySpec, Inc. (United States) . . . . . [7319-21]

Tuesday-Thursday 14-16 April 2009 • Proceedings of SPIE Vol. 7320

Advanced Photon Counting Techniques III

Conference Chairs: **Mark A. Itzler,** Princeton Lightwave, Inc.; **Joe C. Campbell,** Univ. of Virginia

Program Committee: **Wolfgang Becker,** Becker & Hickl GmbH (Germany); **Gerald S. Buller,** Heriot-Watt Univ. (United Kingdom); **Sergio D. Cova,** Politecnico di Milano (Italy); **William H. Farr,** Jet Propulsion Lab.; **Robert H. Hadfield,** Heriot-Watt Univ. (United Kingdom); **Majeed M. Hayat,** The Univ. of New Mexico; **Michael A. Krainak,** NASA Goddard Space Flight Ctr.; **Alan L. Migdall,** National Institute of Standards and Technology; **Frederick S. Perry,** Boston Electronics Corp.; **Peter T. C. So,** Massachusetts Institute of Technology; **Michael Wahl,** PicoQuant GmbH (Germany); **Hugo Zbinden,** Univ. de Genève (Switzerland)

Tuesday 14 April

WELCOME REMARKS

Room: Atlanta . . . . . .Tues. 8:00 to 8:05 am

Session Chair: **Mark A. Itzler,** Princeton Lightwave, Inc.

SESSION 1

Room: Atlanta . . . . . .Tues. 8:05 to 8:50 am

Photon Counting Applications and Techniques I

Session Chair: **Michael A. Krainak,** NASA Goddard Space Flight Ctr.

8:05 am: **A photon-counting time-of-flight ranging technique developed for the avoidance of range ambiguity at gigahertz clock rates** *(Invited Paper)*, Philip A. Hiskett, SELEX GALILEO (United Kingdom); Aongus McCarthy, Gerald S. Buller, Heriot-Watt Univ. (United Kingdom). . . . . [7320-01]

8:30 am: **Scanning of low-signature targets using time-correlated single-photon counting,** Gerald S. Buller, Robert J. Collins, Nils J. Krichel, Andrew M. Wallace, Aongus McCarthy, Heriot-Watt Univ. (United Kingdom) . . . . . [7320-02]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 2

Room: Atlanta . . . . . .Tues. 10:30 to 11:55 am

Photon Counting Applications and Techniques II

Session Chair: **Michael A. Krainak,** NASA Goddard Space Flight Ctr.

10:30 am: **Single-photon detectors for quantum applications** *(Invited Paper)*, Robert T. Thew, Nino Walenta, Patrick Eraerds, Damien Stucki, Jun Zhang, Nicolas Gisin, Hugo Zbinden, Univ. de Genève (Switzerland) . . . . . [7320-03]

10:55 am: **Photon detectors with large dynamic range and at near-infrared wavelengths**, Xiaoli Sun, Michael A. Krainak, Guang-Ning Yang, Laddawan R. Miko, James B. Abshire, NASA Goddard Space Flight Ctr. (United States). . . . . [7320-04]

11:15 am: **Gigahertz bandwidth photon counting**, William H. Farr, Jonathan W. Gin, Danh H. Nguyen, Jet Propulsion Lab. (United States). . . . . [7320-05]

11:35 am: **Photon counting measurements at NPL**, Jane Ireland, Jessica Y. Cheung, Christopher J. Chunnilall, John C. Gallop, Ling Hao, Malcolm G. White, National Physical Lab. (United Kingdom) . . . . . [7320-06]

Lunch/Exhibition Break . . . . . 11:55 am to 1:10 pm

SESSION 3

Room: Atlanta . . . . . .Tues. 1:10 to 3:10 pm

Photon Counting Applications and Techniques III

Session Chair: **Michael Wahl,** PicoQuant GmbH (Germany)

1:10 pm: **Wigner function reconstruction by hybrid photodetectors in the linear regime** *(Invited Paper)*, Maria Bondani, Consiglio Nazionale delle Ricerche (Italy); Alessia Allevi, Univ. degli Studi dell'Insubria (Italy); Alessandra Andreoni, Univ. degli Studi dell'Insubria (Italy) and CNISM (Italy) . . . . . [7320-07]

1:35 pm: **Optical biopsy and tissue phantom selection: a novel approach combining single-photon timing and spatial-mode selection**, Luca Nardo, Univ. degli Studi dell'Insubria (Italy) and C.N.R.-I.N.F.M. (Italy); Maria Bondani, National Lab. for Ultrafast and Ultraintense Optical Science (ULTRAS) (Italy) and C.N.R.-I.N.F.M. (Italy); Alessandra Andreoni, Univ. degli Studi dell'Insubria (Italy) and C.N.R.-I.N.F.M. (Italy) . . . . . [7320-08]

1:55 pm: **Spatial localization of multiple discrete fluorescent inclusions with SPAD and TCSPC measurements in the time domain** *(Invited Paper)*, Yves Bérubé-Lauzière, Julien Pichette, Éric Lapointe, Univ. de Sherbrooke (Canada) . . . . . [7320-09]

2:20 pm: **Photon counting technology enables novel applications in systems biology** *(Invited Paper)*, Samantha Fore, PicoQuant Photonics North America, Inc. (United States); Felix Koberling, PicoQuant GmbH (Germany); Thomas Huser, Tingjuan Gao, Sonny S. Ly, Univ. of California, Davis (United States) . . . [7320-10]

2:45 pm: **Recent advances in multichannel photon counting and timing instrumentation** *(Invited Paper)*, Michael Wahl, Hans-Juergen Rahn, Tino Roehlicke, PicoQuant GmbH (Germany); Gerald Kell, Fachhochschule Brandenburg (Germany); Rainer Erdmann, PicoQuant GmbH (Germany) . . . . . [7320-11]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 4

Room: Atlanta . . . . . .Tues. 3:40 to 5:20 pm

Superconducting Single Photon Detectors

Session Chair: **Robert H. Hadfield,** Heriot-Watt Univ. (United Kingdom)

3:40 pm: **Long-distance quantum key distribution using superconducting nanowire single-photon detectors** *(Invited Paper)*, Burm Baek, Sae Woo Nam, National Institute of Standards and Technology (United States) . . . . . [7320-12]

4:05 pm: **Photon number resolving detectors at telecom wavelengths based on superconducting nanowires** *(Invited Paper)*, Andrea Fiore, Francesco Marsili, David Bitauld, Technische Univ. Eindhoven (Netherlands); Alessandro Gaggero, Roberto Leoni, Francesco Mattioli, Istituto di Fotonica e Nanotecnologie del CNR (Italy); Aleksander Divochiy, Alexander A. Korneev, Gregory N. Gol'tsman, Moscow State Pedagogical Univ. (Russian Federation) . . . . . [7320-13]

4:30 pm: **Ultralow crosstalk multi-element superconducting nanowire single photon** *(Invited Paper)*, Eric A. Dauler, MIT Lincoln Lab. (United States); Martin J. Stevens, Burm Baek, National Institute of Standards and Technology (United States); Richard Molnar, Andrew J. Kerman, MIT Lincoln Lab. (United States); Sae Woo Nam, Richard P. Mirin, National Institute of Standards and Technology (United States); Scott Hamliton, MIT Lincoln Lab. (United States); Karl K. Berggren, Massachusetts Institute of Technology (United States). . . . . [7320-14]

4:55 pm: **Progress on multipixel superconducting nanowire single-photon detectors for optical communication** (Invited Paper), Jeffrey A. Stern, David C. Aveline, Bret J. Naylor, William H. Farr, Jet Propulsion Lab. (United States). . . . . [7320-15]

POSTERS-TUESDAY

Room: Palms Foyer . . . . . .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.

Time-resolved FRET for single-nucleotide polymorphism genotyping, Alessandra Andreoni, Univ. degli Studi dell'Insubria (Italy); Maria Bondani, National Lab. for Ultrafast and Ultraintense Optical Science (ULTRAS) (Italy); Luca Nardo, Univ. degli Studi dell'Insubria (Italy) . . . . . [7320-39]

Wednesday 15 April

SESSION 5

Room: Atlanta . . . . . Wed. 8:30 to 10:20 am

Single Photon APDs I: Devices

Session Chair: **Joe C. Campbell,** Univ. of Virginia

8:30 am: **High-performance silicon single-photon avalanche diode arrays** *(Invited Paper)*, Ivan Rech, Angelo Gulinatti, Franco Zappa, Massimo Ghioni, Sergio D. Cova, Politecnico di Milano (Italy) . . . . . [7320-16]

8:55 am: **4×4 4H-SiC single-photon avalanche photodiodes array**, Xiaogang Bai, Dion McIntosh, Han-Din Liu, Joe C. Campbell, Univ. of Virginia (United States) . . . . . [7320-17]

9:15 am: **Deep-UV Geiger-mode APD performance and applications** *(Invited Paper)*, Gary A. Shaw, Andrew M. Siegel, Joshua Model, Adam Geboff, MIT Lincoln Lab. (United States) . . . . . [7320-18]

9:40 am: **Timing jitter modeling in single-photon avalanche diodes**, Antonino Ingargiola, Mattia Assanelli, Ivan Rech, Andrea Gallivanoni, Massimo Ghioni, Sergio D. Cova, Politecnico di Milano (Italy) . . . . . [7320-19]

10:00 am: **Demonstration of the quantum dot avalanche photodiode (QDAP)**, David A. Ramirez, Jiayi Shao, Majeed M. Hayat, Sanjay Krishna, The Univ. of New Mexico (United States) . . . . . [7320-20]

Coffee Break . . . . . 10:20 to 10:50 am

SESSION 6

Room: Atlanta . . . . . .Wed. 10:50 am to 12:00 pm

Single Photon APDs II: Arrays I

Session Chair: **William H. Farr,** Jet Propulsion Lab.

10:50 am: **Arrays of Geiger-mode avalanche photodiodes for ladar and laser communications** *(Invited Paper)*, Simon Verghese, MIT Lincoln Lab. (United States) . . . . . [7320-21]

11:15 am: **Single-photon counting focal plane arrays and cameras for 3D ladar imaging** *(Invited Paper)*, Rengarajan Sudharsanan, Ping Yuan, Joseph C. Boisvert, Emilio Quesada, Eduardo Labios, Paul A. McDonald, Nasser H. Karam, Spectrolab, Inc. (United States); Michael S. Salisbury, Gary M. Stuart, Harrison Danny, Roger A. Mitchell, Angel A. Portillo, Alric Roybal, Joseph N. Paranto, Boeing-SVS, Inc. (United States) . . . . . [7320-22]

11:40 am: **InP-based Geiger-mode avalanche photodiode arrays for 3D imaging at 1.06 µm**, Mark A. Itzler, Xudong Jiang, Mark Entwistle, Krystyna Slomkowski, Princeton Lightwave, Inc. (United States) . . . . . [7320-23]

Lunch Break . . . . . 12:00 to 1:40 pm

SESSION 7

Room: Atlanta . . . . . Wed. 1:40 to 3:00 pm

Single Photon APDs II: Arrays II

Session Chair: **William H. Farr,** Jet Propulsion Lab.

1:40 pm: **High-performance InP Geiger-mode SWIR avalanche photodiodes**, Ping Yuan, Rengarajan Sudharsanan, Joseph C. Boisvert, Paul A. McDonald, Takahiro Isshiki, William Hong Hong, Spectrolab, Inc. (United States). . . [7320-24]

2:00 pm: **Crosstalk analysis of integrated Geiger-mode avalanche photodiode focal plane arrays**, Richard D. Younger, Alex K. McIntosh, Joseph W. Chludzinski, Douglas C. Oakley, Leonard J. Mahoney, Joseph E. Funk, Joseph P. Donnelly, Simon Verghese, MIT Lincoln Lab. (United States) . . . . . [7320-25]

2:20 pm: **Reliable InP-based Geiger-mode avalanche photodiode arrays**, Gary M. Smith, Alex K. McIntosh, Joseph P. Donnelly, Joseph E. Funk, Leonard J. Mahoney, Simon Verghese, MIT Lincoln Lab. (United States) . . . . . [7320-26]

2:40 pm: **Packaging and qualification of single-photon counting avalanche photodiode focal plane arrays**, Joseph E. Funk, Gary M. Smith, Alex K. McIntosh, Joseph P. Donnelly, Michael A. Brattain, Albert C. Ruff, Simon Verghese, MIT Lincoln Lab. (United States) . . . . . [7320-27]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 8

Room: Atlanta . . . . . Wed. 3:30 to 5:30 pm

Single Photon APDs III: Enhanced Circuits

Session Chair: **Gerald S. Buller,** Heriot-Watt Univ. (United Kingdom)

3:30 pm: **Ultrafast single-photon detection with InGaAs avalanche photodiodes for Mbit/s secure key-rate quantum key distribution** *(Invited Paper)*, Zhiliang Yuan, Alex R. Dixon, James F. Dynes, Andrew W. Sharpe, Andrew J. Shields, Toshiba Research Europe Ltd. (United Kingdom) . . . [7320-28]

3:55 pm: **Telecom-band entanglement swapping using high-speed single-photon detectors based on sinusoidally gated InGaAs/InP avalanche photodiodes** *(Invited Paper)*, Hiroki Takesue, NTT Basic Research Labs. (Japan) . . . . . [7320-29]

4:20 pm: **Avalanche photodiodes beyond 1.65 µm** *(Invited Paper)*, Jo Shien Ng, Chee Hing Tan, John P. R. David, The Univ. of Sheffield (United Kingdom) . . . . . [7320-30]

4:45 pm: **Improved passive quenching with active reset circuit**, Chong Hu, Univ. of Virginia (United States); Mingguo Liu, Photodigm, Inc. (United States); Joe C. Campbell, Univ. of Virginia (United States) . . . . . [7320-31]

5:05 pm: **Stand-alone receiver module for near-infrared gated or nongated single-photon detection** *(Invited Paper)*, Alexis Rochas, Laurent Monat, Jean Benoit Page, Cyril Maillard, Przemek Sobocinski, Grégoire Ribordy, id Quantique SA (Switzerland) . . . . . [7320-32]

Thursday 16 April

SESSION 9

Room: Atlanta . . . . . Thurs. 8:30 to 10:45 am

Self-quenching SPADs and Linear-mode APDs

Session Chair: **Mark A. Itzler,** Princeton Lightwave, Inc.

8:30 am: **The silicon photomultiplier for low-light sensing applications** *(Invited Paper)*, Carl Jackson, SensL (Ireland) . . . . . [7320-33]

8:55 am: **Very high-gain and low-excess noise near-infrared single-photon avalanche detector: an NIR solid state photomultiplier** *(Invited Paper)*, Krishna R. Linga, Amplification Technologies, Inc. (United States) . . . . . [7320-34]

9:20 am: **Self-quenched InGaAs single-photon detector** *(Invited Paper)*, Yuhwa Lo, Kai Zhao, Sifang You, James Chang, Arthur Zhang, Univ. of California, San Diego (United States) . . . . . [7320-35]

9:45 am: **Negative feedback avalanche diodes for near-infrared single-photon detection**, Xudong Jiang, Mark A. Itzler, Bruce Nyman, Krystyna Slomkowski, Princeton Lightwave, Inc. (United States) . . . . . [7320-36]

10:05 am: **High-speed photon counting with linear-mode APD receivers**, George M. Williams, Jr., Andrew S. Huntington, Madison A. Compton, Sam Coykendall, Voxtel, Inc. (United States) . . . . . [7320-37]

10:25 am: **High-detection probability, broadband single-photon counting receivers**, Leye A. Aina, Ayub M. Fathimulla, Harry S. Hier, Mark Lecates, Epitaxial Technologies, LLC (United States); Sachi R. Babu, Parminder S. Ghuman, NASA Goddard Space Flight Ctr. (United States); James J. Foshee, Air Force Research Lab. (United States) . . . . . [7320-38]

Bio-Inspired/Biomimetic Sensor Technologies and Applications

Conference Chairs: **Nicholas F. Fell, Jr.,** Army Research Lab.; **Venkataraman S. Swaminathan,** U.S. Army Research, Development and Engineering Command

Program Committee: **Joanna Aizenberg,** Harvard Univ.; **Guillermo C. Bazan,** Univ. of California, Santa Barbara; **Socrates Deligeorges,** BioMimetic Systems; **Frank Doyle,** Univ. of California, Santa Barbara; **Madan Dubey,** Army Research Lab.; **James S. Humbert,** Univ. of Maryland, College Park; **Daniel E. Morse,** Univ. of California, Santa Barbara; **Richard M. Murray,** California Institute of Technology; **Rajesh R. Naik,** Air Force Research Lab.; **Paul M. Pellegrino,** Army Research Lab.; **Tien Pham,** Army Research Lab.; **Paul D. Willson,** U.S. Army Armament Research, Development and Engineering Ctr.

Monday 13 April

SESSION 1

Room: Atlanta . . . . . Mon. 8:30 to 10:20 am

Sensors

Session Chair: **Venkataraman S. Swaminathan,** U.S. Army Research, Development and Engineering Command

8:30 am: **Super-bright, stable, reproducible, SERS biotags for simultaneous identification of multiple biomarkers** *(Invited Paper)*, Martin Moskovits, Norbert Reich, Gary Braun, SeungJoon Lee, Univ. of California, Santa Barbara (United States) . . . . . [7321-01]

9:00 am: **Novel nanorod array substrates for high-sensitivity biomolecular sensing**, Richard A. Dluhy, Jeremy Driskell, Yiping Zhao, Ralph A. Tripp, The Univ. of Georgia (United States) . . . . . [7321-03]

9:20 am: **Selective photoluminescence-based detection of biomolecules by antibody functionalized Diatom biosilica**, Debra Gale, Oregon State Univ. (United States); Timothy Gutu, Portland State Univ. (United States); Chih-hung Chang, Oregon State Univ. (United States); Jun Jiao, Portland State Univ. (United States); Gregory L. Rorrer, Oregon State Univ. (United States) . . . . . [7321-04]

9:40 am: **Electrochemical aptamer-based sensor optimization: from benchtop to bedside**, Ryan J. White, Kevin W. Plaxco, Univ. of California, Santa Barbara (United States) . . . . . [7321-05]

10:00 am: **Approaches to detection of airborne biological agents**, An-Cheng Chang, Mary Beth Tabacco, Smiths Detection (United States) . . . . . [7321-06]

Coffee Break . . . . . 10:20 to 10:50 am

SESSION 2

Room: Atlanta . . . . . Mon. 10:50 am to 12:40 pm

Acoustic Detection

Session Chair: **Nicholas F. Fell, Jr.,** Army Research Lab.

10:50 am: **Biomimetic smart sensors for autonomous robotic behavior part I: acoustic processing** *(Invited Paper)*, Socrates Deligeorges, Shuwan Xue, Aaron Soloway, Lee Lichenstien, Tyler Gore, BioMimetic Systems, Inc. (United States); Allyn E. Hubbard, Boston Univ. (United States) . . . . . [7321-07]

11:20 am: **Biomimetic smart sensors for autonomous robotic behavior part II: vestibular processing**, Shuwan Xue, Socrates Deligeorges, Aaron Soloway, Lee Lichenstien, Tyler Gore, BioMimetic Systems, Inc. (United States); Allyn E. Hubbard, Boston Univ. (United States) and BioMimetic Systems, Inc. (United States) . . . . . [7321-08]

11:40 am: **Biologically inspired circuitry that mimics mammalian hearing**, Allyn E. Hubbard, David Mountain, Cassandra Browning, David Freedman, Christian Karl, Sarah Kelsall, Marianne Nourzad, Yirong Pu, Boston Univ. (United States); Socrates Deligeorges, BioMimetic Systems, Inc. (United States) . . . . . [7321-09]

12:00 pm: **Optimal design of bio-inspired directional microphones**, Haijun Liu, Xuming Zhang, Miao Yu, Univ. of Maryland, College Park (United States)[7321-10]

12:20 pm: **Microscale implementation of a bio-inspired acoustic localization device**, Luke Currano, Army Research Lab. (United States); Haijun Liu, Miao Yu, Univ. of Maryland, College Park (United States) . . . . . [7321-11]

Lunch Break . . . . . 12:40 to 2:00 pm

SESSION 3

Room: Atlanta . . . . . Mon. 2:00 to 3:10 pm

Locomotion and Robotics

Session Chair: **Paul M. Pellegrino,** Army Research Lab.

2:00 pm: **Mechanisms of frictional adhesion in biological adhesion and locomotion** *(Invited Paper)*, Jacob Israelachvili, Kimberly L. Turner, Hongbo Zeng, Univ. of California, Santa Barbara (United States); Noshir Pesika, Tulane Univ. (United States); Boxin Zhao, Univ. of Waterloo (Canada); Sathya S. Chary, John Tamelier, Univ. of California, Santa Barbara (United States) . . . . . [7321-12]

2:30 pm: **Polymer-based biomimetic jellyfish for future Naval undersea surveillance**, John B. Blottman III, Naval Undersea Warfare Ctr. (United States); Dennis F. Jones, Defence Research and Development Canada (Canada); Roger T. Richards, Naval Undersea Warfare Ctr. (United States) . . . . . [7321-13]

2:50 pm: **Bio-inspired locomotion for a modular snake robot**, Yi Guo, Shubo Zhang, Stevens Institute of Technology (United States) . . . . . [7321-14]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 4

Room: Atlanta . . . . . Mon. 3:40 to 4:50 pm

Algorithms

Session Chair: **Socrates Deligeorges,** BioMimetic Systems

3:40 pm: **GeoTrack: global video tracking by networks of unmanned aircraft systems (UAS)** *(Invited Paper)*, Joao P. Hespanha, Univ. of California, Santa Barbara (United States); Prabir Barooah, Univ. of Florida (United States); Gaemus Collins, Toyon Research Corp. (United States) . . . . . [7321-15]

4:10 pm: **A comparison of foveated acquisition and tracking performance relative to uniform resolution approaches**, Thayne R. Coffman, 21st Century Technologies, Inc. (United States) and Univ. of Texas at Austin (United States); Alan C. Bovik, Univ. of Texas at Austin (United States); Shaun F. Dubuque, Charles W. Thomas, 21st Century Technologies, Inc. (United States) . . . [7321-16]

4:30 pm: **Fuzzy logic and coarse coding using programmable logic devices**, Geoffrey Brooks, Florida State Univ., Panama City (United States) . . . . . [7321-17]

Tuesday 14 April

POSTERS-TUESDAY

Room: Palms Foyer . . . . . 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.

Bio-inspired synthesis and laser processing of nanostructured barium titanate thin films: implications for uncooled IR sensor development, Frank E. Livingston, The Aerospace Corp. (United States); Wendy L. Sarney, Army Research Lab. (United States); Andrea R. Tao, Daniel E. Morse, Univ. of California, Santa Barbara (United States) . . . . . [7321-02]

Photonic Microdevices/Microstructures for Sensing

Conference Chairs: **Hai Xiao,** Missouri Univ. of Science and Technology; **Xudong Fan,** Univ. of Missouri/Columbia; **Anbo Wang,** Virginia Polytechnic Institute and State Univ.

Program Committee: **Brian T. Cunningham,** Univ. of Illinois at Urbana-Champaign; **Junhang Dong,** Univ. of Cincinnati; **Wei Jin,** The Hong Kong Polytechnic Univ. (Hong Kong China); **Susan M. Maley,** U.S. Dept. of Energy, National Energy Technology Lab.; **Radislav A. Potyrailo,** GE Global Research; **Yun-Jiang Rao,** Univ. of Electronic Science and Technology of China (China); **Sharon M. Weiss,** Vanderbilt Univ.; **Ian M. White,** Univ. of Missouri/Columbia; **John X. J. Zhang,** The Univ. of Texas at Austin; **Yibing Zhang,** ExxonMobil Research and Engineering Co.; **Mohammed M. Zourob,** Biophage Pharma Inc. (Canada)

Thursday 16 April

OPENING REMARKS

Room: Grand 3 . . . . . Thurs. 8:00 to 8:20 am

SESSION 1

Room: Grand 3 . . . . . Thurs. 8:20 to 11:50 am

Microphotonic Devices in Biosensing I

Session Chair: **Ian M. White,** Univ. of Maryland, College Park

8:20 am: **Biomolecular detection using optofluidics** *(Invited Paper)*, David Erickson, Cornell Univ. (United States) . . . . . [7322-01]

9:00 am: **Fiber inline core-cladding-mode Michelson interferometer fabricated by one point CO_2 laser irradiation**, Tao Wei, Yanjun Li, Yinan Zhang, Xinwei Lan, Hai Xiao, Missouri Univ. of Science and Technology (United States) . . . . . [7322-16]

9:20 am: **Optofluidic ring resonator sensor for sensitive label-free detection of breast cancer antigen CA15-3 in human serum**, Hongying Zhu, Paul S. Dale, Xudong Fan, Univ. of Missouri, Columbia (United States) . . . . . [7322-03]

9:40 am: **Porous waveguide in the Kretschmann configuration for small molecule detection**, Yang Jiao, Guoguang Rong, Sharon M. Weiss, Vanderbilt Univ. (United States) . . . . . [7322-04]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Microfluidic and nanofluidic integration of plasmonic substrates for biosensing** *(Invited Paper)*, David Sinton, Alexandre G. Brolo, Reuven Gordon, Univ. of Victoria (Canada) . . . . . [7322-05]

11:10 am: **Mass fabrication tolerances for integrated optical sensors**, Jeroen A. W. Van Houwelingen, Mirvais Yousefi, Michael Engelmann, Ruud Schmits, Hans van den Berg, TNO (Netherlands) . . . . . [7322-06]

11:30 am: **Label-free DNA methylation analysis using the optofluidic ring resonator sensor**, Jonathan D. Suter, Xudong Fan, Daniel J. Howard, Charles W. Caldwell, Huidong Shi, Univ. of Missouri, Columbia (United States) . . . . [7322-07]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 2

Room: Grand 3 . . . . . Thurs. 1:20 to 3:00 pm

Microphotonic Devices for Biosensing II

Session Chair: **Sharon M. Weiss,** Vanderbilt Univ.

1:20 pm: **Photonic materials for encoding and detection of biomolecules** *(Invited Paper)*, Zhongze Gu, Southeast Univ. (China) . . . . . [7322-08]

2:00 pm: **Waveguide evanescent-field fluorescence microscopy and its application to cell biology** *(Invited Paper)*, Silvia Mittler, Abdollah Hassanzadeh, The Univ. of Western Ontario (Canada). . . . . [7322-09]

2:40 pm: **Photonic crystal slab and waveguide design for biological detection**, Elizabeth A. Tanner, Juronica Arch, Anne-Marie Dorsett, Digital Fusion Inc. (United States); Derek Strembicke, Milan C. Buncick, AEgis Technologies Group, Inc. (United States); Jian Han, HudsonAlpha Institute for Biotechnology (United States); Scott T. Retterer, Darrell K. Thomas, Oak Ridge National Lab. (United States). . . . . [7322-10]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 3

Room: Grand 3 . . . . . Thurs. 3:30 to 5:10 pm

Microphotonic Sensors for Chemical Detection

Session Chair: **Xudong Fan,** Univ. of Missouri, Columbia

3:30 pm: **Nanocrystalline Cu-doped zirconia film-coated long-period fiber grating for CO monitoring at high temperature** *(Invited Paper)*, Xiling Tang, Jian Zhang, Junhang Dong, Univ. of Cincinnati (United States); Tao Wei, Hai Xiao, Missouri Univ. of Science and Technology (United States) . . . . . [7322-11]

4:10 pm: **Optofluidic ring resonator sensors for CD^{4+} detection**, John Gohring, Xudong Fan, Univ. of Missouri, Columbia (United States) . . . . . [7322-19]

4:30 pm: **Development of optofluidic ring resonator based chemical vapor sensing platform**, Yuze Sun, Jing Liu, Univ. of Missouri, Columbia (United States); Gregory C. Frye-Mason, Aaron Thompson, Shiou-Jyh Ja, ICx Technologies, Inc. (United States); Xudong Fan, Univ. of Missouri, Columbia (United States). . . . . [7322-13]

4:50 pm: **Miniaturized fiber inline Fabry-Perot interferometer for chemical sensing**, Tao Wei, Yukun Han, Hai-Lung Tsai, Hai Xiao, Missouri Univ. of Science and Technology (United States) . . . . . [7322-14]

Friday 17 April

OPENING REMARKS:

Room: Grand 3 . . . . . Fri. 8:00 to 8:10 am

SESSION 4

Room: Grand 3 . . . . . Fri. 8:10 to 10:10 am

Robust Microphotonic Sensors and Applications in Extreme Environments

Session Chair: **Junhang Dong,** Univ. of Cincinnati

8:10 am: **Fiber-based sensing in harsh environments for fossil energy applications** *(Invited Paper)*, Susan M. Maley, U.S. Dept. of Energy (United States). . . . . [7322-15]

8:50 am: **Micro fiber-optic etalons for sensing applications** *(Invited Paper)*, Yun-Jiang Rao, Univ. of Electronic Science and Technology of China (China) . . . . . [7322-17]

9:30 am: **Near-surface sensing at elevated temperatures using surface plasmon resonance and optical waveguide spectroscopy**, Yibing Zhang, Mohsen Yeganeh, ExxonMobil Research and Engineering Co. (United States). . . . . [7322-18]

9:50 am: **Study on CO_2 laser irradiation-induced mode coupling in a single-mode fiber for development of high-performance miniaturized interferometric sensors**, Xinwei Lan, Tao Wei, Yanjun Li, Yinan Zhang, Missouri Univ. of Science and Technology (United States); Xiling Tang, Junhang Dong, Univ. of Cincinnati (United States); Hai Xiao, Missouri Univ. of Science and Technology (United States) . . . . . [7322-20]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 5

Room: Grand 3 . . . . . Fri. 10:40 am to 12:00 pm

Microphotonic Sensor Fabrication

Session Chair: **Hai Xiao,** Missouri Univ. of Science and Technology

10:40 am: **Fiber optics low-coherence IR interferometry for defense sensors manufacturing**, Wojtek J. Walecki, Fanny Szondy, Sunrise Optical LLC (United States) . . . . . [7322-21]

11:00 am: **Photodetectors array driven MEMS deformable mirrors**, Bahareh Haji-Saeed, Air Force Research Lab. (United States); Brian Krejca, Andrew Davis, John Kierstead, Solid State Scientific Corp. (United States); Jed Khoury, Kenneth Vaccaro, Charles L. Woods, Air Force Research Lab. (United States); William D. Goodhue, Univ. of Massachusetts Lowell (United States) . . . . . [7322-22]

11:20 am: **Theoretical and experimental development of label-free biosensors based on localized plasmon resonances on nanohole and nanopillar arrays**, Radislav A. Potyrailo, GE Global Research (United States) . . . . . [7322-02]

11:40 am: **Photonic bandgap fiber-enabled Raman detection of nitrogen gas**, Rui Chen, Peter J. Codella, Renato Guida, Anis Zribi, Alexey Vert, Radislav A. Potyrailo, GE Global Research (United States); Marko Baller, GE Global Research (Germany) . . . . . [7322-12]

Get the training you need to stay ahead of the technology curve.

See daily course schedule, pp. 23–26.

Laser Radar Technology and Applications XIV

Conference Chairs: **Monte D. Turner,** Defense Advanced Research Projects Agency; **Gary W. Kamerman,** FastMetrix, Inc.

Program Committee: **Ravil R. Agishev,** Kazan State Univ. (Russian Federation); **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 (Russian Federation); **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 15 April

OPENING REMARKS

Room: Grand 8B . . . . . Wed. 8:00 to 8:10 am

Session Chairs: **Monte D. Turner,** Defense Advanced Research Projects Agency; **Gary W. Kamerman,** FastMetrix, Inc.

SESSION 1

Room: Grand 8B . . . . . Wed. 8:10 to 10:30 am

3D Imaging Lidar

Session Chair: **Monte D. Turner,** Defense Advanced Research Projects Agency

8:10 am: **Echo digitizing imaging LIDAR for rendezvous and docking**, Martin Pfennigbauer, RIEGL Laser Measurement Systems GmbH (Austria); Bettina G. U. Möbius, Jena-Optronik GmbH (Germany); Andreas Ullrich, RIEGL Laser Measurement Systems GmbH (Austria); Joao Pereira do Carmo, European Space Research and Technology Ctr. (Netherlands) . . . . . [7323-01]

8:30 am: **Real-time 3D color imaging of scenes using the Eyesafe LADAR Test-bed**, Robert T. Pack, Utah State Univ. (United States); Jason A. Swasey, Space Dynamics Lab. (United States); Rollin R. Fullmer, Scott E. Budge, Paul D. Israelsen, Utah State Univ. (United States); Brad Petersen, Space Dynamics Lab. (United States); T. Dean Cook, Naval Air Warfare Ctr. (United States) . . . [7323-02]

8:50 am: **Waveform comparison for coherent ladar imaging using a helicopter facet model target**, Douglas G. Youmans, SPARTA, Inc. (United States) . . . . . [7323-03]

9:10 am: **Stand-off 3D face imaging for biometric identification using two-illumination-angle digital holography**, Brian Redman, Nathan Seldomridge, Dr. Sandalphon, Taylor Grow, Thomas Höft, Joseph C. Marron, Mark Blair, Lockheed Martin Coherent Technologies (United States) . . . . . [7323-04]

9:30 am: **Low-cost stand-off 3D face imaging for biometric identification using Fourier/wavelet transform profilometry**, Brian Redman, Dr. Sandalphon, Thomas Höft, Nathan Seldomridge, Taylor Grow, Mark Blair, Lockheed Martin Coherent Technologies (United States); John W. Edwards, Lockheed Martin Information Systems & Global Services (United States) . . . . . [7323-05]

9:50 am: **Integration of 3D and 2D imaging data for assured navigation in unknown environments**, Maarten Uijt de Haag, Evan Dill, Ohio Univ. (United States) . . . . . [7323-06]

10:10 am: **Detection of concealed objects with a mobile laser scanning system**, Martin Pfennigbauer, Peter Rieger, Andreas Ullrich, RIEGL Laser Measurement Systems GmbH (Austria) . . . . . [7323-46]

Coffee Break . . . . . 10:30 to 11:00 am

SESSION 2

Room: Grand 8B . . . . . Wed. 11:00 am to 12:00 pm

Modeling Laser Radar I

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

11:00 am: **A method for automatic reconstruction 3D models**, Ling Zhu, Beijing Normal Univ. (China); Keqin Zhou, Beijing Univ. of Civil Engineering and Architecture (China) . . . . . [7323-07]

11:20 am: **Fundamental relationships inherent to LIDAR waveforms for classification**, Amy L. Neuenschwander, Lori A. Magruder, The Univ. of Texas at Austin (United States) . . . . . [7323-08]

11:40 am: **Design and validation of the Eyesafe LADAR Test-bed (ELT) using the LadarSIM system simulator**, Scott E. Budge, Kevin D. Neilsen, Robert T. Pack, Rollin R. Fullmer, Utah State Univ. (United States); T. Dean Cook, Naval Air Warfare Ctr. (United States) . . . . . [7323-09]

Lunch/Exhibition Break . . . . . 12:00 to 2:10 pm

SESSION 2A

Room: Grand 8B . . . . . Wed. 2:10 to 2:50 pm

Modeling Laser Radar II

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

2:10 pm: **Data simulation of an airborne LIDAR system**, Seongjoon Kim, Seonghong Min, Geunhan Kim, Impyeong Lee, Chulmin Jun, The Univ. of Seoul (Korea, Republic of) . . . . . [7323-11]

2:30 pm: **Photographic-based target models for LADAR applications**, James T. Jack, Lockheed Martin Missiles and Fire Control (United States); Walter H. Delashmit, Univ. of North Texas (United States) . . . . . [7323-12]

Coffee Break . . . . . 2:50 to 3:20 pm

SESSION 3

Room: Grand 8B . . . . . Wed. 3:20 to 4:40 pm

Photon-counting 3D Lidar

Session Chair: **Richard M. Marino,** MIT Lincoln Lab.

3:20 pm: **Present and future space applications of photon-counting lidars**, John J. Degnan, Sigma Space Corp. (United States) . . . . . [7323-13]

3:40 pm: **Improved coincidence processing of 3D laser radar data**, Alexandru N. Vasile, Richard M. Marino, MIT Lincoln Lab. (United States) . . . . . [7323-14]

4:00 pm: **Design and development of a compact single photon detection LADAR camera**, Rengarajan Sudharsanan, Ping Yuan, Emilio Quesada, Joseph C. Boisvert, Eduardo Labios, Paul A. McDonald, Spectrolab, Inc. (United States); Michael S. Salisbury, Gary M. Stuart, Harrison Danny, Roger A. Mitchell, Angel A. Portillo, Alric Roybal, Boeing-SVS, Inc. (United States) . . . . . [7323-15]

4:20 pm: **Photon-counting lidar for aerosol detection and 3D imaging**, Jonathan M. Richardson, Richard M. Marino, Robert Garnier, Laura J. Bickmeier, Christina M. Siracusa, Patrick M. Quinn, David B. Ireland, MIT Lincoln Lab. (United States) . . . . . [7323-18]

Thursday 16 April

SESSION 5

Room: Grand 8B . . . . . Thurs. 8:00 to 9:20 am

Foliage Poke-through Imaging Lidar

Session Chair: **Monte D. Turner,**
Defense Advanced Research Projects Agency

8:00 am: **Effects of lidar point density on bare earth extraction and DEM creation**, Richard C. Olsen, Angela M. Puetz, Brian C. Anderson, Naval Postgraduate School (United States) . . . . . [7323-22]

8:20 am: **Modeling and simulation return waveforms from forest canopy of large footprint LIDAR**, Zhaoyan Liu, Ran Li, Xiaohuan Xi, Lingli Tang, Chuanrong Li, Caixing Li, Academy of Opto-Electronics (China) . . . . . [7323-23]

8:40 am: **Study on the vegetation structure parameters using lidar and IR photography**, Ling Zhu, Beijing Normal Univ. (China) . . . . . [7323-24]

9:00 am: **Lidar full-waveform analysis for detection of faint returns through obscurants**, Lori A. Magruder, Amy L. Neuenschwander, The Univ. of Texas at Austin (United States) . . . . . [7323-25]

SESSION 6

Room: Grand 8B . . . . . Thurs. 9:20 to 10:40 am

Sparse and Synthetic Aperture Lidar

Session Chair: **Phillip Gatt,** Lockheed Martin Coherent Technologies

9:20 am: **Increasing midfrequency contrast in sparse aperture optical imaging systems**, Andrew J. Stokes, Bradley D. Duncan, Univ. of Dayton (United States) and Ladar and Optical Communications Institute (United States); Matthew P. Dierking, Air Force Research Lab. (United States); Nicholas J. Miller, Univ. of Dayton (United States) and Ladar and Optical Communications Institute (United States) . . . . . [7323-26]

9:40 am: **Multiple chirp sparse frequency LFM ladar signals**, Robert V. Chimenti, Univ. of Dayton (United States); Matthew P. Dierking, Air Force Research Lab. (United States); Peter E. Powers, Joseph W. Haus, Univ. of Dayton (United States) . . . . . [7323-27]

10:00 am: **Monte Carlo simulation of the effects of pulse and platform jitter on holographic aperture ladar systems**, Jason W. Stafford, Bradley D. Duncan, Univ. of Dayton (United States); Matthew P. Dierking, Air Force Research Lab. (United States) . . . . . [7323-28]

10:20 am: **Performance bounds of the phase gradient autofocus algorithm for synthetic aperture ladar**, Bert Bradford, Phillip Gatt, Brian Krauss, Joseph C. Marron, Lockheed Martin Coherent Technologies (United States) . . . . . [7323-29]

Coffee Break . . . . . 10:40 to 11:10 am

SESSION 7

Room: Grand 8B . . . . . Thurs. 11:10 am to 12:50 pm

Aerosol and Atmospheric Sensing

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

11:10 am: **Bio-aerosol elastic scatter signatures in the near- and mid-wave IR spectral regions**, Jonathan M. Richardson, John C. Aldridge, Adam B. Milstein, Joseph J. Lacirignola, MIT Lincoln Lab. (United States) . . . . . [7323-30]

11:30 am: **Multiwavelength multiangular characterization of aerosols**, Andrea M. Wyant, David M. Brown, Perry S. Edwards, C. Russell Philbrick, The Pennsylvania State Univ. (United States) . . . . . [7323-31]

11:50 am: **Supercontinuum lidar measurements of atmospheric constituents**, Perry S. Edwards, David M. Brown, Andrea M. Wyant, Zhiwen Liu, C. Russell Philbrick, The Pennsylvania State Univ. (United States) . . . . . [7323-32]

12:10 pm: **System performance and modeling of a bio-aerosol detection lidar sensor utilizing polarization diversity**, John J. Glennon, Terry L. Nichols, Phillip Gatt, Tahllee Baynard, John H. Marquardt, Lockheed Martin Coherent Technologies (United States) . . . . . [7323-33]

12:30 pm: **High-speed laser wavelength agility, stabilization, and locking for heterodyne detection differential scatter lidar**, Diego F. Pierrottet, George E. Busch, Bruce W. Barnes, Thedric D. Jones, Coherent Applications, Inc. (United States) . . . . . [7323-34]

Lunch/Exhibition Break . . . . . 12:50 to 2:00 pm

SESSION 8

Room: Grand 8B . . . . . Thurs. 2:00 to 3:40 pm

Emerging Ladar Applications and Technology I

Session Chair: **Monte D. Turner,**
Defense Advanced Research Projects Agency

2:00 pm: **Compact eye-safe LADAR based on directly modulated high-power single-mode diode lasers**, Mikhail A. Maiorov, Igor E. Trofimov, Vladimir A. Zeidel, Robert F. Sellers, Akela Laser Corp. (United States) . . . . . [7323-35]

2:20 pm: **Narrow linewidth fiber laser systems via Brillouin-tailored optical fiber**, Peter D. Dragic, Neolight Technologies LLC (United States) . . . . . [7323-36]

2:40 pm: **Low-cost compact ladar for ground robots**, Barry L. Stann, Mark M. Giza, William B. Lawler, Pey-Schuan Jian, Army Research Lab. (United States) . . . . . [7323-37]

3:00 pm: **Identification of air and sea-surface targets with a laser range profiler**, Johan C. van den Heuvel, Robin M. Schoemaker, Dolf H. W. Bos, Ric M. A. Schleijpen, TNO Defense, Security and Safety (Netherlands) . . . . . [7323-38]

3:20 pm: **Wideband dual-frequency lidar-radar for simultaneous velocity and high-resolution range profile measurements**, Grégoire Pillet, Loic Morvan, Daniel Dolfi, Jean-Pierre Huignard, Thales Research & Technology (France) . . . . . [7323-39]

Coffee Break . . . . . 3:40 to 4:10 pm

SESSION 9

Room: Grand 8B . . . . . Thurs. 4:10 to 6:10 pm

Emerging Ladar Applications and Technology II

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

4:10 pm: **Advances in multispectral and polarimetric imaging systems**, Arnaud Bénière, Mehdi Alouini, Thales Research & Technology (France); François Goudail, Univ. Paris-Sud 11 (France); Arnaud Grisard, Jérôme Bourderionnet, Daniel Dolfi, Thales Research & Technology (France); Ivar Baarstad, Trond Loke, Peter Kaspersen, Norsk Elektro Optikk A/S (Norway); Xavier Normandin, Gérard Berginc, Thales Optronique S.A. (France) . . . . . [7323-40]

4:30 pm: **Flight test performance of a high-precision navigation Doppler lidar**, Diego F. Pierrottet, Coherent Applications, Inc. (United States); Farzin Amzajerdian, Larry B. Petway, Bruce W. Barnes, George E. Lockard, NASA Langley Research Ctr. (United States) . . . . . [7323-41]

4:50 pm: **The aircraft laser uplink ranging experiment (ALURE): an overview**, K. Wilson, J. Kovalik, M. Wright, A. Biswas, Y. Bar-sever, R. Meyer, V. Garkanian, Jet Propulsion Lab. (United States) . . . . . [7323-42]

5:10 pm: **ColorDazl/Daylight Dazzlers and eye detection**, James P. Hauck, Scientific Applications & Research Associates, Inc. (United States) . . . . [7323-43]

5:30 pm: **Off-axis laser warning sensor**, Didier Goular, ONERA (France); Jean-Pierre Cariou, Leosphere France (France); Claudine Beson, Thierry Gaudo, ONERA (France); Arnaud Bêche, Vincent Megaides, Thales Optronique S.A. (France) . . . . . [7323-44]

5:50 pm: **Research on 3D reconstruction based on stereo vision**, Yahui Liu, Beijing Univ. of Posts and Telecommunications (China) . . . . . [7323-45]

Atmospheric Propagation VI

Conference Chairs: **Linda M. Wasiczko Thomas,** Naval Research Lab.; **G. Charmaine Gilbreath,** Naval Research Lab.

Program Committee: **Larry C. Andrews,** Univ. of Central Florida; **Gary J. Baker,** Lockheed Martin Advanced Technology Ctr.; **Harris Rayvon Burris, Jr.,** Naval Research Lab.; **John J. Degnan,** Sigma Space Corp.; **Georges R. Fournier,** Defence R&D Canada, Valcartier (Canada); **Gary G. Gimmestad,** Georgia Tech Research Institute; **Kenneth J. Grant,** Defence Science and Technology Organisation (Australia); **Christopher I. Moore,** Naval Research Lab.; **Sergio R. 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

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

WELCOMING REMARKS

Room: Crystal A . . . . . .Tues. 1:30 to 1:40 pm

Session Chairs: **Linda M. Wasiczko Thomas,** Naval Research Lab.; **G. Charmaine Gilbreath,** Naval Research Lab.

SESSION 1

Room: Crystal A . . . . . .Tues. 1:40 to 3:10 pm

Theory, Modeling, and Simulation I

Session Chair: **Gary J. Baker,** Lockheed Martin Advanced Technology Ctr.

1:40 pm: **Near-ground vertical profile of refractive-index fluctuations** *(Invited Paper)*, Larry C. Andrews, Ronald L. Phillips, David T. Wayne, Troy Leclerc, Paul Sauer, Robert F. Crabbs, Jr., John Kiriazes, Univ. of Central Florida (United States). . . . . [7324-01]

2:10 pm: **Laser beam propagation in the low-order turbulence: exact solution**, Mikhail I. Charnotskii, Zel Technologies, LLC (United States). . [7324-02]

2:30 pm: **Simulation and theory of speckle noise for an annular aperture frequency-modulation differential-absorption LIDAR (FM-DIAL) system**, Paul E. Keller, Michael T. Batdorf, Jana D. Strasburg, Warren W. Harper, Pacific Northwest National Lab. (United States). . . . . [7324-03]

2:50 pm: **Coherence and cross-polarization properties of light beams in active laser systems**, Serkan Sahin, Zhisong Tong, Olga Korotkova, Univ. of Miami (United States) . . . . . [7324-04]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 2

Room: Crystal A . . . . . .Tues. 3:40 to 4:40 pm

Theory, Modeling, and Simulation II

Session Chair: **Jonathan M. Saint Clair,** The Boeing Co.

3:40 pm: **Availability of free-space optical communication systems under influence of beam wandering and optical turbulence**, Jose Paulo G. de Oliveira, Univ. Karlsruhe (Germany); Maurus Tacke, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany). . . . . [7324-05]

4:00 pm: **Method to reduce computational requirements for modeling point source beam propagation in turbulence**, Gary J. Baker, Kevin R. Bock, Troy E. Wenski, Lockheed Martin Space Systems Co. (United States) . . . . . [7324-06]

4:20 pm: **Chase decoding applied to optical communications through the turbulent atmosphere,** Majed Ben-Kalefa, Consultant (United States). . . . . [7324-07]

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

Phase trajectories for the turbulent parameters in connection with laser beam propagation and focusing problems in turbulent medium, Evgeni N. Terentiev, Fedor V. Shugaev, Ludmila S. Shtemenko, Olga I. Dokukina, Tatiana A. Petrova, Lomonosov Moscow State Univ. (Russian Federation) . . . . . [7324-42]

Scintillation studies over varied terrain, Linda M. Wasiczko Thomas, Naval Research Lab. (United States); Justin Vierra, Univ. of Hawai'i at Manoa (United States); Amey R. Peltzer, Naval Research Lab. (United States); Mark A. Davis, Naval Research Lab. (United States) and Honeywell Technology Solutions Inc. (United States); Mehrdad N. Ghasemi-Nejhad, Univ. of Hawai'i at Manoa (United States). . . . . [7324-43]

The angle-of-arrival fluctuation of Gaussian beam propagation through turbulent atmosphere channel, Chao Li, Univ. of Electronic Science and Technology of China (China) . . . . . [7324-44]

Wednesday 15 April

SESSION 3

Room: Crystal A . . . . . Wed. 8:30 to 10:20 am

Experimental Studies I

Session Chair: **Linda M. Wasiczko Thomas,** Naval Research Lab.

8:30 am: **Optical propagation in the underwater environment** *(Invited Paper)*, Linda J. Mullen, Naval Air Systems Command (United States) . . . . . [7324-09]

9:00 am: **Optical homodyne RZ-QPSK transmission through wind tunnel at 3.8 and 1.55 micron via wavelength conversion**, Pak S. Cho, Geof Harston, CeLight, Inc. (United States); Kai-Daniel F. Buchter, Univ. Paderborn (Germany); David C. Soreide, Jonathan M. Saint Clair, The Boeing Co. (United States); Wolfgang Sohler, Univ. Paderborn (Germany); Yaakov Achiam, Isaac Shpantzer, CeLight, Inc. (United States) . . . . . [7324-10]

9:20 am: **Analysis of rapid Cn_2 fluctuations observed during a 5-km communication link experiment**, Timothy M. Yarnall, Steven S. Michael, John D. Moores, Ronald R. Parenti, William E. Wilcox, Jr., MIT Lincoln Lab. (United States). . . . . [7324-11]

9:40 am: **Inversion of differential image motion profiles to determine refractive turbulence profiles**, John M. Stewart, Gary G. Gimmestad, Georgia Tech Research Institute (United States); Ian R. Gatland, Georgia Institute of Technology (United States) . . . . . [7324-12]

10:00 am: **Statistical properties of a short analog free-space optical link**, Frank Bucholtz, Harris R. Burris, Jr., Christopher I. Moore, C. S. McDermitt, Rita Mahon, Michelle Siute, G. Charmaine Gilbreath, William S. Rabinovich, Naval Research Lab. (United States). . . . . [7324-13]

Coffee Break . . . . . 10:20 to 10:50 am

SESSION 4

Room: Crystal A . . . . . Wed. 10:50 am to 12:10 pm

Experimental Studies II

Session Chair: **Gary G. Gimmestad,** Georgia Tech Research Institute

10:50 am: **Conceptual designs of onboard transceivers for ground-to-satellite quantum cryptography**, Morio Toyoshima, Yozo Shoji, Yoshihisa Takayama, Hiroo Kunimori, Masahiro Takeoka, Mikio Fujiwara, Masahide Sasaki, National Institute of Information and Communications Technology (Japan). . . . . [7324-14]

11:10 am: **Free-space optical communication flight mission: simulations and experimental results on ground level demonstrator**, Valter Ferrero, Ramon Mata Calvo, Politecnico di Torino (Italy); Stefano Camatel, Istituto Superiore Mario Boella (Italy); Valeria Catalano, Agenzia Spaziale Italiana (Italy); Luciana Bonino, Thales Alenia Space (Italy); Italo Toselli, Politecnico di Torino (Italy) . . . . [7324-15]

11:30 am: **Long-range analog RF free-space optical comm link in a maritime environment**, Harris R. Burris, Jr., Frank Bucholtz, Christopher I. Moore, Naval Research Lab. (United States); Kenneth J. Grant, Defence Science and Technology Organisation (Australia); M. R. Suite, C. S. McDermitt, Naval Research Lab. (United States); B. A. Clare, Defence Science and Technology Organisation (Australia); R. Mahon, Naval Research Lab. (United States); W. Martinsen, Defence Science and Technology Organisation (Australia); M. Ferraro, Naval Research Lab. (United States); R. Sawday, Defence Science and Technology Organisation (Australia); Carlos O. Font, Linda M. Wasiczko Thomas, Naval Research Lab. (United States); K. A. Mudge, Defence Science and Technology Organisation (Australia); William S. Rabinovich, G. Charmaine Gilbreath, W. Scharpf, Naval Research Lab. (United States); E. Saint Georges, S. Uecke, NOVASOL (United States). . . . . [7324-16]

11:50 am: **Evaluation of a novel FSO receiver for mitigating alignment errors**, Peter G. LoPresti, Sarah Spaunhorst, The Univ. of Tulsa (United States); Hazem Refai, Univ. of Oklahoma (United States) . . . . . [7324-17]

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

SESSION 5

Room: Crystal A . . . . . Wed. 1:40 to 3:00 pm

Experimental Studies III

Session Chair: **Harris Rayvon Burris, Jr.,** Naval Research Lab.

1:40 pm: **Optical communications receiver array**, Jonathan M. Saint Clair, Eric Y. Chan, Dennis G. Koshinz, Stephen K. Wilcken, The Boeing Co. (United States); David C. Soreide, Optimal Aerospace LLC (United States); Atul B. Joshi, Hakan Durmus, Teledyne Scientific & Imaging, LLC (United States) . . . . . [7324-18]

2:00 pm: **Comparison of scintillation measurements from a 5-km communications link to standard statistical models**, Steven S. Michael, Ronald R. Parenti, Frederick G. Walther, Alicia M. Volpicelli, John D. Moores, William E. Wilcox, Jr., Robert J. Murphy, MIT Lincoln Lab. (United States) . . . . . [7324-19]

2:20 pm: **Evaluation of free-space optical fiber bundle transmitter configurations for receiver tracking**, Peter G. LoPresti, Dayong Zhou, The Univ. of Tulsa (United States); Hazem Refai, Univ. of Oklahoma (United States). . . . . [7324-20]

2:40 pm: **Challenges facing mobile free-space optical communications**, Mouhammad K. Al-Akkoumi, Univ. of Oklahoma (United States); Alan Harris, Univ. of North Florida (United States); Robert C. Huck, James J. Sluss, Jr., Univ. of Oklahoma (United States) . . . . . [7324-21]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 6

Room: Crystal A . . . . . Wed. 3:30 to 4:50 pm

Experimental Studies IV

Session Chair: **Christopher I. Moore,** Naval Research Lab.

3:30 pm: **Mitigation of weak and strong turbulence-induced fading in optical homodyne RZ-QPSK via delay-diversity transmission**, Pak S. Cho, Geof Harston, CeLight, Inc. (United States); David C. Soreide, Jonathan M. Saint Clair, The Boeing Co. (United States); Yaakov Achiam, Isaac Shpantzer, CeLight, Inc. (United States). . . . . [7324-22]

3:50 pm: **Theoretical and experimental results for 1550-nm light scattering in clouds and their predictions for pulse broadening effects on high-throughput optical communications**, Graham J. Martin, William R. Christian, John E. Mansell, Jian Ma, Bruce K. Winker, Teledyne Scientific Co. (United States). . . . . [7324-23]

4:10 pm: **Integrated atmospheric characterization system**, David W. Roberts, Gary G. Gimmestad, John M. Stewart, Georgia Tech Research Institute (United States); David N. Whiteman, NASA Goddard Space Flight Ctr. (United States); Frank D. Eaton, Air Force Research Lab. (United States) . . . . . [7324-24]

4:30 pm: **An atmospheric turbulence, scattering, and weather monitoring system for 3.2-km path for monitoring the statistics of turbulence,** Aleksandr V. Sergeyev, Michael C. Roggemann, Christopher Middlebrook, Michigan Technological Univ. (United States); Piotr Piatrou, Univ. of California, Irvine (United States); Kyle Drexler, Michigan Technological Univ. (United States). . . . . [7324-25]

CLOSING REMARKS

Room: Crystal A . . . . . Wed. 4:50 to 5:00 pm

Session Chairs: **Linda M. Wasiczko Thomas,** Naval Research Lab.; **G. Charmaine Gilbreath,** Naval Research Lab.

Thursday 16 April

OPENING REMARKS

Room: Crystal A . . . . . Thurs. 8:20 to 8:40 am

Workshop Chairs: **G. Charmaine Gilbreath,** Naval Research Lab.; **Chadwick T. Hawley,** National Signature Program

SESSION 7

Room: Crystal A . . . . . Thurs. 8:40 to 11:40 am

Active and Passive Signatures Workshop I

Session Chair: **Chadwick T. Hawley,** National Signature Program

8:40 am: **Operational contexts for signature science** *(Keynote Presentation)*, Hon. James B. Longley, Jr., The Advanced Technical Intelligence Association (United States). . . . . [7324-26]

9:10 am: **Airborne infrared hyperspectral mapping using Fourier-transform spectrometer technology**, Matthias Rolland, Martin Chamberland, Vincent Farley, Jean-Philippe Gagnon, Philippe Lagueux, Yan Montembeault, Simon Savary, André Villemaire, Telops (Canada) . . . . . [7324-46]

9:30 am: **Signature studies using liquid crystal device for atmospheric simulation for short-wave infrared free-space laser communications**, Freddie Santiago, Carlos O. Font, Jonathan R. Andrews, G. Charmaine Gilbreath, Ty Martinez, Naval Research Lab. (United States); Stephen A. Myers, The Univ. of New Mexico (United States); Sergio R. Restaino, Christopher C. Wilcox, Naval Research Lab. (United States). . . . . [7324-29]

9:50 am: **Characterization of the influence function of a piezoelectric deformable mirror for operation at 1550 nm**, Carlos O. Font, Blerta Bajramaj, David S. Kim, Freddie Santiago, G. Charmaine Gilbreath, Ty Martinez, Sergio R. Restaino, Naval Research Lab. (United States) . . . . . [7324-30]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **Optical signatures for autonomous mobility**, Michael Powers, General Dynamics (United States) and Univ. of Maryland, College Park (United States); Christopher C. Davis, Univ. of Maryland, College Park (United States). . . . . [7324-31]

11:00 am: **Spherical detection systems for detecting and tracking IR heat signatures**, Ryan D. Riel, Lucid Dimensions (United States) . . . . . [7324-32]

11:20 am: **Spider webs as air samplers**, Daniel I. Mattei, C. A. Bleckmann, D. J. Bunker, Air Force Institute of Technology (United States); I. Maxis, National MASINT Management Office (United States); A. L. Rypstra, Miami Univ. (United States). . . . . [7324-34]

Lunch/Exhibition Break . . . . . 11:40 am to 2:00 pm

SESSION 8

Room: Crystal A . . . . . Thurs. 2:00 to 4:50 pm

Active and Passive Signatures Workshop II

Session Chair: **G. Charmaine Gilbreath,** Naval Research Lab.

2:00 pm: **Multiple-coincidence active neutron interrogation of fissionable materials**, J. P. Hurley, R. P. Keegan, J. R. Tinsley, R. Trainham, National Security Technologies, LLC (United States) . . . . . [7324-35]

2:20 pm: **Integrated radio control improvised explosive device signature analysis**, Kate Bole, James McGraw, Toan Van, Sean Anklam, Jonathan Kiser, Photon Research Associates, Inc. (United States) . . . . . [7324-36]

2:40 pm: **Terahertz spectral signatures of explosive materials and precursors**, Christopher D. Ball, T. J. Ronningen, Lee C. Oesterling, Battelle Memorial Institute (United States) . . . . . [7324-37]

3:00 pm: **A computational tool for evaluating THz imaging performance in brownout or whiteout conditions at land sites throughout the world**, Steven Fiorino, Seth Marek, Richard J. Bartell, Robb M. Randall, Matthew J. Krizo, Salvatore J. Cusumano, Air Force Institute of Technology (United States) . . . . . [7324-38]

Coffee Break . . . . . 3:20 to 3:50 pm

3:50 pm: **NIST speaker recognition evaluations 1996-2008**, Craig Greenberg, Alvin Martin, National Institute of Standards and Technology (United States) . . . . . [7324-39]

4:10 pm: **Signature-based multichannel image cluster partitioning for automated material detection**, William F. Brooks, Northrop Grumman (United States); Chadwick T. Hawley, National Signature Program (United States) . . . . . [7324-40]

4:30 pm: **Multimodal signature dissemination file formats in Matlab, Octave, and Python,** Kelly Bennett, Army Research Lab. (United States); James Robertson, Clearhaven Technologies LLC (United States) . . . . . [7324-41]

Workshop Summary

Room: Crystal A . . . . . Thurs. 4:50 to 5:00 pm

Workshop Chairs: **G. Charmaine Gilbreath,** Naval Research Lab.; **Chadwick T. Hawley,** National Signature Program

Laser Technology for Defense and Security V

Conference Chairs: **Mark Dubinskii,** Army Research Lab.; **Stephen G. Post,** Missile Defense Agency

Program Committee: **Robert S. Afzal,** Aculight Corp.; **Steven R. Bowman,** Naval Research Lab.; **Anthony M. Johnson,** Univ. of Maryland, Baltimore County; **Mark W. Neice,** High Energy Laser Joint Technology Office; **Robert R. Rice,** Northrop Grumman Space Technology

Monday 13 April

SESSION 1

Room: Grand 9-10. . . . . Mon. 8:30 to 10:10 am

Er-Doped Bulk Lasers

Session Chair: **Stephen G. Post,** Missile Defense Agency

8:30 am: **Theoretical and experimental investigation on an Er^{3+}:YAG solid-state heat-capacity laser**, Marc Eichhorn, French-German Research Institute of Saint-Louis (France) . . . . . [7325-01]

8:50 am: **Measurement of upconversion/cross relaxation constants in erbium YAG from cryogenic to room temperatures**, George A. Newburgh, Army Research Lab. (United States). . . . . [7325-02]

9:10 am: **Synthesis and properties of eye-safe sesquioxide single crystal and transparent ceramic laser sources**, Colin D. McMillen, John M. Ballato, Joseph W. Kolis, Baris Kokuoz, Basak Y. Kokuoz, Karn Serivalsatit, Exley McCormick, Clemson Univ. (United States) . . . . . [7325-03]

9:30 am: **Resonantly diode-pumped Er:YAG laser: 1470-nm versus 1530-nm CW pumping case**, Igor Kudryashov, Princeton Lightwave, Inc. (United States); Nikolai Ter-Gabrielyan, Mark Dubinskii, Army Research Lab. (United States). . . . . [7325-04]

9:50 am: **Laser potential of Er-doped sesquioxides**, Nikolay Ter-Gabrielyan, Tigran V. Sanamyan, Jed A. Simmons, Larry D. Merkle, Mark Dubinskii, Army Research Lab. (United States). . . . . [7325-05]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Grand 9-10. . . . . Mon. 10:40 to 11:40 am

Bulk Solid State Lasers and Their Design Components

Session Chair: **Robert R. Rice,** Northrop Grumman Space Technology

10:40 am: **Diode-pumped blue lasers**, Steven R. Bowman, Nicholas J. Condon, Shawn O'Connor, Armand Rosenberg, Naval Research Lab. (United States). . . . . [7325-06]

11:00 am: **Disk amplifier for generation of ultra-short pulses**, John Vetrovec, Aqwest LLC (United States); Bodo Schmidt, General Atomics (United States). . . . . [7325-07]

11:20 am: **Electronically controlled heat sink for high-power laser diodes**, John Vetrovec, Aqwest LLC (United States). . . . . [7325-09]

Lunch Break . . . . . 11:40 am to 1:30 pm

SESSION 3

Room: Grand 9-10. . . . . Mon. 1:30 to 3:20 pm

Fiber Lasers I

Session Chair: **Robert S. Afzal,** Aculight Corp.

1:30 pm: **Power scaling of resonantly pumped Yb-free Er-doped fiber laser** *(Invited Paper)*, Mark Dubinskii, Jun Zhang, Valerii V. Ter-Mikirtychev, Army Research Lab. (United States). . . . . [7325-10]

2:00 pm: **Latest developments in high-power tunable CW narrow line thulium fiber laser for deployment to the ISTEF**, Vikas Sudesh, Timothy S. McComb, Robert Sims, Larry Shah, Martin C. Richardson, College of Optics & Photonics, Univ. of Central Florida (United States); John Stryjewski, Computer Sciences Corp. (United States). . . . . [7325-11]

2:20 pm: **Latest results on power scaling monolithic high-power high-efficiency 2 µm fiber lasers and amplifiers**, Scott Christensen, Victor Khitrov, Thomas Ehrenreich, John P. Edgecumbe, Gavin P. Frith, Kanishka Tankala, Adrian L. Carter, Bryce N. Samson, David P. Machewirth, Nufern (United States). . . . . [7325-12]

2:40 pm: **Progress in crystalline core optical fibers**, John M. Ballato, Thomas W. Hawkins, Paul R. Foy, Basak Y. Kokuoz, Colin D. McMillen, Andrew James, Clemson Univ. (United States) . . . . . [7325-13]

3:00 pm: **Advances in conductively cooled 1532-nm diode pump lasers**, Paul O. Leisher, Weimin Dong, Mike Grimshaw, Steve Patterson, nLIGHT Corp. (United States) . . . . . [7325-14]

Coffee Break . . . . . 3:20 to 3:50 pm

SESSION 4

Room: Grand 9-10. . . . . Mon. 3:50 to 6:10 pm

Mid-IR Lasers

Session Chair: **Steven R. Bowman,** Naval Research Lab.

3:50 pm: **Compact quantum cascade laser transmitter**, Norman C. Anheier, Jr., Brian K. Hatchell, Kevin L. Gervais, Pacific Northwest National Lab. (United States); Michael D. Wojcik, Space Dynamics Lab. (United States); Kannan Krishnaswami, Bruce E. Bernacki, Pacific Northwest National Lab. (United States). . . . . [7325-15]

4:10 pm: **Mid-IR intracavity OPO**, Santosh N. Pisharody, Yusong Yin, Photonics Industries International, Inc. (United States) . . . . . [7325-16]

4:30 pm: **Spectral beam combining of quantum cascade lasers in an external cavity**, Stefan Hugger, Frank Fuchs, Wolfgang Bronner, Rainer Loesch, Rolf Aidam, Quankui Yang, Nicola Schulz, Joachim Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Eugen Romasew, Michael Raab, Hans D. Tholl, Diehl BGT Defence GmbH & Co. KG (Germany). . . . . [7325-17]

4:50 pm: **Thulium fibre laser pumped mid-IR source**, Ian Elder, SELEX GALILEO (United Kingdom). . . . . [7325-18]

5:10 pm: **High-power lightweight external-cavity quantum cascade lasers**, Eric B. Takeuchi, David Arnone, Michael B. Pushkarsky, David Caffey, David Boyden, Timothy Day, Daylight Solutions, Inc. (United States) . . . . . [7325-19]

5:30 pm: **Wavelength beam combined quantum cascade lasers for IRCM**, John L. Bradshaw, John D. Bruno, Richard P. Leavitt, Kevin M. Lascola, Gregory P. Meissner, John T. Pham, Maxion Technologies, Inc. (United States). . . . . [7325-20]

5:50 pm: **High-power and efficiency and quantum cascade laser systems for defense and security applications**, Alexei G. Tsekoun, Michael Lane, Tyson Macdonald, Rowel Go, Arkadiy Lyakh, Richard Maulini, Chandra Kumar N. Patel, Pranalytica, Inc. (United States) . . . . . [7325-21]

Tuesday 14 April

SESSION 5A

Room: Grand 9-10. . . . . .Tues. 8:10 to 8:50 am

Fiber Lasers II

Session Chair: **Mark Dubinskii,** Army Research Lab.

8:10 am: **Spectral SBS model for Yb:DCF with discrete acoustic core designs**, W. Torruellas, The Johns Hopkins Univ. Applied Physics Lab. (United States); M. Alam, J. Edgecumbe, K. Tankala, Nufern (United States); J. Rothenberg, M. Wickham, Northrop Grumman Space Technology (United States). . . . . [7325-34]

8:30 am: **CW and pulsed operation of a frequency doubled Tm:DCF in the 9xx nm range,** M. Dennis, W. Torruellas, J. Warren, The Johns Hopkins Univ. Applied Physics Lab. (United States); G. Frith, B. Samson, Nufern (United States); T. McComb, CREOL, The College of Optics and Photonics, Univ. of Central Florida (United States); P. Wilcox, RDECOM (United States) . . . . . [7325-35]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 5

Room: Grand 9-10. . . . . Tues. 10:30 am to 12:10 pm

Diode Lasers I

Session Chair: **Anthony M. Johnson,** Univ. of Maryland, Baltimore County

10:30 am: **Compact narrow linewidth semiconductor laser module**, Ghislain Lafrance, Michel Tetu, TeraXion (Canada) . . . . . [7325-22]

10:50 am: **Thermally insensitive laser diode arrays for solid state laser pumping**, Andrew L. White, Gavin J. Hall, John R. M. Barr, SELEX GALILEO (United Kingdom); Mark McElhinney, Prabhu Thiagarajan, Chuanshun Cao, Lasertel Inc. (United States) . . . . . [7325-23]

11:10 am: **Ultra-compact visible R-G-B lasers for defense applications**, Wentao Hu, Yossi Gewirtz, Mark L. Osowski, Robert M. Lammert, Se W. Oh, Victor C. Elarde, Laurent Vaissie, Falgun D. Patel, Paul T. Rudy, Jeffrey E. Ungar, QPC Lasers, Inc. (United States). . . . . [7325-24]

11:30 am: **Highly reliable high-efficiency wavelength-stabilized 885-nm diode laser bars**, Paul O. Leisher, Ling Bao, Hua Huang, Jun Wang, Mark A. DeVito, Weimin Dong, Mike Grimshaw, David R. Balsley, Robert J. Martinsen, Mark DeFranza, Steve Patterson, nLIGHT Corp. (United States). . . . . [7325-25]

11:50 am: **Spectrally combined five-channel fiber laser with kW-level output**, Leonid B. Glebov, Derrek Drachenberg, Oleksiy G. Andrusyak, George B. Venus, College of Optics & Photonics, Univ. of Central Florida (United States); Vadim I. Smirnov, OptiGrate (United States). . . . . [7325-26]

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

SESSION 6

Room: Grand 9-10. . . . . .Tues. 1:10 to 2:20 pm

Diode Lasers II

Session Chair: **Anthony M. Johnson,** Univ. of Maryland, Baltimore County

1:10 pm: **High brightness diode laser module development at nLIGHT Photonics** *(Invited Paper)*, Kirk Price, Scott Karlsen, Aaron Brown, Mitch Reynolds, Ron Mehl, Paul O. Leisher, Steve Patterson, Jacob Bell, Robert J. Martinsen, nLIGHT Corp. (United States) . . . . . [7325-27]

1:40 pm: **High-power laser diodes at SCD: performance and reliability for defence and space applications**, Salomon Risemberg, Yoram Karni, Genadi Klumel, Moshe Levy, Yuri Berk, SCD - SemiConductor Devices (Israel); Markus Rech, Hubert Becht, Carl Zeiss Optronics GmbH (Germany); Bruno Frei, LASAG AG (Switzerland) . . . . . [7325-28]

2:00 pm: **High-power semiconductor lasers at eye-safe wavelengths,** Mark L. Osowski, Yossi Gewirtz, Robert M. Lammert, Se W. Oh, Chameli Panja, Victor C. Elarde, Laurent Vaissie, Falgun D. Patel, Jeffrey E. Ungar, QPC Lasers, Inc. (United States). . . . . [7325-29]

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

Ultra-fast laser directional countermeasures, Michael K. Rafailov, Richer LLC (United States). . . . . [7325-30]

Low-cost plane parallel plate lateral shearing interferometer for infrared laser beam diagnostics, Bruce E. Bernacki, Kannan Krishnaswami, Norman C. Anheier, Jr., Pacific Northwest National Lab. (United States). . . . . [7325-31]

Third-order nonlinear optical properties and its limiting behavior of polyaniline/SiO_2 composite materials, Yun-Dong Zhang, Lei Ma, Ping Yuan, Harbin Institute of Technology (China) . . . . . [7325-32]

Characterization of single-mode chalcogenide optical fibers for midinfrared applications, Kannan Krishnaswami, Hong A. Qiao, Bruce E. Bernacki, Norman C. Anheier, Jr., Pacific Northwest National Lab. (United States) . . . . . [7325-33]

Head- and Helmet-Mounted Displays XIV: Design and Applications

Conference Chairs: **Peter L. Marasco,** Air Force Research Lab.; **Paul R. Havig,** 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)

Thursday 16 April

SESSION 1

Room: Grand 14 . . . . . Thurs. 8:00 to 10:00 am

HMD Flight Tests and Results

Session Chair: **Paul R. Havig,** Air Force Research Lab.

8:00 am: **The effect of a monocular helmet-mounted display on aircrew health: a 10-year prospective cohort study of Apache AH MK 1 pilots: a midstudy update**, Keith L. Hiatt, U.S. Army Research Institute of Environmental Medicine (United States); Clarence E. Rash, U.S. Army Aeromedical Research Lab. (United States); Raymond W. Watters, Mark S. Adams, The British Army (United Kingdom). . . . . [7326-01]

8:20 am: **When the wheels touch Earth and the flight is through, pilots find one eye is better than two**, Brian Valimont, John A. Wise, Honeywell Aerospace (United States). . . . . [7326-02]

8:40 am: **Flight performance using a hyperstereo helmet-mounted display: aircraft handling**, Sion A. Jennings, Gregory L. Craig, National Research Council Canada (Canada); Geoffrey W. Stuart, Defence Science and Technology Organisation (Australia); Melvyn E. Kalich, Clarence E. Rash, Thomas H. Harding, U.S. Army Aeromedical Research Lab. (United States) . . . . . [7326-03]

9:00 am: **Flight performance using a hyperstereo helmet-mounted display: post-flight debriefing questionnaire**, Melvyn E. Kalich, Clarence E. Rash, Thomas H. Harding, U.S. Army Aeromedical Research Lab. (United States); Sion A. Jennings, Gregory L. Craig, National Research Council Canada (Canada); Geoffrey W. Stuart, Defence Science and Technology Organisation (Australia). . . . . [7326-04]

9:20 am: **Flight performance using a hyperstereo helmet-mounted display: workload assessment and pilot acceptance**, Geoffrey W. Stuart, Defence Science and Technology Organisation (Australia); Sion A. Jennings, National Research Council Canada (Canada); Melvyn E. Kalich, Clarence E. Rash, Thomas H. Harding, U.S. Army Aeromedical Research Lab. (United States); Gregory L. Craig, National Research Council Canada (Canada) . . . . . [7326-05]

9:40 am: **Flight experiment of pilot display for search-and-rescue helicopter**, Kohei Funabiki, Japan Aerospace Exploration Agency (Japan) . . . . . [7326-06]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 2

Room: Grand 14 . . . . . Thurs. 10:30 am to 12:10 pm

HMD Development and Concepts

Session Chair: **Sion A. Jennings,**
National Research Council Canada (Canada)

10:30 am: **Low-cost helmet-mounted cueing system for A-10C**, Robert Atac, Gentex Corp. (United States); Bryan M. Walters, Charles Porterfield, Lockheed Martin Systems Integration-Owego (United States) . . . . . [7326-07]

10:50 am: **Digital day/night HMD development**, Bob D. Foote, Louis M. Taddeo, Vision Systems International, LLC (United States) . . . . . [7326-08]

11:10 am: **The Cognitive Pilot Helmet: enabling pilot-aware smart avionics**, Pieter Poolman, Thomas Schnell, Univ. of Iowa (United States); James E. Melzer, Rockwell Collins Optronics (United States); Steve J. Robbins, Rockwell Collins, Inc. (United States) . . . . . [7326-09]

11:30 am: **Helmet-mounted displays: why haven't they taken off?**, Paul R. Havig, Air Force Research Lab. (United States); Sion A. Jennings, National Research Council Canada (Canada); Chris Goff, Defence Science and Technology Lab. (United Kingdom). . . . . [7326-10]

11:50 am: **Current and future helmet-mounted displays for piloted systems**, Doug L. Franck, Paul R. Havig, Peter L. Marasco, Air Force Research Lab. (United States); John P. McIntire, General Dynamics Advanced Information Systems (United States). . . . . [7326-11]

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

SESSION 3

Room: Grand 14 . . . . . Thurs. 1:40 to 3:20 pm

Display Concepts and Technologies

Session Chair: **Thomas H. Harding,**
U.S. Army Aeromedical Research Lab.

1:40 pm: **Virtual reality: a reality for future military pilotage?**, John P. McIntire, Gary L. Martinsen, Peter L. Marasco, Paul R. Havig, Air Force Research Lab. (United States). . . . . [7326-12]

2:00 pm: **Low-power SXGA active matrix OLED**, Ihor Wacyk, Olivier Prache, Amal Ghosh, eMagin Corp. (United States) . . . . . [7326-13]

2:20 pm: **Active matrix organic light-emitting diode (OLED)-XL performance and life test results**, David A. Fellowes, Michael V. Wood, Arthur Hastings, Jr., U.S. Army Night Vision & Electronic Sensors Directorate (United States); Amalkumar P. Ghosh, Olivier Prache, eMagin Corp. (United States) . . . . [7326-14]

2:40 pm: **A manufacturable full-color SXGA AMLCD for military head-mounted displays (HMDs) and other viewer applications**, Hong K. Choi, Ollie C. Woodard, Wen-Foo Chern, Jason Lo, Murshed Khandaker, Frederick Herrmann, Hiap L. Ong, Boryeu Tsaur, Kopin Corp. (United States); Colin E. Reese, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7326-15]

3:00 pm: **The application of holographic optical waveguide technology to the Q-Sight family of helmet-mounted displays**, Alexander A. Cameron, BAE Systems (United Kingdom) . . . . . [7326-16]

Coffee Break . . . . . 3:20 to 3:50 pm

SESSION 4

Room: Grand 14 . . . . . Thurs. 3:50 to 6:10 pm

Enabling Research and Development

Session Chair: **Peter L. Marasco,** Air Force Research Lab.

3:50 pm: **Comparative analysis of pixel resolution of standard digital imaging formats to Generation III image intensifiers based on nighttime man-size target recognition**, Joseph P. Estrera, L-3 Electro-Optical Systems (United States). . . . . [7326-17]

4:10 pm: **Low-light-level limiting resolution of various digital imaging and image intensified systems**, Joseph P. Estrera, L-3 Electro-Optical Systems (United States). . . . . [7326-18]

4:30 pm: **All solid-state electrochromic device for helmet-mounted displays**, Hulya Demiryont, Kenneth C. Shannon III, Eclipse Energy Systems, Inc. (United States); Sharon A. Dixon, Alan R. Pinkus, Air Force Research Lab. (United States). . . . . [7326-19]

4:50 pm: **In-flight evaluation of an optical head motion tracker**, Kazuho Tawada, Shimadzu Corp. (Japan). . . . . [7326-20]

5:10 pm: **Infrastructure-free 6 DOF location and pose estimation for mixed reality systems**, Rakesh Kumar, Supun Samarasekera, Taragay Oskiper, Zhiwei Zhu, Oleg Naroditsky, Janet Kim, Sarnoff Corp. (United States) . . . . . [7326-21]

5:30 pm: **Micro-environment condensation-induced obscuration on optics**, David W. Davis, Dynameos, LLC (United States) . . . . . [7326-22]

5:50 pm: **Simulating the attenuation performance of integrated display helmet designs**, S. C. McCallum, Alexander A. Cameron, BAE Systems (United Kingdom). . . . . [7326-23]

Display Technologies and Applications for Defense, Security, and Avionics III

Conference Chairs: **John Tudor Thomas,** General Dynamics Canada Ltd. (Canada); **Daniel D. Desjardins,** Air Force Research Lab. Space Vehicles Directorate

Program Committee: **Patrick J. Gardner,** Western Carolina Univ.; **Kevin W. Greeley,** Lockheed Martin Corp.; **David C. Huffman,** L-3 Display Systems; **Asad A. Khan,** Kent Displays, Inc.; **Frederick M. Meyer,** Air Force Research Lab.; **Kalluri R. Sarma,** Honeywell Technology; **Paul L. Wisely,** BAE Systems plc (United Kingdom)

Friday 17 April

SESSION 1

Room: Crystal B . . . . . Fri. 8:00 to 9:30 am

Military Display Systems and Applications

Session Chair: **David C. Huffman,** L-3 Display Systems

8:00 am: **High-definition wide-format COTS displays required for next-generation vetronic applications**, Tracy J. Barnidge, Joseph L. Tchon, Bruce D. Hufnagel, Rockwell Collins, Inc. (United States) . . . . . [7327-01]

8:20 am: **Digital map and situation surface: a team-oriented multidisplay workspace for network-enabled situation analysis**, Elisabeth Peinsipp-Byma, Jürgen Geisler, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany); Thomas Bader, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany) and Univ. Karlsruhe (Germany) . . . . . [7327-02]

8:40 am: **Performance and cost improvements in the display control module for DVE**, John T. Thomas, General Dynamics Canada Ltd. (Canada) . . . [7327-03]

9:00 am: **Military display market: update to fourth comprehensive edition** *(Invited Paper)*, Daniel D. Desjardins, Darrel G. Hopper, James C. Byrd, Air Force Research Lab. (United States). . . . . [7327-04]

SESSION 2

Room: Crystal B . . . . . Fri. 9:30 to 10:10 am

HUDs, HMDs, and Projection

Session Chair: **John Tudor Thomas,** General Dynamics Canada Ltd. (Canada)

9:30 am: **Head-up and head-mounted display performance improvements through advanced techniques in the manipulation of light**, Paul L. Wisely, BAE Systems (United Kingdom) . . . . . [7327-06]

9:50 am: **Visor projected HMD for fast jets using a holographic video projector**, Jonathan P. Freeman, Paul L. Wisely, BAE Systems (United Kingdom); Timothy D. Wilkinson, Univ. of Cambridge (United Kingdom) . . . . . [7327-07]

Coffee Break . . . . . 10:10 to 10:50 am

SESSION 3

Room: Crystal B . . . . . Fri. 10:50 am to 12:30 pm

3D Display Systems: Hardware and Perspectives

Session Chair: **Patrick J. Gardner,** Western Carolina Univ.

10:50 am: **Toward the establishment of design guidelines for effective 3D perspective interfaces**, Elisabeth W. Fitzhugh, SRA International, Inc. (United States); Sharon A. Dixon, Denise L. Aleva, Joseph Ghrayeb, Air Force Research Lab. (United States); Eric Smith, SRA International, Inc. (United States). . . . . [7327-08]

11:10 am: **Flat panel stereoscopic display: description and applications**, David B. Chenault, Richard P. Edmondson, James F. Morris, J. Larry Pezzaniti, Polaris Sensor Technologies, Inc. (United States); Joseph L. Tchon, Tracy J. Barnidge, Rockwell Collins, Inc. (United States); Brad Pettijohn, Army Research Lab. (United States). . . . . [7327-09]

11:30 am: **Understanding the operational environment: implications for advanced visualizations**, Denise L. Aleva, Sharon A. Dixon, Air Force Research Lab. (United States). . . . . [7327-10]

11:50 am: **Battlefield radiology: a new approach**, Max Robinson, Kromek (United Kingdom). . . . . [7327-11]

12:10 pm: **3D displays in military applications**, Murray Trakalo, General Dynamics Canada Ltd. (Canada). . . . . [7327-12]

Lunch Break . . . . . 12:30 to 1:40 pm

SESSION 4

Room: Crystal B . . . . . Fri. 1:40 to 4:20 pm

New Display Technology for Military and Civil Applications

Session Chair: **Paul L. Wisely,** BAE Systems plc (United Kingdom)

1:40 pm: **OCB LCD technology for military and avionics applications**, Kalluri R. Sarma, John Schmidt, Jerry Roush, Honeywell International Inc. (United States). . . . . [7327-18]

2:00 pm: **Next-generation AMLCD microdisplays**, Tony Bacarella, Timothy B. Hogan, Kopin Corp. (United States) . . . . . [7327-13]

2:20 pm: **eDisplay: the next advancement for defense and security applications**, Vincent Rowley, Pleora Technologies Inc. (Canada) . . . . . [7327-14]

2:40 pm: **The utility of an airframe referenced spatial auditory display for general aviation operations**, Alan J. Wigdahl, U.S. Air Force (United States); Mehndi H. Naqvi, Aerospace Engineering Test Establishment (Canada); Richard J. Ranaudo, Univ. of Tennessee Space Institute (United States) . . . . . [7327-15]

3:00 pm: **Polymeric optical filters are not created equal**, Claude Gaudette, Peter Frazier, Wamco, Inc. (United States) . . . . . [7327-16]

Coffee Break . . . . . 3:20 to 3:40 pm

3:40 pm: **An OLED-based MRC measurement bench**, Hannes Böhm, Martin Gangl, Bernd Mohring, Alfred Fendt, LFK-Lenkflugkörpersysteme GmbH (Germany) . . . . . [7327-17]

4:00 pm: **Image compression with Iris-C**, David Gains, General Dynamics Canada Ltd. (Canada) . . . . . [7327-21]

SESSION 5

Room: Crystal B . . . . . Fri. 4:20 to 5:00 pm

Human/Display Interaction

Session Chair: **Daniel D. Desjardins,** Air Force Research Lab.

4:20 pm: **Human factors guidelines for applications of 3D perspectives: a comprehensive literature review**, Sharon A. Dixon, Denise L. Aleva, Air Force Research Lab. (United States); Elisabeth W. Fitzhugh, SRA International, Inc. (United States). . . . . [7327-19]

4:40 pm: **The placement of visual alerts in a shared display system**, Lisa Douglas, Wright-Patterson Air Force Base (United States). . . . . [7327-20]

Enhanced and Synthetic Vision 2009

Conference Chairs: **Jeff J. Güell,** The Boeing Co.; **Maarten Uijt de Haag,** Ohio Univ.

Program Committee: **Trey Arthur,** NASA Langley Research Ctr.; **Kenneth L. Bernier,** The Boeing Co.; **Bernd R. Korn,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Jens Schiefele,** Jeppesen GmbH (Germany); **Jacques G. Verly,** Univ. de Liège (Belgium)

Tuesday 14 April

SESSION 1

Room: Crystal F. . . . . .Tues. 8:10 to 8:50 am

Simulation and Modeling

Session Chairs: **Jeff J. Güell,** The Boeing Co.; **Trey Arthur,** NASA Langley Research Ctr.; **Maarten Uijt de Haag,** Ohio Univ.

8:10 am: **A sensor simulation framework for the testing and evaluation of external hazard monitors and integrated alerting and notification functions**, Maarten Uijt de Haag, Ananth K. Vadlamani, Kyle Venable, Tony Adami, Ohio Univ. (United States) . . . . . [7328-01]

8:30 am: **Simulation evaluation of equivalent vision technologies for aerospace operations,** Lynda J. Kramer, Steven P. Williams, Susan J. Wilz, Jarvis J. Arthur III, NASA Langley Research Ctr. (United States) . . . . . [7328-02]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 2

Room: Crystal F. . . . . .Tues. 10:30 to 11:30 am

Image Processing and Algorithms

Session Chairs: **Bernd R. Korn,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **Trey Arthur,** NASA Langley Research Ctr.; **Maarten Uijt de Haag,** Ohio Univ.

10:30 am: **Passive obstacle detection system (PODS) for wire detection**, Jack N. Sanders-Reed, Dennis J. Yelton, Christian C. Witt, Ralph R. Galetti, Boeing-SVS, Inc. (United States) . . . . . [7328-03]

10:50 am: **Data modeling for lightning strike severity prediction**, Holger M. Jaenisch, Alabama A&M Univ. (United States) and Licht Strahl Engineering Inc. (United States); James W. Handley, Licht Strahl Engineering Inc. (United States) . . . . . [7328-04]

11:10 am: **An efficient real-time superresolution ASIC system**, Pramod Lakshmi Narasimha, Zhanfeng Yue, Pankaj Topiwala, FastVDO Inc. (United States) . . . . . [7328-05]

SESSION 3

Room: Crystal F. . . . . .Tues. 11:30 to 11:50 am

Database and Maps I

Session Chairs: **Maarten Uijt de Haag,** Ohio Univ.; **Kenneth L. Bernier,** The Boeing Co.; **Jacques G. Verly,** Univ. de Liège (Belgium)

11:30 am: **Rapid self-organizing maps for terrain surface reconstruction**, Niklas Peinecke, Bernd R. Korn, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [7328-06]

Lunch/Exhibition Break . . . . . 11:50 am to 1:40 pm

SESSION 4

Room: Crystal F. . . . . .Tues. 1:40 to 3:00 pm

Synthetic Vision and Symbology

Session Chairs: **Jeff J. Güell,** The Boeing Co.; **Trey Arthur,** NASA Langley Research Ctr.; **Bernd R. Korn,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

1:40 pm: **Eurocopter research on pilot assistance for rotorcraft**, Wolfgang G. Kreitmair-Steck, Stefan Haisch, Eurocopter Deutschland GmbH (Germany) . . . . . [7328-08]

2:00 pm: **Exploring the potential of energy-awareness information in a synthetic vision display for UAV control**, Jochum Tadema, Netherlands Defence Academy (Netherlands); Erik Theunissen, Delft Univ. of Technology (Netherlands) . . . . . [7328-09]

2:20 pm: **Depiction of large angles of view in perspective flight guidance displays through the use of nonplanar projections**, Andreas Sindlinger, Jeppesen GmbH (Germany); Uwe Klingauf, Technische Univ. Darmstadt (Germany) . . . . . [7328-10]

2:40 pm: **FMS flight plans in synthetic vision primary flight displays**, Gang He, Honeywell International Inc. (United States); Thea Feyereisen, Honeywell Automation & Control Solutions (United States); Sandy Wyatt, Honeywell International Inc. (United States) . . . . . [7328-11]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 5

Room: Crystal F. . . . . .Tues. 3:30 to 4:10 pm

Database and Maps II

Session Chairs: **Maarten Uijt de Haag,** Ohio Univ.; **Kenneth L. Bernier,** The Boeing Co.; **Jacques G. Verly,** Univ. de Liège (Belgium)

3:30 pm: **Data-link and surface map traffic intent displays for NextGen 4DT and equivalent visual surface operations**, Kevin J. Shelton, Lawrence J. Prinzel III, Jarvis J. Arthur III, Denise R. Jones, Angela S. Allamandola, Randall E. Bailey, NASA Langley Research Ctr. (United States) . . . . . [7328-12]

3:50 pm: **High-integrity databases for helicopter operations**, Christian Pschierer, Jens Schiefele, Jeppesen GmbH (Germany) . . . . . [7328-13]

SESSION 6

Room: Crystal F. . . . . .Tues. 4:10 to 5:30 pm

Sensors and Integration

Session Chairs: **Kenneth L. Bernier,** The Boeing Co.; **Jens Schiefele,** Jeppesen GmbH (Germany); **Jacques G. Verly,** Univ. de Liège (Belgium)

4:10 pm: **Characterization of airborne FLIR sensors for runway incursion**, Cynthia I. Archer, FLIR Systems, Inc. (United States); Joseph White, RTI International (United States); Robert T. Neece, NASA Langley Research Ctr. (United States) . . . . . [7328-14]

4:30 pm: **ALLFlight: a full-scale enhanced and synthetic vision sensor suite for helicopter applications**, Hans-Ullrich Döhler, Thomas Lueken, Robin Lantzsch, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . [7328-15]

4:50 pm: **Rotorcraft visual situational awareness (VSA): solving the pilotage problem for landing in degraded visual environments**, Trevor S. Taylor, BAE Systems (United Kingdom) . . . . . [7328-16]

5:10 pm: **Integration of forward-looking infrared (FLIR) and traffic information**, Maarten Uijt de Haag, Sumit Bhattacharya, Zhen Zhu, Ohio Univ. (United States) . . . . . [7328-17]

Wednesday-Thursday 15-16 April 2009 • Proceedings of SPIE Vol. 7329

Three-Dimensional Imaging, Visualization, and Display 2009

Conference Chairs: **Bahram Javidi,** Univ. of Connecticut; **Jung-Young Son,** Daegu Univ. (Korea, Republic of)

Conference Co-Chairs: **Manuel Martinez-Corral,** Univ. de València (Spain); **Fumio Okano,** Ultra-Realistic Communications Forum (Japan); **Wolfgang Osten,** Univ. Stuttgart (Germany)

Program Committee: **Saeed Bagheri,** IBM Corp.; **Frank Dubois,** Univ. Libre de Bruxelles (Belgium); **Pietro Ferraro,** Istituto Nazionale di Ottica Applicata (Italy); **Toshiaki Fujii,** Tokyo Institute of Technology (Japan); **William E. Higgins,** The Pennsylvania State Univ.; **Osamu Matoba,** Kobe Univ. (Japan); **Thomas J. Naughton,** National Univ. of Ireland, Maynooth (Ireland); **Takanori Nomura,** Wakayama Univ. (Japan); **Adrian Stern,** Ben-Gurion Univ. of the Negev (Israel); **Wa James Tam,** Communications Research Ctr. Canada (Canada); **Edward A. Watson,** Air Force Research Lab.; **S. Yeom,** Daegu Univ. (South Korea)

Wednesday 15 April

SESSION 1

Room: Crystal B . . . . . Wed. 8:30 to 10:30 am

3D and Related Technologies

Session Chairs: **Bahram Javidi,** Univ. of Connecticut; **Fumio Okano,** Ultra-Realistic Communications Forum (Japan)

8:30 am: **Research on ultra-realistic communications** *(Invited Paper)*, Kazumasa Enami, National Institute of Information and Communications Technology (Japan) . . . . . [7329-01]

9:00 am: **Challenge of 3D LCD displays** *(Invited Paper)*, Rung-Ywan Tsai, Industrial Technology Research Institute (Taiwan) . . . . . [7329-02]

9:30 am: **Geometrical super-resolved imaging using nonperiodic spatial masking** *(Invited Paper)*, Amikam Borkowski, Zeev Zalevsky, Bar-Ilan Univ. (Israel); Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7329-03]

10:00 am: **Advances in 3D asphere testing and reconstruction** *(Invited Paper)*, Christof Pruss, Eugenio Garbusi, Wolfgang Osten, Univ. Stuttgart (Germany) . . . . . [7329-04]

Coffee Break . . . . . 10:30 to 11:00 am

SESSION 2

Room: Crystal B . . . . . Wed. 11:00 am to 12:40 pm

Integral Photography I

Session Chairs: **Manuel Martinez-Corral,** Univ. de València (Spain); **Saeed Bagheri,** IBM Corp.

11:00 am: **Extension of the depth of field in integral imaging: an overview** *(Invited Paper)*, Saeed Bagheri, IBM Thomas J. Watson Research Ctr. (United States); Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7329-05]

11:30 am: **Analysis of incident light rays into a pupil in integral imaging** *(Invited Paper)*, Fumio Okano, Ultra-Realistic Communications Forum (Japan) . . . . . [7329-06]

12:00 pm: **Computational reconstruction of three-dimensional integral imaging by rearrangement of elemental image pixels**, Myungjin Cho, Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7329-07]

12:20 pm: **In-water 3D integral imaging**, Robert T. Schulein, Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7329-08]

Lunch/Exhibition Break . . . . . 12:40 to 2:10 pm

SESSION 3

Room: Crystal B . . . . . Wed. 2:10 to 3:40 pm

Holographic 3D Image I

Session Chairs: **Chia-Lung Hsieh,** Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Thomas J. Naughton,** National Univ. of Ireland, Maynooth (Ireland)

2:10 pm: **Processing of optically captured digital holograms for three-dimensional display** *(Invited Paper)*, Thomas J. Naughton, National Univ. of Ireland, Maynooth (Ireland) and Univ. of Oulu (Finland) . . . . . [7329-09]

2:40 pm: **Comparison between a new holographically generated complex filter and the binary phase filter for depth-of-field extension**, Frederic Diaz, Thales Research & Technology (France); François Goudail, Lab. Charles Fabry de l'Institut d'Optique (France); Brigitte Loiseaux, Jean-Pierre Huignard, Thales Research & Technology (France) . . . . . [7329-10]

3:00 pm: **Visual perception of digital holograms on autostereoscopic displays**, Taina M. Lehtimäki, Univ. of Oulu (Finland); Thomas J. Naughton, National Univ. of Ireland, Maynooth (Ireland) and Univ. of Oulu (Finland) . . . . . [7329-11]

3:20 pm: **Hologram generation from orthographic view images of three-dimensional object and its optimization**, Jae-Hyeung Park, Ganbat Baasantseren, Min-Young Shin, Nam Kim, Chungbuk National Univ. (Korea, Republic of) . . . . . [7329-12]

Coffee Break . . . . . 3:40 to 4:10 pm

SESSION 4

Room: Crystal B . . . . . Wed. 4:10 to 5:10 pm

Holographic 3D Image II

Session Chairs: **Thomas J. Naughton,** National Univ. of Ireland, Maynooth (Ireland); **Jung-Young Son,** Daegu Univ. (Korea, Republic of)

4:10 pm: **3D visualization and identification of biological micro-organisms using partially temporal incoherent light in-line computational holographic imaging**, Inkyu Moon, Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7329-13]

4:30 pm: **Study on elimination of twin image in a combined dual-type digital hologram microscope system**, Moonseok Kim, Sukjoon Hong, Kwangdong Roh, Kwangsup Soh, Seoul National Univ. (Korea, Republic of); Sanghoon Shin, Alpha of Professional Person & Technology, Inc. (Korea, Republic of); Jung-Young Son, Daegu Univ. (Korea, Republic of); Jaisoon Kim, Seoul National Univ. (Korea, Republic of) . . . . . [7329-14]

4:50 pm: **New alignment liquid crystal techniques for operation at harsh ambient conditions and high-intensity light**, Zbigniew Celinski, Ian Harward, Anatoliy V. Glushchenko, Univ. of Colorado at Colorado Springs (United States) . . . . . [7329-15]

Thursday 16 April

SESSION 5

Room: Crystal B . . . . . Thurs. 8:30 to 10:10 am

3D Visualization I

Session Chairs: **Jung-Young Son,** Daegu Univ. (Korea, Republic of); **Zeev Zalevsky,** Bar-Ilan Univ. (Israel)

8:30 am: **Harmonic holography for 3D cellular imaging** *(Keynote Presentation)*, Chia-Lung Hsieh, Rachel Grange, Ye Pu, Demetri Psaltis, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [7329-16]

9:00 am: **Processing of three-dimensional flash lidar terrain images generating an airborne platform** *(Invited Paper)*, Alexander Bulyshev, Analytical Mechanics Associates, Inc. (United States); Diego F. Pierrottet, Coherent Applications, Inc. (United States); Farzin Amzajerdian, NASA Langley Research Ctr. (United States); George E. Busch, Coherent Applications, Inc. (United States); Michael D. Vanek, Robert A. Reisse, NASA Langley Research Ctr. (United States) . . . . . [7329-17]

9:30 am: **Improved 3D and range estimation via inter-planar interpolation of projected axially varied patterns**, Hamootal Duadi, Bar-Ilan Univ. (Israel); Eyal Gordon, Gur A. Bittan, Amihai Loven, Shabtay Negry, Mantis Vision Ltd. (Israel); Zeev Zalevsky, Bar-Ilan Univ. (Israel) . . . . . [7329-18]

9:50 am: **Design and implementation of mobile 3D DMB receiver**, BongHo Lee, Kugjin Yun, Namho Hur, Jinwoong Kim, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [7329-19]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 6

Room: Crystal B . . . . . Thurs. 10:40 am to 12:30 pm

3D Visualization II

Session Chairs: **Thierry Fournel,** Univ. Jean Monnet Saint-Etienne (France); **Osamu Matoba,** Kobe Univ. (Japan)

10:40 am: **Stereo images in millimeter-wave regime** *(Invited Paper)*, Jung-Young Son, Daegu Univ. (Korea, Republic of) . . . . . [7329-20]

11:10 am: **Holographic codes and object authentication** *(Invited Paper)*, Thierry Fournel, Univ. Jean Monnet Saint-Etienne (France) . . . . . [7329-21]

11:40 am: **Optical fabrication of 3D scattering medium for secure optical memory card** *(Invited Paper)*, Osamu Matoba, Yuri Kitamura, Kouichi Nitta, Kobe Univ. (Japan); Wataru Watanabe, National Institute of Advanced Industrial Science and Technology (Japan) . . . . . [7329-22]

12:10 pm: **Quality estimation for visual image in autostereoscopic 3D display**, Vladimir V. Saveljev, Hanyang Univ. (Korea, Republic of); Jung-Young Son, Daegu Univ. (Korea, Republic of); Son-Bo Woo, Hanyang Univ. (Korea, Republic of); Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Dong-Su Lee, Daegu Univ. (Korea, Republic of); Kae-Dal Kwack, Hanyang Univ. (Korea, Republic of) . . . . . [7329-23]

Lunch/Exhibition Break . . . . . 12:30 to 2:00 pm

SESSION 7

Room: Crystal B . . . . . Thurs. 2:00 to 3:40 pm

Integral Photography II

Session Chairs: **Fumio Okano,** Ultra-Realistic Communications Forum (Japan); **Osamu Matoba,** Kobe Univ. (Japan)

2:00 pm: **Progresses in 3D imaging and display by integral imaging** *(Invited Paper)*, Manuel Martinez-Corral, Genaro Saavedra, Raul Martinez-Cuenca, Univ. de València (Spain); Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7329-24]

2:30 pm: **Pattern recognition using 3D passive imaging technique**, S. Yeom, Daegu Univ. (Korea, Republic of) . . . . . [7329-25]

2:50 pm: **Three-dimensional visualization of objects in scattering medium by use of computational integral imaging** *(Invited Paper)*, Inkyu Moon, Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7329-26]

3:20 pm: **Resolution-enhanced 3D image correlation using optically reconstructed integral plane images**, Dong-Hak Shin, Dongseo Univ. (Korea, Republic of); Yongri Piao, Eun-Soo Kim, Kwangwoon Univ. (Korea, Republic of) . . . . . [7329-27]

Coffee Break . . . . . 3:40 to 4:10 pm

SESSION 8

Room: Crystal B . . . . . Thurs. 4:10 to 5:50 pm

3D Displays and Image Processing

Session Chairs: **Rung-Ywan Tsai,** Industrial Technology Research Institute (Taiwan); **Masayuki Tanimoto,** Nagoya Univ. (Japan)

4:10 pm: **Free viewpoint TV and its international standardization** *(Invited Paper)*, Masayuki Tanimoto, Nagoya Univ. (Japan) . . . . . [7329-28]

4:40 pm: **Time-sequential autostereoscopic OLED display with segmented scanning parallax barrier** *(Invited Paper)*, Dae-Sik Kim, Sergey A. Shestak, Kyung-Hoon Cha, Sang-Moo Park, Seon-Deok Hwang, Samsung Electronics Co., Ltd. (Korea, Republic of) . . . . . [7329-29]

5:10 pm: **Three-dimensional stereo flat panel display**, David B. Chenault, J. Larry Pezzaniti, Richard P. Edmondson, James F. Morris, Polaris Sensor Technologies, Inc. (United States); Joseph L. Tchon, Tracy J. Barnidge, Rockwell Collins, Inc. (United States); Brad Pettijohn, Army Research Lab. (United States); David Kingston, Scott Newell, Varilynmae Geulen, Concurrent Technologies Corp. (United States) . . . . . [7329-31]

5:30 pm: **Perceptive visual attention model based on depth information for free viewpoint video rendering,** Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Jung-Young Son, Daegu Univ. (Korea, Republic of) . . . . . [7329-32]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

Research on matching landform with features for large-scale 3D terrain visualization based on VTK, Ruoming Shi, Shengtao Lu, Beijing Univ. of Civil Engineering and Architecture (China) . . . . . [7329-33]

Efficient generation of holographic video of 3D objects by use of redundancy of image and look-up table methods, Seung-Cheol Kim, Jae-Eun Kang, Eun-Soo Kim, Kwangwoon Univ. (Korea, Republic of) . . . . . [7329-34]

Sensors and Systems for Space Applications III

Conference Chairs: **Joseph L. Cox,** Missile Defense Agency; **Pejmun Motaghedi,** The Boeing Co.

Program Committee: **Marco Bacaloni,** The Aerospace Corp.; **Pat Bush,** National Reconnaissance Office; **Steven C. Gordon,** Georgia Tech Research Institute; **Richard T. Howard,** NASA Marshall Space Flight Ctr.; **David Irvin,** U.S. Air Force; **Jeffrey L. Janicik,** Innoflight Inc.; **James A. Kiessling,** Missile Defense Agency; **Ou Ma,** New Mexico State Univ.; **Greg J. Meyer,** U.S. Air Force; **Khanh D. Pham,** Air Force Research Lab.; **Amanda Vaughn,** Air Force; **Randy M. Villahermosa,** The Aerospace Corp.

Tuesday 14 April

SESSION 1

Room: Crystal L. . . . . .Tues. 8:10 to 8:50 am

Radar Systems and Large Optics Testing

Session Chairs: **James A. Kiessling,** Missile Defense Agency; **Richard T. Howard,** NASA Marshall Space Flight Ctr.

8:10 am: **The new German high-resolution satellite SAR reconnaissance system started its 10-year operations**, Hans M. Braun, RST Raumfahrt Systemtechnik GmbH (Germany); Fritz Merkle, OHB-System AG (Germany) . . . . . [7330-01]

8:30 am: **Atmospheric optical turbulence measurements in the LOTIS vacuum chamger and LOTIS collimator jitter analysis results,** Stephen A. Borota, Laurence H. Li, Greg Cuzner, Sheldon Hutchison, Andrew T. Cochrane, Lockheed Martin Space Systems Co. (United States) . . . . . [7330-36]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

Space Technologies and Operations Track Plenary

Tues. 10:30 to 11:30 am • Room: Crystal L

Flight Operations at U.C. Berkeley: Earth Orbit and Beyond *(Presentation Only)*

Manfred G. Bester, Univ. of California, Berkeley (United States)

See p. 8 for details.

SESSION 2

Room: Crystal L. . . . . Tues. 11:30 am to 12:10 pm

Attitude and Control

Session Chairs: **Ou Ma,** New Mexico State Univ.; **Khanh D. Pham,** Air Force Research Lab.

11:30 am: **Angular-velocity tracking with unknown dynamics for satellite rendezvous and docking**, Xiumin Diao, Ou Ma, Jianxun Liang, New Mexico State Univ. (United States) . . . . . [7330-03]

11:50 am: **The use of linear covariance techniques in the evaluation of nanosatellite attitude determination system accuracy**, Rollin R. Fullmer, Utah State Univ. (United States); Klaus-Juergen Schilling, Univ. Würzburg (Germany); Anders Forslund, David Geller, Alexander Nucera, Utah State Univ. (United States). . . . . [7330-05]

Lunch/Exhibition Break . . . . . 12:10 to 2:00 pm

SESSION 3

Room: Crystal L. . . . . .Tues. 2:00 to 3:40 pm

Optical Systems

Session Chairs: **Richard T. Howard,** NASA Marshall Space Flight Ctr.; **James A. Kiessling,** Missile Defense Agency

2:00 pm: **Temporally resolved infrared spectra from the detonation of advanced munitions**, Joe M. Gordon, Kevin C. Gross, Glen P. Perram, Air Force Institute of Technology (United States) . . . . . [7330-06]

2:20 pm: **Sofradir MCT technology for space applications**, Philippe Chorier, SOFRADIR (France). . . . . [7330-07]

2:40 pm: **A video sensor for spacecraft docking: past, present, and future**, Richard T. Howard, NASA Marshall Space Flight Ctr. (United States) . . . [7330-08]

3:00 pm: **Segmented space telescope image utility and image quality analysis**, Michael Zelinski, Rochester Institute of Technology (United States). . . . . [7330-09]

3:20 pm: **Spherical detection system for ONIR and space situational awareness**, Ryan D. Riel, Lucid Dimensions (United States). . . . . [7330-10]

Coffee Break . . . . . 3:40 to 4:10 pm

SESSION 4

Room: Crystal L. . . . . .Tues. 4:10 to 5:10 pm

Calibration

Session Chairs: **Randy M. Villahermosa,** The Aerospace Corp.; **Jeffrey L. Janicik,** Innoflight Inc.

4:10 pm: **Calibration of on-orbit IR sensors by off-board illumination of neighboring satellites**, Lorraine E. Ryan, Randy M. Villahermosa, Munson A. Kwok, The Aerospace Corp. (United States); Joseph L. Cox, Missile Defense Agency (United States) . . . . . [7330-11]

4:30 pm: **Performance of the cryogenic Michelson interferometer**, Philippe Lagueux, Martin Chamberland, André J. Villemaire, Telops (Canada); Adriaan C. Carter, National Institute of Standards and Technology (United States) . [7330-12]

4:50 pm: **Space-based IR tracking bias removal using background star observations**, Thomas M. Clemons III, Kuo-Chu Chang, George Mason Univ. (United States). . . . . [7330-13]

Wednesday 15 April

Space Technologies and Operations Track Plenary

Wed. 8:10 to 9:00 am • Room: Crystal L

A History of US Infrared Capability in Space *(Presentation Only)*

David Irvin, U.S. Air Force (United States)

See p. 8 for details.

SESSION 5

Room: Crystal L. . . . . Wed. 9:00 to 10:20 am

Structures and Thermal

Session Chairs: **Ou Ma,** New Mexico State Univ.; **David Irvin,** U.S. Air Force

9:00 am: **Thermal control system challenges and requirements for operationally responsive space**, Andrew D. Williams, Michael E. Lyall, Air Force Research Lab. (United States); Derek Hengeveld, Purdue Univ. (United States). . . . . [7330-14]

9:20 am: **Thermal management integration for small satellites using plug-and-play variable emissivity devices**, Kenneth C. Shannon III, Judd Sheets, Howard P. Groger, Eclipse Energy Systems, Inc. (United States); Andrew D. Williams, Air Force Research Lab. (United States) . . . . . [7330-15]

9:40 am: **Development of an analytical model for an optical mass gauge sensor**, Cyrille J. Doux, Advanced Technologies Group (United States). . . . . [7330-16]

10:00 am: **Optomechanical structures using single crystal silicon**, Roger A. Paquin, Advanced Materials, Inc. (United States) and McCarter Machine, Inc. (United States); Douglas R. McCarter, McCarter Machine, Inc. (United States). . . . . [7330-17]

Coffee Break . . . . . 10:20 to 10:50 am

SESSION 6

Room: Crystal L. . . . . Wed. 10:50 to 11:30 am

Acquisition and Track Algorithms I

Session Chairs: **Khanh D. Pham,** Air Force Research Lab.; **Greg J. Meyer,** U.S. Air Force

10:50 am: **Comparison of several space target tracking filters**, Huimin Chen, Univ. of New Orleans (United States); Genshe Chen, DCM Research Resources, LLC (United States); Erik P. Blasch, Khanh D. Pham, Air Force Research Lab. (United States); Mo Wei, Xiaokun Li, DCM Research Resources, LLC (United States). . . . . [7330-18]

11:10 am: **Cooperative target tracking for many-on-many engagement**, Pradeep Bhatta, Michael Paluszek, Princeton Satellite Systems, Inc. (United States). . . . . [7330-19]

SESSION 7

Room: Crystal L. . . . . Wed. 11:30 am to 12:10 pm

Acquisition and Track Algorithms II

Session Chairs: **Khanh D. Pham,** Air Force Research Lab.; **Greg J. Meyer,** U.S. Air Force

11:30 am: **CPHD and PHD filters for unknown backgrounds part I: dynamic data clustering**, Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States). . . . . [7330-22]

11:50 am: **CPHD and PHD filters for unknown backgrounds part II: multitarget filtering in dynamic clutter**, Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States) . . . . . [7330-23]

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

SESSION 8

Room: Crystal L. . . . . Wed. 1:30 to 2:50 pm

Tasking and Scheduling

Session Chairs: **Khanh D. Pham,** Air Force Research Lab.; **Jeffrey L. Janicik,** Innoflight Inc.

1:30 pm: **Adaptive sensor management for multiple missions**, Peter J. Shea, Joe Kirk, Dave Welchons, Black River Systems Co., Inc. (United States). . . . . [7330-24]

1:50 pm: **Joint search and sensor management of space-based EO/IR sensors for LEO threat estimation**, Adel I. El-Fallah, Aleksandar Zatezalo, Raman K. Mehra, Scientific Systems Co., Inc. (United States); Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States); Khanh D. Pham, Air Force Research Lab. (United States) . . . . . [7330-25]

2:10 pm: **Game-theoretic homological sensor resource management for SSA**, Sang H. Chin, SAIC (United States) . . . . . [7330-26]

2:30 pm: **Awareness-based game theoretic multi-agent space resource management**, Mo Wei, Genshe Chen, DCM Research Resources, LLC (United States); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (United States); Jose B. Cruz, Jr., The Ohio State Univ. (United States) . . . . . [7330-27]

Coffee Break . . . . . 2:50 to 3:30 pm

SESSION 9

Room: Crystal L. . . . . Wed. 3:30 to 4:20 pm

Communications

Session Chairs: **Jeffrey L. Janicik,** Innoflight Inc.; **Randy M. Villahermosa,** The Aerospace Corp.

3:30 pm: **NFIRE-to-TerraSARX laser communication results: satellite pointing, disturbances, and other attributes consistent with successful performance** *(Invited Paper)*, Renny A. Fields, Carl T. Lunde, Robert L. Wong, Josef M. Wicker, The Aerospace Corp. (United States); John Jordan, General Dynamics Advanced Information Systems (United States); Brian W. Hansen, The Aerospace Corp. (United States); Gerd Muhlnikel, Tesat-Spacecom GmbH & Co. KG (Germany); Wayne Scheel, General Dynamics Advanced Information Systems (United States); Uwe Sterr, Audens (Germany); Ralph Kahle, Rolf Meyer, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [7330-28]

4:00 pm: **Optical receiver using silicon APD for space applications**, Frederic Laforce, PerkinElmer Optoelectronics (Canada) . . . . . [7330-29]

SESSION 10

Room: Crystal L. . . . . Wed. 4:20 to 5:40 pm

Architecture

Session Chairs: **Steven C. Gordon,** Georgia Tech Research Institute; **Khanh D. Pham,** Air Force Research Lab.

4:20 pm: **Collaborative space surveillance**, Ching-Fang Lin, American GNC Corp. (United States); Khanh D. Pham, Air Force Research Lab. (United States). . . . . [7330-30]

4:40 pm: **Optimal constellation design of low Earth orbit (LEO) EO/IR sensor platforms for space situational awareness**, Aleksandar Zatezalo, Adel I. El-Fallah, Scientific Systems Co., Inc. (United States); Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States); Raman K. Mehra, Scientific Systems Co., Inc. (United States); Khanh D. Pham, Air Force Research Lab. (United States). . . . . [7330-31]

5:00 pm: **Multiple weapon system distributed sensor concept**, Michael K. Rafailov, Richer LLC (United States) . . . . . [7330-32]

5:20 pm: **Technology collaboration by means of an open source government**, Steven M. Berardi, U.S. Air Force (United States) . . . . . [7330-33]

Space Exploration Technologies II

Conference Chair: **Wolfgang Fink,** California Institute of Technology

Program Committee: **Danilo F. Bassi,** Univ. de Santiago de Chile (Chile); **Manfred G. Bester,** Univ. of California, Berkeley

Monday 13 April

SESSION 1

Room: Crystal L. . . . . Mon. 8:30 to 10:20 am

Autonomous Aerial/Space Operations and Control

Session Chairs: **Manfred G. Bester,** Univ. of California, Berkeley; **Wolfgang Fink,** California Institute of Technology

8:30 am: **Mission planning for geophysical exploration by means of autonomous aerial vehicles**, Danilo F. Bassi, Univ. de Santiago de Chile (Chile). . . . . [7331-01]

8:50 am: **Terrain following an obstacle avoidance system for autonomous air vehicles by laser range sensor and simplified aerodynamic model**, Danilo F. Bassi, Univ. de Santiago de Chile (Chile) . . . . . [7331-02]

9:10 am: **Fast aerodynamic actuation and control design for close terrain autonomous flights**, Danilo F. Bassi, Univ. de Santiago de Chile (Chile). . . . . [7331-03]

9:30 am: **Autonomous self-configuration of artificial neural networks (ASCANN) for data classification or system control**, Wolfgang Fink, California Institute of Technology (United States) . . . . . [7331-04]

9:50 am: **BEARS: a multimission anomaly response system** *(Invited Paper)*, Bryce A. Roberts, Univ. of California, Berkeley (United States) . . . . . [7331-05]

Coffee Break . . . . . 10:20 to 10:50 am

SESSION 2

Room: Crystal L. . . . . Mon. 10:50 to 11:50 am

Models and Algorithms for Space Operations

Session Chairs: **Danilo F. Bassi,** Univ. de Santiago de Chile (Chile); **Wolfgang Fink,** California Institute of Technology

10:50 am: **3D position computations of the International Space Station Solar Array Wing using close-range photogrammetry approach**, Valer O. Papanyan, Jacobs Technology (United States); Donn Liddle, MEI Technologies, Inc. (United States); Edward Oshel, Jacobs Technology (United States); Orrin Thomas, GeoControl Systems, Inc. (United States). . . . . [7331-07]

11:10 am: **An improved differential algorithm for GPS static**, Qiuting Wang, Xiuling Hu, Huazhong Univ. of Science and Technology (China) . . . . . [7331-08]

11:30 am: **Parameter extraction for flexible photovoltaic (FPV) modules to determine the impact of FPV technology on high-insolation module performance**, Pooja Sharma, Siddhartha P. Duttagupta, Vivek Agarwal, Indian Institute of Technology (India) . . . . . [7331-09]

Lunch Break . . . . . 11:50 am to 1:40 pm

SESSION 3

Room: Crystal L. . . . . Mon. 1:40 to 3:20 pm

American and Chinese Space Robotics

Session Chairs: **Danilo F. Bassi,** Univ. de Santiago de Chile (Chile); **Wolfgang Fink,** California Institute of Technology

1:40 pm: **A hexapod robot to demonstrate mesh walking in a microgravity environment**, Alberto Behar, Jet Propulsion Lab. (United States) . . . . . [7331-10]

2:00 pm: **Multi-rover testbed for teleconducted and autonomous surveillance, reconnaissance, and exploration**, Wolfgang Fink, Mark A. Tarbell, California Institute of Technology (United States) . . . . . [7331-11]

2:20 pm: **The dynamic analysis and control strategy of spherical robot with telescopic manipulator**, Hanxu Sun, Qingxuan Jia, Yili Zheng, Chengkun Shi, Beijing Univ. of Posts and Telecommunications (China). . . . . [7331-12]

2:40 pm: **Research on modeling and motion simulation of a spherical space robot with telescopic manipulator based on virtual prototype technology**, Chengkun Shi, Hanxu Sun, Qingxuan Jia, Kailiang Zhao, Beijing Univ. of Posts and Telecommunications (China) . . . . . [7331-13]

3:00 pm: **The hydrodynamics analysis for the underwater robot with a spherical hull**, Xiaojuan Lan, Hanxu Sun, Qingxuan Jia, Beijing Univ. of Posts and Telecommunications (China) . . . . . [7331-14]

Coffee Break . . . . . 3:20 to 3:50 pm

SESSION 4

Room: Crystal L. . . . . Mon. 3:50 to 6:00 pm

Support Technologies for Space Missions

Session Chairs: **Manfred G. Bester,** Univ. of California, Berkeley; **Wolfgang Fink,** California Institute of Technology

3:50 pm: **MEMS-based warm gas thruster system for CubeSat orbital maneuver applications** *(Invited Paper)*, Po-Hao A. Huang, Univ. of Arkansas (United States); Eui-Hyeok Yang, Stevens Institute of Technology (United States). . . . . [7331-15]

4:20 pm: **Design of a stereo imaging system for the lunar environment using commercial off-the-shelf cameras**, Kelleher R. Guerin, Erika Bannon, Carnegie Mellon Univ. (United States) . . . . . [7331-16]

4:40 pm: **3D imaging lidar: a promising technology for lunar robotic exploration**, Marwan Hussein, Jeffrey W. Tripp, Optech, Inc. (Canada) . . . . . [7331-17]

5:00 pm: **Thermal region heat modulating electrochromic mirror**, Hulya Demiryont, Kenneth C. Shannon III, Eclipse Energy Systems, Inc. (United States). . . . . [7331-18]

5:20 pm: **Fiber optic transceivers for military avionic, missile, and space applications**, Chuck Tabbert, Ultra Communications, Inc. (United States). . . . . [7331-19]

5:40 pm: **Piezomechatronic-based systems in aircraft, space, and defense applications**, Alfredo Vazquez Carazo, Micromechatronics, Inc. (United States); Thomas Maillard, Frank Claeyssen, Ronan Le Letty, Olivier Sosnicki, A. Pages, CEDRAT Technologies SA (France) . . . . . [7331-20]

Tuesday 14 April

Space Technologies and Operations Track Plenary

Tues. 10:30 to 11:30 am • Room: Crystal L

Flight Operations at U.C. Berkeley: Earth Orbit and Beyond *(Presentation Only)*

Manfred G. Bester, Univ. of California, Berkeley (United States)

See p. 8 for details.

Wednesday 15 April

Space Technologies and Operations Track Plenary

Wed. 8:10 to 9:00 am • Room: Crystal L

A History of US Infrared Capability in Space *(Presentation Only)*

David Irvin, U.S. Air Force (United States)

See p. 8 for details.

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Unmanned Systems Technology XI

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: **Johann Borenstein,** Univ. of Michigan; **Jonathan A. Bornstein,** Army Research Lab.; **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 Tank-Automotive Research, Development and Engineering Ctr.; **Karl D. Iagnemma,** Massachusetts Institute of Technology; **Jeffrey J. Jaczkowski,** U.S. Army Tank-Automotive and Armaments Command; **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; **Frank L. Lewis,** The Univ. of Texas at Arlington; **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 Tank-Automotive Research, Development and Engineering Ctr.; **Marc Raibert,** Boston Dynamics; **Klaus-Juergen Schilling,** Univ. Würzburg (Germany); **Nahid N. Sidki,** Science Applications International Corp.; **Harpreet Singh,** Wayne State Univ.; **Magnus S. Snorrason,** Charles River Analytics, Inc.; **Anthony Stentz,** Carnegie Mellon Univ.; **David L. Stone,** Mechatron Consulting; **Venkataraman Sundareswaran,** Teledyne Scientific Co.; **Brian H. Wilcox,** Jet Propulsion Lab.; **Gary Witus,** Turing Associates, Inc.; **Brian M. Yamauchi,** iRobot Corp.

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Grand 13 . . . . . .Tues. 10:30 to 11:50 am

Self-Organizing, Collaborative, Unmanned ISR Robotic Teams I

Session Chairs: **George Vachtsevanos,** Georgia Institute of Technology; **Nahid N. Sidki,** SAIC; **Venkataraman Sundareswaran,** Teledyne Scientific Co.

Joint session between conference 7350: Defense Transformation and Net-Centric Systems 2009 and conference 7332: Unmanned Systems Technologies XI.

10:30 am: **Using multiple unmanned systems for a site security task**, Matthew O. Anderson, Curtis W. Nielsen, Mark D. McKay, Derek C. Wadsworth, Ryan C. Hruska, John A. Koudelka, Idaho National Lab. (United States). . . . . [7350-25]

10:50 am: **Border Eye: a compound UAS for continuous border patrol**, Samuel B. Wilson, Andy Turnbull, Paul A. Gelhausen, AVID LLC (United States). . . . . [7350-27]

11:10 am: **Fusion of inertial, optical flow and airspeed measurements for UAV navigation in GPS-denied environments**, Andrey Soloviev, Univ. of Florida (United States); Adam Rutkowski, Air Force Research Lab. (United States). . . . . [7332-01]

11:30 am: **Free Space Optical Network (FSN) for manned/unmanned sensor platforms under poly-environment**, Tariq Manzur, Naval Undersea Warfare Ctr. (United States); Michael L. Talbert, Air Force Research Lab. (United States); Gunasekaran S. Seetharaman, Air Force Institute of Technology (United States). . . . . [7332-02]

Lunch/Exhibition Break . . . . . 11:50 am to 1:40 pm

SESSION 2

Room: Grand 13 . . . . . .Tues. 1:40 to 4:10 pm

Self-Organizing, Collaborative, Unmanned ISR Robotic Teams II

Session Chairs: **Nahid N. Sidki,** SAIC; **Venkataraman Sundareswaran,** Teledyne Scientific Co.

Joint session between conference 7350: Defense Transformation and Net-Centric Systems 2009 and conference 7332: Unmanned Systems Technologies XI.

1:40 pm: **Integrated long-range UAV/UGV collaborative target tracking**, Mark Moseley, iRobot Corp. (United States); Benjamin P. Grocholsky, Carnegie Mellon Univ. (United States); Carol Cheung, iRobot Corp. (United States); Sanjiv Singh, Carnegie Mellon Univ. (United States) . . . . . [7332-03]

2:00 pm: **PRISTA UAVs: evolving from troop companion to troop replacement**, Jon R. Maynell, Lite Machines Corp. (United States) . . . . [7332-04]

2:20 pm: **Maintaining communication links in unstructured environments with a team of mobile robots**, Jindong Tan, Xi Chen, Michigan Technological Univ. (United States). . . . . [7332-05]

2:40 pm: **Determining the position of runways from UAV video**, Richard K. Warren, Amber D. Fischer, 21st Century Systems, Inc. (United States) . . [7332-06]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Complexity of robotic sensor networks**, Adam M. Mustapha, Harpreet Singh, Arati M. Dixit, Wayne State Univ. (United States); Grant R. Gerhart, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States). . . . . [7332-07]

3:50 pm: **Toward developing a UAV-based rapid mapping system for emergency response**, Kyoungah Choi, Impyeong Lee, Juseok Hong, Taewan Oh, The Univ. of Seoul (Korea, Republic of); Sung-Woong Shin, Electronics and Telecommunications Research Institute (Korea, Republic of); William J. Park, UAS Ctr. Co., Ltd. (Korea, Republic of). . . . . [7332-08]

SESSION 3

Room: Grand 13 . . . . . .Tues. 4:10 to 6:10 pm

Special Topics I

Session Chairs: **Douglas W. Gage,** XPM Technologies; **Charles M. Shoemaker,** General Dynamics Robotic Systems

Joint session between conference 7350: Defense Transformation and Net-Centric Systems 2009 and conference 7332: Unmanned Systems Technologies XI.

4:10 pm: **The DARPA LANdroids Program**, Mark McClure, Defense Advanced Research Projects Agency (United States); Douglas W. Gage, XPM Technologies (United States). . . . . [7332-09]

4:30 pm: **Biologically inspired collision avoidance system for unmanned vehicles**, Fernando E. Ortiz, Kyle Spagnoli, EM Photonics, Inc. (United States); Brett Graham, Univ. of Delaware (United States) . . . . . [7332-10]

4:50 pm: **Design and construction of an autonomous underwater vehicle for the launch of a small UAV**, Arturo E. Cadena, Jr., Escuela Superior Politécnica del Litoral (Ecuador) . . . . . [7332-11]

5:10 pm: **Parallel robot for high-acceleration (above 40g) motions**, François Pierrot, Olivier Company, Sébastien Krut, Univ. de Montpellier II (France); Cédric Baradat, Fondation Fatronik (France) . . . . . [7332-12]

5:30 pm: **Implementation of a piezoelectrically actuated self-contained quadruped robot**, Sangyoon Lee, Thanhtam Ho, Konkuk Univ. (Korea, Republic of). . . . . [7332-13]

5:50 pm: **Safety technology advances and trends in the mobile vehicle industry (material handling)**, Steve Aamodt, SICK, Inc. (United States). . . . . [7332-71]

Wednesday 15 April

SESSION 4

Room: Grand 13 . . . . . .Wed. 8:00 to 9:40 am

Special Topics II

Session Chairs: **Douglas W. Gage,** XPM Technologies; **Charles M. Shoemaker,** General Dynamics Robotic Systems

8:00 am: **Advancing manufacturing research through competitions**, Stephen B. Balakirsky, Raj Madhavan, Christopher Scrapper, Jr., National Institute of Standards and Technology (United States) . . . . . [7332-72]

8:20 am: **On the development of an unmanned underwater robotic crawler for operation on subsea flexible risers**, Dimitris G. Psarros, Panagiotis Chatzakos, Dimitrios Korres, Alexandros Louridas, Vasilis A. Papadimitriou, Vasilis Spais, Kostas Chryssagis, ZENON S.A. (Greece); Ian Nicholson, TWI Ltd. (United Kingdom). . . . . [7332-14]

8:40 am: **Robust formation control of multi-robot systems subject to interconnection time-delays using minimum dynamic communication**, Junjie Zhang, Suhada Jayasuriya, Texas A&M Univ. (United States) . . . . . [7332-15]

9:00 am: **Preliminary results in force-guided assembly for teams of heterogeneous robots**, Juan Rojas, Vanderbilt Univ. (United States); Richard A. Peters II, Vanderbilt Univ. (United States) and Universal Robotics (United States). . . . . [7332-16]

9:20 am: **Shape characterization methods for defect identification in automatic visual inspection systems**, Amir H. Shirkhodaie, Naresh Hanchate, Tennessee State Univ. (United States) . . . . . [7332-17]

SESSION 5

Room: Grand 13 . . . . . .Wed. 9:40 am to 12:00 pm

UGV Tele-Operation

Session Chair: **Gary Witus,** Turing Associates, Inc.

9:40 am: **Field experiments using SPEAR: a speech control system for UGVs**, Siddharth Chhatpar, Chris Blanco, Think-A-Move, Ltd. (United States); Jeffrey Czerniak, Orin Hoffman, iRobot Corp. (United States); Amit Juneja, Tarun Pruthi, Dongqing Liu, Think-A-Move, Ltd. (United States); Robert E. Karlsen, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States); Jonathan Brown, Think-A-Move, Ltd. (United States) . . . . . [7332-18]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Head-aimed remote vision in a networked battlespace** *(Invited Paper)*, Martha Jane Chatten, Leonid Tochinski, Chatten Associates, Inc. (United States); Jamal R. Musbeh, Norman P. Coleman, U.S. Army Armament Research, Development and Engineering Ctr. (United States). . . . . [7332-19]

11:00 am: **Flat panel 3D display for unmanned ground vehicles**, David B. Chenault, J. Larry Pezzaniti, Richard P. Edmondson, James F. Morris, Polaris Sensor Technologies, Inc. (United States); Joseph L. Tchon, Tracy J. Barnidge, Rockwell Collins, Inc. (United States); Brad Pettijohn, Army Research Lab. (United States); David Kingston, Scott Newell, Varilynmae Geulen, Concurrent Technologies Corp. (United States) . . . . . [7332-20]

11:20 am: **Improved situational awareness and mission performance for explosive ordnance disposal robots**, Kent Massey, Chatten Associates, Inc. (United States). . . . . [7332-21]

11:40 am: **FOCU:S: future operator control unit: soldier**, Barry J. O'Brien, Cem Karan, Stuart H. Young, Army Research Lab. (United States) . . . . . [7332-22]

Lunch/Exhibition Break . . . . . 12:00 to 1:40 pm

SESSION 6

Room: Grand 13 . . . . . .Wed. 1:40 to 5:50 pm

Intelligent Behaviors

Session Chairs: **Frank L. Lewis,** The Univ. of Texas at Arlington; **Gregory Robert Hudas,** U.S. Army Tank-Automotive Research, Development and Engineering Ctr.

1:40 pm: **Autonomous group behavior** *(Invited Paper)*, Vijay Kumar, Univ. of Pennsylvania (United States). . . . . [7332-23]

2:10 pm: **The interaction of perception and planning in autonomous vehicles** *(Invited Paper)*, Mark Campbell, Cornell Univ. (United States) . . . . . [7332-24]

2:40 pm: **Adaptable formations utilizing heterogeneous unmanned systems**, Laura E. Barnes, The Univ. of Texas at Arlington (United States); Richard Garcia, MaryAnne Fields, Army Research Lab. (United States); Kimon P. Valavanis, Univ. of Denver (United States) . . . . . [7332-25]

3:00 pm: **ComMotion: an integrative approach for communication and motion planning in robotic networks**, Rafael Fierro, The Univ. of New Mexico (United States). . . . . [7332-26]

3:20 pm: **Road surveillance using a team of small UAVs**, Derek B. Kingston, Siva Banda, Air Force Research Lab. (United States). . . . . [7332-27]

Coffee Break . . . . . 3:40 to 4:10 pm

4:10 pm: **Discrete event command and control for networked teams with multiple missions**, Frank L. Lewis, The Univ. of Texas at Arlington (United States); Gregory R. Hudas, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States). . . . . [7332-28]

4:30 pm: **Robot learning: from vision to behavior**, Gary Witus, Turing Associates, Inc. (United States); Robert E. Karlsen, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States) . . . . . [7332-29]

4:50 pm: **System identification and discrete nonlinear control of miniature helicopters using backstepping**, Ioannis A. Raptis, Univ. of South Florida (United States); Kimon P. Valavanis, Univ. of Denver (United States); Wilfrido A. Moreno, Univ. of South Florida (United States). . . . . [7332-30]

5:10 pm: **Neural network control of nonholonomic robot formations using limited communication with reliability assessment**, Travis A. Dierks, Jagannathan Sarangapani, Missouri Univ. of Science and Technology (United States). . . . . [7332-31]

5:30 pm: **Toward cognitive robotics**, John E. Laird, Univ. of Michigan (United States). . . . . [7332-70]

Thursday 16 April

SESSION 7

Room: Grand 13 . . . . . Thurs. 8:40 to 11:50 am

Perception

Session Chairs: **Magnus S. Snorrason,** Charles River Analytics, Inc.; **Larry Henry Matthies,** Jet Propulsion Lab.

8:40 am: **Stereo vision-based terrain mapping for off-road autonomous navigation**, Arturo L. Rankin, Larry H. Matthies, Jet Propulsion Lab. (United States) . . . . . [7332-32]

9:00 am: **Using a laser range finder mounted on a microvision robot to estimate environmental parameters**, Duc Fehr, Nikos Papanikolopoulos, Univ. of Minnesota (United States) . . . . . [7332-33]

9:20 am: **Characterization of the Hokuyo 2D laser rangefinder for mobile robot obstacle negotiation**, Yoichi Okubo, Univ. of Michigan (United States); Cang Ye, Univ. of Arkansas at Little Rock (United States); Johann Borenstein, Univ. of Michigan (United States) . . . . . [7332-34]

9:40 am: **Image-based navigation for cloud avoidance**, Daniel Gutchess, Christopher P. Mow, Charles River Analytics, Inc. (United States); Dawn Wheeler, Stanford Univ. (United States); Magnus S. Snorrason, Charles River Analytics, Inc. (United States) . . . . . [7332-35]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Tessellated structure from motion**, Minbo Shim, Samson Yilma, General Dynamics Robotic Systems (United States) . . . . . [7332-36]

10:50 am: **Detecting and tracking humans using a man-portable robot**, David Baran, Nicholas Fung, Sean Ho, Army Research Lab. (United States) . . . [7332-37]

11:10 am: **A stereo camera system for the autonomous maritime navigation vehicles**, Weihong Zhang, Technology Solutions (United States); Ping Zhuang, Les Elkins, Rick Simon, David Gore, Jeff Cogar, Spatial Integrated Systems, Inc. (United States); Kevin Hildebrand, Steve Crawford, Technology Solutions (United States); Joe Fuller, Marshall Univ. (United States) . . . . . [7332-38]

11:30 am: **Detection of moving targets from a moving ground platform**, Thomas B. Sebastian, Peter H. Tu, Christopher Wynnyk, GE Global Research (United States); Sabrina Barnes, Lockheed Martin Space Operations (United States) . . . . . [7332-39]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 8

Room: Grand 13 . . . . . Thurs. 1:20 to 4:30 pm

Mobility and Navigation

Session Chairs: **Karl D. Iagnemma,** Massachusetts Institute of Technology; **Mel W. Torrie,** Autonomous Solutions, Inc.

1:20 pm: **Increasing agility in unmanned ground vehicles using variable internal mass and inertial properties**, Simo Cusi Van Dooren, Univ. Politècnica de Catalunya (Spain); Jainam Shah, Matthew J. Spenko, Illinois Institute of Technology (United States) . . . . . [7332-40]

1:40 pm: **Planning and control of a quadrotor helicopter in a GPS-denied environment**, Nicholas Roy, Abraham Bachrach, Ruijie He, Sam Prentice, Massachusetts Institute of Technology (United States) . . . . . [7332-41]

2:00 pm: **Test results of autonomous behaviors for urban environment exploration**, Estrellina B. Pacis, Greg T. Kogut, Brandon Sights, Gaurav Ahuja, Donald Fellars, Hobart R. Everett, Space and Naval Warfare Systems Ctr., San Diego (United States) . . . . . [7332-42]

2:20 pm: **Toward a generic UGV autopilot**, Kevin L. Moore, Mark A. Whitehorn, Alejandro Weinstein, Junjun Xia, Colorado School of Mines (United States) . . . . . [7332-43]

2:40 pm: **An interactive, physics-based unmanned ground vehicle simulator leveraging commercial gaming technology: progress in the development and application of the virtual autonomous navigation environment (VANE) desktop**, Mitchell M. Rohde, Justin Crawford, Matthew Toschlog, Quantum Signal LLC (United States); Karl D. Iagnemma, Guarav Kewlani, Massachusetts Institute of Technology (United States); Christopher L. Cummins, Randolph A. Jones, David A. Horner, U.S. Army Engineer Research and Development Ctr. (United States) . . . . . [7332-44]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **GPS-denied navigation for unmanned aerial vehicles using visual terrain matching**, Jonah C. McBride, Camille S. Monnier, Magnus S. Snorrason, Charles River Analytics, Inc. (United States) . . . . . [7332-45]

3:50 pm: **Reconfigurable tracked robot controllers for autonomous climbing of obstacles**, Isabelle Vincent, Jared Giesbrecht, Defence Research and Development Canada (Canada) . . . . . [7332-46]

4:10 pm: **Evaluation of terrain parameter estimation using a stochastic terrain model,** Laura E. Ray, Danielle Dumond, Dartmouth College (United States) . . . . . [7332-47]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

On software implementation of reliability of unmanned ground vehicles, Arati M. Dixit, Kassem Saab, Harpreet Singh, Adam M. Mustapha, Wayne State Univ. (United States); Grant R. Gerhart, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States) . . . . . [7332-65]

Dynamic task allocation in cooperative robot teams: a limited lookahead control policy, Athanasios Tsalatsanis, Ali Yalcin, Univ. of South Florida (United States); Kimon P. Valavanis, Univ. of Denver (United States) . . . . [7332-66]

UGV application modeling and sensor simulation using a rapid prototyping testbed environment, James N. Falasco, GE Fanuc Intelligent Platforms (United States) . . . . . [7332-67]

Comparison of real-time performances of Kalman filter-based slam methods for unmanned ground vehicle (UGV) navigation, Hakan Temeltas, Deniz Kavak, Istanbul Teknik Üniv. (Turkey) . . . . . [7332-69]

Friday 17 April

SESSION 9

Room: Grand 13 . . . . . Fri. 8:20 am to 12:10 pm

Government Session

Session Chairs: **Jonathan A. Bornstein,** Army Research Lab.; **Jeffrey F. Jaster,** U.S. Army TARDEC; **James L. Overholt,** U.S. Army TARDEC

8:20 am: **Starting up a National Robotics Center** *(Invited Paper)*, James L. Overholt, U.S. Army TARDEC (United States) . . . . . [7332-48]

8:50 am: **Robotic Systems Joint Project Office Programmatic Overview** *(Invited Paper)*, Jeffrey J. Jaczkowski, U.S. Army RDECOM-TARDEC (United States) . . . . . [7332-49]

9:20 am: **Land, sea, and air unmanned systems research and development at SPAWAR Systems Center Pacific**, Hoa G. Nguyen, Rich Arrieta, Hobart R. Everett, Robin T. Laird, Barbara Fletcher, Greg T. Kogut, Todd Webber, Space and Naval Warfare Systems Ctr., San Diego (United States) . . . . . [7332-50]

9:40 am: **Evolving U.S. Department of Defense (DoD) unmanned systems research, development, test, acquisition & evaluation (RDTA&E)**, Robin T. Laird, Space and Naval Warfare Systems Ctr., San Diego (United States) . . . . . [7332-51]

10:00 am: **TARDEC's Intelligent Ground Systems Overview**, Jeffrey F. Jaster, U.S. Army TARDEC (United States) . . . . . [7332-52]

Coffee Break . . . . . 10:20 to 10:50 am

10:50 am: **Domestic networked unmanned system application**, Curtis Strange, Michael Zahuranic, U.S. Army (United States) . . . . . [7332-53]

11:10 am: **Immediate visual assessment and neutralization (I.V.A.N.) small robotic utility vehicle**, Kenneth Lien, Air Force Research Lab. (United States) . . . . . [7332-54]

11:30 am: **Joint collaborative technology experiment**, Michael L. Wills, Dominic A. Ciccimaro, See Yee, Space and Naval Warfare Systems Ctr., San Diego (United States); Thomas A. Denewiler, Nicholas C. Stroumtsos, SAIC (United States); John Messamore, L-3 Communications Titan Group (United States); Rodney Brown, Brian K. Skibba, Air Force Research Lab. (United States); Daniel Clapp, Jeff Wit, Wintec, Inc. (United States); Randy J. Shirts, Gary N. Dion, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States); Gary S. Anselmo, SAIC (United States) . . . . . [7332-55]

11:50 am: **Robotic leader/follower using a pan/tilt/zoom camera**, Jared Giesbrecht, Defence Research and Development Canada (Canada) . . . . [7332-74]

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

SESSION 10

Room: Grand 13 . . . . . Fri. 1:30 to 2:50 pm

Mobile Manipulators

Session Chairs: **Brian M. Yamauchi,** iRobot Corp.;
Robert E. Karlsen, U.S. Army TARDEC

1:30 pm: **Mobile manipulation: the next frontier in mobile robots; advances, challenges, and opportunities**, Martin Buehler, iRobot Corp. (United States). . . . . [7332-56]

1:50 pm: **3D visualization for improved manipulation and mobility in EOD and combat engineering applications**, Josh M. Johnston, Joel Alberts, John Edwards, Autonomous Solutions, Inc. (United States) . . . . . [7332-57]

2:10 pm: **OzBot and Haptics: remote surveillance to physical presence**, James A. Mullins, Deakin Univ. (Australia) . . . . . [7332-58]

2:30 pm: **Laser-assisted real-time and scaled-telerobotic control of a manipulator for defense and security applications**, Eduardo Veras, Karan Khokar, Redwan Alqasemi, Rajiv V. Dubey, Univ. of South Florida (United States). . . . . [7332-59]

SESSION 11

Room: Grand 13 . . . . . Fri. 2:50 to 5:20 pm

Small Robots

Session Chair: **Stuart H. Young,** Army Research Lab.

2:50 pm: **Stingray: high-speed control of small UGVs in urban terrain**, Brian M. Yamauchi, iRobot Corp. (United States); Kent Massey, Chatten Associates, Inc. (United States). . . . . [7332-60]

Coffee Break . . . . . 3:10 to 3:40 pm

3:40 pm: **Implementation of small robot autonomy in an integrated environment**, Barry J. O'Brien, Laurel Sadler, Army Research Lab. (United States). . . . . [7332-61]

4:00 pm: **Vision-based effective dispersion of miniature robots by using local sensing**, Hyeun-Jeong Min, Nikos Papanikolopoulos, Univ. of Minnesota (United States). . . . . [7332-62]

4:20 pm: **Smaller, lighter, faster, stronger: how the current threat is shaping small robotics**, James J. Crosby, SAIC (United States); Michael Zahuranic, U.S. Army (United States) . . . . . [7332-63]

4:40 pm: **Ten-kilogram vehicle autonomous operations**, John R. Rogers, United States Military Academy (United States) . . . . . [7332-64]

5:00 pm: **Inexpensive robot for remote detection of UXO**, Joshua Galloway, Daren R. Wilcox, Southern Polytech State Univ. (United States) . . . . . [7332-73]

Monday-Thursday 13-16 April 2009 • Proceedings of SPIE Vol. 7333

Unattended Ground, Sea, and Air Sensor Technologies and Applications XI

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

Program Committee: **Jacques Bédard,** Defence R&D Canada/Valcartier (Canada); **John C. Carrano,** Luminex Corp.; **Christina J. Deckard,** Space and Naval Warfare Systems Ctr., San Diego; **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.; **Tien Pham,** Army Research Lab.; **Ronald B. Sartain,** Army Research Lab.; **Huub A.J.M. van Hoof,** TNO (Netherlands); **Graeme P. van Voorthuijsen,** TNO-FEL (Netherlands)

Monday 13 April

SESSION 1

Room: Grand 14 . . . . . Mon. 8:30 to 9:50 am

Keynote Session

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

8:30 am: **Coding computation optical sensors** *(Keynote Presentation)*, David J. Brady, Duke Univ. (United States). . . . . [7333-01]

9:10 am: **Physical and chemical sensing based on micro- and nanotechnologies** *(Keynote Presentation)*, Panos Datskos, Univ. of Tennessee (United States). . . . . [7333-02]

Coffee Break . . . . . 9:40 to 10:20 am

SESSION 2

Room: Grand 14 . . . . . Mon. 10:20 to 11:20 am

Unattended Sensor Systems I

Session Chairs: **Edward M. Carapezza,** Univ. of Connecticut and DARPA; **Tariq Manzur,** Naval Undersea Warfare Ctr.

10:20 am: **Energy scavenging oceanographic surveillance system**, David C. Sparks, SeaLandAire Technologies, Inc. (United States). . . . . [7333-03]

10:40 am: **Persistant Ocean Surveillance (POS) technologies for unattended sensing applications**, Linda J. Frizzell-Makowski, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7333-04]

11:00 am: **Littoral surveillance with distributed sensor networks**, Aldo Bargnesi, Naval Undersea Warfare Ctr. (United States) . . . . . [7333-05]

SESSION 3

Room: Grand 14 . . . . . Mon. 11:20 am to 12:00 pm

Keynote Session

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

11:20 am: **Science and disruptive technologies** *(Keynote Presentation)*, John A. Parmentola, U.S. Army (United States) . . . . . [7333-06]

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

SESSION 4

Room: Grand 14 . . . . . Mon. 1:30 to 3:30 pm

Unattended Sensor Systems II

Session Chairs: **Todd M. Hintz,** Space & Naval Warfare Systems Command SPAWARSYSCEN; **Michael A. Kolodny,** Army Research Lab.

1:30 pm: **Sensing, the road ahead ...**, Michael A. Kolodny, Army Research Lab. (United States). . . . . [7333-07]

1:50 pm: **Human factors considerations in the design and deployment of UGS systems**, Robert A. Johnson, Harris Corp. (United States) . . . . . [7333-08]

2:10 pm: **Security concerns and solutions for unattended ground sensors**, Ron A. Knobler, McQ, Inc. (United States); Mike Gora, Patrick Schaumont, Virginia Polytechnic Institute and State Univ. (United States) . . . . . [7333-09]

2:30 pm: **SCORPION II Persistent Surveillance System with Universal Gateway**, Michael A. Coster, Jonathan L. Chambers, Michael J. Winters, Albert J. Brunck, Northrop Grumman-Xetron (United States) . . . . . [7333-10]

2:50 pm: **Remote video surveillance systems**, Robert P. Post, Hiro Sasaki, Harris Corp. (United States) . . . . . [7333-11]

3:10 pm: **Rifle-mounted gunshot locator**, Alan Wignall, John Martin, Ultra Electronics Sonar & Communication Systems (United Kingdom). . . . . [7333-12]

Coffee Break . . . . . 3:30 to 4:00 pm

SESSION 5

Room: Grand 14 . . . . . Mon. 4:00 to 5:40 pm

Sensor Networks and Communications

Session Chairs: **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom); **Graeme P. van Voorthuijsen,** TNO Defense, Security and Safety (Netherlands)

4:00 pm: **Heterogeneous sensor networks: a bio-inspired overlay architecture**, Jerry A. Burman, Teledyne Scientific Co. (United States); Joao P. Hespanha, Upamanyu Madhow, Univ. of California, Santa Barbara (United States); Tien Pham, Ananthram Swami, Army Research Lab. (United States); Daniel J. Klein, Univ. of California, Santa Barbara (United States) . . . . . [7333-13]

4:20 pm: **Universal resource interface module (URIM) for the Joint Force Protection Advanced Security System (JFPASS)**, Christopher M. Barngrover, Scott H. Cutler, James R. Cruickshanks, Space and Naval Warfare Systems Ctr., San Diego (United States) . . . . . [7333-14]

4:40 pm: **Wireless mesh networked radios optimized for UGS applications**, Wade Calcutt, Steve Brady, Jonathan Williams, Barry Jones, McQ, Inc. (United States). . . . . [7333-15]

5:00 pm: **Intelligent route surveillance**, Robin M. Schoemaker, Aad Koot, Rody D. Sandbrink, Graeme P. van Voorthuijsen, TNO Defense, Security and Safety (Netherlands) . . . . . [7333-16]

5:20 pm: **Free-space optical technologies for distributed sensor networks**, Tariq Manzur, Naval Undersea Warfare Ctr. (United States). . . . . [7333-17]

Tuesday 14 April

SESSION 6

Room: Grand 14 . . . . . .Tues. 8:10 to 8:30 am

Keynote Session

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

8:10 am: **DARPA heterostructural uncooled magnetic sensor (HUMS) program** *(Keynote Presentation)*, William S. Coblenz, Defense Advanced Research Projects Agency (United States) . . . . . [7333-18]

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 7

Room: Grand 14 . . . . . Tues. 10:30 am to 12:10 pm

NATO Field Experiment I

Session Chairs: **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom); **Tien Pham,** Army Research Lab.

10:30 am: **NATO SET-093 joint field experiment at Bourges**, Christophe R. Marty, Florent Bruel, Dominique Prieur, Délégation Générale pour l'Armement (France); Pierre Naz, French-German Research Institute of Saint-Louis (France) . . . . . [7333-19]

10:50 am: **Canada participation to the NATO SET-093 field experiment at Bourges France**, Jacques Bédard, Defence Research and Development Canada Valcartier (Canada) . . . . . [7333-20]

11:10 am: **Acoustic source localization and cueing from an aerostat during the NATO SET-093 field experiment**, Christian G. Reiff, Army Research Lab. (United States). . . . . [7333-21]

11:30 am: **Acoustic detection and localization of weapon fire by unattended ground sensors and aerostat-borne sensors**, Pierre Naz, Sébastien Hengy, French-German Research Institute of Saint-Louis (France); Christophe R. Marty, La Délégation Générale pour l'Armement (France); Scott Miller, Army Research Lab. (United States). . . . . [7333-22]

11:50 am: **Sound-source localization using distributed elevated acoustic sensors**, Xiao Di, Ronald A. Wagstaff, John D. Anderson, Kenneth E. Gilbert, The Univ. of Mississippi (United States). . . . . [7333-23]

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

SESSION 8

Room: Grand 14 . . . . . .Tues. 1:30 to 2:10 pm

NATO Field Experiment II

Session Chairs: **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom); **Graeme P. van Voorthuijsen,** TNO Defense, Security and Safety (Netherlands)

1:30 pm: **U.S. Army RDECOM-ARDEC's results of the TG-53 experiment and field test**, Sachi V. Desai, Amir Morcos, U.S. Army Armament Research, Development and Engineering Ctr. (United States). . . . . [7333-24]

1:50 pm: **Detection of impulsive sources from an aerostat-based acoustic array**, Wayne E. Prather, Chris Clark, Joshua N. Strickland, Miltec Research & Technology (United States) . . . . . [7333-25]

SESSION 9

Room: Grand 14 . . . . . .Tues. 2:10 to 4:20 pm

Signal Processing and Instrumentation

Session Chairs: **Jacques Bédard,** Defence Research and Development Canada Valcartier (Canada); **Myron E. Hohil,** U.S. Army Research, Development and Engineering Command

2:10 pm: **AerostatBallon deployed acoustic arrays and data acquisition system**, Jeffrey Allanach, Univ. of Connecticut (United States) . . . . . [7333-26]

2:30 pm: **Optimal sensor placement with terrain-based constraints and signal propagation effects**, Sergey Vecherin, U.S. Army Cold Region Research and Engineering Lab. (United States); D. Keith Wilson, U.S. Army Engineer Research and Development Ctr. (United States); Chris L. Pettit, U.S. Naval Academy (United States). . . . . [7333-27]

2:50 pm: **Time-delay estimation in a time-warping environment**, Joshua Ash, Randolph L. Moses, The Ohio State Univ. (United States) . . . . . [7333-28]

Coffee Break . . . . . 3:10 to 3:40 pm

3:40 pm: **General framework for predicting environmental effects on signatures and sensor performance in complex environments**, D. Keith Wilson, Richard Bates, U.S. Army Engineer Research and Development Ctr. (United States). . . . . [7333-29]

4:00 pm: **Integrated operational control and dynamic task allocation of unattended distributed sensor systems**, Ashit Talukder, Jet Propulsion Lab. (United States). . . . . [7333-31]

SESSION 10

Room: Grand 14 . . . . . .Tues. 4:20 to 5:40 pm

Acoustic, Seismic, Magnetic, and Multimodal Sensing

Session Chairs: **Alan J. Gray,** Defence Science and Technology Lab. (United Kingdom); **Graeme P. van Voorthuijsen,** TNO Defense, Security and Safety (Netherlands)

4:20 pm: **High-performance air acoustic detection and classification sensor**, Wade Calcutt, Richard D. Porter, Robert Fish, Barry Jones, McQ, Inc. (United States). . . . . [7333-32]

4:40 pm: **Advanced-flow noise reducing acoustic sensor arrays**, Kevin S. Fine, Scientific Applications & Research Associates, Inc. (United States) . . . . [7333-33]

5:00 pm: **Seismic bearing**, Dennis Power, Textron Systems Corp. (United States). . . . . [7333-34]

5:20 pm: **Miniature, ruggedized data collector**, Scott Jackson, Wade Calcutt, Ron A. Knobler, Barry Jones, McQ, Inc. (United States). . . . . [7333-35]

Wednesday 15 April

SESSION 11

Room: Grand 14 . . . . . Wed. 8:30 to 11:20 am

Profiling, Sensing, and Personnel Detection

Session Chairs: **Ronald B. Sartain,** Army Research Lab.; **Michael A. Kolodny,** Army Research Lab.

8:30 am: **Comparison of classification algorithms for object recognition with profiling sensors**, Srikant K. Chari, Carl E. Halford, Forrest A. Smith, Eddie L. Jacobs, David J. Russomanno, The Univ. of Memphis (United States) . . [7333-36]

8:50 am: **Long-wave infrared profile feature extractor (PFx) sensor**, Ronald B. Sartain, Keith Aliberti, Army Research Lab. (United States) . . . . . [7333-37]

9:10 am: **Underground intrusion sensor for urban operations**, Jaroslav Cechak, Univ. Obrany (Czech Republic) . . . . . [7333-38]

9:30 am: **Long, multipoint, fiber optic sensor for unattended ground intruder detection and identification**, Edgar A. Mendoza, Redondo Optics, Inc. (United States) . . . . . [7333-39]

9:50 am: **Digital tripwire: a small automated human detection system**, Amber D. Fischer, 21st Century Systems, Inc. (United States); Emmett Redd, A. Steven Younger, Missouri State Univ. (United States) . . . . . [7333-40]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **A data-driven personnel detection scheme for indoor surveillance using seismic sensors**, Arun Subramanian, Satish G. Iyengar, Kishan G. Mehrotra, Chilukuri K. Mohan, Pramod K. Varshney, Syracuse Univ. (United States); Thyagaraju Damarla, Army Research Lab. (United States) . . . . . [7333-41]

11:00 am: **Development of an unattended ground sensor array using piezoresistive sensors**, Kelly Lee, Infotonics Technology Ctr. (United States); Ronald B. Sartain, Neelam Gupta, Army Research Lab. (United States) . [7333-42]

Lunch/Exhibition Break . . . . . 11:20 am to 1:00 pm

SESSION 12

Room: Grand 14 . . . . . Wed. 1:00 to 1:40 pm

Keynote Session

Session Chairs: **Michael A. Kolodny,** Army Research Lab.; **Tien Pham,** Army Research Lab.

1:00 pm: **Coalition interoperability in empire challenge** *(Keynote Presentation)*, TBD . . . . . [7333-43]

Coffee Break . . . . . 3:40 to 4:10 pm

SESSION 13

Room: Grand 14 . . . . . Wed. 1:40 to 3:40 pm

Interoperability and Coalition Operations

Session Chairs: **Michael A. Kolodny,** Army Research Lab.; **Tien Pham,** Army Research Lab.

1:40 pm: **SensorWeb: interoperability through standardized Web services and metadata**, Charles Gates, SAIC (United States). . . . . [7333-44]

2:00 pm: **The ITA sensor fabric**, Christopher Gibson, Flavio Bergamaschi, IBM United Kingdom Ltd. (United Kingdom); Tien Pham, Army Research Lab. (United States). . . . . [7333-45]

2:20 pm: **Layered sensing**, Robert L. Williams, Air Force Research Lab. (United States). . . . . [7333-46]

2:40 pm: **Family of unattended ground sensors (UGS)**, Michael A. Kolodny, Army Research Lab. (United States) . . . . . [7333-47]

3:00 pm: **Common command-and control user interface for current force UGS**, Gary H. Stolovy, Army Research Lab. (United States) . . . . . [7333-48]

3:20 pm: **Payloads in motion,** Larry Tokarcik, Robert P. Winkler, Army Research Lab. (United States). . . . . [7333-49]

PANEL DISCUSSION ON

Room: Grand 14 . . . . . Wed. 4:10 to 5:40 pm

Interoperability and Coalition Operations

Panel Moderators: **Michael A. Kolodny,** Army Research Lab.; **Tien Pham,** Army Research Lab.

Thursday 16 April

SESSION 6

Room: Grand 5 . . . . . Thurs. 8:30 to 11:40 am

Unattended Sensors and Sensor Networks

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

Joint Session with 7333-Unattended Ground, Sea, and Air Sensor Technologies and Applications XI.

8:30 am: **Status of UGS technology on U.S. Borders**, John H. McQuiddy, McQ, Inc. (United States) . . . . . [7305-21]

8:50 am: **Binary sensor system in homeland security and military applications**, Tomasz P. Jannson, Thomas C. Forrester, Kang S. Lee, Eric Gans, Victor Grubsky, Edward Patton, Kevin Walter, Physical Optics Corp. (United States) . . . . . [7305-22]

9:10 am: **System-on-chip-centric unattended embedded sensors in homeland security and defense applications**, Tomasz P. Jannson, Thomas C. Forrester, Kevin Degrood, Kevin Walter, Physical Optics Corp. (United States). . . . . [7305-23]

9:30 am: **Expanding the role of unattended ground sensor to multitiered systems**, David R. Garrison II, Paul E. Voglewede, David Garigen, Harris Corp. (United States). . . . . [7305-24]

9:50 am: **Classifying humans of interest utilizing active ultrasonic transducer**, Shafik A. Quoraishee, Sachi V. Desai, U.S. Army Research, Development and Engineering Command (United States); Amir Morcos, U.S. Army Armament Research, Development and Engineering Ctr. (United States) . . . . . [7305-25]

Coffee Break . . . . . 10:10 to 10:40 am

10:40 am: **Power-resource management and low-power remote wireless RF electronics**, Tomasz P. Jannson, Thomas C. Forrester, Kevin Degrood, Robert Kremer, Kang S. Lee, Eric Gans, Kevin Walter, Physical Optics Corp. (United States). . . . . [7305-26]

11:00 am: **Acoustic threatening sound detection and recognition system**, Hongmei Deng, Kun Sun, Roger Xu, Intelligent Automation, Inc. (United States). . . . . [7305-27]

11:20 am: **Novel radar-based unattended ground sensor (UGS) for DHS border monitoring applications**, , ... [7305-28]

SESSION 8

Room: Grand 5 . . . . . Thurs. 3:30 to 5:30 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

Joint Session with 7333-Unattended Ground, Sea, and Air Sensor Technologies and Applications XI.

3:30 pm: **Weapon identification using hierarchical classification of acoustic signatures**, Saad M. Khan, Ajay Divakaran, Harpreet S. Sawhney, Sarnoff Corp. (United States). . . . . [7305-35]

3:50 pm: **Bayesian detection of acoustic muzzle blasts**, Kenneth D. Morton, Leslie M. Collins, Duke Univ. (United States) . . . . . [7305-36]

4:10 pm: **Field-based gunfire location systems**, Charles A. Uzes, Marine Physics & Technology Co. (United States) and Douglas Machines, Inc. (United States). . . . . [7305-37]

4:30 pm: **Back-end algorithms that enhance the functionality of a biomimetic acoustic gunfire direction-finding system**, Yirong Pu, Sarah Kelsall, Allyn E. Hubbard, Boston Univ. (United States). . . . . [7305-38]

4:50 pm: **Detection and classification of objects using acoustic excitations**, Pawan Setlur, Moeness G. Amin, Villanova Univ. (United States); Abdelhak Zoubir, Technische Univ. Darmstadt (Germany) . . . . . [7305-39]

5:10 pm: **Efficient algorithms for the dynamic resource allocation problem of counter-RAM systems**, Markus Graswald, Hendrik Rothe, Helmut-Schmidt Univ. (Germany) . . . . . [7305-40]

SESSION 7

Room: Grand 5 . . . . . Thurs. 1:00 to 3:00 pm

Command, Control, Communications, and Intelligence (C3I)

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

Joint Session with 7333-Unattended Ground, Sea, and Air Sensor Technologies and Applications XI.

1:00 pm: **Modeling of decision-making for Navy Command and Control System through extended mark flow graph and fuzzy logic**, Roger I. Valencia Reyes, Servicios Industriales de la Marina S.A. (Peru) and Univ. de Sao Paulo (Brazil); Paulo E. Miyagi, Escola Politecnica da Univ. de Sao Paulo (Brazil); Alvaro Talavera Lopez, Pontifícia Univ. Católica do Rio de Janeiro (Brazil). . . . . [7305-29]

1:20 pm: **Assured communications and combat resiliency: the relationship between effective national communications and combat efficiency**, Glenn O. Allgood, Teja Kuruganti, James Nutaro, Oak Ridge National Lab. (United States); Jay Saffold, Research Network Inc. (United States) . . . . . [7305-30]

1:40 pm: **An extreme-events laboratory to provide network-centric collaborative situation assessment and decision making**, Brian J. Panulla, Loretta D. More, Wade R. Shumaker, Michael D. Jones, Robert Hooper, Jeffrey M. Vernon, Stanley G. Aungst, The Pennsylvania State Univ. (United States). . . . . [7305-31]

2:00 pm: **Dynamically relayed wireless networks for disaster response**, Wenxuan Guo, Xinming Huang, Worcester Polytechnic Institute (United States). . . . . [7305-32]

2:20 pm: **A Department of Homeland Security program for countering explosives attacks at large public events and mass transit facilities**, Christa K. Knudson, Pacific Northwest National Lab. (United States); Michael C. Kemp, Iconal Technology Ltd. (United Kingdom); Nicholas J. Lombardo, Pacific Northwest National Lab. (United States). . . . . [7305-33]

2:40 pm: **Content-addressable environments for public safety**, Scott A. Valcourt, Pushpa Datla, Univ. of New Hampshire (United States) . . . . . [7305-34]

Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XV

Conference Chairs: **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; **James R. Irons,** NASA Goddard Space Flight Ctr.; **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 Velez-Reyes,** Univ. de Puerto Rico Mayagüez

Monday 13 April

SESSION 1

Room: Grand 4 . . . . . Mon. 8:30 to 10:10 am

Detection and Identification I

Session Chair: **Sylvia S. Shen,** The Aerospace Corp.

8:30 am: **Is there a best hyperspectral detection algorithm?** *(Invited Paper)*, Dimitris G. Manolakis, MIT Lincoln Lab. (United States); Ronald B. Lockwood, Thomas W. Cooley, Air Force Research Lab. (United States); John Jacobson, NASIC/DEKA (United States) . . . . . [7334-01]

9:10 am: **The affine matched filter**, Alan P. Schaum, Richard G. Priest, Naval Research Lab. (United States). . . . . [7334-02]

9:30 am: **A hyperspectral anomaly detector based on partialling out a background subspace**, Edisanter Lo, Susquehanna Univ. (United States); Alan P. Schaum, Naval Research Lab. (United States). . . . . [7334-03]

9:50 am: **Reduction of false alarms caused by background boundaries in real-time subspace RX anomaly detection**, Andrey V. Kanaev, Global Strategies Group (North America) Inc. (United States); Eric C. Allman, Jeremy J. Murray-Krezan, Naval Research Lab. (United States). . . . . [7334-04]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Grand 4 . . . . . Mon. 10:40 am to 12:20 pm

Spectral Data Analysis Methodologies I

Session Chair: **Paul E. Lewis,** National Geospatial-Intelligence Agency

10:40 am: **Mixed projection pursuit-based dimensionality reduction**, Haleh Safavi, Chein-I Chang, Univ. of Maryland, Baltimore County (United States). . . . . [7334-05]

11:00 am: **Hyperspectral band selection with similarity assessment**, He Yang, Qian Du, Mississippi State Univ. (United States) . . . . . [7334-06]

11:20 am: **A comparative study of lossless compression algorithms on multispectral imager data**, Michael D. Grossberg, Irina Gladkova, Srikanth Gottipati, City College/CUNY (United States) . . . . . [7334-07]

11:40 am: **VNIR hyperspectral background characterization methods in adverse weather conditions**, Joao M. Romano, U.S. Army Armament Research, Development and Engineering Ctr. (United States); Dalton S. Rosario, Army Research Lab. (United States); Luz Roth, U.S. Army Armament Research, Development and Engineering Ctr. (United States). . . . . [7334-08]

12:00 pm: **Tracking of vehicles across multiple radiance and reflectance hyperspectral datasets**, Emmett J. Ientilucci, Rochester Institute of Technology (United States); Stefania Matteoli, Univ. of Pisa (Italy); John P. Kerekes, Rochester Institute of Technology (United States) . . . . . [7334-09]

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

SESSION 3

Room: Grand 4 . . . . . Mon. 1:30 to 3:10 pm

Clustering and Classification

Session Chair: **Glenn E. Healey,** Univ. of California, Irvine

1:30 pm: **Rotation and scale invariant hyperspectral classification using 3D filters**, Glenn E. Healey, Tien Bau, Univ. of California, Irvine (United States). . . . . [7334-11]

1:50 pm: **Supervised soft classification of hyperspectral imagery using linear unmixing and fuzzy classifiers**, Wilma N. Pabon-Ramirez, Univ. del Turabo (United States); Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez (United States). . . . . [7334-12]

2:10 pm: **Spatial principle components analysis: application to flightline C1**, Melissa J. Rura, The Univ. of Texas at Dallas (United States) . . . . . [7334-13]

2:30 pm: **Denoising and segmentation of hyperspectral imagery using nonlocal operators**, Alexey Castrodad, John B. Greer, National Geospatial-Intelligence Agency (United States). . . . . [7334-14]

2:50 pm: **Unsupervised learning in hyperspectral classifiers using hidden Markov models**, Vikram Jayaram, The Univ. of Texas at El Paso (United States). . . . . [7334-15]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 4

Room: Grand 4 . . . . . Mon. 3:40 to 5:00 pm

Sensor Design and Performance Analysis

Session Chair: **Eustace L. Dereniak,** College of Optical Sciences, The Univ. of Arizona

3:40 pm: **Longwave multispectral diffractive optic imaging spectrometer**, David Kryskowski, Justin Renken, Ann Arbor Sensor Systems, LLC (United States). . . . . [7334-16]

4:00 pm: **Snapshot hyperspectral imaging: the hyperpixel array camera**, Andrew Bodkin, Bodkin Design & Engineering, LLC (United States); Andrew I. Sheinis, Univ. of Wisconsin, Madison (United States); Adam E. Norton, Norton Engineered Optics (United States); James Daly, Bodkin Design & Engineering, LLC (United States); Scott G. Beaven, Jeff Weinheimer, Space Computer Corp. (United States). . . . . [7334-17]

4:20 pm: **Multichannel imaging in remote sensing**, Jon S. Schoonmaker, Yuliya Podobna, Advanced Coherent Technologies LLC (United States) . . . . . [7334-18]

4:40 pm: **Sensor modeling and demonstration of a multi-object spectrometer for performance-driven sensing**, John P. Kerekes, Zoran Ninkov, Alan Raisanen, Kenny Fourspring, Michael Presnar, Jeff Patel, Robert MacIntyre, David R. Pogorzala, Scott D. Brown, Rochester Institute of Technology (United States); Juan R. Vasquez, Andrew C. Rice, Numerica Corp. (United States) . . . . [7334-19]

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 5

Room: Grand 4 . . . . . Tues. 10:20 am to 12:00 pm

Spectral Data Analysis Methodologies II

Session Chair: **Michael T. Eismann,** Air Force Research Lab.

10:20 am: **Hyperspectral anomaly detection using Sony's PlayStation 3**, Dalton S. Rosario, Army Research Lab. (United States); Joao M. Romano, U.S. Army Armament Research, Development and Engineering Ctr. (United States); Rene Sepulveda, Invoke LLC (United States) . . . . . [7334-20]

10:40 am: **Methods for multitemporal change detection in HSI**, Joseph Meola, Michael T. Eismann, Air Force Research Lab. (United States) . . . . . [7334-21]

11:00 am: **Persistent hyperspectral adaptive multi-modal feature-aided tracking**, Andrew C. Rice, Juan R. Vasquez, Numerica Corp. (United States); John P. Kerekes, Rochester Institute of Technology (United States); Michael J. Mendenhall, Air Force Institute of Technology (United States) . . . . . [7334-22]

11:20 am: **Fusion to enhance anomaly detection**, Rulon R. Mayer, Yiannis Antoniaddes, Mark M. Baumback, David Chester, Jonathan Edwards, Alon Goldstein, Daniel Haas, Samuel Henderson, BAE Systems (United States) . . . . . [7334-23]

11:40 am: **Interest point detection in hyperspectral imagery**, Leidy P. Dorado-Muñoz, Univ. de Puerto Rico Mayagüez (United States); Amit Mukherjee, Rensselaer Polytechnic Institute (United States); Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez (United States); Badrinath Roysam, Rensselaer Polytechnic Institute (United States) . . . . . [7334-24]

Lunch/Exhibition Break . . . . . 12:00 to 1:10 pm

SESSION 6

Room: Grand 4 . . . . . Tues. 1:10 to 3:10 pm

Modeling and Simulation

Session Chair: **Glenn E. Healey,** Univ. of California, Irvine

1:10 pm: **Simulation framework for spatio-spectral anomalous change detection**, James Theiler, Neal R. Harvey, Reid B. Porter, Brendt E. Wohlberg, Los Alamos National Lab. (United States) . . . . . [7334-25]

1:30 pm: **Hyperspectral texture synthesis by multiresolution pyramid decomposition**, Nestor Diaz, Vidya B. Manian, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7334-26]

1:50 pm: **Models for hyperspectral image synthesis and implications for algorithm evaluation**, Glenn E. Healey, Subhadip Sarkar, Univ. of California, Irvine (United States) . . . . . [7334-27]

2:10 pm: **VNIR/SWIR atmospheric database construction using high-dimensional spectral radiance models**, Glenn E. Healey, Univ. of California, Irvine (United States); Anthony J. Ratkowski, Air Force Research Lab. (United States) . . . . . [7334-28]

2:30 pm: **Impact of BRDF on physics-based modeling as applied to target detection in hyperspectral imagery**, Emmett J. Ientilucci, Michael G. Gartley, Rochester Institute of Technology (United States) . . . . . [7334-29]

2:50 pm: **WorldView-2 data simulation and analysis results**, Angela M. Puetz, Krista R. Lee, Michael J. Loomis, Richard C. Olsen, Naval Postgraduate School (United States) . . . . . [7334-30]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 7

Room: Grand 4 . . . . . Tues. 3:40 to 4:40 pm

Spectral Methodologies and Applications I

Session Chair: **Gail P. Anderson,** Air Force Research Lab.

3:40 pm: **Comparison of spectral matching techniques for vegetation species delineation of the National Arboretum**, Mark Z. Salvador, Logos Technologies, Inc. (United States) . . . . . [7334-31]

4:00 pm: **Hyperspectral signal-processing application in recognition, classification, and mapping of the aggressive plant species cattail**, Guoxiang Liu, Jeffery S. Allen, Clemson Univ. (United States); Gary Kleppel, Univ. at Albany (United States); Jeff Parkey, Craig E. Campbell, Clemson Univ. (United States); Kang Lu, Towson Univ. (United States) . . . . . [7334-32]

4:20 pm: **Algorithm for retrieving vegetative canopy and leaf/needle parameters from multi- and hyperspectral imagery,** Christoph C. Borel, Ball Aerospace & Technologies Corp. (United States) . . . . . [7334-33]

POSTERS-TUESDAY

Room: Palms Foyer . . . . . 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.

Investigating face recognition from hyperspectral data: the impact of feature extraction, Stefan A. Robila, Montclair State Univ. (United States); Andrew LaChance, Appalachian State Univ. (United States); Shawna Ruff, Gonzaga Univ. (United States) . . . . . [7334-34]

Study on the technique of distinguishing rock from coal based on statistical analysis of fast Fourier transform, Tao Gu, Li Xu, North China Institute of Science and Technology (China) . . . . . [7334-70]

Non-negative matrix factorization (NMF)-based linear spectral unmixing method, Jun He, Beijing Normal Univ. (China) . . . . . [7334-71]

Modified vertex component analysis (VCA) for end-member extraction from hyperspectral data, Jun He, Beijing Normal Univ. (China) . . . . . [7334-72]

HIBASE: hyperspectral band selection, Piet B. W. Schwering, Herman H. P. T. Bekman, Harm H. van Seijen, TNO Defense, Security and Safety (Netherlands) . . . . . [7334-73]

Visualization of hyperspectral images, Angel Gutierrez, Stefan A. Robila, Montclair State Univ. (United States); Mindy Schockling, Capital Univ. (United States); Roberto Bonce, California State Univ., Long Beach (United States) . . . . . [7334-74]

Multiscale, multivariate autoregressive detection for hyperspectral imagery, Lin He, South China Univ. of Technology (China); Wei Di, Purdue Univ. (United States); Yuanqing Li, South China Univ. of Technology (China) . . . . . [7334-75]

DSmT-based anomaly detection for hyperspectral imagery, Lin He, South China Univ. of Technology (China); Wei Di, Purdue Univ. (United States); Yuanqing Li, South China Univ. of Technology (China) . . . . . [7334-76]

Retrieval research on fog all time detection using FY2C multispectral imagery combined with automatic weather station data, Fan Yu, Lei Zhao, Qing Zhu, Nanjing Univ. (China) . . . . . [7334-77]

Effects of image restoration in classification and visual analysis of LANDSAT imagery over Puerto Rico, Elsie V. Morales-Irizarry, ITT Corp. (United States); Miguel Velez-Reyes, Univ. de Puerto Rico Mayagüez (United States) . . . [7334-78]

Wednesday 15 April

SESSION 8

Room: Grand 4 . . . . . Wed. 8:10 to 10:10 am

Spectral Data Analysis Methodologies III

Session Chair: **Gail P. Anderson,** Air Force Research Lab.

8:10 am: **Data reduction via segmentation for hyperspectral imagery**, Thomas R. Braun, National Geospatial-Intelligence Agency (United States) and North Carolina State Univ. (United States) . . . . . [7334-79]

8:30 am: **Cloud effects in hyperspectral imagery from first-principles scene simulations**, Steven M. Adler-Golden, David C. Robertson, Steven C. Richtsmeier, Spectral Sciences, Inc. (United States); Anthony J. Ratkowski, Air Force Research Lab. (United States) . . . . . [7334-35]

8:50 am: **MODTRAN®5 analysis of co-located space- and ground-based infrared atmospheric measurements: AERI, AIRS, CERES, MODIS**, Paul E. Lewis, National Geospatial-Intelligence Agency (United States); Gail P. Anderson, Air Force Research Lab. (United States); Sylvia S. Shen, The Aerospace Corp. (United States); James H. Chetwynd, Jr., Air Force Research Lab. (United States); Miguel Roman III, Crystal L. Barker Schaaf, Boston Univ. (United States); David D. Turner, Univ. of Wisconsin, Madison (United States); Alexander Berk, Spectral Sciences, Inc. (United States); David A. Rutan, Science Systems and Applications, Inc. (United States); David P. Miller, Northrop Grumman Information Technology-TASC (United States); Robert T. Kroutil, Los Alamos National Lab. (United States). . . . . [7334-36]

9:10 am: **Dynamic thresholding for hyperspectral shadow detection using Levenberg-Marquardt minimization on multiple Gaussian illumination distributions**, Brian D. Wemett, Jonathan K. Riek, VirtualScopics, Inc. (United States); Robert A. Leathers, Naval Research Lab. (United States) . . . . . [7334-37]

9:30 am: **Experimental determination of bi-directional reflectance distribution at the LSpec vicarious calibration site**, Harry N. Gross, Integrity Applications, Inc. (United States); Stanley L. Green, S. L. Green Consulting (United States). . . . . [7334-38]

9:50 am: **Atmospheric transmittance and radiance modeling based-hyperspectral sensor calibration**, Xiaofeng Zhao, Jonathan K. Riek, VirtualScopics, Inc. (United States); Robert A. Leathers, Naval Research Lab. (United States). . . . . [7334-39]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 9

Room: Grand 4 . . . . . Wed. 10:40 am to 12:20 pm

Sensor Calibration and Performance Analysis

Session Chair: **Paul E. Lewis,** National Geospatial-Intelligence Agency

10:40 am: **Hyperspectral image compressive projection algorithm**, Joseph P. Rice, David W. Allen, Jorge E. Neira, National Institute of Standards and Technology (United States) . . . . . [7334-40]

11:00 am: **Hyperspectral projection of a coral reef scene using the NIST hyperspectral image projector**, David W. Allen, Joseph P. Rice, National Institute of Standards and Technology (United States); James A. Goodman, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7334-41]

11:20 am: **Comparative and quantitative assessment of hyperspectral sensor calibration**, Darryl G. Wilson, Consultant (United States); Wayne A. Hallada, National Geospatial-Intelligence Agency (United States) . . . . . [7334-42]

11:40 am: **Estimation of low-resolution visible spectra from RGB imagery**, Harvey C. Schau, Meridian Systems LLC (United States) . . . . . [7334-43]

12:00 pm: **Sensor-informed representation of hyperspectral images**, Torbjorn Skauli, Norwegian Defense Research Establishment (Norway) . . . . . [7334-44]

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

SESSION 10

Room: Grand 4 . . . . . Wed. 1:30 to 3:30 pm

Image Registration and Data Fusion

Session Chair: **Miguel Velez-Reyes,** Univ. de Puerto Rico Mayagüez

1:30 pm: **Geolocation and image registration for day and night time multispectral imagery**, Beato Cheng, Goodrich Corp. (United States). . [7334-45]

1:50 pm: **Automated road extraction using multi-image modalities**, Peter J. Doucette, ITT Corp. (United States); Jacek Grodecki, Richard Clelland, GeoEye, Inc. (United States); Andrew Hsu, ITT Corp. (United States) . . . . . [7334-46]

2:10 pm: **Kernel-based joint fusion/detection of anomalies using hyperspectral and SAR imagery**, Nasser M. Nasrabadi, Army Research Lab. (United States). . . . . [7334-47]

2:30 pm: **Hyperspectral imagery and LiDAR for geological analysis of Cuprite, Nevada**, Michael S. West, The MITRE Corp. (United States); Ronald G. Resmini, National Geospatial-Intelligence Agency (United States) . . . . . [7334-48]

2:50 pm: **Multispectral iris fusion for enhancement, interoperability, and cross-spectrum matching**, Mark Burge, Matthew Monaco, Noblis, Inc. (United States). . . . . [7334-49]

3:10 pm: **A variational approach to hyperspectral image fusion**, Michael Moeller, Todd Wittman, Andrea Bertozzi, Univ. of California, Los Angeles (United States). . . . . [7334-50]

Coffee Break . . . . . 3:30 to 4:00 pm

SESSION 11

Room: Grand 4 . . . . . Wed. 4:00 to 5:20 pm

Spectral Methodologies and Applications II

Session Chair: **Sylvia S. Shen,** The Aerospace Corp.

4:00 pm: **Updating road feature vector data accuracy with images**, Peter J. Doucette, ITT Corp. (United States); Boris Kovalerchuk, Michael Kovalerchuk, BKF Systems (United States); Robert Brigantic, Pacific Northwest National Lab. (United States). . . . . [7334-51]

4:20 pm: **Directional filtering and classification techniques for dust storm detection in NOAA-AVHRR imagery**, Swapna Janugani, Vikram Jayaram, Sergio D. Cabrera, Jose G. Rosiles, Thomas E. Gill, Nancy I. Rivera, The Univ. of Texas at El Paso (United States) . . . . . [7334-52]

4:40 pm: **Sea surface temperature algorithm with transmittance and wind speed dependent**, Chow Jeng Wong, Hou Guan Ng, Mohd Zubir Mat Jafri, Abdullah Khiruddin, Hwee San Lim, Univ. Sains Malaysia (Malaysia) . . . [7334-53]

5:00 pm: **Determination of aerosol concentration using a digital SLR camera**, Chow Jeng Wong, Univ. Sains Malaysia (Malaysia) . . . . . [7334-54]

Thursday 16 April

SESSION 12

Room: Grand 4 . . . . . Thurs. 8:30 to 10:10 am

Hyperspectral Data Dimensionality and Spectral Unmixing

Session Chair: **Miguel Velez-Reyes,** Univ. de Puerto Rico Mayagüez

8:30 am: **Does virtual dimensionality work in hyperspectral images?**, Peter Bajorski, Rochester Institute of Technology (United States). . . . . [7334-55]

8:50 am: **Effect of manmade pixels on the inherent dimension of natural material distributions**, Ariel A. Schlamm, David W. Messinger, William F. Basener, Rochester Institute of Technology (United States) . . . . . [7334-56]

9:10 am: **Causal pixel purity index**, Chao-Cheng Wu, Chein-I Chang, Univ. of Maryland, Baltimore County (United States). . . . . [7334-57]

9:30 am: **L1 unmixing and its application to hyperspectral image enhancement**, Zhaohui Guo, Todd Wittman, Stanley J. Osher, Univ. of California, Los Angeles (United States) . . . . . [7334-58]

9:50 am: **A comparison of unmixing algorithms for hyperspectral imagery**, Andrea Santos-Garcia, Miguel Velez-Reyes, Samuel Rosario-Torres, Jesus D. Chinea, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7334-59]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 13

Room: Grand 4 . . . . . Thurs. 10:40 am to 12:20 pm

Spectral Data Analysis Methodologies IV

Session Chair: **Paul E. Lewis,** National Geospatial-Intelligence Agency

10:40 am: **Topological anomaly detection performance with multispectral polarimetric imagery**, Michael G. Gartley, William F. Basener, Rochester Institute of Technology (United States) . . . . . [7334-60]

11:00 am: **Anomaly grouping in TAD algorithm**, Tim Doster, Rochester Institute of Technology (United States) . . . . . [7334-61]

11:20 am: **Enhanced detection and visualization of anomalies in spectral imagery**, William F. Basener, David W. Messinger, Rochester Institute of Technology (United States) . . . . . [7334-62]

11:40 am: **Accelerating hyperspectral manifold learning using graphical processing units**, Santiago Velasco-Forero, Vidya B. Manian, Univ. de Puerto Rico Mayagüez (United States) . . . . . [7334-63]

12:00 pm: **A tool for the nonparametric characterization of the geometry of spectra in hyperspace**, Ronald G. Resmini, National Geospatial-Intelligence Agency (United States) . . . . . [7334-64]

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

SESSION 14

Room: Grand 4 . . . . . Thurs. 1:30 to 3:10 pm

Detection and Identification II

Session Chair: **Sylvia S. Shen,** The Aerospace Corp.

1:30 pm: **A Bayesian approach to identification of gaseous effluents in passive LWIR imagery**, Shawn D. Higbee, Air Force Research Lab. (United States) and Rochester Institute of Technology (United States); David W. Messinger, Yolande Tra, Joseph G. Voelkel, Rochester Institute of Technology (United States); Lawrence K. Chilton, Pacific Northwest National Lab. (United States) . . . . . [7334-65]

1:50 pm: **Combined temporal-differencing with temporal-spectral based detection in longwave infrared hyperspectral imagery**, Daniel C. Heinz, Charles E. Davidson, Science and Technology Corp. (United States); Avishai Ben-David, U.S. Army Edgewood Chemical Biological Ctr. (United States) . . [7334-66]

2:10 pm: **Application of the wavelet packet subspace to reflective hyperspectral imagery**, Mark Z. Salvador, Logos Technologies, Inc. (United States) . . . . . [7334-67]

2:30 pm: **A comparative study of target detection algorithms for hyperspectral imagery**, Xiaoying Jin, Scott Paswaters, Harold J. Cline, ITT Visual Information Solutions (United States) . . . . . [7334-68]

2:50 pm: **Target detection in hyperspectral images: a comparative study of algorithms**, Kailash C. Tiwari, Manoj K. Arora, Dharmendra P. Singh, Indian Institute of Technology Roorkee (India) . . . . . [7334-69]

Monday-Tuesday 13-14 April 2009 • Proceedings of SPIE Vol. 7335

Automatic Target Recognition XIX

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, Information Fusion Technologies; **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; **Behzad 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 Ali 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.

Monday 13 April

SESSION 1

Room: Grand 2 . . . . . Mon. 8:30 to 10:30 am

Advanced Concepts/Algorithms in ATR I

Session Chair: **Alan J. Van Nevel,** Naval Air Warfare Ctr.

8:30 am: **Urban reasoning and geospatial exploitation technology (URGENT)** *(Keynote Presentation)*, Todd Hughes, Defense Advanced Research Projects Agency (United States) . . . . . [7335-01]

9:10 am: **High-speed automatic target recognition based on anisotropic diffusion and discrete cosine transform**, Gokhan Korkusuz, Roketsan Missiles Industries Inc. (Turkey) . . . . . [7335-02]

9:30 am: **Cellular automata enabling novel fast shape recognition for Muon tomography**, Holger M. Jaenisch, Licht Strahl Engineering Inc. (United States) and Alabama A&M Univ. (United States); James W. Handley, Licht Strahl Engineering Inc. (United States) . . . . . [7335-03]

9:50 am: **Moment invariants for quasi-distributions**, Leon Cohen, Hunter College/CUNY (United States) . . . . . [7335-05]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Grand 2 . . . . . Mon. 10:40 am to 12:10 pm

Advanced Concepts/Algorithms in ATR II

Session Chair: **Alan J. Van Nevel,** Naval Air Warfare Ctr.

10:40 am: **Contextual object understanding through geospatial analysis and reasoning (COUGAR)** *(Invited Paper)*, Joel Douglas, Matthew Antone, James M. Coggins, Bradley J. Rhodes, Erik C. Sobel, BAE Systems (United States); Frank Stolle, Univ. of Massachusetts Amherst (United States); Lori Vinciguerra, Majid Zandipour, Yu Zhong, BAE Systems (United States) . . . . . [7335-06]

11:10 am: **Moments of a wave propagating with dispersion and damping**, Patrick J. Loughlin, Univ. of Pittsburgh (United States) . . . . . [7335-07]

11:30 am: **Comparison of kernel-based PDF estimation methods**, David E. Freund, Philippe Burlina, Amit Banerjee, Erik Justen, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7335-08]

11:50 am: **Automatic building identification under bomb damage conditions**, Robert Woodley, Joseph W. Barker, Warren Noll, 21st Century Systems, Inc. (United States); Donald C. Wunsch II, Missouri Univ. of Science and Technology (United States) . . . . . [7335-09]

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

SESSION 3

Room: Grand 2 . . . . . Mon. 1:30 to 4:30 pm

Multi- and Hyperspectral Processing in ATR

Session Chair: **Nasser M. Nasrabadi,** Army Research Lab.

1:30 pm: **3D multiview passive sensing and visualization using randomly distributed sensors** *(Keynote Presentation)*, Bahram Javidi, Mehdi DaneshPanah, Univ. of Connecticut (United States) . . . . . [7335-10]

2:10 pm: **Wavelet-based hyperspectral target detection using spectral fringe-adjusted joint transform correlation**, Wesam A. Sakla, Texas A&M Univ. (United States); Adel A. Sakla, Mohammad S. Alam, Univ. of South Alabama (United States) . . . . . [7335-11]

2:30 pm: **Application of the SVDD to target detection in hyperspectral imagery**, Wesam A. Sakla, Andrew K. Chan, Texas A&M Univ. (United States); Adel A. Sakla, Univ. of South Alabama (United States) . . . . . [7335-12]

2:50 pm: **A general purpose adaptive approach to image classification, automatic target detection, and recognition for multispectral imagery**, Beato Cheng, Goodrich Corp. (United States) . . . . . [7335-13]

3:10 pm: **An interactive graphical performance analysis tool for hyperspectral exploitation evaluations**, Karmon M. Vongsy, Jason Kaufman, Jacobs Engineering (United States); Philip M. Hanna, Air Force Research Lab. (United States) . . . . . [7335-14]

Coffee Break . . . . . 3:30 to 3:50 pm

3:50 pm: **Hyperspectral target detection in noisy environment using wavelet filter and correlation-based detector**, Erol Sarigul, Alcorn State Univ. (United States); Mohammad S. Alam, Univ. of South Alabama (United States) . . [7335-15]

4:10 pm: **Multilook fusion identification: a paradiym shift from quality to quantity in data samples**, Silvester K. Wong, Defence Research and Development Canada (Canada) . . . . . [7335-16]

SESSION 4

Room: Grand 2 . . . . . Mon. 4:30 to 6:00 pm

Radar Processing for ATR

Session Chair: **Leon Cohen,** Hunter College/CUNY

4:30 pm: **Probing waveform synthesis and receive filter design for active sensing systems** *(Invited Paper)*, Xing Tan, Hao He, William L. Roberts, Duc Vu, Jian Li, Univ. of Florida (United States); Petre Stoica, Uppsala Univ. (Sweden) . . . . . [7335-17]

5:00 pm: **On the equivalence of the generalized likelihood ratio test and backprojection method in synthetic aperture imaging**, Kaitlyn Voccola, Birsen Yazici, Margaret Cheney, Rensselaer Polytechnic Institute (United States); Matthew Ferrara, Air Force Research Lab. (United States) . . . . . [7335-18]

5:20 pm: **A joint position/wave-number distribution approach to scattering and clutter**, Leon Cohen, Hunter College/CUNY (United States) . . . . . [7335-19]

5:40 pm: **On the airworthiness approval of a SAR ATR system**, Dieter N. Willersinn, Uwe E. Jaeger, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany); Herbert Schlatt, Christoph Stahl, EADS Deutschland GmbH (Germany) . . . . . [7335-20]

Tuesday 14 April

SESSION 5

Room: Grand 2 . . . . . .Tues. 8:00 to 8:40 am

Performance Evaluation Issues in ATR I

Session Chair: **Mahmood R. Azimi-Sadjadi,** Colorado State Univ.

8:00 am: **Image quality and performance modeling for automated target detection**, John M. Irvine, Eric Nelson, Draper Labs. (United States) . . . [7335-21]

8:20 am: **Performance of using superresolution reconstruction for point target, Judith Dijk, TNO Defense, Security and Safety** (Netherlands); Adam W. M. van Eekeren, Klamer Schutte, Dirk-Jan J. de Lange, TNO Defence, Security and Safety (Netherlands); Lucas J. van Vliet, Delft Univ. of Technology (Netherlands) . . . . . [7335-23]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 6

Room: Grand 2 . . . . . .Tues. 10:30 to 11:30 am

Performance Evaluation Issues in ATR II

Session Chair: **Mahmood Azimi-Sadjdadi,** Colorado State Univ.

10:30 am: **Error estimation procedure for large dimensionality data with small sizes**, Arnold Willaims, Gregory M. Wagner, Raytheon Missile Systems (United States) . . . . . [7335-24]

10:50 am: **Determining training data requirements for template-based normalized cross correlation**, Peter Knee, Raytheon Missile Systems (United States) . . . . . [7335-25]

11:10 am: **Automated rapid training of ATR algorithms**, Jonah C. McBride, Jessica Lowell, Magnus S. Snorrason, Charles River Analytics, Inc. (United States); John M. Irvine, Draper Labs. (United States); Ross S. Eaton, General Dynamics Robotic Systems (United States); Jonathan Mills, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (United States) . . . . . [7335-22]

SESSION 7

Room: Grand 2 . . . . . Tues. 11:30 am to 12:40 pm

Advanced Concepts/Algorithms in ATR III

Session Chair: **Abhijit Mahalanobis,** Lockheed Martin Missiles and Fire Control

11:30 am: **Uncertain geometry: a new approach to modeling for recognition** *(Invited Paper)*, Joseph L. Mundy, Ozge C. Ozcanli-Ozbay, Brown Univ. (United States) . . . . . [7335-26]

12:00 pm: **Using video for multiview object categorization in security systems**, Humera Noor Minhas, Shahid H. Mirza, NED Univ. of Engineering and Technology (Pakistan); Shaheena Noor, Sir Syed Univ. of Engineering & Technology (Pakistan) . . . . . [7335-27]

12:20 pm: **A multiframe 2D-to-3D video georegistration algorithm**, Scott A. Merritt, Naval Air Warfare Ctr. (United States) . . . . . [7335-28]

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

SESSION 8

Room: Grand 2 . . . . . .Tues. 1:40 to 2:20 pm

Advanced Concepts/Algorithms in ATR IV

Session Chair: **Abhijit Mahalanobis,** Lockheed Martin Missiles and Fire Control

1:40 pm: **Automatic tracking system with target classification**, Jik-Han Jung, Won-Chul Choi, Dong-Jo Park, Korea Advanced Institute of Science and Technology (Korea, Republic of); Byung-In Choi, Samsung Thales Co., Ltd. (Korea, Republic of) . . . . . [7335-29]

2:00 pm: **Tracking targets in multiplexed imagery**, Robert R. Muise, Lockheed Martin Missiles and Fire Control (United States) . . . . . [7335-30]

SESSION 9

Room: Grand 2 . . . . . .Tues. 2:20 to 3:40 pm

Advanced Concepts/Algorithms in ATR V

Session Chair: **Izidor Gertner,** City College/CUNY

2:20 pm: **Component-based target recognition inspired by human vision**, Yufeng Zheng, Kwabena Agyepong, Alcorn State Univ. (United States) . . . . . [7335-31]

2:40 pm: **Discrimination of classes of ships for aided recognition in a coastal environment**, Sebastiaan P. van den Broek, Henri Bouma, Marianne A. C. Degache, Gertjan Brughouts, TNO Defence, Security and Safety (Netherlands) . . . . . [7335-32]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Incremental learning in automatic target recognition**, Chaitanya Raju, Karthik Mahesh Varadarajan, Aditya Kothari, Jacob Yadegar, UtopiaCompression Corp. (United States); Jonathan Mills, U.S. Army Aviation and Missile Command (United States) . . . . . [7335-33]

3:50 pm: **Gauge features for curvilinear target identification**, James M. Coggins, BAE Systems (United States) . . . . . [7335-34]

AWARD PRESENTATION

Room: Grand 2 . . . . . 4:10 to 4:20 pm

The 2008-2009 Best Paper Awards for the Automatic Target Recognition (ATR) conference will be presented by Ray O. Johnson, the 2009 DSS Symposium Chair from Lockheed Martin Corp.

Best Paper Award 2008

Active and passive 3D image sensing and visualization . . . . . [6967-13]
Authors are **Paul F. McManamon,** Air Force Research Lab.; **Bahram Javidi,** Univ. of Connecticut; **Edward A. Watson,** Air Force Research Lab.; **Mehdi M. Daneshpanah,** Univ. of Connecticut

Best Student Paper Award 2008

Clutter performance and confuser rejection on infrared data using distortion-invariant filters for ATR . . . . . [6967-04]

Student Author is **Rohit Patniak,** Carnegie Mellon Univ.; Coauthor is **David P. Casasent,** also at Carnegie Mellon Univ.

The 2009 Award Winners will also be announced and presented at this time.

Awards sponsored by

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SESSION 10

Room: Grand 2 . . . . . .Tues. 4:20 to 6:40 pm

Polarimetric and Infrared Processing for ATR

Session Chair: **Firooz A. Sadjadi,** Lockheed Martin Maritime Systems & Sensors

4:20 pm: **Polarimetric calibration and its influence on target recognition performance**, Hartmut M. Schimpf, FGAN-FHR (Germany) . . . . . [7335-35]

4:40 pm: **Estimation and detection with active degree of polarization imaging systems**, Arnaud Bénière, François Goudail, Institut d'Optique (France); Mehdi Alouini, Daniel Dolfi, Thales Research & Technology (France) . . . . . [7335-36]

5:00 pm: **Polarization-aided multiple target tracking in infrared systems**, Cornell S. L. Chun, Physics Innovations Inc. (United States) . . . . . [7335-37]

5:20 pm: **A presentation of ATR processing chain validation procedure of IR terminal guidance version of the AASM modular air-to-ground weapon**, Daniel Duclos, Nicolas Quinquis, Gregory Broda, Farid Oudyi, François Galmiche, Nicolas Coulon, Didier Cordier, Christophe Sonier, Sagem Defense Securite (France) . . . . . [7335-38]

5:40 pm: **Development of the demeaning filter for detection of a small object in IR images**, Hwal-Suk Lee, Seok-Kon Kim, Jehee Lee, Dong-Jo Park, Korea Advanced Institute of Science and Technology (Korea, Republic of) . . . . [7335-39]

6:00 pm: **Robust automatic target tracking based on a Bayesian ego-motion compensation framework for airborne FLIR imagery**, Carlos R. del Blanco, Fernando F. Jaureguizar, Narciso García, Luis L. Salgado, Univ. Politécnica de Madrid (Spain) . . . . . [7335-40]

6:20 pm: **Tracking of multiple objects under partial occlusion**, Dapeng O. Wu, Univ. of Florida (United States) . . . . . [7335-41]

Signal Processing, Sensor Fusion, and Target Recognition XVIII

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

Program Committee: **Mark G. Alford,** Air Force Research Lab.; **William D. Blair,** Georgia Tech Research Institute; **Erik P. Blasch,** Air Force Research Lab.; **Mark J. Carlotto,** General Dynamics Advanced Information Systems; **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,** Consultant; **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 II,** MITRE Corp.; **James Llinas,** Univ. at Buffalo; **Ronald P. Mahler,** Lockheed Martin Corp.; **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 Demokritos (Greece); **Wiley E. Thompson,** New Mexico State Univ.; **Pierre Valin,** Defence R&D Canada, Valcartier (Canada)

Monday 13 April

SESSION 1

Room: Grand 3 . . . . . Mon. 8:10 to 10:10 am

Multisensor Fusion, Multitarget Tracking, and Resource Management I

Session Chairs: **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Thiagalingam Kirubarajan,** McMaster Univ. (Canada)

8:10 am: **Gradient estimation for particle flow induced by log homotopy for nonlinear filters**, Frederick E. Daum, A. J. Noushin, Raytheon Co. (United States). . . . . [7336-01]

8:30 am: **Nonlinear filters with particle flow induced by log homotopy**, Frederick E. Daum, Jim Huang, Raytheon Co. (United States). . . . . [7336-02]

8:50 am: **Improved target tracking using kinematic measurements and orientation estimates**, Sivagnanam Sutharsan, McMaster Univ. (Canada) and Defence Research and Development Canada (Canada) and General Dynamics Canada Ltd. (Canada); Mike McDonald, Defence Research and Development Canada (Canada); Tom Lang, General Dynamics Canada Ltd. (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada). . . . . [7336-03]

9:10 am: **Effects of measurement unobservability on neural extended Kalman filter tracking**, Stephen C. Stubberud, Rockwell Collins, Inc. (United States); Kathleen A. Kramer, Univ. of San Diego (United States). . . . . [7336-04]

9:30 am: **Post-update compensation (PUC) with maneuver indicator**, Chun Yang, Sigtem Technology, Inc. (United States); Erik P. Blasch, Air Force Research Lab. (United States); Ivan Kadar, Interlink Systems Sciences, Inc. (United States). . . . . [7336-05]

9:50 am: **Generating reliable quality of information (QoI) metrics for target tracking**, Chung-Huat J. Tan, Imperial College London (United Kingdom) and DSO National Labs. (Singapore); Duncan F. Gillies, Imperial College London (United Kingdom). . . . . [7336-07]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Grand 3 . . . . . Mon. 10:40 am to 12:20 pm

Multisensor Fusion, Multitarget Tracking, and Resource Management II

Session Chairs: **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Kenneth J. Hintz,** George Mason Univ.

10:40 am: **A model for graceful degradation of tracking systems**, Trond Jorgensen, James R. McCombs, SPARTA, Inc. (United States) . . . . . [7336-08]

11:00 am: **An automated metrics assessment system for track fusion**, Claire L. McCullough, The Univ. of Tennessee at Chattanooga (United States); William J. Farrell III, Adaptive Methods (United States); Robert Canavan, The Univ. of Tennessee at Chattanooga (United States). . . . . [7336-09]

11:20 am: **Adaptive sensing for target tracking in covert operations**, Patricia R. Barbosa, Colorado State Univ. (United States) and Intermap Technologies Inc. (United States); Edwin K. P. Chong, Colorado State Univ. (United States). . . . . [7336-10]

11:40 am: **A dynamic path planning algorithm for UAV tracking**, Kuo-Chu Chang, Hongda Chen, George Mason Univ. (United States); Craig Agate, Toyon Research Corp. (United States). . . . . [7336-11]

12:00 pm: **Adaptive filtering for single-target tracking**, Maria Scalzo, Mark G. Alford, Adnan Bubalo, Eric C. Jones, Gregory Horvath, Air Force Research Lab. (United States); Pramod K. Varshney, Ruixin Niu, Syracuse Univ. (United States). . . . . [7336-12]

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

SESSION 3

Room: Grand 3 . . . . . Mon. 1:30 to 2:50 pm

Multisensor Fusion Methodologies and Applications I

Session Chair: **Ronald P. Mahler,** Lockheed Martin Corp.

1:30 pm: **The multisensor PHD filter part II: erroneous solution via 'Poisson magic'**, Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States). . . . . [7336-13]

1:50 pm: **The multisensor PHD filter part I: general solution via multitarget calculus**, Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States). . . . . [7336-14]

2:10 pm: **Maneuvering target tracking using probability hypothesis density smoothing**, Nandakumaran Nadarajah, Thiagalingam Kirubarajan, McMaster Univ. (Canada). . . . . [7336-15]

2:30 pm: **Joint target detection and tracking smoothers**, Daniel E. Clark, Heriot-Watt Univ. (United Kingdom) . . . . . [7336-16]

Coffee Break . . . . . 2:50 to 3:20 pm

SESSION 4

Room: Grand 3 . . . . . Mon. 3:20 to 5:40 pm

Multisensor Fusion Methodologies and Applications II

Session Chair: **Ronald P. Mahler,** Lockheed Martin Corp.

3:20 pm: **Sensor management of space-based multiplatform EO/IR sensors for tracking geosynchronous satellites**, Adel I. El-Fallah, Aleksandar Zatezalo, Scientific Systems Co., Inc. (United States); Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States); Raman K. Mehra, Scientific Systems Co., Inc. (United States); James H. Brown, Air Force Research Lab. (United States). . . . . [7336-17]

3:40 pm: **Tracking low Earth-orbit objects using dispersed and disparate sensors**, Aleksandar Zatezalo, Adel I. El-Fallah, Scientific Systems Co., Inc. (United States); Ronald P. Mahler, Lockheed Martin Maritime Systems & Sensors (United States); Raman K. Mehra, Scientific Systems Co., Inc. (United States); James H. Brown, Air Force Research Lab. (United States) . . . . . [7336-18]

4:00 pm: **First-principles mapping of fusion applications into the JDL model**, Richard T. Antony, SAIC (United States); Joseph A. Karakowski, U.S. Army (United States). . . . . [7336-19]

4:20 pm: **Bounds on the ROC curves from fused correlated ATR systems**, Christine M. Schubert, Virginia Commonwealth Univ. (United States); Mark E. Oxley, Kenneth W. Bauer, Jr., Air Force Institute of Technology (United States). . . . . [7336-21]

4:40 pm: **ROC manifolds of multiple fused independent ATR systems**, Mark E. Oxley, Air Force Institute of Technology (United States); Christine M. Schubert, Virginia Commonwealth Univ. (United States); Steven N. Thorsen, Air Force Institute of Technology (United States) . . . . . [7336-22]

5:00 pm: **Receding horizon controller using particle swarm optimization for closed-loop ground target surveillance and tracking**, Andrew J. Newman, Sean R. Martin, Jonathan T. DeSena, Jesse C. Clarke, Jeromy W. McDerment, Walter O. Preissler, Cameron K. Peterson, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7336-23]

5:20 pm: **Tracking targets moving in random forests,** Michael A. Kouritzin, Dandan Luo, Biao Wu, Fraser Newton, Univ. of Alberta (Canada) . . . . . [7336-24]

INVITED PANEL DISCUSSION ON
Room: Grand Ballroom 3 . . . . . .Mon. 7:15 to 9:45 pm

Issues and Challenges in:

(1) Robust Methods in Tracking, Fusion, and Decision Making, and

(2) Sensor Bias Estimation and Data Fusion with Applications to Real-World Problems

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

Moderators: **Ivan Kadar,** Interlink Systems Sciences, Inc., and **Frederick E. Daum,** Raytheon Co.

Panelists: **Dale Blair,** GTRI; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Frederick E. Daum,** Raytheon Co.; **Ivan Kadar,** Interlink Systems Sciences, Inc.; **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **Ronald P. Mahler,** Lockheed Martin Tactical Systems

Tuesday 14 April

SESSION 5

Room: Grand 3 . . . . . .Tues. 8:00 to 9:00 am

Multisensor Fusion Methodologies and Applications III

Session Chairs: **Martin E. Liggins II,** MITRE Corp.; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Michael L. Hinman,** Air Force Research Lab.

8:00 am: **Performance analysis of structured pedigree distributed fusion systems**, Pablo O. Arambel, BAE Systems (United States) . . . . . [7336-25]

8:20 am: **An epidemic model for data fusion/dissemination in wireless sensor networks,** Kuo-Chu Chang, Shensheng Tang, George Mason Univ. (United States) . . . . . [7336-26]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 6

Room: Grand 3 . . . . . .Tues. 10:30 to 11:30 am

Multisensor Fusion Methodologies and Applications IV

Session Chairs: **Michael L. Hinman,** Air Force Research Lab.; **Martin E. Liggins II,** MITRE Corp.; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies

10:30 am: **An AOA-based optimal sensor locations self-adjusting with moving targets location estimation**, Jiecai Luo, Southern Univ. (United States) . . . . . [7336-28]

10:50 am: **A near-optimal low-complexity sensor fusion technique for accurate localization based on ultrasound time of arrival measurements from low-quality sensors**, Stelios A. Mitilineos, Nick D. Argyreas, Stelios C. A. Thomopoulos, National Ctr. for Scientific Research Demokritos (Greece) . . . . . [7336-29]

11:10 am: **Analysis of sniper localization for mobile asynchronous sensors**, Gene T. Whipps, Lance M. Kaplan, Thyagaraju Damarla, Army Research Lab. (United States) . . . . . [7336-30]

Lunch/Exhibition Break . . . . . 11:30 am to 1:00 pm

SESSION 7

Room: Grand 3 . . . . . .Tues. 1:00 to 2:20 pm

Multisensor Fusion Methodologies and Applications V

Session Chairs: **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Martin E. Liggins II,** MITRE Corp.; **Michael L. Hinman,** Air Force Research Lab.

1:00 pm: **A risk-based comparison of classification systems**, Steven N. Thorsen, Seth B. Wagenman, U.S. Air Force (United States); Mark E. Oxley, Air Force Institute of Technology (United States) . . . . . [7336-31]

1:20 pm: **The effects of correlation on the performance of ATR systems**, Christine M. Schubert, Virginia Commonwealth Univ. (United States); Steven N. Thorsen, Mark E. Oxley, Air Force Institute of Technology (United States) . . . . . [7336-32]

1:40 pm: **The exact fundamental solution for the Benes tracking problem**, Bhashyam Balaji, Defence Research and Development Canada (Canada) . . . . . [7336-33]

2:00 pm: **Efficient target tracking using adaptive grid and sparse tensors**, Bhashyam Balaji, Defence Research and Development Canada (Canada) . . . . . [7336-34]

SESSION 8

Room: Grand 3 . . . . . .Tues. 2:20 to 4:30 pm

Multisensor Fusion Methodologies and Applications VI

Session Chairs: **Martin E. Liggins II,** MITRE Corp.; **Chee-Yee Chong,** BAE Systems Advanced Information Technologies; **Michael L. Hinman,** Air Force Research Lab.

2:20 pm: **A continuous motion object recognition methodology for the assessment of multispectral fusion algorithms**, Alexander Toet, TNO Defense, Security and Safety (Netherlands); Alan R. Pinkus, Air Force Research Lab. (United States) . . . . . [7336-35]

2:40 pm: **Performance metrics for multisensor image fusion in target detection and tracking**, Xiaokun Li, Genshe Chen, DCM Research Resources, LLC (United States); Erik P. Blasch, Jim Patrick, Air Force Research Lab. (United States); Chun Yang, Sigtem Technology, Inc. (United States) . . . . . [7336-36]

3:00 pm: **Fusion of multisensory saliency maps for automated perception and control**, David J. Huber, Deepak Khosla, Paul A. Dow, HRL Labs., LLC (United States) . . . . . [7336-37]

Coffee Break . . . . . 3:20 to 3:50 pm

3:50 pm: **A general image fusion framework for concealed weapon detection**, Hongmei Deng, Roger Xu, Intelligent Automation, Inc. (United States); Rick S. Blum, Lehigh Univ. (United States) . . . . . [7336-39]

4:10 pm: **Radar-lidar multisensor array for highly reliable detection of humans based on behavior analysis,** Heinrich Ruser, Vladislav Pavlov, Christian Kargel, Univ. der Bundeswehr München (Germany) . . . . . [7336-38]

POSTERS-TUESDAY

Room: Palms Foyer . . . . . 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.

Localization using scale invariant feature transform in infrared image sequences, Changhan Park, Samsung Advanced Institute of Technology (Korea, Republic of) . . . . . [7336-61]

Supervised learning approaches for the detection of diabetic type II, Yugowati Praharsi, Harold Szu, Shaou-Gang Miaou, Chung Yuan Christian Univ. (Taiwan) . . . . . [7336-62]

Target detection for SAR imagery combining adaptive despeckling, region-based segmetation, and shape matching, Sang Hoon Lee, Kyungwon Univ. (Korea, Republic of) . . . . . [7336-63]

Multispectral air pollution sensor to characterize of total suspended particulates (TSP) concentration, Chow Jeng Wong, Univ. Sains Malaysia (Malaysia) . . . . . [7336-65]

Temporal and spatial air quality monitoring using internet protocol camera and ALOS satellite image, Chow Jeng Wong, Univ. Sains Malaysia (Malaysia) . . . . . [7336-66]

Wednesday 15 April

SESSION 9

Room: Grand 3 . . . . . 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.

8:00 am: **Dynamic algorithm selection for multisensor image registration**, Stephen P. DelMarco, Victor T. Tom, Helen F. Webb, David Lefebvre, BAE Systems (United States) . . . . . [7336-40]

8:20 am: **Shadow and feature recognition aids for rapid image geo-registration in UAV vision system architectures**, Wolfgang Baer, Mathias N. Kölsch, Naval Postgraduate School (United States) . . . . . [7336-41]

8:40 am: **Image-based querying of urban knowledge databases**, Peter L. Cho, MIT Lincoln Lab. (United States); Soonmin Bae, Fredo Durand, MIT Artificial Intelligence Lab. (United States) . . . . . [7336-42]

9:00 am: **CASSIE: contextual analysis for spectral and spatial information extraction**, Laurie D. Gibson, James Horne, Donna Haverkamp, SAIC (United States) . . . . . [7336-43]

9:20 am: **Degenerate directional polarization multiplexing for compressive imaging**, Jeremy D. Ellis, Aristide C. Dogariu, College of Optics & Photonics, Univ. of Central Florida (United States); Cristian Toma, Iveron Partners (United States); Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control (United States) . . . . . [7336-44]

9:40 am: **High-resolution reconstruction of objects from cloud-covered infrared images**, Jing Wang, Jason F. Ralph, John Y. Goulermas, The Univ. of Liverpool (United Kingdom) . . . . . [7336-45]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Elevation extraction and object recognition from aerial stereo images**, Hongwei Zhu, Frank Scarpace, Univ. of Wisconsin, Madison (United States) . . . . . [7336-46]

10:50 am: **Rural road extraction from SPOT images based on a Hermite transform pansharpening fusion algorithm**, Boris Escalante-Ramirez, Univ. Nacional Autónoma de México (Mexico); Alejandra A. López-Caloca, Ctr. de Investigación en Geografía y Geomática (Mexico) . . . . . [7336-47]

11:10 am: **Development of performance metrics to characterize the degree of polarization of man-made objects using passive polarimetric images**, Daniel A. Lavigne, Defence Research and Development Canada (Canada); Mélanie Breton, AEREX avionique inc. (Canada); Georges R. Fournier, Mario Pichette, Defence Research and Development Canada (Canada); Vincent Rivet, AEREX avionique inc. (Canada) . . . . . [7336-48]

11:30 am: **Man-made objects cuing in satellite imagery**, Alexei N. Skurikhin, Los Alamos National Lab. (United States) . . . . . [7336-49]

11:50 am: **Quad-emissive display for multispectral sensor analyses**, Alan R. Pinkus, Air Force Research Lab. (United States) . . . . . [7336-50]

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

SESSION 10

Room: Grand 3 . . . . . Wed. 1:30 to 3:10 pm

Signal and Image Processing II

Session Chairs: **Mark G. Alford,** Air Force Research Lab.;
Alastair D. McAulay, Lehigh Univ.;
Lynne L. Grewe, California State Univ., East Bay

1:30 pm: **Detecting deviations from normality using higher-order spectra combined with a nonlinear filter**, Jonathan M. Nichols, Colin C. Olson, Joseph V. Michalowicz, Frank Bucholtz, Naval Research Lab. (United States) . . [7336-51]

1:50 pm: **Exploiting active ultrasonic sensors to discriminate adult humans from children and quadrupeds**, Sachi V. Desai, Shafik A. Quoraishee, Amir Morcos, U.S. Army Research, Development and Engineering Command (United States) . . . . . [7336-52]

2:10 pm: **Use of unidirectional microphones and signal processing for the localization of sound sources**, Piervincenzo Rizzo, Univ. of Pittsburgh (United States); Giacomo Bordoni, Univ. degli Studi di Bologna (Italy); Alessandro Marzani, Univ. of Bologna (Italy) . . . . . [7336-53]

2:30 pm: **Statistical modeling of interferometric signals in underwater applications**, Gerard Llort, Christophe Sintes, TELECOM Bretagne (France) . . . . . [7336-54]

2:50 pm: **Tracking dust: tracking and state estimation for dusty plasmas**, Jason F. Ralph, Dmitry Samsonov, Celine Durniak, The Univ. of Liverpool (United Kingdom); Gregor E. Morfill, Max-Planck-Institut für Extraterrestrische Physik (Germany) . . . . . [7336-55]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 11

Room: Grand 3 . . . . . Wed. 3:40 to 4:40 pm

Signal and Image Processing III

Session Chairs: **Alastair D. McAulay,** Lehigh Univ.;
Lynne L. Grewe, California State Univ., East Bay;
Mark G. Alford, Air Force Research Lab.

3:40 pm: **Perimeter intrusion detection and intruder classification**, James F. Smith III, Naval Research Lab. (United States) . . . . . [7336-56]

4:00 pm: **Detecting modulated lasers in the battlefield and determining their direction**, Alastair D. McAulay, Lehigh Univ. (United States) . . . . . [7336-57]

4:20 pm: **Decomposing radar measurements through comprehensive response modeling**, Ilkka Venäläinen, Juha Jylhä, Ville Väisänen, Juho V. Vihonen, Marja H. Ruotsalainen, Ari Visa, Tampere Univ. of Technology (Finland) . . . . . [7336-58]

Algorithms for Synthetic Aperture Radar Imagery XVI

Conference Chairs: **Edmund G. Zelnio,** Air Force Research Lab.; **Frederick D. Garber,** Wright State Univ.

Program Committee: **Bir Bhanu,** Univ. of California/Riverside; **Mujdat Cetin,** Sabanci Univ. (Turkey); **Dan E. Dudgeon,** BAE Systems; **Gil J. Ettinger,** BAE Systems Advanced Information Technologies; **Robert A. Hummel,** Booz Allen Hamilton; **Charles V. Jakowatz, Jr.,** Sandia National Labs.; **Eric R. Keydel,** Science Applications International Corp.; **Randolph L. Moses,** The Ohio State Univ.; **Lee C. Potter,** 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 Welby,** Consultant

Thursday 16 April

SESSION INTRODUCTION

Room: Crystal k/L . . . . . Thurs. 9:00 to 9:10 am

Session Chair: **Lee C. Potter,** The Ohio State Univ.

SESSION 1

Room: Crystal k/L . . . . . Thurs. 9:10 to 10:30 am

Advanced Imaging

Session Chair: **Lee C. Potter,** The Ohio State Univ.

9:10 am: **Enhancement and fusion of multipass 3D SAR GOTCHA images**, Matthew A. Ferrara, Air Force Research Lab. (United States); Julie A. Jackson, The Ohio State Univ. (United States). . . . . [7337-01]

9:20 am: **Sparse multipass 3D imaging: applications to the GOTCHA data set**, Christian D. Austin, Emre Ertin, Randolph L. Moses, The Ohio State Univ. (United States). . . . . [7337-02]

9:30 am: **Surface models to constrain three-dimensional sparse SAR reconstruction**, Robert A. Weisenseel, Tony Falcone, Scientific Systems Co., Inc. (United States). . . . . [7337-05]

9:40 am: **Compressed sensing of monostatic and mulitistatic SAR**, Ivana Stojanovic, William C. Karl, Boston Univ. (United States); Mujdat Cetin, Sabanci Univ. (Turkey). . . . . [7337-04]

9:50 am: **SAR imaging via iterative adaptive approach and sparse Bayesian learning**, Ming Xue, Enrique A. Santiago, Univ. of Florida (United States); Matteo Sedehi, Univ. of Rome (Italy); Xing Tan, Jian Li, Univ. of Florida (United States). . . . . [7337-03]

10:00 am: **Chirp-scaling-based true amplitude imaging for synthetic aperture radar**, Can-Evren Yarman, WesternGeco-Schlumberger (United States); Ling Wang, Birsen Yazici, Rensselaer Polytechnic Institute (United States) . . [7337-06]

10:10 am: **High-performance synthetic aperture radar image formation on commodity architectures**, Daniel S. McFarlin, Markus Pueschel, Franz Franchetti, Carnegie Mellon Univ. (United States) . . . . . [7337-07]

10:20 am: **Fast sparse reconstruction of SAR imagery**, Frederik Andersson, Lund Univ. (Sweden); Christian D. Austin, Randolph L. Moses, The Ohio State Univ. (United States); Matthew A. Ferrara, Air Force Research Lab. (United States). . . . . [7337-28]

Coffee Break . . . . . 10:30 to 11:00 am

SESSION INTRODUCTION

Room: Crystal k/L . . . . . Thurs. 11:00 to 11:10 am

Session Chair: **Charles V. Jakowatz, Jr.,** Sandia National Labs.

SESSION 2

Room: Crystal k/L . . . . . Thurs. 11:10 am to 12:20 pm

Motion and Focusing

Session Chair: **Charles V. Jakowatz, Jr.,** Sandia National Labs.

11:10 am: **Considerations for autofocus of spotlight-mode SAR imagery created using a beamforming algorithm**, Charles V. Jakowatz, Jr., Daniel E. Wahl, Sandia National Labs. (United States). . . . . [7337-08]

11:20 am: **Minimum-entropy autofocus for three-dimensional SAR imaging**, Thomas J. Kragh, BAE Systems (United States). . . . . [7337-09]

11:30 am: **A nonquadratic regularization-based technique for joint SAR imaging and model error correction**, N. Ozben Onhon, Mujdat Cetin, Sabanci Univ. (Turkey). . . . . [7337-10]

11:40 am: **Exact and approximate time-shift operators**, John E. Piper, Naval Surface Warfare Ctr. (United States). . . . . [7337-11]

11:50 am: **Simulating the effects of long-range collection on synthetic aperture radar imagery**, John A. Richards, Sandia National Labs. (United States). . . . . [7337-12]

12:00 pm: **Analysis of target rotation and translation in SAR imagery**, Brian D. Rigling, Wright State Univ. (United States); Ahmed Fasih, Randolph L. Moses, The Ohio State Univ. (United States). . . . . [7337-13]

12:10 pm: **SAR-based GMTI challenge problem and public release data set**, Michael J. Minardi, Steven M. Scarborough, Uttam K. Majumder, Matthew Judge, Curtis H. Casteel, Jr., LeRoy A. Gorham, Air Force Research Lab. (United States); Gregory J. Owirka, Douglas Page, Howard E. Nichols, BAE Systems (United States). . . . . [7337-14]

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

POSTERS-THURSDAY . . . . . Thurs. 1:30 to 3:30 pm

Coffee Break . . . . . 3:30 to 4:00 pm

PANEL DISCUSSION/WORKSHOP . . . . . Thurs. 4:00 to 5:00 pm

Friday 17 April

SESSION INTRODUCTION

Room: Crystal k/L . . . . . Fri. 9:00 to 9:10 am

Session Chair: **Gerard W. Titi,** BAE Systems

SESSION 3

Room: Crystal k/L . . . . . Fri. 9:10 to 10:00 am

SAR Feature Extraction

Session Chair: **Gerard W. Titi,** BAE Systems

9:10 am: **An algorithm for 3D target scatterer feature estimation from sparse SAR apertures**, Julie A. Jackson, Randolph L. Moses, The Ohio State Univ. (United States). . . . . [7337-15]

9:20 am: **Multiple feature-enhanced synthetic aperture radar imaging**, Sadegh Samadi, Shiraz Univ. (Iran, Islamic Republic of); Mujdat Cetin, Sabanci Univ. (Turkey); Mohammad Ali Masnadi-Shirazi, Shiraz Univ. (Iran, Islamic Republic of) . . . . . [7337-16]

9:30 am: **Localization of scattering centers in radar imaging based on sparsity constraints**, Suman Kumar Gunnala, Jeffrey B. Hall, Jonathan W. Bredow, Saibun Tjuatja, The Univ. of Texas at Arlington (United States). . . . . [7337-17]

9:40 am: **Independent source extraction applied to radar imaging**, Jeffrey B. Hall, The Univ. of Texas at Arlington (United States) and Lockheed Martin Corp. (United States); Suman Kumar Gunnala, Saibun Tjuatja, The Univ. of Texas at Arlington (United States) . . . . . [7337-18]

9:50 am: **The spectrum parted linked image test (SPLIT) algorithm for estimating the frequency dependence of scattering center amplitudes**, Dane F. Fuller, Michael A. Saville, Air Force Institute of Technology (United States). . . . . [7337-19]

Coffee Break . . . . . 10:00 to 10:50 am

SESSION INTRODUCTION

Room: Crystal k/L . . . . . Fri. 10:50 to 11:00 am

Session Chair: **Stephen Welby,** Consultant

SESSION 4

Room: Crystal k/L . . . . . Fri. 11:00 am to 12:10 pm

SAR ATR

Session Chair: **Stephen Welby,** Consultant

11:00 am: **Utilizing feedback in adaptive SAR ATR systems**, Owen Horsfield, Land Engineering Agency (Australia); David Blacknell, Cranfield Univ. (United Kingdom). . . . . [7337-22]

11:10 am: **Shadow-based SAR ATR performance prediction**, David Blacknell, Cranfield Univ. (United Kingdom) . . . . . [7337-23]

11:20 am: **A convex optimization strategy for exploitation of multipass 3D SAR imagery**, Kirk E. Sturtz, Universal Mathematics (United States); Gregory Arnold, Matthew A. Ferrara, Air Force Research Lab. (United States) . . . [7337-24]

11:30 am: **Target detection and classification in SAR images using region covariance**, Kaan Duman, Abdülkadir Eryildirim, A. Enis Cetin, Bilkent Univ. (Turkey) . . . . . [7337-25]

11:40 am: **Analysis of uncompensated phase error on automatic target recognition performance**, Lee J. Montagnino, Raytheon Missile Systems (United States). . . . . [7337-26]

11:50 am: **Classifying civilian vehicles using a wide-field circular SAR**, Kerry E. Dungan, Lee C. Potter, The Ohio State Univ. (United States). . . . . [7337-27]

12:00 pm: **Effects of SAR image compression on coherent change detection**, Leslie M. Novak, Carl E. Frost, Scientific Systems Co., Inc. (United States). . . . . [7337-29]

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

Posters-Friday . . . . . Fri. 1:30 to 3:30 pm

Coffee Break . . . . . 3:30 to 4:00 pm

Panel Discussion/Workshop . . . . . Fri. 4:00 to 5:00 pm

Acquisition, Tracking, Pointing, and Laser Systems Technologies XXIII

Conference Chairs: **Steven L. Chodos,** Boeing-SVS, Inc.; **William E. Thompson,** New Mexico Institute of Mining and Technology

Conference Co-Chair: **Ali T. Alouani,** Tennessee Technological Univ.*Program Committee:* **James E. Kimbrell,** L-3 Brashear; **Jim F. Riker,** Air Force Research Lab.; **William D. Blair,** Georgia Tech Research Institute; **John E. Gray,** Naval Surface Warfare Ctr.; **Gillian K. Groves,** Raytheon Space & Airborne Systems; **Christopher J. Musial,** Boeing-SVS, Inc.; **James M. Hilkert,** Alpha-Theta Technologies; **Glenn A. Tyler,** The Optical Sciences Co.; **Juan R. Vasquez,** Numerica Corp.

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Crystal C . . . . . Tues. 10:30 am to 12:10 pm

Control Systems and Components

Session Chairs: **Ali T. Alouani,** Tennessee Technological Univ.; **William E. Thompson,** New Mexico Institute of Mining and Technology

10:30 am: **Adaptive filter techniques for optical beam jitter control**, Michael J. Beerer, Hyungjoo Yoon, Brij N. Agrawal, Naval Postgraduate School (United States) . . . . . [7338-01]

10:50 am: **Development of mirror stabilization line-of-sight rate equations for an unconventional sensor-to-gimbal orientation**, James M. Hilkert, Alpha-Theta Technologies (United States); Steve Cohen, Atlantic Positioning Systems (United States) . . . . . [7338-02]

11:10 am: **Line-of-sight position and rate kinematics for a two-axis head mirror**, James M. B. Royalty, Harris Corp. (United States). . . . . [7338-03]

11:30 am: **Performance of a deformable mirror in a high-energy Nd:YAG laser**, Ian Elder, James Beedell, SELEX GALILEO (United Kingdom). . . . [7338-04]

11:50 am: **Neuro-fuzzy control of a photovoltaic system**, Ali T. Alouani, Mohammad S. Alam, Tennessee Technological Univ. (United States) . . . [7338-05]

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

SESSION 2

Room: Crystal C . . . . . Tues. 1:40 to 3:00 pm

Target Detection and Tracking

Session Chairs: **Steven L. Chodos,** Boeing-SVS, Inc.; **William E. Thompson,** New Mexico Institute of Mining and Technology

1:40 pm: **Adaptive processing for enhanced target acquisition**, William J. Oxford, Mark Bernhardt, Duncan L. Hickman, Waterfall Solutions Ltd. (United Kingdom); Norman Watson, Fiona Beath, SELEX GALILEO (United Kingdom). . . . . [7338-06]

2:00 pm: **Adaptive detection and enhancement preprocessor for tracking**, Douglas A. Scott, Olegs Mise, GE Fanuc Intelligent Platforms (United Kingdom). . . . . [7338-07]

2:20 pm: **Shadow detection using 2D cepstrum**, Behcet U. Toreyin, A. Enis Cetin, Bilkent Univ. (Turkey) . . . . . [7338-08]

2:40 pm: **Spatial multimodal mean background model for real-time MTI**, Jonathan Williford, Minbo Shim, General Dynamics Robotic Systems (United States). . . . . [7338-09]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 3

Room: Crystal C . . . . . Tues. 3:30 to 5:50 pm

Tracker Algorithms

Session Chairs: **William E. Thompson,** New Mexico Institute of Mining and Technology; **Steven L. Chodos,** Boeing-SVS, Inc.

3:30 pm: **Relating image, shape, position, and velocity in visual tacking**, Sebastien C. Wong, Univ. of South Australia (Australia) and Defence Science and Technology Organisation (Australia) . . . . . [7338-10]

3:50 pm: **Image domain moving target tracking with advanced image registration and time-differencing techniques**, Hai-Wen Chen, Denis C. Braunreiter, SAIC (United States) . . . . . [7338-11]

4:10 pm: **Online contour structure from motion with known camera pose**, Vitaliy M. Kaganovich, Raytheon Space & Airborne Systems (United States). . . . . [7338-12]

4:30 pm: **Motion detection with camera shake**, Masato Kazui, Masaya Itoh, Hitachi, Ltd. (Japan); Hiroki Yaemori, Hidenori Takauji, Shun'ichi Kaneko, Hokkaido Univ. (Japan) . . . . . [7338-13]

4:50 pm: **Bayesian color-augmented target tracking using a liquid crystal tunable filter camera**, Michael Gran, Space Computer Corp. (United States). . . . . [7338-14]

5:10 pm: **The extended preferred ordering theorem for precision ATP**, Donald M. Leskiw, Hong Wang, Syracuse Univ. (United States) . . . . . [7338-15]

5:30 pm: **The judicious multiple hypothesis tracker**, James G. McAnanama, L-3 Wescam (Canada) and McMaster Univ. (Canada); Thiagalingam Kirubarajan, McMaster Univ. (Canada) . . . . . [7338-16]

Wednesday 15 April

SESSION 4

Room: Crystal C . . . . . Wed. 8:00 to 9:20 am

System Level Applications, Evaluation, and Test

Session Chairs: **William E. Thompson,** New Mexico Institute of Mining and Technology; **Ali T. Alouani,** Tennessee Technological Univ.

8:00 am: **Design of an optical system for a 5th generation, multispectral, air-to-air missile, considering the imaging performance degradation due to the aerodynamic heating**, Paulo R. J. Leite, Jr., Mauricio da Silva, The Brazilian Air Force (Brazil); Eduardo T. Paoli, Mectron S.A. (Brazil) . . . . . [7338-21]

8:20 am: **State space representation of optical systems**, Clay B. Jones, The Boeing Co. (United States); Steven F. Griffin, Boeing-SVS, Inc. (United States). . . . . [7338-17]

8:40 am: **A comparative evaluation of visual tracking systems**, Adam Gatt, Univ. of South Australia (Australia); Sebastien C. Wong, Univ. of South Australia (Australia) and Defence Science and Technology Organisation (Australia); David Kearney, Univ. of South Australia (Australia); Edward Watts, Defence Science and Technology Organisation (Australia) . . . . . [7338-19]

9:00 am: **The design of the pointing control system for the VISSTA ladar test bed**, Rollin R. Fullmer, Robert T. Pack, Utah State Univ. (United States); Jason Swayse, Space Dynamics Lab. (United States); Scott E. Budge, Utah State Univ. (United States); T. Dean Cook, U.S. Navy (United States) . . . . . [7338-20]

SESSION 5

Room: Crystal C . . . . . Wed. 9:20 to 10:20 am

Tracking and Clutter

Session Chairs: **Steven L. Chodos,** Boeing-SVS, Inc.; **William E. Thompson,** New Mexico Institute of Mining and Technology

9:20 am: **Robust image-domain target tracking process under heavy clutter conditions**, Hai-Wen Chen, Denis C. Braunreiter, SAIC (United States). . . . . [7338-23]

9:40 am: **Neurological correlation tracker for ground-to-ground target tracking in cluttered backgrounds**, Nebai I. Franco, Defence Science and Technology Organisation (United States) . . . . . [7338-25]

10:00 am: **A jammer tolerant laser designator/semi-active laser seeker system**, Walter B. Britton, Coherent Vision, Inc. (United States); Fraser R. Dalgleish, Florida Atlantic Univ. (United States) . . . . . [7338-26]

Monday-Tuesday 13-14 April 2009 • Proceedings of SPIE Vol. 7339

Enabling Photonics Technologies for Defense, Security, and Aerospace Applications V

Conference Chairs: **Michael J. Hayduk,** Air Force Research Lab.; **Peter J. Delfyett, Jr.,** College of Optics & Photonics, Univ of Central Florida

Conference Co-Chairs: **Andrew R. Pirich,** ACP Consulting; **Eric J. Donkor,** Univ. of Connecticut

Program Committee: **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

Monday 13 April

SESSION 1

Room: Crystal P . . . . . Mon. 8:30 to 10:40 am

Lasers and Optical Detectors

Session Chairs: **Eric J. Donkor,** Univ. of Connecticut; **Michael L. Fanto,** Air Force Research Lab.

8:30 am: **Frequency stabilized optical comb source with high finesse intracavity etalon** *(Invited Paper)*, Ibrahim T. Ozdur, Sarper Ozharar, Mehmetcan Akbulut, Dimitrios Mandridis, Franklyn J. Quinlan, Peter J. Delfyett, Jr., College of Optics & Photonics, Univ. of Central Florida (United States) . . . . . [7339-01]

9:00 am: **CW injection locking for long-term stability of frequency combs**, Charles G. Williams, Franklyn J. Quinlan, Peter J. Delfyett, Jr., College of Optics & Photonics, Univ. of Central Florida (United States). . . . . [7339-02]

9:20 am: **An electro-optical feedforward system for dynamic control of a chirped laser source suitable For photonic analog-to-digital conversion**, Dimitrios Mandridis, Peter J. Delfyett, Jr., Ibrahim T. Ozdur, College of Optics & Photonics, Univ. of Central Florida (United States). . . . . [7339-03]

9:40 am: **Low phase noise, high power handling, InGaAs photodiodes for precise timing applications** *(Invited Paper)*, Shubhashish Datta, Abhay M. Joshi, Donald A. Becker, Discovery Semiconductors, Inc. (United States). . . . . [7339-04]

10:10 am: **Epitaxially grown germanium/silicon avalanche photodiodes for near infrared light detection** *(Invited Paper)*, Yimin Kang, Han-Din Liu, Mike T. Morse, Mario J. Paniccia, Intel Corp. (United States); Moshe Zadka, Stas Litski, Gadi Sarid, Numonyx (Israel); Alexandre Pauchard, Synova SA (Switzerland); Hui-Wen Chen, Wissem Sfar Zaoui, John E. Bowers, Univ. of California, Santa Barbara (United States); Dion McIntosh, XiaoGuang Zheng, Joe C. Campbell, Univ. of Virginia (United States). . . . . [7339-05]

Coffee Break . . . . . 10:40 to 11:00 am

SESSION 2

Room: Crystal P . . . . . Mon. 11:00 am to 12:20 pm

Keynote Session

Session Chairs: **Michael J. Hayduk,** Air Force Research Lab.; **Robert L. Kaminski,** Air Force Research Lab.

11:00 am: **OE-VCSEL based WDM modules: focus on manufacturing** *(Keynote Presentation)*, Peter S. Guilfoyle, Duane A. Louderback, John Joseph, Dhiraj Kumar, Mike Hoag, OptiComp Corp. (United States). . . . . [7339-06]

11:40 am: **Photon counting passive 3D sensing and imaging** *(Keynote Presentation)*, Bahram Javidi, Univ. of Connecticut (United States); E. Watson, Univ of Connecticut (United States) . . . . . [7339-07]

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

SESSION 3

Room: Crystal P . . . . . Mon. 1:20 to 3:40 pm

Emerging Component Technology

Session Chairs: **Peter J. Delfyett, Jr.,** College of Optics & Photonics, Univ. of Central Florida; **Andrew R. Pirich,** ACP Consulting

1:20 pm: **Plasmon-polariton crystals with ultra-high Purcell factor and optical bandwidth for single molecule detection** *(Invited Paper)*, Hooman Mohseni, Northwestern Univ. (United States). . . . . [7339-08]

1:50 pm: **2 x 2 quantum dot based switching device employing multimode interference effects** *(Invited Paper)*, Nathan Bickel, Patrick Likamwa, College of Optics & Photonics, Univ. of Central Florida (United States) . . . . . [7339-09]

2:20 pm: **Tunable LYOT-filter**, Eric J. Donkor, Patrick D. Kumavor, Carlos E. Villa-Angulo, Univ. of Connecticut (United States) . . . . . [7339-10]

2:40 pm: **Variable fiber-optic attenuator using optofluidics**, Syed A. Reza, Nabeel A. Riza, College of Optics & Photonics, Univ. of Central Florida (United States). . . . . [7339-11]

3:00 pm: **Optofluidic tuning of multimode interference fiber filters**, Jose E. Antonio-Lopez, Daniel A. May-Arrioja, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Patrick Likamwa, College of Optics & Photonics, Univ. of Central Florida (United States) . . . . . [7339-12]

3:20 pm: **Efficient T/R switch design for beam steering with liquid crystal spatial light modulator**, Katherine Drain, Qiwen Zhan, Univ. of Dayton (United States); Matthew P. Dierking, Air Force Research Lab. (United States) . . [7339-28]

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 4

Room: Crystal P . . . . . Tues. 10:30 am to 12:40 pm

Photonic Applications and Systems

Session Chairs: **Andrew R. Pirich,** ACP Consulting;
Guifang Li, College of Optics & Photonics, Univ. of Central Florida

10:30 am: **Extending dynamic range using ND filtering on an 8 bit sensor**, Chuck D. Balogh, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7339-13]

10:50 am: **A 1.28GSPS 12-bit optoelectronic analog-to-digital converter**, Carlos E. Villa-Angulo, Patrick D. Kumavor, Univ. of Connecticut (United States); Guanghai Jin, Agiltron, Inc. (United States); Eric J. Donkor, Univ. of Connecticut (United States). . . . . [7339-14]

11:10 am: **RF photonic notch filters in high dynamic range links**, Charles F. Middleton IV, Richard J. DeSalvo, Harris Corp. (United States) . . . . . [7339-15]

11:30 am: **Sub-millimeter resolution laser ranging at 9.3 kilometers using temporally stretched, frequency chirped pulses from a mode locked laser** *(Invited Paper)*, Mohammad Umar Piracha, Dat Nguyen, College of Optics & Photonics, Univ. of Central Florida (United States); Tolga Yilmaz, Raydiance, Inc. (United States); Dimitrios Mandridis, College of Optics & Photonics, Univ. of Central Florida (United States); David Gaudiosi, Raydiance, Inc. (United States); Peter J. Delfyett, Jr., College of Optics & Photonics, Univ. of Central Florida (United States). . . . . [7339-16]

12:00 pm: **Electrowetting beam steering using microprism array designs**, Joseph W. Haus, Wei Han, Univ. of Dayton (United States); Jason C. Heikenfeld, Univ. of Cincinnati (United States); Paul F. McManamon, Univ. of Dayton (United States). . . . . [7339-17]

12:20 pm: **A MIMO-inspired rapidly switchable photonic interconnect architecture**, Henry Zmuda, Univ. of Florida (United States); Joseph M. Osman, Michael L. Fanto, Thomas McEwen, Air Force Research Lab. (United States). . . . . [7339-18]

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

SESSION 5

Room: Crystal P . . . . . Tues. 1:40 to 3:30 pm

Optical Communications and Simulations

Session Chairs: **Michael L. Fanto,** Air Force Research Lab.;
Michael J. Hayduk, Air Force Research Lab.

1:40 pm: **QPSK free-space optical communication with electronic wavefront correction** *(Invited Paper)*, Xiaobo Xie, Guifang Li, College of Optics & Photonics, Univ. of Central Florida (United States). . . . . [7339-19]

2:10 pm: **New preemptive scheduling for OBS networks considering cascaded wavelength conversion**, Xingbo Gao, Mostafa A. Bassiouni, Univ. of Central Florida (United States); Guifang Li, College of Optics & Photonics, Univ. of Central Florida (United States) . . . . . [7339-20]

2:30 pm: **Transmission of quadrature amplitude modulation (QAM) signal using electrical post-compensation of SOA nonlinearity**, Xiaoxu Li, College of Optics & Photonics, Univ. of Central Florida (United States) . . . . . [7339-21]

2:50 pm: **CAD model for co-propagating spatially multiplexed channels of same wavelength over standard multimode fibers**, Syed H. Murshid, Raka Biswas, Abhijit Chakravarty, Florida Institute of Technology (United States). . . . . [7339-22]

3:10 pm: **Optical signal infrastucture in a SPICE-based optoelectronic simulation framework,** Pavan Gunupudi, Tom J. Smy, Carleton Univ. (Canada); Jackson Klein, Z. Jan Jakubczyk, Optiwave Systems Inc. (Canada) . . . . [7339-23]

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

All-fiber tunable MMI fiber laser, Jose E. Antonio-Lopez, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Arturo A. Castillo-Guzman, Univ. Autonoma de Nuevo Leon (Mexico); Daniel A. May-Arrioja, Instituto Nacional de Astrofísica, Óptica y Electrónica (Mexico); Romeo J. Selvas-Aguilar, Univ. Autonoma de Nuevo Leon (Mexico); Patrick Likamwa, College of Optics & Photonics, Univ. of Central Florida (United States). . . . . [7339-24]

Cr-doped materials as broadband and tunable sources in communication and instrumentation, Jausheng Wang, National Sun Yat-sen Univ (Taiwan); Vincent Huang, Wood-Hi Cheng, National Sun Yat-Sen Univ. (Taiwan). . [7339-29]

Nitride image intensifiers, J. W. Glesener, L-3 Electro-Optical Systems (United States); A. M. Dabiran, SVT Associates, Inc. (United States); J. P. Estrera, L-3 Electro-Optical Systems (United States). . . . . [7339-30]

Optical Pattern Recognition XX

Conference Chairs: **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.; **B.V.K. Vijaya Kumar,** Carnegie Mellon Univ.; **Dennis R. Pape,** AlphaLaunch; **Yunlong Sheng,** Univ. Laval (Canada); **Joseph L. Stufflebeam,** NewTec; **Ashit Talukder,** Univ. of Southern California; **Rupert C. D. Young,** Univ. of Sussex at Brighton (United Kingdom)

Thursday 16 April

SESSION 1

Room: Crystal P . . . . . Thurs. 8:00 to 10:15 am

Pattern Recognition Invited Papers

Session Chair: **David P. Casasent,** Carnegie Mellon Univ.

8:00 am: **Automatic target recognition using 3D passive sensing and imaging with independent component analysis** *(Keynote Presentation)*, Cuong M. Do, Univ. of Connecticut (United States); Raúl Martínez-Cuenca, Univ. de València (Spain); Bahram Javidi, Univ. of Connecticut (United States) . . . . . [7340-01]

8:45 am: **Automatic target recognition (ATR) performance improvement using integrated grayscale optical correlator and neural network** *(Invited Paper)*, Tien-Hsin Chao, Thomas Lu, Jet Propulsion Lab. (United States) . . . . . [7340-02]

9:15 am: **An optical space domain volume holographic correlator** *(Invited Paper)*, Philip M. Birch, Akber A. Gardezi, Bhargav K. Mitra, Rupert C. D. Young, Christopher R. Chatwin, Univ. of Sussex (United Kingdom) . . . . . [7340-03]

9:45 am: **Object detection in compressively sensed data using quadratic correlation filters** *(Invited Paper, Presentation Only)*, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control (United States) . . . . . [7340-04]

Coffee Break . . . . . 10:15 to 10:45 am

SESSION 2

Room: Crystal P . . . . . Thurs. 10:45 am to 12:15 pm

Distortion Invariant Filters

Session Chairs: **Mohammad S. Alam,** Univ. of South Alabama; **Tien-Hsin Chao,** Jet Propulsion Lab.

10:45 am: **Composite correlation filter for O-ring detection in stationary colored noise** *(Invited Paper)*, Laurence G. Hassebrook, Univ. of Kentucky (United States) . . . . . [7340-05]

11:15 am: **Optimization of OT-MACH filter generation for target recognition**, Thomas Lu, Oliver Johnson, Weston Edens, Tien-Hsin Chao, Jet Propulsion Lab. (United States) . . . . . [7340-06]

11:35 am: **Distortion invariant pattern recognition using neural network based shifted phase-encoded joint transform correlation**, Mohammed Nazrul Islam, Old Dominion Univ. (United States); Md. H. Islam, Bangladesh Univ. of Engineering and Technology (Bangladesh); Vijayan K. Asari, Mohammad A. Karim, Old Dominion Univ. (United States); Mohammad S. Alam, Univ. of South Alabama (United States) . . . . . [7340-07]

11:55 am: **Nonlinear Fourier correlation**, Kaveh Heidary, Alabama A&M Univ. (United States) . . . . . [7340-08]

Lunch/Exhibition Break . . . . . 12:15 to 1:15 pm

SESSION 3

Room: Crystal P . . . . . Thurs. 1:15 to 3:15 pm

New Tracking Techniques and Results

Session Chairs: **Ashit Talukder,** Jet Propulsion Lab.; **Tien-Hsin Chao,** Jet Propulsion Lab.

1:15 pm: **Remote event detection and tracking using multiple heterogeneous satellite data fusion** *(Invited Paper)*, Ashit Talukder, Shen-Shyang Ho, Jet Propulsion Lab. (United States) . . . . . [7340-09]

1:45 pm: **Data fusion based target tracking in FLIR imagery** *(Invited Paper)*, Mohammad S. Alam, Univ. of South Alabama (United States) . . . . . [7340-10]

2:15 pm: **Visual target tracking in the presence of unknown observer motion**, Stephen Williams, Thomas Lu, Jet Propulsion Lab. (United States) . . . . . [7340-11]

2:35 pm: **Correlation based swarm trackers for 3-dimensional manifold mesh formation**, Charles J. Casey, Laurence G. Hassebrook, Priyanka Chaudhary, Univ. of Kentucky (United States) . . . . . [7340-12]

2:55 pm: **Improving recognition by using two patterns of the same classifier**, Salim Alsharif, Aed M. El-Saba, Univ. of South Alabama (United States). [7340-13]

Coffee Break . . . . . 3:15 to 3:45 pm

SESSION 4

Room: Crystal P . . . . . Thurs. 3:45 to 4:55 pm

Novel Image Processing Techniques

Session Chairs: **Rupert C. D. Young,** Univ. of Sussex (United Kingdom); **Mohammad S. Alam,** Univ. of South Alabama

3:45 pm: **An improved multi-frame super-resolution technique** *(Invited Paper)*, Pramod Lakshmi Narasimha, Zhanfeng Yue, Pankaj Topiwala, FastVDO Inc. (United States) . . . . . [7340-15]

4:15 pm: **Nonlinear optical dynamic range compression with thin-film organic photorefractive material**, Bahareh Haji-Saeed, Solid State Scientific Corp. (United States); Jed Khoury, Charles L. Woods, Air Force Research Lab. (United States); John Kierstead, Solid State Scientific Corp. (United States); Nasser N. Peyghambarian, College of Optical Sciences, The Univ. of Arizona (United States) . . . . . [7340-16]

4:35 pm: **Neural network target identification system For false alarm reduction,** David Ye, Thomas Lu, Tien-Hsin Chao, Jet Propulsion Lab. (United States) . . . . . [7340-17]

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

A novel clustering method using weighted sub-sampling for an infrared search and track system, Byung-In Choi, Sanghoon Nam, Jungsu Youn, Samsung Thales Co., Ltd. (Korea, Republic of); Yukyung Yang, Sungho Kim, Joo-Hyoung Lee, Yong-Chan Park, Agency for Defense Development (Korea, Republic of) . . . . . [7340-26]

Linear methods for input scenes restoration from signals of optical-digital pattern recognition correlator, Sergey N. Starikov, Mikhail V. Konnik, Edward A. Manykin, Vladislav G. Rodin, Moscow Engineering Physics Institute (Russian Federation) . . . . . [7340-27]

Realization of LPCC filters as binary amplitude hologram in 4-f correlator: range limitation of hologram pixels representation, Nikolay N. Evtikhiev, Sergey N. Starikov, Rostislav S. Starikov, Evgeny Y. Zlokazov, Moscow Engineering Physics Institute (Russian Federation) . . . . . [7340-28]

The image restoration based on feed forward neural networks, Igor Mardare, Veacheslav L. Perju, Olga Ghincul, Technical Univ. of Moldova (Moldova); David P. Casasent, Carnegie Mellon Univ. (United States) . . . . . [7340-29]

Image complexity matrix for pattern and target recognition based on Fourier spectrum analysis, Veacheslav L. Perju, Technical Univ. of Moldova (Moldova) and Free International Univ. of Moldova (Moldova) . . . . . [7340-30]

Kernel synthetic discriminant function (SDF) filters for fast object recognition, Rohit Patnaik, David P. Casasent, Carnegie Mellon Univ. (United States) . . . . . [7340-31]

Friday 17 April

SESSION 5

Room: Crystal P . . . . . Fri. 9:00 to 10:00 am

Image Processing Applications

Session Chairs: **Tien-Hsin Chao,** Jet Propulsion Lab.; **Mohammad S. Alam,** Univ. of South Alabama

9:00 am: **Detecting people in IR border surveillance video using scale invariant image moments**, Stephen O'Hara, Amber D. Fischer, 21st Century Systems, Inc. (United States) . . . . . [7340-18]

9:20 am: **Analytical feature filter used in an analytically preprocessed picture image**, Chia-Lun J. Hu, Univ. of Colorado at Boulder (United States) . . . [7340-19]

9:40 am: **Logarithmic r-θ mapping for hybrid optical neural network filter for multiple objects recognition within cluttered scenes**, Ioannis I. Kypraios, Rupert C. D. Young, Christopher R. Chatwin, Univ. of Sussex (United Kingdom) . . . . . [7340-21]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 6

Room: Crystal P . . . . . Fri. 10:30 to 11:30 am

Pattern Recognition Applications

Session Chairs: **Rupert C. D. Young,** Univ. of Sussex (United Kingdom); **Tien-Hsin Chao,** Jet Propulsion Lab.

10:30 am: **Joint transform correlator fingerprint verification using complementary-reference and complementary-scene images**, Hussain A. Kamal, Abdallah K. Cherri, Kuwait Univ. (Kuwait) . . . . . [7340-22]

10:50 am: **High performance and fast face recognition technique based on components of phases of face images**, Nasser Zaeri, Abdallah K. Cherri, Kuwait Univ. (Kuwait) . . . . . [7340-23]

11:10 am: **Digital images inpainting using modified convolution based method**, Sameh Z. Shenoda, Mohiy M. Hadhoud, Kamel A. Mostafa, Minufiya Univ. (Egypt) . . . . . [7340-25]

Visual Information Processing XVIII

Conference Chairs: **Zia-Ur Rahman,** Old Dominion Univ.; **Stephen E. Reichenbach,** Univ. of Nebraska, Lincoln; **Mark A. Neifeld,** The Univ. of Arizona

Program Committee: **Gary W. Euliss,** The MITRE Corp.; **Richard D. Juday,** NASA Johnson Space Ctr.; **Ram M. 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 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Crystal N . . . . . Tues. 10:30 am to 12:10 pm

Hardware and Video Applications

Session Chair: **Mark Allen Neifeld,** The Univ. of Arizona

10:30 am: **An embedded processor for real-time atmoshperic compensation**, Michael R. Bodnar, Petersen F. Curt, Fernando E. Ortiz, EM Photonics, Inc. (United States); Carmen J. Carrano, Lawrence Livermore National Lab. (United States); Eric J. Kelmelis, EM Photonics, Inc. (United States) . . . . . [7341-01]

10:50 am: **Electronic image stablization: a hardware efficient approach**, Drew Manville, Teresa L. Pace, Eugene L. Cloud, Richard Skoblick, Steve J. Marteney, DRS Technologies, Inc. (United States) . . . . . [7341-02]

11:10 am: **Accelerating image processing algorithms using graphics processors**, Jason L. Dale, Gordon A. Cain, Vision4ce Ltd. (United Kingdom). . . . . [7341-03]

11:30 am: **Appearance based key shot selection for 3D scene reconstruction with a hand-held camera system**, Bram G. Alefs, Judith Dijk, TNO Defense, Security and Safety (Netherlands). . . . . [7341-04]

11:50 am: **Study of video distortion for real-time video transmission over wireless channels**, Dapeng O. Wu, Univ. of Florida (United States) . . . . [7341-05]

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

SESSION 2

Room: Crystal N . . . . . .Tues. 1:40 to 3:20 pm

Applications of Image Processing

Session Chair: **Ram M. Narayanan,** The Pennsylvania State Univ.

1:40 pm: **Water quality mapping using Landsat TM imagery**, Chow Jeng Wong, Univ. Sains Malaysia (Malaysia) . . . . . [7341-06]

2:00 pm: **Visualization and analysis of three-dimensional hyperspectral images**, Stephen E. Reichenbach, Univ. of Nebraska, Lincoln (United States); Alex Henderson, Univ. of Manchester (United Kingdom); Robert Lindquist, Univ. of Nebraska, Lincoln (United States); Qingping Tao, GC Image, LLC (United States); John C. Vickerman, Univ. of Manchester (United Kingdom). . . . . [7341-07]

2:20 pm: **Three-dimensional tracking for efficient fire fighting in complex situations**, Moulay A. Akhloufi, Univ. Laval (Canada); Lucile Rossi, Univ. di Corsica (France) . . . . . [7341-40]

2:40 pm: **A new feature front based stereo correspondence technique**, Beddhu Murali, Univ. of Southern Mississippi (United States) and EKS, LLC (United States). . . . . [7341-08]

3:00 pm: **Adaptive pattern-based image compression for ultra-low bandwidth weapon seeker image communication**, Hai Wei, Sakina Zabuawala, Karthik Mahesh Varadarajan, Jacob Yadegar, Joseph Yadegar, UtopiaCompression Corp. (United States); David Gray, John F. McCalmont, Air Force Research Lab. (United States); James M. Utt, Defense Engineering Corp. (United States) . . . . . [7341-09]

Coffee Break . . . . . 3:20 to 3:50 pm

SESSION 3

Room: Crystal N . . . . . .Tues. 3:50 to 4:50 pm

Image Enhancement

Session Chair: **Stephen E. Reichenbach,** Univ. of Nebraska, Lincoln

3:50 pm: **Multi-objective evolutionary algorithm based filters for image enhancement**, Lifford McLauchlan, Texas A&M Univ., Kingsville (United States); Mehrube Mehrubeoglu, Texas A&M Univ., Corpus Christi (United States). . . . . [7341-11]

4:10 pm: **Bio-inspired color image enhancement model**, Yufeng Zheng, Alcorn State Univ. (United States) . . . . . [7341-12]

4:30 pm: **Human vision based high-dynamic-range image rendering,** Xiaoxia Wan, Dehong Xie, Wuhan Univ. (China) . . . . . [7341-13]

POSTERS-TUESDAY

Room: Palms Foyer. . . . . .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.

Visualizing multidimensional climate model data, John S. DaPonte, Paidemwoyo Munhutu, Southern Connecticut State Univ. (United States). . . . . [7341-31]

Novel image fusion quality metrics based on sensor models and image statistics, Forrest A. Smith, Srikant K. Chari, Carl E. Halford, The Univ. of Memphis (United States); Joseph P. Reynolds, Jonathan D. Fanning, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7341-32]

Linearization of RAW data from commercial photo cameras for optical-digital imaging systems, Sergey N. Starikov, Mikhail V. Konnik, Moscow Engineering Physics Institute (Russian Federation) . . . . . [7341-33]

Increase of input dynamic range of optical-digital image correlator using spatially varying pixels exposure technique, Sergey N. Starikov, Mikhail V. Konnik, Moscow Engineering Physics Institute (Russian Federation). . . . [7341-34]

X-ray CT and magnetic resonance imaging to detect the light bruises of pears, Shuiqin Zhou, Yibin Ying, Zhejiang Univ. (China) . . . . . [7341-36]

Tracking method of multi-object based on Mumford-Shah model, Jie Su, Harbin Univ. of Science and Technology (China) . . . . . [7341-37]

Using webcam for indoor air quality monitoring, Chow Jeng Wong, Univ. Sains Malaysia (Malaysia) . . . . . [7341-39]

A fast and robust wavelet-based dynamic range compression and contrast enhancement model with color restoration, Numan Unaldi, Turkish Air Force (Turkey); Vijayan K. Asari, Zia-ur Rahman, Old Dominion Univ. (United States). . . . . [7341-44]

Wednesday 15 April

SESSION 4

Room: Crystal N . . . . . Wed. 9:00 to 10:20 am

Image Resolution, Registration, and Fusion

Session Chair: **Zia-ur Rahman,** Old Dominion Univ.

9:00 am: **Steerable optical flow based image registration: application to aligning human torso images**, Ahmed S. Elsafi, Rami Zewail, Nelson Durdle, Univ. of Alberta (Canada) . . . . . [7341-15]

9:20 am: **Image registration using conformal log polar mapping**, Bala Krishna Vadapally, Zia-ur Rahman, Old Dominion Univ. (United States) . . . . . [7341-16]

9:40 am: **Resolution enhancement of video sequences with real number magnification factor**, Jingning Pan, Dave Douglas, Raytheon Co. (United States) . . . . . [7341-17]

10:00 am: **Assessment of super-resolution for face recognition from very-low resolution images in sensor networks**, James R. Roeder, Sergio D. Cabrera, Univ. of Texas at El Paso (United States) . . . . . [7341-18]

Coffee Break . . . . . 10:20 to 10:50 am

SESSION 5

Room: Crystal N . . . . . Wed. 10:50 am to 12:10 pm

Face and Expression Recognition and Tracking

Session Chair: **Zia-ur Rahman,** Old Dominion Univ.

10:50 am: **Multispectral face recognition using non linear dimensionality reduction**, Moulay A. Akhloufi, Abdelhakim Bendada, Laval Univ. (Canada); Jean-Christophe Batsale, Ecole Nationale d'Arts et Metiers (France) . . . . . [7341-19]

11:10 am: **PainRec: multi-algorithm based automatic pain recognition system**, MD. Maruf Monwar, Univ. of Calgary (Canada); Siamak Rezaei, Univ. of Northern British Columbia (Canada) . . . . . [7341-20]

11:30 am: **An automatic eye detection and tracking technique for stereo video sequences**, Dimitrios Charalampidis, Anirudh Paduru, Univ. of New Orleans (United States) . . . . . [7341-22]

11:50 am: **Multi-user vision interface based on range imaging**, Tobias K. Kohoutek, ETH Zürich (Switzerland) . . . . . [7341-23]

Lunch/Exhibition Break . . . . . 12:10 to 2:00 pm

SESSION 6

Room: Crystal N . . . . . Wed. 2:00 to 4:50 pm

Feature Detection, Change Detection, and Tracking

Session Chair: **Zia-ur Rahman,** Old Dominion Univ.

2:00 pm: **A structural framework for anomalous change detection and characterization**, Lakshman Prasad, James Theiler, Los Alamos National Lab. (United States) . . . . . [7341-24]

2:20 pm: **A framework for activity detection in wide-area motion imagery**, Reid B. Porter, Donald R. Hush, John D. Morrison, Los Alamos National Lab. (United States) . . . . . [7341-25]

2:40 pm: **Automation of the CCTV-mediated detection of individuals illegally carrying firearms: combining psychological and technological approaches**, Iain T. Darker, Loughborough Univ. (United Kingdom); Paul Kuo, Kingston Univ. (United Kingdom); Ming Yuan Yang, Univ. of Central Lancaster (United Kingdom); Anastassia Blechko, Loughborough Univ. (United Kingdom); Christos Grecos, Univ. of Central Lancashire (United Kingdom); Dimitrios Makris, Jean-Christophe Nebel, Kingston Univ. (United Kingdom); Alastair G. Gale, Loughborough Univ. (United Kingdom) . . . . . [7341-26]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Detection of facilities in satellite imagery using semi-supervized image classification and auxiliary contextual observables**, Neal R. Harvey, Steven P. Brumby, Norma Pawley, Christy Ruggiero, Rachel Hixson, Lee K. Balick, Alden Oyer, Brian MacDonald, Los Alamos National Lab. (United States) . . . . . [7341-27]

3:50 pm: **Summarization and visualization of target trajectories from massive video archives**, Zhanfeng Yue, Pramod L. Narasimha, Pankaj Topiwala, FastVDO Inc. (United States) . . . . . [7341-28]

4:10 pm: **A change detection approach to moving object detection in low fame rate video**, Reid B. Porter, Neal R. Harvey, James Theiler, Los Alamos National Lab. (United States) . . . . . [7341-29]

4:30 pm: **Robust tracking of people in crowds with covariance descriptors**, Juergen Metzler, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany); Dieter N. Willersinn, Fraunhofer Institute for Information and Data Processing (Germany) . . . . . [7341-30]

Get the training you need to stay ahead of the technology curve.

See daily course schedule, pp. 23–26.

Quantum Information and Computation VII

Conference Chairs: **Eric J. Donkor,** Univ. of Connecticut; **Andrew R. Pirich,** ACP Consulting; **Howard E. Brandt,** Army Research Lab.

Program Committee: **Chip B. Elliott,** BBN Technologies; **Michael J. Hayduk,** Air Force Research Lab.; **Louis H. Kauffman,** Univ. of Illinois at Chicago; **Vladimir E. Korepin,** Stony Brook Univ.; **Samuel J. Lomonaco, Jr.,** Univ. of Maryland, Baltimore County; **John M. Myers,** Harvard Univ.; **Vladimir Privman,** Clarkson Univ.; **Alexander V. Sergienko,** Boston Univ.; **Tai Tsun Wu,** Harvard Univ.

Thursday 16 April

SESSION 1

Room: Crystal N . . . . . Thurs. 9:10 to 10:10 am

Quantum Computation I

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

9:10 am: **Applied operator quantum fault tolerance**, Gerald N. Gilbert, The MITRE Corp. (United States); Vaneet Aggarwal, Robert Calderbank, Princeton Univ. (United States); Yaakov S. Weinstein, The MITRE Corp. (United States) . . . . . [7342-01]

9:30 am: **A space-efficient quantum computer simulator suitable for high-speed FPGA implementation**, Michael P. Frank, Liviu Oniciuc, Uwe Meyer-Baese, Irinel Chiorescu, Florida State Univ. (United States) . . . . . [7342-02]

9:50 am: **The case for biological quantum computer elements**, Wolfgang Baer, Naval Postgraduate School (United States); Rita Pizzi, Univ. of Milan (Italy) . . . . . [7342-03]

Coffee Break . . . . . 10:10 to 10:40 am

SESSION 2

Room: Crystal N . . . . . Thurs. 10:40 am to 12:00 pm

Quantum Computation II

Session Chairs: **Samuel J. Lomonaco, Jr.,** Univ. of Maryland, Baltimore County; **Louis H. Kauffman,** Univ. of Illinois at Chicago

10:40 am: **Aspects of quantum computational geodesics**, Howard E. Brandt, Army Research Lab. (United States) . . . . . [7342-04]

11:00 am: **Highly directive light signals in the quantum setting**, John M. Myers, Harvard Univ. (United States) . . . . . [7342-05]

11:20 am: **Simultaneously authenticated deterministic quantum key distribution without public channel**, Binbin Zhang, Yu Liu, Huazhong Univ. of Science and Technology (China) . . . . . [7342-06]

11:40 am: **Riemann curvature in quantum computational geometry**, Howard E. Brandt, Army Research Lab. (United States) . . . . . [7342-07]

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

SESSION 3

Room: Crystal N . . . . . Thurs. 1:30 to 3:20 pm

Quantum Imaging

Session Chair: **John M. Myers,** Harvard Univ.

1:30 pm: **Quantum limits of super-resolution and a priori information**, Mikhail I. Kolobov, Univ. des Sciences et Technologies de Lille (France) . . . . . [7342-11]

1:50 pm: **Quantum entangled radar theory and a correction method for the effects of attenuation on entanglement**, James F. Smith III, Naval Research Lab. (United States) . . . . . [7342-08]

2:10 pm: **Quantum imaging: enhanced image formation using quantum states of light** *(Invited Paper)*, Robert W. Boyd, Univ. of Rochester (United States) . . . . . [7342-09]

2:40 pm: **Topological quantum image analysis**, George F. Chapline, Jr., Jonathan Dubois, Lawrence Livermore National Lab. (United States) . . . [7342-10]

3:00 pm: **Schrodinger transformation of image and application**, Liantang Lou, Wuhan Univ. (China) and Wuhan Institute of Technology (China); Zhongliang Fu, Wuhan Univ. (China) . . . . . [7342-12]

Coffee Break . . . . . 3:20 to 3:50 pm

SESSION 4

Room: Crystal N . . . . . Thurs. 3:50 to 5:30 pm

Quantum Measurement and Sensors

Session Chairs: **Eric J. Donkor,** Univ. of Connecticut; **Michael J. Hayduk,** Air Force Research Lab.

3:50 pm: **The post-selection approach to relativistic wave equations**, John E. Gray, Naval Surface Warfare Ctr. (United States); Stephen R. Addison, Univ. of Central Arkansas (United States) . . . . . [7342-13]

4:10 pm: **Measurement of a subsystem of a coupled quantum system**, Michael J. Steiner, Naval Research Lab. (United States); Michael R. Frey, Bucknell Univ. (United States); Armen M. Gulian, Physics Arts Frontiers (United States); Ronald W. Rendell, Naval Research Lab. (United States); A. K. Rajagopal, Inspire Institute (United States) . . . . . [7342-14]

4:30 pm: **The post-selection probability current and its implications**, John E. Gray, Allen D. Parks, Naval Surface Warfare Ctr. (United States) . . . . . [7342-16]

4:50 pm: **Sensing intruders using entanglement: a photonic quantum fence**, Travis S. Humble, Ryan S. Bennink, Warren P. Grice, Oak Ridge National Lab. (United States); Israel J. Owens, Los Alamos National Lab. (United States) . . . . . [7342-17]

5:10 pm: **Quantum sensor miniaturization prospectus**, Gerald N. Gilbert, Anthony Donadio, Michael D. Hamrick, Stephen P. Pappas, Yaakov S. Weinstein, The MITRE Corp. (United States) . . . . . [7342-18]

Friday 17 April

SESSION 5

Room: Crystal N . . . . . Fri. 10:30 am to 1:20 pm

Quantum Information Theory

Session Chair: **Howard E. Brandt,** Army Research Lab.

10:30 am: **An improved architecture of a realizable quantum computer for quantum programming languages**, Nan Wu, Nan Jing Univ. (China) and CUNY Graduate School (United States); FangMin Song, Nan Jing Univ. (China); Xiangdong Li, CUNY Graduate School (United States) . . . . . [7342-27]

10:50 am: **Quantum knots II** *(Invited Paper)*, Samuel J. Lomonaco, Jr., Univ. of Maryland, Baltimore County (United States); Louis H. Kauffman, Univ. of Illinois at Chicago (United States) . . . . . [7342-19]

11:20 am: **Quantum algorithms for colored Jones polynomials**, Louis H. Kauffman, Univ. of Illinois at Chicago (United States); Samuel J. Lomonaco, Jr., Univ. of Maryland, Baltimore County (United States) . . . . . [7342-20]

11:40 am: **Twisting of filamentary vortex solitons demarcated by fast poincare recursion**, Jeffrey Yepez, Air Force Research Lab. (United States); George Vahala, The College of William & Mary (United States); Linda L. Vahala, Old Dominion Univ. (United States) . . . . . [7342-21]

12:00 pm: **Entangled designs for parametric identification of the depolarization channel**, Michael R. Frey, Bucknell Univ. (United States) . . . . . [7342-22]

12:20 pm: **Temperley-Lieb algebra and the Fibonacci model**, Louis H. Kauffman, Univ. of Illinois at Chicago (United States); Samuel J. Lomonaco, Jr., Univ. of Maryland, Baltimore County (United States) . . . . . [7342-23]

12:40 pm: **Topological quantum computation via Khovanov homology**, Juan F. Ospina, Univ. EAFIT (Colombia) . . . . . [7342-24]

1:00 pm: **Abstract error groups via Jones unitary braid group representations at q=i**, Yong Zhang, Univ. of Central Florida (United States) . . . . . [7342-25]

Monday-Friday 13-17 April 2009 • Proceedings of SPIE Vol. 7343

Independent Component Analyses, Wavelets, Neural Networks, Biosystems, and Nanoengineering VII

Conference Chairs: **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate; **F. Jack Agee,** Rice Univ.*Conference Co-Chairs:* **Toshio Fukuda,** Nagoya Univ. (Japan); **Fredric M. Ham,** Florida Institute of Technology; **Tzyy-Ping Jung,** Univ. of California San Diego and National Chiao-Tung Univ.; **M. Victor Wickerhauser,** Washington Univ. in St. Louis; **Kitt C. Reinhardt,** AFOSR

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 (Japan); **Ronald A. DeVore,** Univ. of South Carolina; **Qian Du,** Mississippi State Univ.; **Norden E. Huang,** National Central Univ. (Taiwan); **Phillip Q. Hwang,** National Imagery & Mapping; **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 W. Liou,** Western Michigan Univ.; **Kevin W. Lyons,** National Institute of Standards and Technology; **Shoji Makino,** Nippon Telegraph and Telephone Corp. (Japan); **Anke Meyer-Baese,** Florida State Univ.; **Uwe Meyer-Baese,** Florida State Univ.; **Francesco Carlo Morabito,** Univ. 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.; **M. Victor Wickerhauser,** Washington Univ. in St. Louis; **Donald C. Wunsch II,** Missouri Univ. of Science and Technology; **Ning Xi,** Michigan State Univ.; **Takeshi Yamakawa,** Kyushu Institute of Technology (Japan); **Fred Yang,** Missioncare Hospital Group (Taiwan)

Monday 13 April

Wavelet Pioneer Award

Room: Crystal Q . . . . . .Mon. 8:30 to 9:30 am

Session Chairs: **Mark J. T. Smith,** Purdue Univ.; **M. Victor Wickerhauser,** Washington Univ. in St. Louis; **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate

Wavelet Pioneer Award is given for the contribution and elucidation of diffusion wavelets and applications

Presented to: **Ronald Coifman,** Yale Univ. (United States)

8:30 am: **Wavelets and applications past and future** *(Invited Paper)*, Ronald R. Coifman, Yale Univ. (United States). . . . . [7343-01]

PANEL DISCUSSION

Room: Crystal Q . . . . . .Mon. 9:30 to 10:10 am

Future of Wavelet Analysis for Privacy and Prediction Mining

Session Chair: **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate

Panelists: **Ronald R. Coifman,** Yale Univ.; **Mark J. T. Smith,** Purdue Univ.; **M. Victor Wickerhauser,** Washington Univ. in St. Louis; **Patricia H. Carter,** Naval Surface Warfare Ctr.; **John E. Gray,** Naval Surface Warfare Ctr.; **Liden Miao,** Microsoft Inc.; **Glenn R. Easley,** System Planning Corp.

Coffee Break . . . . . 10:10 to 10:30 am

SESSION 2

Room: Crystal Q . . . . . .Mon. 10:30 am to 12:00 pm

Wavelets Applications I

Session Chairs: **Amy Sunshine Smith-Carroll,** Naval Surface Warfare Ctr.; **Mark J. T. Smith,** Purdue Univ.

10:30 am: **To be determined** *(Invited Paper)*, M. Victor Wickerhauser, Washington Univ. in St. Louis (United States). . . . . [7343-02]

11:00 am: **Next-generation wavelets predicting 6W relevant linkage data mining statistics** *(Invited Paper)*, Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7343-03]

11:30 am: **Wavelet radar** *(Invited Paper)*, Kim Scheff, Peter Hansen, Naval Research Lab. (United States); Jefferey Willey, NRL (United States); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7343-04]

Lunch Break . . . . . 12:00 to 2:00 pm

SESSION 3

Room: Crystal Q . . . . . Mon. 2:00 to 2:50 pm

Wavelet Applications II

Session Chairs: **Patricia H. Carter,** Naval Surface Warfare Ctr.; **Glenn R. Easley,** System Planning Corp.

2:00 pm: **Improved radon-based imaging using the Shearlet transform** *(Invited Paper)*, Glenn R. Easley, System Planning Corp. (United States); Demetrio Labate, North Carolina State Univ. (United States); Flavia Colonna, George Mason Univ. (United States). . . . . [7343-06]

2:30 pm: **Sensor performance monitoring using Fourier and wavelet transforms**, Abolfazl M. Amini, Southern Univ. (United States) . . . . . [7343-08]

Coffee Break . . . . . 2:50 to 3:30 pm

SESSION 4

Room: Crystal Q . . . . . Mon. 3:30 to 4:50 pm

Wavelet Applications III

Session Chairs: **Charles C. Hsu,** Trident Systems Inc.; **Adrian B. Johnson,** The MITRE Corp.

3:30 pm: **Synthetic aperture radar on unmanned air vehicle** *(Invited Paper)*, Howard B. Mendelson, Charles C. Hsu, Daniel Bindbeutel, Trident Systems Inc. (United States). . . . . [7343-09]

4:00 pm: **How to convert a numerical data set into a continuous function or data model** *(Invited Paper)*, James W. Handley, Holger M. Jaenisch, Kristina L. Jaenisch R.N., Licht Strahl Engineering Inc. (United States) . . . . . [7343-10]

4:30 pm: **New technique of distinguishing rock from coal based on statistical analysis of wavelet transform**, Tao Gu, Li Xu, North China Institute of Science and Technology (China). . . . . [7343-11]

Tuesday 14 April

ICA Unsupervised Learning Award
Room: Crystal Q . . . . . Tues. 8:00 to 8:50 am

Session Chairs: **Tzyy-Ping Jung,** Univ. of California, San Diego; **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate

ICA Unsupervised Learning Award is given to a key player related to the inferential science machine learning field

Presented to: **Mark Girolami,** Univ. of Glasgow (United Kingdom)

8:00 am: **ICA Pioneer Award presentation** *(Invited Paper, Presentation Only)*, Mark Girolami, Univ. of Glasgow (United Kingdom) . . . . . [7343-12]

Symposium-Wide Plenary Presentation
Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*
Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

PANEL DISCUSSION
Room: Crystal Q . . . . . Tues. 10:30 to 11:10 am

The Future Perspective of PCA, ICA, DCA, BSS, etc.

Session Chair: **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate

Panelists: **Tzyy-Ping Jung,** Univ. of California, San Diego; **John E. Gray,** Naval Surface Warfare Ctr.; **Qian Du,** Mississippi State Univ.

SESSION 6
Room: Crystal Q . . . . . Tues. 11:10 am to 12:40 pm

ICA Applications I

Session Chairs: **Tzyy-Ping Jung,** Univ. of California, San Diego; **John E. Gray,** Naval Surface Warfare Ctr.; **Qian Du,** Mississippi State Univ.

11:10 am: **Independent modulators mediate spectra of multiple brain processes in a VR-based driving experiment**, Shang-Wen Chuang, Jong-Liang Jeng, Li-Wei Ko, National Chiao-Tung Univ. (Taiwan); Ruey-Song Huang, Jeng-Ren Duann, Tzyy-Ping Jung, National Chiao-Tung Univ. (Taiwan) and Univ. of California, San Diego (United States); Chin-Teng Lin, National Chiao-Tung Univ. (Taiwan) . . . . . [7343-48]

11:40 am: **The semantic problem of information and its implications** *(Invited Paper)*, John E. Gray, Naval Surface Warfare Ctr. (United States); **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7343-14]

12:10 pm: **Precipitation data merging using artificial neural networks** *(Invited Paper)*, Qian Du, Mississippi State Univ. (United States) . . . . . [7343-15]

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

SESSION 7
Room: Crystal Q . . . . . Tues. 1:40 to 3:10 pm

ICA Applications II: Neural Network Learning

Session Chairs: **Tzyy-Ping Jung,** Univ. of California, San Diego; **Fredric M. Ham,** Florida Institute of Technology; **Qian Du,** Mississippi State Univ.

1:40 pm: **Denoising using adaptive thresholding and higher order statistics** *(Invited Paper)*, Samuel P. Kozaitis, Timothy Young, Florida Institute of Technology (United States) . . . . . [7343-16]

2:10 pm: **Relationship mapping** *(Invited Paper)*, Dalila Benachenhou, MG Inc. (United States) . . . . . [7343-17]

2:40 pm: **Information-theoretic feature extraction and selection for robust classification** *(Invited Paper)*, Chandra S. Dhir, KAIST (Korea, Republic of); Soo-Young Lee, KAIST (Korea, Republic of) and RIKEN Brain Science Institute (Japan) . . . . . [7343-18]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 8
Room: Crystal Q . . . . . Tues. 3:40 to 5:40 pm

ICA Applications III: Neural Network Applications

Session Chairs: **Tzyy-Ping Jung,** Univ. of California, San Diego; **Samuel P. Kozaitis,** Florida Institute of Technology; **Bim Prasad Shrestha,** Kathmandu Univ. (Nepal)

3:40 pm: **Neural network approaches for mobile bay water quality mapping with spaceborne measurements**, He Yang, Qian Du, Mississippi State Univ. (United States) . . . . . [7343-19]

4:00 pm: **Design of neuropfisiologically motivated structure of time pulse coded neurons**, Alexander I. Nikolskyy, Vinnitsa State Technical Univ. (Ukraine); Vladimir G. Krasilenko, Raisa F. Lobodzinska, Open International Univ. of Human Development (Ukraine) . . . . . [7343-20]

4:20 pm: **Classification of biological and non-biological fluvial particles using image processing and artificial neural network**, Bim P. Shrestha, Nabin K. Shrestha, Laxman Paudel, Kathmandu Univ. (Nepal) . . . . . [7343-21]

4:40 pm: **New advances for automated IP soft-core watermarking**, Encarnacion Castillo, Univ. de Granada (Spain); Uwe Meyer-Baese, Florida State Univ. (United States); Luis Parrilla, Antonio García, Antonio Lloris, Univ. de Granada (Spain) . . . . . [7343-22]

5:00 pm: **How to convert Bayesian causal networks into equivalent equation-based data models**, Holger M. Jaenisch, James W. Handley, Kristina L. Jaenisch R.N., Licht Strahl Engineering Inc. (United States) . . . . . [7343-23]

5:20 pm: **Artificial neural network (ANN) based atmospheric temperature determination from MODIS data**, Guoyin Cai, Beijing Univ. of Civil Engineering and Architecture (China) . . . . . [7343-24]

Wednesday 15 April

SESSION 9
Room: Crystal Q . . . . . Wed. 8:30 to 9:10 am

Nanoengineering Applications I

Session Chairs: **Toshio Fukuda,** Nagoya Univ. (Japan); **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate

8:30 am: **Nanoscale electronics** *(Invited Paper),* Chagaan Baatar, Office of Naval Research (United States) . . . . . [7343-25]

PANEL DISCUSSION
Room: Crystal Q . . . . . Wed. 9:10 to 10:00 am

Paths from Nanoscience to Nanotechnology to Nanoengineering

Session Chairs: **Toshio Fukuda,** Nagoya Univ. (Japan); **Robert D. Shull,** National Institute of Standards and Technology; **Harold H. Szu,** Office of Naval Research

Panelists: **Kitt C. Reinhardt,** Air Force Office of Scientific Research; **F. Jack Agee,** Rice Univ.; **Chagaan Baatar,** Office of Naval Research

Coffee Break . . . . . 10:00 to 10:40 am

SESSION 10
Room: Crystal Q . . . . . Wed. 10:40 am to 12:10 pm

Nanoengineering Applications II

Session Chairs: **Toshio Fukuda,** Nagoya Univ. (Japan); **Y. Sheng,** George Washington Univ.

10:40 am: **Nanomaterial sensing** *(Invited Paper)*, Francisco Santiago, NSWCDD (United States); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7343-26]

11:10 am: **Nanosurgeon** *(Invited Paper)*, Huan-Yao Lei, National Cheng Kung Univ. (Taiwan); Ching-An Peng, Nanyang Technological Univ. (Taiwan); Ming J. Tang, National Cheng Kung Univ. (Taiwan); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Kitt C. Reinhardt, Air Force Office of Scientific Research (United States) . . . . . [7343-27]

11:40 am: **Reviews of nano-manipulators** *(Invited Paper)*, Toshio Fukuda, Nagoya Univ. (Japan) . . . . . [7343-28]

Lunch/Exhibition Break . . . . . 12:10 to 1:20 pm

SESSION 11

Room: Crystal Q . . . . . Wed. 1:20 to 3:00 pm

Nano-Applications

Session Chairs: **F. Jack Agee,** Rice Univ.;
Y. Sheng, George Washington Univ.

1:20 pm: **Accelerate electromagnetics computation for wireless localization using reconfigurable hardware**, Robert Weir, Xinming Huang, Worcester Polytechnic Institute (United States) . . . . . [7343-53]

1:40 pm: **Soft decoding MIMO wireless communications and its implementations on FPGA**, Chen Shen, Xinming Huang, Worcester Polytechnic Institute (United States) . . . . . [7343-54]

2:00 pm: **Nanotechnology research for aerospace applications** *(Invited Paper)*, F. Jack Agee, Alice Chow, Rice Univ. (United States) . . . . . [7343-29]

2:30 pm: **Solar energy** *(Invited Paper)*, Jong-Horng H. Dai, Yin-Lin Shen, The George Washington Univ. (United States); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Kitt C. Reinhardt, Air Force Office of Scientific Research (United States) . . . . . [7343-30]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 12

Room: Crystal Q . . . . . Wed. 3:30 to 4:20 pm

Hardware and Applications

Session Chair: **Y. Sheng,** George Washington Univ.

3:30 pm: **Satellite detection of crustal stress concentrations under China** *(Invited Paper)*, Han-Shou Liu, NASA Goddard Space Flight Ctr. (United States) . . . . . [7343-31]

4:00 pm: **DSP structure to motion computation on reconfigurable hardware,** Guillermo Botella Juan, Univ. Complutense de Madrid (Spain); Antonio Garcia Rios, Manuel Rodriguez Alvarez, Univ. de Granada (Spain); Uwe Meyer-Baese, Florida State Univ. (United States) . . . . . [7343-32]

Nanoengineering Pioneer Award

Room: Crystal Q . . . . . Wed. 4:20 to 5:00 pm

Session Chairs: **Toshio Fukuda,** Nagoya Univ. (Japan);
F. Jack Agee, Rice Univ.

This pioneer award is for excellence in the field of nano-magnetism material science.

Presented to: **Dr. Robert Shull,**
National Institute of Standards and Technology

4:20 pm: **Nanomagnetism! What is it? And why should we care?** *(Invited Paper)*, Robert D. Shull, National Institute of Standards and Technology (United States) . . . . . [7343-33]

Thursday 16 April

Biomedical Wellness Award

Room: Crystal Q . . . . . Thurs. 8:30 to 9:30 am

Session Chairs: **Soo-Young Lee,** Korea Advanced Institute of Science and Technology (Korea, Republic of); **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate

The Biomedical Wellness Award is given for the contribution to brain disorder analysis.

Presented to: **Takeshi Yamakawa,**
Kyushu Institute of Technology (Japan)

8:30 am: **Fuzzy logic for man-machine interface** (Invited Paper), Takeshi Yamakawa, Kyushu Institute of Technology (Japan) . . . . . [7343-34]

PANEL DISCUSSION

Room: Crystal Q . . . . . Thurs. 9:30 to 10:10 am

Panel Discussion: Challenge of Human Characteristics

Session Chairs: **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate; **Takeshi Yamakawa,** Kyushu Institute of Technology (Japan)

Panelists: **Soo-Young Lee,** Korea Advanced Institute of Science and Technology (Korea, Republic of); **Keith A. Krapels,** U.S. Army Night Vision & Electronic Sensors Directorate

Coffee Break . . . . . 10:10 to 10:30 am

SESSION 15

Room: Crystal Q . . . . . Thurs. 10:30 to 11:50 am

Standoff Biometrics I

Session Chairs: **J. Andrew Hutchinson,** Defense Advanced Research Projects Agency; **Barbara L. O'Kane,**
U.S. Army Night Vision & Electronic Sensors Directorate

10:30 am: **FLIR biometrics** *(Invited Paper)*, Barbara L. O'Kane, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7343-36]

11:00 am: **Field verification of the direct view optics (DVO) model for human facial identification**, K. A. Krapels, S. Aghera, J. Hixson, U.S. Army Night Vision & Electronic Sensors Directorate (United States); R. Driggers, Naval Research Lab. (United States) . . . . . [7343-37]

11:20 am: **Diagnostic biometrics** *(Invited Paper)*, Alan Krzywicki, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7343-38]

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

SESSION 16

Room: Crystal Q . . . . . Thurs. 1:30 to 2:40 pm

Standoff Biometric II

Session Chairs: **David E. Bonzo,** U.S. Army Night Vision & Electronic Sensors Directorate; **Alan Krzywicki,** U.S. Army Night Vision & Electronic Sensors Directorate

1:30 pm: **Dual infrared spectral cameras** *(Invited Paper)*, David E. Bonzo, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . [7343-39]

2:00 pm: **Extremely low frequency (ELF) processing of isotopes**, Kenneth A. Byrd, Howard Univ. (United States) and Naval Research Lab. (United States); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Michael J. Wardlaw, Office of Naval Research (United States) . . [7343-40]

2:20 pm: **A refined hybrid scoring approach for human candidate selection in IR image sequences**, Kenneth A. Byrd, Mohamed F. Chouikha, Howard Univ. (United States) . . . . . [7343-41]

SESSION 17

Room: Crystal Q . . . . . Thurs. 2:40 to 3:20 pm

Standoff Biometric III

Session Chairs: **Henry C. H. Chu,** Univ. of Louisiana at Lafayette;
Charles C. Hsu, Trident Systems Inc.

2:40 pm: **Recovering affine illumination changes from ray projections in an image pair**, Henry C. H. Chu, Yun Zhang, Univ. of Louisiana at Lafayette (United States) . . . . . [7343-42]

3:00 pm: **Modularity biometrics**, Charles C. Hsu, Trident Systems Inc. (United States); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States) . . . . . [7343-43]

Friday 17 April

System Biology Award

Room: Crystal Q . . . . . Fri. 8:30 to 9:30 am

Session Chairs: **Fredric M. Ham,** Florida Institute of Technology; **Anke Meyer-Baese,** Florida State Univ.

The System Biology Award is given for key contributions to the field of neuro-degeneration bioinformatics data engineering

Presented to: **Olaf Wolkenhauer,** Univ. of Rostock (Germany)

8:30 am: **System biology and applications** *(Invited Paper),* Olaf Wolkenhauer, Univ. of Rostock (Germany) . . . . . [7343-44]

PANEL DISCUSSION

Room: Crystal Q . . . . . Fri. 9:30 to 10:10 am

Future of System Biology

Session Chairs: **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate; **Olaf Wolkenhauer,** Univ. of Rostock (Germany)

Panelists: **Toshio Fukuda,** Nagoya Univ. (Japan); **Fredric M. Ham,** Florida Institute of Technology; **Anke Meyer-Baese,** Florida State Univ.

Coffee Break . . . . . 10:10 to 10:30 am

SESSION 19

Room: Crystal Q . . . . . Fri. 10:30 am to 12:00 pm

System Biology Applications I

Session Chairs: **Fredric M. Ham,** Florida Institute of Technology; **Olaf Wolkenhauer,** Univ. of Rostock (Germany); **Toshio Fukuda,** Nagoya Univ. (Japan)

10:30 am: **Unsupervised learning for standoff diagnostic biometrics** *(Invited Paper)*, Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Charles Hsu, The George Washington Univ. (United States); Philip Hoekstra, Therma-Scan Inc (United States); Felix Hong, Wayne State Medical School (United States); Jerry Beeney, FLIR (United States)[7343-45]

11:00 am: **Visual exploratory analysis of DCE-MRI data in breast cancer based on novel nonlinear dimensional data reduction techniques** *(Invited Paper)*, Anke Meyer-Baese, Adrian Barbu, Florida State Univ. (United States). . . . . [7343-46]

11:30 am: **Review of system biology** *(Invited Paper)*, Toshio Fukuda, Nagoya Univ. (Japan) . . . . . [7343-47]

Lunch Break . . . . . 12:00 to 1:50 pm

SESSION 20

Room: Crystal Q . . . . . Fri. 1:50 to 2:40 pm

System Biology Applications II

Session Chairs: **Fredric M. Ham,** Florida Institute of Technology; **Anke Meyer-Baese,** Florida State Univ.

1:50 pm: **Grouping individual independent BOLD effects: a new way to ICA group analysis** *(Invited Paper)*, Jeng-Ren Duann, Tzyy-Ping Jung, University of California San Diego (United States); Terrence J. Sejnowski, The Salk Institute (United States); Scott Makeig, University of California San Diego (United States). . . . . [7343-13]

2:10 pm: **Flow injection analysis system design for environmental multi-ion sensing using independent component analysis signal processing** *(Invited Paper)*, Wen-Yan D. Chung, Febus Reidj G. Cruz, Chung Yuan Christian Univ. (Taiwan); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States); Dorota G. Pijanowska, Marek Dawgul, Institute of Biocybernetics and Biomedical Engineering (Poland); Piotr Grabiec, Bohdan Jarosewicz, Institute of Electron Technology (Poland); Kuo-Chung Chang, Cheanyeh Cheng, Chung Yuan Christian Univ. (Taiwan); Jung-Lung Chiang, Chung Chou Institute of Technology (Taiwan) . . . . . [7343-49]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 21

Room: Crystal Q . . . . . Fri. 3:30 to 4:50 pm

System Biology Applications III

Session Chairs: **Fredric M. Ham,** Florida Institute of Technology; **Wen-Yan Danny Chung,** Chung Yuan Christian Univ. (Taiwan)

3:30 pm: **IR methods for estimating glucose concentrations** *(Invited Paper, Presentation Only)*, Fredric M. Ham, Florida Institute of Technology (United States). . . . . [7343-50]

4:00 pm: **Dual IR imagery by BSS local contrast enhancement** *(Invited Paper)*, Ming Kai Hsu, Ting N. Lee, gwu (United States); Harold H. Szu, U.S. Army Night Vision & Electronic Sensors Directorate (United States). . . . . [7343-51]

4:30 pm: **Predictive data modeling of human type II diabetes related statistics**, Kristina L. Jaenisch R.N., Holger M. Jaenisch, James W. Handley, Licht Strahl Engineering Inc. (United States). . . . . [7343-52]

Data Mining, Intrusion Detection, Information Security and Assurance, and Data Networks Security 2009

Conference Chair: **Belur V. Dasarathy,** Consultant, Information Fusion Technologies

Program Committee: **Jonathan A. Gloster,** The Van Dyke Technology Group, Inc.; **Sajid Hussain,** Acadia Univ. (Canada); **Robert S. Lynch, Jr.,** Naval Undersea Warfare Ctr.; **Vahid R. Riasati,** Boeing Satellite Systems; **John J. Salerno, Jr.,** Air Force Research Lab.; **Martin R. Stytz,** Institute for Defense Analyses; **Shusaku Tsumoto,** Shimane Univ. (Japan)

Wednesday 15 April

SESSION 1

Room: Los Angeles . . . . . Wed. 8:20 to 9:20 am

Intrusion Detection and Network Security I

Session Chairs: **Robert S. Lynch, Jr.,** Naval Undersea Warfare Ctr.; **Belur V. Dasarathy,** Consultant, Information Fusion Technologies

8:20 am: **Exploring social relations for the intrusion detection in ad hoc networks**, Wei Wang, Hong Man, Stevens Institute of Technology (United States) . . . . . [7344-01]

8:40 am: **A comparison of passive optical network security**, Alan Harris, Univ. of North Florida (United States); Mouhamad K. Akkoumi, James J. Sluss, Jr., Univ. of Oklahoma (United States) . . . . . [7344-03]

9:00 am: **Feature-based alerts correlation for network's security using self organizing maps**, Munesh K. Kella, Shoaib Siddiqui, Humera N. Yusuf, NED Univ. of Engineering and Technology (Pakistan) . . . . . [7344-04]

SESSION 2

Room: Los Angeles . . . . . Wed. 9:20 to 10:20 am

Intrusion Detection and Network Security II

Session Chairs: **Jonathan A. Gloster,** The Van Dyke Technology Group, Inc.; **Martin R. Stytz,** Institute for Defense Analyses

9:20 am: **Secure data aggregation in heterogeneous and disparate networks using stand off server architecture**, Vimalathithan Subramanian, Sudarsan S. Damodaran, Remzi Seker, Lenin B. Rathinasamy, Srinivasan Ramaswamy, Univ. of Arkansas at Little Rock (United States) . . . . . [7344-05]

9:40 am: **Security in MANETs using reputation-adjusted routing**, Attila Ondi, Katherine Hoffman, Richard A. Ford, William H. Allen, Florida Institute of Technology (United States); Marco M. Carvalho, Carlos A. Perez, Institute for Human and Machine Cognition (United States) . . . . . [7344-06]

10:00 am: **Application of a clustering-remote sensing method in analyzing security patterns**, Alejandra A. López-Caloca, Elvia Martínez-Viveros, José I. Chapela-Castañares, Ctr. de Investigación en Geografía y Geomática (Mexico) . . . . . [7344-08]

Coffee Break . . . . . 10:20 to 11:10 am

SESSION 3

Room: Los Angeles . . . . . Wed. 11:10 to 11:50 am

Data Mining and Classification I

Session Chairs: **Sajid Hussain,** Acadia Univ. (Canada); **Vahid R. Riasati,** Boeing Satellite Systems International, Inc.

11:10 am: **Estimating the threshold for maximizing expected gain in supervised discrete Bayesian classification**, Robert S. Lynch, Jr., Naval Undersea Warfare Ctr. (United States) . . . . . [7344-09]

11:30 am: **Analyzing journaling to template response matching for autonomous context recognition**, Holger M. Jaenisch, James W. Handley, Licht Strahl Engineering Inc. (United States) . . . . . [7344-10]

Lunch/Exhibition Break . . . . . 11:50 am to 12:50 pm

SESSION 4

Room: Los Angeles . . . . . Wed. 12:50 to 1:50 pm

Data Mining and Classification II

Session Chairs: **Shusaku Tsumoto,** Shimane Univ. (Japan); **Sajid Hussain,** Acadia Univ. (Canada)

12:50 pm: **Temporal data mining for hospital management**, Shusaku Tsumoto, Shimane Univ. (Japan) . . . . . [7344-11]

1:10 pm: **Malware distributed collection and preclassification system using honeypot technology**, Andre Gregio, Univ. Estadual de Campinas (Brazil); Rafael Santos, Instituto Nacional de Pesquisas Espaciais (Brazil); Paulo L. de Geus, Univ. Estadual de Campinas (Brazil); Isabela Oliveira, Adriano Cansian, Univ. Estadual de São Paulo (Brazil) . . . . . [7344-12]

1:30 pm: **SAM: an interoperable metadata model for multimodal surveillance applications**, Peter Schallauer, Werner Bailer, Roland Mörzinger, Albert Hofmann, JOANNEUM RESEARCH Forschungsgesellschaft mbH (Austria) . . . . . [7344-13]

SESSION 5

Room: Los Angeles . . . . . Wed. 1:50 to 3:10 pm

Miscellaneous Applications: Issues and Innovations I

Session Chairs: **Vahid R. Riasati,** Boeing Satellite Systems International, Inc.; **John J. Salerno, Jr.,** Air Force Research Lab.

1:50 pm: **A method to characterize dataset based on objective rule evaluation indices**, Hidenao Abe, Shusaku Tsumoto, Shimane Univ. (Japan) . . . . . [7344-14]

2:10 pm: **Adaptation of the projection-slice theorem for stock valuation estimation using random Markov fields**, Vahid R. Riasati, Boeing Satellite Systems International, Inc. (United States) . . . . . [7344-15]

2:30 pm: **Identifying hidden voice and video streams**, Dapeng O. Wu, Univ. of Florida (United States) . . . . . [7344-16]

2:50 pm: **Using received signal strength indicator to detect node replacement and replication attack in sensor networks**, Sajid Hussain, Shafayat Rahman, Acadia Univ. (Canada) . . . . . [7344-30]

Coffee Break . . . . . 3:10 to 3:40 pm

SESSION 6

Room: Los Angeles . . . . . Wed. 3:40 to 5:00 pm

Miscellaneous Applications: Issues and Innovations II

Session Chairs: **John J. Salerno, Jr.,** Air Force Research Lab.; **Shusaku Tsumoto,** Shimane Univ. (Japan)

3:40 pm: **Considerations and foundations for Botnet simulation**, Martin R. Stytz, Institute for Defense Analyses (United States); Sheila B. Banks, Calculated Insight (United States) . . . . . [7344-18]

4:00 pm: **High-speed packet filtering utilizing stream processors**, Errin W. Fulp, Richard Hummel, Wake Forest Univ. (United States) . . . . . [7344-19]

4:20 pm: **Remote optical authentication of objects**, Roland D. Gillard, Univ. Joseph Fourier (France); Thierry Fournel, Univ. St. Etienne (France); Jean Lancrenon, Univ. Joseph Fourier (France) . . . . . [7344-20]

4:40 pm: **Information assurance requirements development and specification**, Martin R. Stytz, Michael May, Institute for Defense Analyses (United States); Sheila B. Banks, Calculated Insight (United States) . . . . [7344-21]

Thursday 16 April

POSTERS-THURSDAY

Room: Crystal M . . . . . Thurs. 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.

Thursday-Friday 16-17 April 2009 • Proceedings of SPIE Vol. 7345

Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2009

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.; **Michael Heizmann,** Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany); **Charles F. Hester,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Mieczyslaw M. Kokar,** Northeastern Univ.; **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

Thursday 16 April

SESSION 1

Room: Los Angeles . . . . . Thurs. 8:20 to 9:40 am

Low-Level Fusion

Session Chairs: **Jerome J. Braun,** MIT Lincoln Lab.;
Belur V. Dasarathy, Consultant, Information Fusion Technologies

8:20 am: **Evaluation of a color fused dual-band NVG-sensor**, Maarten A. Hogervorst, TNO Defense, Security and Safety (Netherlands) . . . . . [7345-02]

8:40 am: **The TRICLOBS portable triband lowlight color observation system**, Alexander Toet, Maarten A. Hogervorst, TNO Defense, Security and Safety (Netherlands) . . . . . [7345-03]

9:00 am: **Enhancing image fusion performance and utility for defence and security applications**, James Sadler, Moira I. Smith, Waterfall Solutions Ltd. (United Kingdom). . . . . [7345-04]

9:20 am: **ACT-Vision: active collaborative tracking for multiple PTZ cameras**, Christopher Broaddus, Thomas E. Germano, Nicholas Vandervalk, Shunguang Wu, Ajay Divakaran, Harpreet S. Sawhney, Sarnoff Corp. (United States). . . . . [7345-05]

Coffee Break . . . . . 9:40 to 10:30 am

SESSION 2

Room: Los Angeles . . . . . Thurs. 10:30 to 11:50 am

Networks

Session Chairs: **Damian M. Lyons,** Fordham Univ.;
Charles F. Hester, OPTS Inc.

10:30 am: **Soft Adaptive Fusion of Sensor Energy (SAFE) in large-scale sensor networks**, Amir H. Shirkhodaie, Haroun Rababaah, Tennessee State Univ. (United States) . . . . . [7345-07]

10:50 am: **Manned/unmanned Common Architecture Program (MCAP) network centric flight tests**, Dale L. Johnson, U.S. Army Aviation Applied Technology Directorate (United States) . . . . . [7345-08]

11:10 am: **A multi-layer network architecture for dynamic resource configuration and management of multiple mobile resources in maritime surveillance**, Roozbeh Farahbod, Uwe P. Glaesser, Ali Khalili-Araghi, Simon Fraser Univ. (Canada) . . . . . [7345-09]

11:30 am: **Semantic enrichment of multi-INT data within a net-centric environment**, Richard D. Hull, Modus Operandi, Inc. (United States); Larry Lashine, U.S. Army (United States); Don Jenkins, Modus Operandi, Inc. (United States). . . . . [7345-10]

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

SESSION 3

Room: Los Angeles . . . . . Thurs. 1:10 to 2:50 pm

Fusion System Architectures

Session Chairs: **Charles F. Hester,** OPTS Inc.; **Michael Heizmann,** Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany)

1:10 pm: **Innovative system architecture for spatial volumetric acoustic seeing**, Eugene Levin, Aleksandr V. Sergeyev, Michigan Technological Univ. (United States). . . . . [7345-21]

1:30 pm: **An integrated multi-source JDL high-level data fusion architecture using recombinant cognition synthesis**, Marco A. Solano, Texas Tech Univ. (United States). . . . . [7345-11]

1:50 pm: **Information fusion across expert groups with dependent and independent components**, Victor M. Vergara, Shan Xia, Thomas P. Caudell, Frank Gilfeather, The Univ. of New Mexico (United States) . . . . . [7345-12]

2:10 pm: **Data Fusion Engine (DFE) for the Force Protection Joint Experiment (FPJE)**, Christopher M. Barngrover, Robin T. Laird, James R. Cruickshanks, Scott H. Cutler, Space and Naval Warfare Systems Ctr., San Diego (United States). . . . . [7345-13]

2:30 pm: **Fuzzy fusion, an application architecture for multisource information fusion**, Ronda R. Henning, Kevin L. Fox, Harris Corp. (United States). . . . . [7345-14]

Coffee Break . . . . . 2:50 to 3:30 pm

SESSION 4

Room: Los Angeles . . . . . Thurs. 3:30 to 4:30 pm

Applications I

Session Chairs: **Jerome J. Braun,** MIT Lincoln Lab.;
Sheela V. Belur, The Van Dyke Technology Group, Inc.

3:30 pm: **Explosive detection in the presence of clutter by processing Raman spectra with a kernel adatron**, Amy E. Stevens, Edward A. Rietman, Patrick T. Rourke, Physical Sciences Inc. (United States) . . . . . [7345-15]

3:50 pm: **Tracking and sharing landmarks in a team of autonomous robots**, Damian M. Lyons, Sirhan Chaudhry, D. Frank Hsu, Fordham Univ. (United States). . . . . [7345-17]

4:10 pm: **Energy Logic (EL): a novel fusion engine of multi-modality multi-agent data/information fusion for intelligent surveillance systems**, Haroun Rababaah, Amir H. Shirkhodaie, Tennessee State Univ. (United States). . . . . [7345-19]

Friday 17 April

SESSION 5

Room: Los Angeles . . . . . Fri. 8:40 to 9:40 am

Applications II

Session Chairs: **Michael Heizmann,** Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany); **Shanchieh Jay Yang,** Rochester Institute of Technology

8:40 am: **Force Protection Joint Experiment (FPJE) Battlefield Anti-Intrusion System (BAIS) sensors data analysis and filtering metrics**, Christopher M. Barngrover, Robin T. Laird, James R. Cruickshanks, Space and Naval Warfare Systems Ctr., San Diego (United States) . . . . . [7345-20]

9:00 am: **Biologically-inspired robust and adaptive multi-sensor fusion and active control**, Deepak Khosla, Paul A. Dow, David J. Huber, HRL Labs., LLC (United States) . . . . . [7345-22]

9:20 am: **Information abstraction for enhanced fusion-based surveillance systems**, Scott F. Page, William J. Oxford, Moira I. Smith, Duncan L. Hickman, Waterfall Solutions Ltd. (United Kingdom); Paul K. Kimber, SELEX GALILEO (United Kingdom). . . . . [7345-24]

Coffee Break . . . . . 9:40 to 10:30 am

SESSION 6

Room: Los Angeles . . . . . Fri. 10:30 am to 12:10 pm

Miscellaneous Issues and Approaches

Session Chairs: **Pierre Valin,** Defence Research and Development Canada Valcartier (Canada); **Damian M. Lyons,** Fordham Univ.

10:30 am: **Target tracking for randomly varying number of targets and sensors using random finite set theory**, Andreas M. Ali, Ralph E. Hudson, Kung Yao, Univ. of California, Los Angeles (United States) . . . . . [7345-25]

10:50 am: **Field-based data collection techniques for the evaluation of information fusion systems**, Brian Antonishek, Brian A. Weiss, Craig I. Schlenoff, National Institute of Standards and Technology (United States) . . . . . [7345-27]

11:10 am: **A local approach for focussed Bayesian fusion**, Jennifer Sander, Univ. Karlsruhe (Germany); Michael Heizmann, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany); Igor Goussev, Univ. Karlsruhe (Germany); Jürgen Beyerer, Fraunhofer-Institut für Informations-und Datenverarbeitung (Germany) . . . . . [7345-28]

11:30 am: **3D hierarchical spatial representation and memory of multimodal sensory data**, Paul A. Dow, Deepak Khosla, David J. Huber, HRL Labs., LLC (United States) . . . . . [7345-29]

11:50 am: **Multisensor information compression and reconstruction**, Bing Du, Liang Liu, Jun Zhang, BeiHang Univ. (China) . . . . . [7345-26]

Visual Analytics for Homeland Defense and Security

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

Program Committee: **Bruce Campbell,** Univ. of Washington; **John Dill,** Simon Fraser Univ. (Canada); **David S. Ebert,** Purdue Univ.; **Brian Fisher,** Simon Fraser Univ. (Canada); **John Gerth,** Stanford Univ.; **Ashok K. Goel,** Georgia Institute of Technology; **Robert Kosara,** The Univ. of North Carolina at Charlotte; **William Pike,** Pacific Northwest National Lab.; **Anita Raja,** Univ. of North Carolina at Charlotte; **Anthony Robinson,** Pennsylvania State Univ.; **Antonio Sanfilippo,** Pacific Northwest National Lab.; **John Stasko,** Georgia Institute of Technology; **Matthew O. Ward,** Worcester Polytechnic Institute; **Pak Chung Wong,** Pacific Northwest National Lab.; **Jing Yang,** The Univ. of North Carolina at Charlotte

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

Welcome and Opening Remarks

Room: Los Angeles . . . . . Tues. 10:30 to 10:50 am

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

SESSION 1

Room: Los Angeles . . . . . Tues. 10:50 am to 12:30 pm

Infrastructure Protection, Incident Response, and Public Safety

Session Chair: **William J. Tolone,** The Univ. of North Carolina at Charlotte

10:50 am: **Recommendation-based geovisualization support for reconstitution in critical infrastructure protection**, David C. Wilson, Okan Pala, William J. Tolone, Wei-Ning Xiang, Univ. of North Carolina at Charlotte (United States) . . . . . [7346-01]

11:10 am: **Visual analytics for law enforcement: deploying a service-oriented analytic framework for Web-based visualization**, Joe Bruce, Richard May, William Pike, Pacific Northwest National Lab. (United States) . . . . . [7346-02]

11:30 am: **Toward sustainable infrastructure management: knowledge-based service-oriented computing framework for visual analytics**, Seok-Won Lee, William J. Tolone, Ajeet Murty, Rashna Vatcha, Xiaoyu Wang, Wenwen Dou, Remco Chang, William Ribarsky, Wanqiu Liu, Shenen Chen, Edd Hauser, Univ. of North Carolina at Charlotte (United States). . . . . [7346-03]

11:50 am: **Analyzing networks of static and dynamic geospatial entities**, Delsey M. Sherrill, Michael Yee, Peter L. Cho, MIT Lincoln Lab. (United States). . . . . [7346-04]

12:10 pm: **Knowledge integrated visual analysis of bridge safety and maintenance**, Xiaoyu Wang, Wenwen Dou, Seok-Won Lee, Remco Chang, William Ribarsky, Univ. of North Carolina at Charlotte (United States). . . [7346-05]

Lunch/Exhibition Break . . . . . 12:30 to 1:40 pm

SESSION 2

Room: Los Angeles . . . . . Tues. 1:40 to 3:00 pm

Maritime Surveillance and Port Security

Session Chair: **William Ribarsky,** The Univ. of North Carolina at Charlotte

1:40 pm: **VISAD: an interactive and visual analytical tool for the detection of behavioral anomalies in maritime traffic data**, Maria Riveiro, Göran Falkman, Tom Ziemke, Univ. of Skövde (Sweden); Håkan Warston, Saab Microwave Systems AB (Sweden) . . . . . [7346-06]

2:00 pm: **A semantic based video indexing and retrieval system for maritime surveillance**, Hieu T. Nguyen, Prakash Ramu, Xiaoqing Liu, Hai Wei, Jacob Yadegar, UtopiaCompression Corp. (United States) . . . . . [7346-07]

2:20 pm: **Adaptive maritime video surveillance**, Kalyan M. Gupta, Knexus Research (United States); David W. Aha, Ralph L. Hartley, Naval Research Lab. (United States). . . . . [7346-08]

2:40 pm: **Reasoning about anomalies: a study of the analytical process of detecting and identifying anomalous behavior in maritime traffic data**, Maria Riveiro, Göran Falkman, Tom Ziemke, Univ. of Skövde (Sweden); Thomas R. Kronhamn, Saab Microwave Systems AB (Sweden) . . . . . [7346-09]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 3

Room: Los Angeles . . . . . Tues. 3:30 to 4:50 pm

Integration and Interaction in Support of Defense and Security

Session Chair: **William J. Tolone,** The Univ. of North Carolina at Charlotte

3:30 pm: **Integration of heterogeneous processes through visual analytics**, Xiaoyu Wang, Wenwen Dou, William Ribarsky, Remco Chang, The Univ. of North Carolina at Charlotte (United States). . . . . [7346-10]

3:50 pm: **Integrating time-series visualizations within parallel coordinates for exploratory analysis of incident databases**, Michael Butkiewicz, Univ. of Pittsburgh (United States); Thomas Butkiewicz, William Ribarsky, Remco Chang, Univ. of North Carolina at Charlotte (United States) . . . . . [7346-11]

4:10 pm: **Hierarchical multi-touch selection techniques for collaborative geospatial analysis**, Thomas Butkiewicz, Dong H. Jeong, Remco Chang, William Ribarsky, Univ. of North Carolina at Charlotte (United States) . . . . . [7346-12]

4:30 pm: **Human behavior digitization and intent recognition using data modeling,** Holger M. Jaenisch, James W. Handley, Licht Strahl Engineering Inc. (United States). . . . . [7346-13]

Closing Remarks

Room: Los Angeles . . . . . Tues. 4:50 to 5:00 pm

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

Evolutionary and Bio-Inspired Computation: Theory and Applications III

Conference Chairs: **Teresa H. O'Donnell,** Air Force Research Lab.; **Misty Blowers,** Air Force Research Lab.; **Kevin L. Priddy,** Air Force Research Lab.

Program Committee: **Robert Bird,** Red Lambda, Inc.; **Peter M. LaMonica,** Air Force Research Lab.; **Leonid I. Perlovsky,** Air Force Research Lab.; **Michael Peterson,** Univ. of Alaska Anchorage; **John C. Sciortino, Jr.,** Naval Research Lab.; **Alex F. Sisti,** Air Force Research Lab.; **Hugh Southall,** Air Force Research Lab.

Tuesday 14 April

SESSION 1

Room: San Francisco . . . . . .Tues. 8:00 to 9:00 am

Theoretic Approaches

Session Chair: **Emily R. Budlong,** Air Force Research Lab.

8:00 am: **Multi-variable analysis, correlation, and prediction** *(Invited Paper)*, Misty Blowers, Air Force Research Lab. (United States) . . . . . [7347-01]

8:20 am: **Multiobjective information theoretic ensemble selection** *(Invited Paper)*, Stuart W. Card, Syracuse Univ. (United States) . . . . . [7347-02]

8:40 am: **Common computational properties found in natural sensory systems** *(Invited Paper),* Geoffrey Brooks, Florida State Univ., Panama City (United States). . . . . [7347-03]

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 2

Room: San Francisco . . . . . Tues. 10:20 am to 12:10 pm

Knowledge Discovery and Understanding I

Session Chairs: **John Spina,** Air Force Research Lab.; **Peter M. LaMonica,** Air Force Research Lab.

10:20 am: **Intelligent computing: the key to meeting the most important challenge to defense and service campaign-level wargaming** *(Keynote Presentation)*, Matthew B. Caffrey, Jr., Air Force Research Lab. (United States). . . . . [7347-04]

11:10 am: **Semi-automated ontology generation and evolution**, Craig S. Anken, Air Force Research Lab. (United States); Anthony Stirtzinger, Securboration Corp. (United States) . . . . . [7347-39]

11:30 am: **Secure wireless knowledge management and dissemination for intelligence analysis** *(Invited Paper)*, Catherine H. Clark, Vision Systems & Technology, Corp. (United States); John Spina, Air Force Research Lab. (United States). . . . . [7347-06]

11:50 am: **Distributed task allocation in dynamic environments** *(Invited Paper)*, Annie S. Wu, Univ. of Central Florida (United States); John C. Sciortino, Jr., Naval Research Lab. (United States). . . . . [7347-07]

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

SESSION 3

Room: San Francisco . . . . . .Tues. 1:10 to 3:00 pm

Knowledge Discovery and Understanding II

Session Chairs: **John Spina,** Air Force Research Lab.; **Peter M. LaMonica,** Air Force Research Lab.

1:10 pm: **Modeling evolution of the mind and cultures** *(Keynote Presentation)*, Leonid I. Perlovsky, Air Force Research Lab. (United States). . . . . [7347-08]

2:00 pm: **Effective learning techniques for military applications using the Personalized Assistant that Learns** *(Invited Paper)*, Peter M. LaMonica, Roger Dziegiel, Jr., Air Force Research Lab. (United States); Raymond Liuzzi, Raymond Technologies (United States) . . . . . [7347-09]

2:20 pm: **Perceptron simulation of human thought** *(Invited Paper)*, Bradley A. Hertz, IEEE (United States) . . . . . [7347-10]

2:40 pm: **Creating a two layered augmented artificial immune system for application to computer network intrusion detection** *(Invited Paper)*, Matthew Judge, Gary Lamont, U.S. Air Force Institute of Technology (United States). . . . . [7347-11]

Coffee Break . . . . . 3:00 to 3:20 pm

SESSION 4

Room: San Francisco . . . . . .Tues. 3:20 to 6:00 pm

Advanced Approaches for Image and Audio Processing

Session Chair: **Michael Peterson,** Univ. of Alaska Anchorage

3:20 pm: **The role of wavelet coefficients in fitness landscapes of image transforms for defense applications** *(Invited Paper)*, Michael R. Peterson, Univ. of Alaska Anchorage (United States); Gary Lamont, Air Force Institute of Technology (United States); Frank W. Moore, Univ. of Alaska Anchorage (United States). . . . . [7347-12]

3:40 pm: **Efficiently determining transform filter coefficients for image processing by applying distributed genetic algorithms** *(Invited Paper)*, Martin Gilligan, U.S. Air Force Institute of Technology (United States); Michael R. Peterson, University of Alaska Anchorage (United States); Gary Lamont, U.S. Air Force Institute of Technology (United States). . . . . [7347-13]

4:00 pm: **Thermal infrared sensor exploitation for 3D face reconstruction** *(Invited Paper)*, Bernard Abayowa, Air Force Research Lab. (United States). . . . . [7347-14]

4:20 pm: **Recognizing connotative meaning in military chat communications** *(Invited Paper)*, Emily R. Budlong, Sharon M. Walter, Air Force Research Lab. (United States); Ozgur Yilmazel, Syracuse Univ. (United States) . . . . . [7347-15]

4:40 pm: **Aerial image registration incorporating GPS/IMU data** *(Invited Paper)*, Keith A. Redmill, John I. Martin, Umit Ozguner, The Ohio State Univ. (United States). . . . . [7347-16]

5:00 pm: **PLS regression technique for the analysis of glioblastoma data** *(Invited Paper)*, Anke Meyer-Baese, Florida State Univ. (United States). . [7347-17]

5:20 pm: **Motion compensation techniques applied to breast MRI** *(Invited Paper)*, Anke Meyer-Baese, Adrian Barbu, Florida State Univ. (United States). . . . . [7347-18]

5:40 pm: **Feature extracting recognition networks based on concurrent evolutionary process**, Victor Hannak, Andreas E. Savakis, Shanchieh J. Yang, Peter G. Anderson, Rochester Institute of Technology (United States) . . [7347-38]

Wednesday 15 April

SESSION 5

Room: San Francisco . . . . . Wed. 8:20 to 10:00 am

Space Situational Awareness

Session Chair: **Adrian Stoica,** Jet Propulsion Lab.

8:20 am: **Situational awareness from above-the-head biometrics using shadow dynamics** *(Invited Paper)*, Adrian Stoica, Jet Propulsion Lab. (United States) . . . . . [7347-19]

8:40 am: **Programmable genetic algorithm IP core for sensing and surveillance applications** *(Invited Paper)*, Srinivas Katkoori, Pradeep R. Fernando, Hariharan Sankaran, Univ. of South Florida (United States); Adrian Stoica, Didier Keymeulen, Ricardo Zebulum, Jet Propulsion Lab. (United States) . . . . . [7347-20]

9:00 am: **Emergency response networks for disaster monitoring and detection from space** *(Invited Paper)*, Tanya Vladimirova, Univ. of Surrey (United Kingdom); Ivan Vitanov, BAE Systems (United Kingdom); Valentin I. Vitanov, Durham Univ. (United Kingdom) . . . . . [7347-21]

9:20 am: **Optimized satellite image compression and reconstruction via evolution strategies** *(Invited Paper)*, Brendan J. Babb, Frank W. Moore, Michael Peterson, Univ. of Alaska Anchorage (United States) . . . . . [7347-22]

9:40 am: **An adaptive approach to space based picosatellite sensor networks** *(Invited Paper)*, Tughrul Arslan, Erfu Yang, Nakul Haridas, Alicia Morales, Ahmet T. Erdogan, Univ. of Edinburgh (United Kingdom); Adrian Stoica, Jet Propulsion Lab. (United States) . . . . . [7347-23]

Coffee Break . . . . . 10:00 to 10:20 am

SESSION 6

Room: San Francisco . . . . . Wed. 10:20 am to 12:00 pm

Design and Optimization of Systems and Components

Session Chair: **Hugh Southall,** Air Force Research Lab.

10:20 am: **Endgame implemention for the efficient global optimization (EGO) algorithm** *(Invited Paper)*, Hugh Southall, Teresa H. O'Donnell, Bryan Kaanta, Air Force Research Lab. (United States) . . . . . [7347-24]

10:40 am: **Hybrid chromosome design for genetic optimization of a fragmented patch antenna** *(Invited Paper)*, Teresa H. O'Donnell, S. G. Santarelli, H. Steyskal, Hugh Southall, Air Force Research Lab. (United States) . . . [7347-25]

11:00 am: **Tailored disruption of phase-locked loops via evolutionary algorithms** *(Invited Paper)*, Colin C. Olson, Naval Research Lab. (United States); Joseph V. Michalowicz, Global Strategies Group (United States); Frank Bucholtz, Jonathan M. Nichols, Naval Research Lab. (United States) . . . . . [7347-26]

11:20 am: **Wireless synapses in bio-inspired neural networks** *(Invited Paper)*, Tomasz P. Jannson, Thomas C. Forrester, Physical Optics Corp. (United States) . . . . . [7347-27]

11:40 am: **Issues involved in developing a genetic algorithm methodology for optimizing the position of ship-board antennas** *(Invited Paper)*, Teresa H. O'Donnell, ARCON Corp. (United States); Randy Haupt, The Pennsylvania State Univ. (United States); Keith Lysiak, Southwest Research Institute (United States) . . . . . [7347-28]

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

SESSION 7

Room: San Francisco . . . . . Wed. 1:30 to 4:30 pm

Advanced Sensors and Sensing Systems

Session Chair: **Olga Mendoza-Schrock,** Air Force Research Lab.

1:30 pm: **Precision registration for layered and persistent sensing systems** *(Invited Paper)*, Olga Mendoza-Schrock, Matthew Garing, Air Force Research Lab. (United States) . . . . . [7347-29]

1:50 pm: **Adversarial behavior recognition from layered and persistent sensing systems** *(Invited Paper)*, Georgiy M. Levchuk, Aptima Inc. (United States); Olga Mendoza-Schrock, Air Force Research Lab. (United States); Kevin Gildea, Aptima Inc. (United States); Wayne L. Shebilske, Wright State Univ. (United States) . . . . . [7347-30]

2:10 pm: **Reputation-based neural networks for detection and identification of intrusion attacks in wireless ad hoc sensor networks** *(Invited Paper)*, William S. Hortos, Associates in Communication Engineering Research and Technology (United States) . . . . . [7347-32]

2:30 pm: **Neural network based state of health diagnostics for an automated radioxenon sampler/analyzer** *(Invited Paper)*, Paul E. Keller, Lars J. Kangas, James C. Hayes, Brian T. Schrom, Reynold Suarez, Charles W. Hubbard, Tom R. Heimbigner, Justin I. McIntyre, Pacific Northwest National Lab. (United States) . . . . . [7347-33]

2:50 pm: **Multi-sensor fusion and tracking in a persistent sensor network** *(Invited Paper)*, Sangil Jwa, Umit Ozguner, The Ohio State Univ. (United States) . . . . . [7347-34]

Coffee Break . . . . . 3:10 to 3:30 pm

3:30 pm: **Coupled sensor/platform control design for low-level chemical detection with position-adaptive micro-UAV's** *(Invited Paper)*, Thomas Goodwin, Louisiana Tech Univ. (United States); Atindra K. Mitra, Air Force Research Lab. (United States); Rastko R. Selmic, Louisiana Tech Univ. (United States); Ryan Carr, Air Force Research Lab. (United States) . . . . [7347-35]

3:50 pm: **Situation awareness and information superiority in a multiple UAVs sensor network** *(Invited Paper)*, Isabella Panella, Thales U.K. (United Kingdom) . . . . . [7347-36]

4:10 pm: **MITRE sensor layer prototype** *(Invited Paper)*, Donald P. McGarry, Francis J. Duff III, David M. Zasada, Scott D. Foote, The MITRE Corp. (United States) . . . . . [7347-37]

Modeling and Simulation for Military Operations IV

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

Program Committee: **James N Elele,** NavAir; **Eric J. Kelmelis,** EM Photonics, Inc.; **Alex F. Sisti,** Air Force Research Lab.

Wednesday 15 April

SESSION 1

Room: San Antonio . . . . . Wed. 1:30 to 2:50 pm

Modeling for ISR

Session Chair: **Carla B. Willis,** Air Force Research Lab.

1:30 pm: **A stochastic process algebraic abstraction of detection evidence fusion in tactical sensor networks**, David J. Thornley, Duncan F. Gillies, Imperial College London (United Kingdom); Chatschik Bisdikian, IBM Thomas J. Watson Research Ctr. (United States) . . . . . [7348-01]

1:50 pm: **A simulation program for the Firefinder weapon locating radar**, Eric P. Lam, Thales-Raytheon Systems Co. LLC (United States) . . . . . [7348-02]

2:10 pm: **Updates on fuze and SAR modes in RF channel for Irma 5.2 Signature Prediction Model**, Bea Thai, Omar Aboutalib, John Pau, Northrop Grumman Integrated Systems (United States); Carla B. Willis, Charles F. Coker, Air Force Research Lab. (United States) . . . . . [7348-03]

2:30 pm: **Generation of large scale urban environments to support advanced sensor and seeker simulation**, Joseph L. Giuliani, Daniel Hershey, David M. McKeown, Jr., TerraSim, Inc. (United States); Carla B. Willis, Tan Van, Air Force Research Lab. (United States). . . . . [7348-04]

SESSION 2

Room: San Antonio . . . . . Wed. 2:50 to 4:40 pm

Advanced Imaging Capabilities

Session Chair: **Ahmed S. Sharkawy,** EM Photonics, Inc.

2:50 pm: **A Practical Enhanced-Resolution Integrated Optical-Digital Imaging Camera (PERIODIC)**, Mark S. Mirotznik, The Catholic Univ. of America (United States). . . . . [7348-05]

3:10 pm: **Development of a robust digital lock-in algorithm utilizing a closed form least squares method**, E. Lee Stein, Jr., Univ. of Delaware (United States); Christopher A. Schuetz, Phase Sensitive Innovations, Inc. (United States); Dennis W. Prather, Univ. of Delaware (United States) . . . . . [7348-06]

Coffee Break . . . . . 3:30 to 4:00 pm

4:00 pm: **Development of a GPU-accelerated super-resolution solver**, Aaron L. Paolini, Fernando E. Ortiz, EM Photonics, Inc. (United States). . . . . [7348-07]

4:20 pm: **Simulation for close air support**, David L. Hench, Air Force Research Lab. (United States). . . . . [7348-08]

SESSION 3

Room: San Antonio . . . . . Wed. 4:40 to 6:00 pm

VV&A for M&S

Session Chair: **Mike Leite,** Science Applications International Corp.

4:40 pm: **FOCUS verification and validation: a case study**, Javier Gestido, SURVICE Engineering Co (United States). . . . . [7348-09]

5:00 pm: **Use of embedded verification and validation for methodology evolution**, W. Keith Bowman, SURVICE Engineering Co. (United States) [7348-10]

5:20 pm: **Assessing risk levels of verification, validation, and accreditation of models and simulations**, James N. Elele, Naval Air Systems Command (United States). . . . . [7348-11]

5:40 pm: **P-8A Poseidon strategy for modeling & simulation VV&A**, Derek L. Kropp, Naval Air Systems Command (United States). . . . . [7348-12]

Thursday 16 April

SESSION 4

Room: San Antonio . . . . . Thurs. 8:40 to 10:00 am

Modeling for the Decision Maker

Session Chair: **Mark S. Mirotznik,** The Catholic Univ. of America

8:40 am: **Adversarial intent modeling using embedded simulation and temporal Bayesian knowledge bases**, Nicholas J. Pioch, James Melhuish, BAE Systems (United States); Eugene Santos, Jr., Deqing Li, Dartmouth College (United States); Andy Seidel, BAE Systems (United States) . . . . . [7348-13]

9:00 am: **Developing methods for timely and relevant mission impact estimation**, Michael R. Grimaila, Air Force Institute of Technology (United States) and Air Force Research Lab. (United States); Larry W. Fortson, Jr., Janet Sutton, Air Force Research Lab. (United States); Robert F. Mills, Air Force Institute of Technology (United States) . . . . . [7348-14]

9:20 am: **Training for emergency response with RimSim:Response!**, Bruce Campbell, Konrad Schroder, Univ. of Washington (United States) . . . . . [7348-15]

9:40 am: **Five-dimensional simulation for advanced decision making**, Craig N. Lammers, Jeffrey S. Steinman, Maria E. Valinski, WarpIV Technologies, Inc. (United States); Karen Roth, Air Force Research Lab. (United States) . . . [7348-16]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 5

Room: San Antonio . . . . . Thurs. 10:30 to 11:50 am

Information Network Technologies

Session Chair: **Lee Stein,** Univ. of Delaware

10:30 am: **Addressing tomorrow's DMO technical challenges today**, James R. Milligan, Air Force Research Lab. (United States). . . . . [7348-17]

10:50 am: **Foundations for Botnet simulation**, Sheila B. Banks, Calculated Insight (United States); Martin R. Stytz, Institute for Defense Analyses (United States). . . . . [7348-18]

11:10 am: **NeoCITIES: an experimental test-bed for quantifying the effects of cognitive aids on team performance in C2 situations**, David B. Hellar, David L. Hall, The Pennsylvania State Univ. (United States). . . . . [7348-19]

11:30 am: **Airborne networking component architecture and simulation environment (AN-CASE) net-centric modeling and simulation**, Mary C. Chruscicki, Patricia J. Baskinger, Northrop Grumman Information Technology (United States); Kurt Turck, Air Force Research Lab. (United States). . . . [7348-20]

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

SESSION 6

Room: San Antonio . . . . . Thurs. 1:30 to 2:50 pm

Vehicle and Terrain Modeling

Session Chair: **John B. Ferris,** Vehicle Terrain Performance Lab.

1:30 pm: **Excitation event design and accuracy verification procedure for high fidelity terrain measurement systems**, Hurtford Smith III, John B. Ferris, Virginia Polytechnic Institute and State Univ. (United States). . . . . [7348-21]

1:50 pm: **Review of current developments in terrain characterization and modeling**, Zachary R. Detweiler, Heather Chemistruck, John B. Ferris, Virginia Polytechnic Institute and State Univ. (United States); Alexander A. Reid, David J. Gorsich, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States) . . . . . [7348-22]

2:10 pm: **Design and implementation of unit-level combat training simulated system**, Mingyi Du, Beijing Univ. of Civil Engineering and Architecture (China) . . . . . [7348-23]

2:30 pm: **GPU-assisted CFD simulation of dynamic interface scenarios**, Michael R. Bodnar, EM Photonics, Inc. (United States); Lyle N. Long, The Pennsylvania State Univ. (United States); John R. Humphrey, Jr., Eric J. Kelmelis, EM Photonics, Inc. (United States) . . . . . [7348-24]

Coffee Break . . . . . 2:50 to 3:30 pm

SESSION 7

Room: San Antonio . . . . . Thurs. 3:30 to 4:50 pm

M&S Technologies and Applications

Session Chair: **Mary C. Chruscicki,**
Northrop Grumman Information Technology

3:30 pm: **A GPU-accelerated toolbox for the solutions of systems of linear equations**, John R. Humphrey, Jr., Daniel K. Price, Eric J. Kelmelis, EM Photonics, Inc. (United States) . . . . . [7348-25]

3:50 pm: **Future requirements for modeling and simulation technology**, Micahel J. Leite, Science Applications International Corp. (United States)[7348-26]

4:10 pm: **Investigating the conducted EMI issues in fighter aircrafts' power supplies**, Ashish Sharma, Vivek Agarwal, Indian Institute of Technology, Bombay (India). . . . . [7348-27]

4:30 pm: **Design and analysis of a Chip-Scale Photonic Analog-to-Digital Converter**, Ahmed S. Sharkawy, Shouyuan Shi, Caihua Chen, EM Photonics, Inc. (United States); BingLin Miao, Univ. of Delaware (United States); Ozgenc Ebil, EM Photonics, Inc. (United States); Dennis Prather, Univ. of Delaware (United States). . . . . [7348-28]

Make time for the Exhibition

Tuesday 14 April . . . . . 10:00 am to 6:00 pm
Wednesday 15 April . . . . . 10:00 am to 5:00 pm
Thursday 16 April . . . . . 10:00 am to 2:00 pm

See pp. 16–20 for exhibition details.

Wireless Sensing and Processing IV

Conference Chairs: **Sohail A. Dianat,** Rochester Institute of Technology; **Michael D. 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; **Yimin Zhang,** Villanova Univ.

Thursday 16 April

SESSION 1

Room: San Francisco . . . . . Thurs. 8:00 to 9:20 am

Diversity and Multicarrier Techniques

Session Chair: **Fred C. Kellerman,** Harris Corp.

8:00 am: **Optimization of MIMO unitary space-time codes**, Xinjia Chen, Ernest L. Walker, Pradeep K. Bhattacharya, Jiecai Luo, Southern Univ. (United States) . . . . . [7349-01]

8:20 am: **Comparative performance evaluation of Hadamard and Vandermonde code-spread OFDM**, Muthanna Al-Mahmoud, Michael D. Zoltowski, Purdue Univ. (United States) . . . . . [7349-02]

8:40 am: **Space-time processing for OFDM using complementary Golay sequences**, Chad C. Lau, Michael D. Zoltowski, Purdue Univ. (United States) . . . . . [7349-03]

9:00 am: **Investigating the effects of filtering, clipping, and power amplification on the performance of OFDM waveforms**, John W. Nieto, Harris Corp. (United States) . . . . . [7349-04]

SESSION 2

Room: San Francisco . . . . . Thurs. 9:20 to 10:00 am

Radio Frequency and Identification (RFID)

Session Chair: **Michael D. Zoltowski,** Purdue Univ.

9:20 am: **Novel RFID collision avoidance protocol exploiting smart antennas**, Xin Li, Yimin Zhang, Moeness G. Amin, Villanova Univ. (United States). . [7349-05]

9:40 am: **Novel techniques for accurate range estimation of RFID tags**, Yimin Zhang, Xin Li, Moeness G. Amin, Villanova Univ. (United States). . . . . [7349-06]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 3

Room: San Francisco . . . . . Thurs. 10:30 to 11:50 am

Implementation and Application

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

10:30 am: **1.25 GHz indoor path loss model for multi-floored buildings**, Ismail F. Isnin, Martin Tomlinson, Mohammed Z. Ahmed, Marcel A. Ambroze, Univ. of Plymouth (United Kingdom) . . . . . [7349-07]

10:50 am: **Handheld emissions detector (HED)**, George J. Valentino, L-3 Communications Nova Engineering (United States); David Schimmel, PM Soldier Warrior (United States) . . . . . [7349-08]

11:10 am: **Near-field sensing using subspace techniques**, Raghuveer M. Rao, Sohail A. Dianat, Rochester Institute of Technology (United States) . . . . [7349-09]

11:30 am: **A feasibility study and experience of implementing LTE PHY on a massively parallel processor array platform**, Paul Y. Chen, Ambric, Inc. (United States) . . . . . [7349-10]

Lunch/Exhibition Break . . . . . 11:50 am to 1:20 pm

SESSION 4

Room: San Francisco . . . . . Thurs. 1:20 to 3:00 pm

Modulation and Coding

Session Chair: **Yimin Zhang,** Villanova Univ.

1:20 pm: **Structured LDPC codes with bandwidth efficient modulations**, Michael K. Cheng, Jet Propulsion Lab. (United States); Stephanie Duy, Univ. of Maine (United States); Dariush Divsalar, Jet Propulsion Lab. (United States) . . . . . [7349-12]

1:40 pm: **Comparison of post detection switching and reduced state trellis detection with coherent diversity combining for continuous phase FSK**, Joseph B. Shaver, Harris Corp. (United States) . . . . . [7349-13]

2:00 pm: **Performance evaluation of CDMA, WDMA, DWDMA networks**, Salim Alsharif, Mohammad S. Alam, Univ. of South Alabama (United States) . . [7349-14]

2:20 pm: **Swarm optimized UWB and protocol design for sensor network**, Rajani S. Muraleedharan-Sreekumaridevi, Syracuse Univ. (United States) . . . . . [7349-15]

2:40 pm: **Some practicalities of popular error correcting codes on fading channels**, Fred C. Kellerman, Harris Corp. (United States) . . . . . [7349-16]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 5

Room: San Francisco . . . . . Thurs. 3:30 to 5:30 pm

Sensor Networks

Session Chair: **John W. Nieto,** Harris Corp.

3:30 pm: **Bio-inspired WSN architecture: event detection and loacalization in a fault tolerant WSN**, Thyagaraju Damarla, Army Research Lab. (United States); Yosef Alayev, The City Univ. of New York (United States) . . . . . [7349-17]

3:50 pm: **Distributed radionuclide sensor network for environmental monitoring**, Yuanwei Jin, Marcos A. Cheney, Univ. of Maryland Eastern Shore (United States); Yimin Zhang, Villanova Univ. (United States); Ali Eydgahi, Univ. of Maryland Eastern Shore (United States) . . . . . [7349-19]

4:10 pm: **Mobility in free space optics based sensor networks**, Anjan K. Ghosh, Pramode Verma, Robert C. Huck, The Univ. of Oklahoma (United States) . . . . . [7349-20]

4:30 pm: **Routing of high-priority packets in wireless sensor networks**, Erol Gelenbe, Edith Ngai, Poonam Yadav, Imperial College London (United Kingdom) . . . . . [7349-21]

4:50 pm: **A new approach to architecture of sensor networks for mission-oriented applications**, Chatschik Bisdikian, Joel W. Branch, IBM Thomas J. Watson Research Ctr. (United States); Kin K. Leung, Chi Harold Liu, Imperial College London (United Kingdom) . . . . . [7349-22]

5:10 pm: **An algorithm to evaluate direction finding ambiguities in interferometer array design**, Peter W. Schuck, Naval Research Lab. (United States); Sverre N. Straatveit, Consultant (United States) . . . . . [7349-23]

Defense Transformation and Net-Centric Systems 2009

Conference Chair: **Raja Suresh,** General Dynamics Advanced Information Systems

Program Committee: **Keith Arthur,** U.S. Army Aviation Applied Technology Directorate; **John S. Eicke,** Army Research Lab.; **Paul S. Gaertner,** Defence Science and Technology Organisation (Australia); **John W. Gowens II,** 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.; **Leo J. Rose,** Air Force Research Lab.; **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 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: Grand 13 . . . . . .Tues. 10:30 to 11:50 am

Self-Organizing, Collaborative, Unmanned ISR Robotic Teams

Session Chairs: **Venkataraman Sundareswaran,** Teledyne Scientific Co.; **Raja Suresh,** General Dynamics Advanced Information Systems

Joint session between conference 7350: Defense Transformation and Net-Centric Systems 2009 and conference 7332: Unmanned Systems Technologies XI.

10:30 am: **Using multiple unmanned systems for a site security task**, Matthew O. Anderson, Curtis W. Nielsen, Mark D. McKay, Derek C. Wadsworth, Ryan C. Hruska, John A. Koudelka, Idaho National Lab. (United States). . . . . [7350-25]

10:50 am: **Border Eye: a compound UAS for continuous border patrol**, Samuel B. Wilson, Andy Turnbull, Paul A. Gelhausen, AVID LLC (United States) . [7350-27]

11:10 am: **Fusion of inertial, optical flow and airspeed measurements for UAV navigation in GPS-denied environments**, Andrey Soloviev, Univ. of Florida (United States); Adam Rutkowski, Air Force Research Lab. (United States). . . . . [7332-01]

11:30 am: **Free Space Optical Network (FSN) for manned/unmanned sensor platforms under poly-environment**, Tariq Manzur, Naval Undersea Warfare Ctr. (United States); Michael L. Talbert, Air Force Research Lab. (United States); Gunasekaran S. Seetharaman, Air Force Institute of Technology (United States). . . . . [7332-02]

Lunch/Exhibition Break . . . . . 11:50 am to 1:40 pm

SESSION 2

Room: Grand 13 . . . . . .Tues. 1:40 to 4:10 pm

Self-Organizing, Collaborative, Unmanned ISR Robotic Teams II

Session Chairs: **Nahid N. Sidki,** SAIC; **Venkataraman Sundareswaran,** Teledyne Scientific Co.

Joint session between conference 7350: Defense Transformation and Net-Centric Systems 2009 and conference 7332: Unmanned Systems Technologies XI.

1:40 pm: **Integrated long-range UAV/UGV collaborative target tracking**, Mark Moseley, iRobot Corp. (United States); Benjamin P. Grocholsky, Carnegie Mellon Univ. (United States); Carol Cheung, iRobot Corp. (United States); Sanjiv Singh, Carnegie Mellon Univ. (United States) . . . . . [7332-03]

2:00 pm: **PRISTA UAVs: evolving from troop companion to troop replacement**, Jon R. Maynell, Lite Machines Corp. (United States) . . . . [7332-04]

2:20 pm: **Maintaining communication links in unstructured environments with a team of mobile robots**, Jindong Tan, Xi Chen, Michigan Technological Univ. (United States). . . . . [7332-05]

2:40 pm: **Determining the position of runways from UAV video**, Richard K. Warren, Amber D. Fischer, 21st Century Systems, Inc. (United States). . [7332-06]

Coffee Break . . . . . 3:00 to 3:30 pm

3:30 pm: **Complexity of robotic sensor networks**, Adam M. Mustapha, Harpreet Singh, Arati M. Dixit, Wayne State Univ. (United States); Grant R. Gerhart, U.S. Army Tank-Automotive Research, Development and Engineering Ctr. (United States). . . . . [7332-07]

3:50 pm: **Toward developing a UAV-based rapid mapping system for emergency response**, Kyoungah Choi, Impyeong Lee, Juseok Hong, Taewan Oh, The Univ. of Seoul (Korea, Republic of); Sung-Woong Shin, Electronics and Telecommunications Research Institute (Korea, Republic of); William J. Park, UAS Ctr. Co., Ltd. (Korea, Republic of). . . . . [7332-08]

SESSION 3

Room: Grand 13 . . . . . .Tues. 4:10 to 6:10 pm

Special Topics I

Session Chairs: **Douglas W. Gage,** XPM Technologies; **Charles M. Shoemaker,** General Dynamics Robotic Systems

Joint session between conference 7350: Defense Transformation and Net-Centric Systems 2009 and conference 7332: Unmanned Systems Technologies XI.

4:10 pm: **The DARPA LANdroids Program**, Mark McClure, Defense Advanced Research Projects Agency (United States); Douglas W. Gage, XPM Technologies (United States). . . . . [7332-09]

4:30 pm: **Biologically inspired collision avoidance system for unmanned vehicles**, Fernando E. Ortiz, Kyle Spagnoli, EM Photonics, Inc. (United States); Brett Graham, Univ. of Delaware (United States) . . . . . [7332-10]

4:50 pm: **Design and construction of an autonomous underwater vehicle for the launch of a small UAV**, Arturo E. Cadena, Jr., Escuela Superior Politécnica del Litoral (Ecuador) . . . . . [7332-11]

5:10 pm: **Parallel robot for high-acceleration (above 40g) motions**, François Pierrot, Olivier Company, Sébastien Krut, Univ. de Montpellier II (France); Cédric Baradat, Fondation Fatronik (France) . . . . . [7332-12]

5:30 pm: **Implementation of a piezoelectrically actuated self-contained quadruped robot**, Sangyoon Lee, Thanhtam Ho, Konkuk Univ. (Korea, Republic of). . . . . [7332-13]

5:50 pm: **Safety technology advances and trends in the mobile vehicle industry (material handling)**, Steve Aamodt, SICK, Inc. (United States). . . . . [7332-71]

Wednesday 15 April

SESSION 4

Room: Grand 2 . . . . . Wed. 1:00 to 4:30 pm

Net-Centric Architectures and Systems

Session Chairs: **Raja Suresh,** General Dynamics Advanced Information Systems; **Paul S. Gaertner,** Embassy of Australia

1:00 pm: **From C4I systems to net centric systems: a DRDO technology overview** *(Invited Paper)*, V. S. Mahalingam, CAIR (India) . . . . . [7350-01]

1:30 pm: **Six net-centric enabling concepts**, Mark T. Sevening, The Boeing Co. (United States). . . . . [7350-02]

1:50 pm: **Semantic policy and adversarial modeling for cyber threat identification and avoidance**, Anton M. DeFrancesco, Securboration (United States). . . . . [7350-03]

2:10 pm: **Network-centric environment oriented information assurance requirements**, Martin R. Stytz, Michael May, Institute for Defense Analyses (United States); Sheila B. Banks, Calculated Insight (United States) . . . . [7350-04]

2:30 pm: **Routing architecture and security in airborne networks**, Hongmei Deng, Peng Xie, Jason Li, Roger Xu, Renato Levy, Intelligent Automation, Inc. (United States). . . . . [7350-05]

2:50 pm: **Net-centric mission data management**, Stephen W. Barth, Northrop Grumman Mission Systems (United States) . . . . . [7350-06]

Coffee Break . . . . . 3:10 to 3:30 pm

3:30 pm: **Implementation of an integrated network of various ISR-systems**, Dietmar Böker, IABG mbH (Germany); Peter Wolf, Bundesamt für Wehrtechnik und Beschaffung (Germany); Christoph Stroscher, IABG mbH (Germany) . . . . . [7350-07]

3:50 pm: **Net-centric transformation to empower the warfighter through enhanced enterprise data services: exploring the SOA approaches**, Deborah L. Farroha, U.S. Dept. of Defense (United States); Bassam S. Farroha, Northrop Grumman Electronic Systems (United States) . . . . . [7350-08]

4:10 pm: **Enabling information sharing through cross domain solutions: architecting the enterprise**, Bassam S. Farroha, Northrop Grumman Electronic Systems (United States) and Univ. of Maryland Univ. College (United States); Melinda M. Whitfield, Unified Cross Domain Management Office (United States); Deborah L. Farroha, U.S. Dept. of Defense (United States) . . . . . [7350-09]

Thursday 16 April

SESSION 5

Room: Grand 2 . . . . . Thurs. 8:30 to 11:50 am

Sensors and Sensor Network Systems

Session Chairs: **Larry B. Stotts,** Defense Advanced Research Projects Agency; **Gayle D. Grant,** U.S. Army Communications-Electronics Command

8:30 am: **GOTCHA radar results and status** *(Invited Paper)*, Michael Bryant, Air Force Research Lab. (United States) . . . . . [7350-11]

9:00 am: **Neuroscience enabled threat detection: cognitive technologies for the field** *(Invited Paper)*, Amy Kruse, Defense Advanced Research Projects Agency (United States) . . . . . [7350-12]

9:30 am: **Transitioning mine warfare to network-centric sensor analysis**, Jason R. Stack, Office of Naval Research (United States); Shane Guthrie, U.S. Navy (United States) . . . . . [7350-13]

Coffee Break . . . . . 9:50 to 10:30 am

10:30 am: **On the influence of problem definition in sensor placement optimization**, Chris L. Pettit, U.S. Naval Academy (United States); D. Keith Wilson, Sergey Vecherin, U.S. Army Cold Region Research and Engineering Lab. (United States). . . . . [7350-14]

10:50 am: **WISER: realistic and scalable wireless mobile IP network emulator**, Michael A. Kaplan, Andrzej S. Cichocki, Stephanie Demers, Mariusz A. Fecko, Telcordia Technologies (United States); Benjamin Greear, Candela Technologies Inc. (United States); Ibrahim Hokelek, Sunil Samtani, John W. Unger, Telcordia Technologies (United States); M. Umit Uyar, City College/CUNY (United States). . . . . [7350-15]

11:10 am: **Radar coordination and resource management in a distributed sensor network using emergent control**, Brad S. Weir, Tom Sokol, The Johns Hopkins Univ. Applied Physics Lab. (United States). . . . . [7350-17]

11:30 am: **Modeling situational awareness in network centric systems**, Eunice E. Santos, Ananya Ojha, John Korah, Virginia Polytechnic Institute and State Univ. (United States). . . . . [7350-18]

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

SESSION 6

Room: Grand 2 . . . . . Thurs. 1:30 to 3:30 pm

Information Management Services

Session Chairs: **Robert G. Hillman,** Air Force Research Lab.; **Guy Vézina,** Defence Research and Development Canada Valcartier (Canada)

1:30 pm: **Need-to-know vs. need-to-share: the net-centric dilemma**, Renato Levy, Margaret Lyell, Intelligent Automation, Inc. (United States). . . . . [7350-19]

1:50 pm: **Semantic service-oriented architecture for range operations**, Richard D. Hull, Modus Operandi, Inc. (United States); Richard A. Hyle, Jr., Richard J. Thiebauth, Air Force Research Lab. (United States); Kent D. Bimson, Bimson Consulting (United States) . . . . . [7350-20]

2:10 pm: **QoS enabled dissemination of managed information objects in a publish-subscribe-query information broker**, Joseph P. Loyall, BBN Technologies (United States); Marco M. Carvalho, Institute for Human and Machine Cognition (United States); Douglas C. Schmidt, Vanderbilt Univ. (United States); Matthew Gillen, BBN Technologies (United States); Andrew Martignoni III, The Boeing Co. (United States); Larry Bunch, Institute for Human and Machine Cognition (United States); James Edmondson, Vanderbilt Univ. (United States); David E. Corman, The Boeing Co. (United States); Asher D. Sinclair, Air Force Research Lab. (United States). . . . . [7350-21]

2:30 pm: **Enabling information management systems in tactical network environments**, Marco M. Carvalho, Institute for Human and Machine Cognition (United States); Philip Ciccio, Northrop Grumman Corp. (United States); James P. Hanna, Air Force Research Lab. (United States); Niranjan Suri, Andrzej Uszok, Jeffrey M. Bradshaw, Institute for Human and Machine Cognition (United States); Asher D. Sinclair, Air Force Research Lab. (United States) . . . . . [7350-22]

2:50 pm: **DEBON-Air: design, execution, and benchmarking of operational networking, airborne**, David R. Van Brackle, Carl E. Hein, Zach Horiatis, Peter Rosenfeld, Lockheed Martin Advanced Technology Labs. (United States); Asher D. Sinclair, Air Force Research Lab. (United States). . . . . [7350-23]

3:10 pm: **Phoenix: SOA based information management services**, Robert C. Grant, Vaughn T. Combs, Air Force Research Lab. (United States); Brian M. Lipa, James F. Reilly, Rome Research Corp. C3I Group (United States); James P. Hanna, Air Force Research Lab. (United States). . . . . [7350-24]

Tuesday-Wednesday 14-15 April 2009 • Proceedings of SPIE Vol. 7351

Mobile Multimedia/Image Processing, Security, and Applications 2009

Tuesday 14 April

Symposium-Wide Plenary Presentation

Tues. 9:00 to 10:00 am • Room: Crystal H Ballroom

Re-engineering Engineering *(Presentation Only)*

Norman Augustine, Ret. Chairman & Chief Executive Officer, Lockheed Martin Corp. (United States)

See p. 6 for details.

SESSION 1

Room: San Antonio . . . . . Tues. 10:30 am to 12:55 pm

Image Enhancement/Restoration Techniques

Session Chair: **David Akopian,** The Univ. of Texas at San Antonio

10:30 am: **Next generation image compression standards: JPEG XR and AIC** *(Invited Paper)*, Touradj Ebrahimi, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [7351-01]

11:05 am: **The design of wavelets for image enhancement and target detection** *(Invited Paper)*, Stephen P. DelMarco, BAE Systems (United States); Sos S. Agaian, The Univ. of Texas at San Antonio (United States). . . . . [7351-02]

11:35 am: **Multi-view video segmentation and tracking for video surveillance**, Gelareh Mohammadi, Frederic Dufaux, Thien M. Ha, Touradj Ebrahimi, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [7351-03]

11:55 am: **A modified image restoration algorithm for multiframe degraded images**, Zexun Geng, Qing Xu, Baoming Zhang, Zhi-hui Gong, Zhenlei Zhao, ZhenGuo Wang, Zhengzhou Institute of Surveying and Mapping (China) . . . . . [7351-04]

12:15 pm: **Compensating image degradation due to atmospheric turbulence in anisoplanatic conditions**, Claudia S. Huebner, Forschungsgesellschaft für Angewandte Naturwissenschaften e.V. (Germany) . . . . . [7351-05]

12:35 pm: **Deghosting based on in-loop selective filtering using motion vector information for low-bit-rate-video coding**, Niranjan D. Narvekar, Arizona State Univ. (United States) and General Dynamics C4 Systems (United States); Wei-Jung Chien, Nabil G. Sadaka, Arizona State Univ. (United States); Glen P. Abousleman, General Dynamics C4 Systems, Inc. (United States); Lina J. Karam, Arizona State Univ. (United States) . . . . . [7351-06]

Lunch/Exhibition Break . . . . . 12:55 to 2:10 pm

SESSION 2

Room: San Antonio . . . . . Tues. 2:10 to 2:50 pm

Networking

Session Chair: **Sabah A. Jassim,** Univ. of Buckingham (United Kingdom)

2:10 pm: **Study of WLAN positioning on mobile platforms**, Bhargav Kalgikar, David Akopian, The Univ. of Texas at San Antonio (United States) . . . . . [7351-07]

2:30 pm: **Integrity monitoring in WLAN positioning systems**, Arsen Melkonyan, Sriphani Yerubandi, Maheedhar Gunturu, David Akopian, Philip Chen, The Univ. of Texas at San Antonio (United States) . . . . . [7351-08]

Coffee Break . . . . . 2:50 to 3:20 pm

SESSION 3

Room: San Antonio . . . . . Tues. 3:20 to 5:00 pm

Biometrics: Templates and Their Protection I

Session Chair: **Harin Sellahewa,** Gray Cancer Institute (United Kingdom)

3:20 pm: **New approach for non-cooperative iris recognition**, Craig Belcher, Yingzi Du, Indiana Univ.-Purdue Univ. Indianapolis (United States) . . . . . [7351-10]

3:40 pm: **An FPGA-based design of a modular approach for integral images in a real-time face detection/recognition system**, Hau T. Ngo, Ryan N. Rakvic, Randy P. Broussard, Robert W. Ives, U.S. Naval Academy (United States). . . . . [7351-11]

4:00 pm: **Wavelet-based isometric projection for face recognition**, Hisham Al-Assam, Harin Sellahewa, Sabah A. Jassim, Univ. of Buckingham (United Kingdom). . . . . [7351-12]

4:20 pm: **Low-cost mobile video-based iris recognition**, Luke Thomas, Yingzi Du, Sriharsha Muttineni, Dylan S. Sran, Shing Mang, Indiana Univ.-Purdue Univ. Indianapolis (United States). . . . . [7351-13]

4:40 pm: **New approach for partial NIR face recognition,** Zhi Zhou, Yingzi Du, Indiana Univ.-Purdue Univ. Indianapolis (United States) . . . . . [7351-23]

POSTERS-TUESDAY

Room: Palms Foyer . . . . . 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.

Small IR target detection using an improved fast method, Zhenmin Tang, Xin Wang, Nanjing Univ. of Science & Technology (China). . . . . [7351-26]

Rate-adaptive video compression (RAVC) Universal Video Stick (UVS), David L. Hench, Air Force Research Lab. (United States) . . . . . [7351-27]

WiMAX-WiFi convergence with OFDM bridge, Ali Al-Sherbaz, Christopher R. Adams, Sabah A. Jassim, Univ. of Buckingham (United Kingdom) . . . . . [7351-28]

On a nascent mathematical-physical latency-information theory part I: the mathematical theory of intelligence, Erlan H. Feria, College of Staten Island, CUNY (United States) . . . . . [7351-29]

On a nascent mathematical-physical latency-information theory part II: the physical theory of life, Erlan H. Feria, College of Staten Island, CUNY (United States). . . . . [7351-30]

Hardware based segmentation in iris recognition and authentication systems, Bradley J. Ulis, Ryan N. Rakvic, Randy P. Broussard, U.S. Naval Academy (United States); Neil Steiner, Univ. of Southern California (United States); Robert W. Ives, Hau T. Ngo, U.S. Naval Academy (United States). . . . . [7351-31]

Enhanced method of palette-based digital image steganography, James C. Collins, Air Force Information Operations Ctr. (United States) . . . . . [7351-32]

Image steganography in fractal compression, Mei-Ching Chen, Sos S. Agaian, C. L. P. Chen, The Univ. of Texas at San Antonio (United States) . . . . . [7351-33]

Improved accuracy with higher protection of a biometric system using image and decision fusion techniques, Salim Alsharif, Aed M. El-Saba, Syed Bokhari, Univ. of South Alabama (United States) . . . . . [7351-35]

Wednesday 15 April

SESSION 4

Room: San Antonio . . . . . Wed. 8:00 to 9:20 am

Security of Digital Media and Steganography

Session Chair: **Karen A. Panetta,** Tufts Univ.

8:00 am: **Selective object encryption for privacy protection**, Yicong Zhou, Karen A. Panetta, Tufts Univ. (United States); Sos S. Agaian, The Univ. of Texas at San Antonio (United States) . . . . . [7351-14]

8:20 am: **Characterizing cryptographic primitives for lightweight digital image encryption**, Farid Ahmed, Cheryl L. Resch, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7351-15]

8:40 am: **Fast unitary heap transforms and their application in cryptography**, Artyom M. Grigoryan, Khalil Naghdali, The Univ. of Texas at San Antonio (United States). . . . . [7351-16]

9:00 am: **A new watermarking scheme based on DWT-SVD**, Gaurav Bhatnagar, Raman Balasubramanian, Indian Institute of Technology Roorkee (India). . . . . [7351-17]

SESSION 5

Room: San Antonio . . . . . Wed. 9:20 to 11:40 am

Image Quality/Evaluation Measures

Session Chair: **Sos S. Agaian,** The Univ. of Texas at San Antonio

9:20 am: **A new reference-based measure for objective edge map evaluation**, Shahan C. Nercessian, Karen A. Panetta, Tufts Univ. (United States); Sos S. Agaian, The Univ. of Texas at San Antonio (United States) . . . . . [7351-18]

9:40 am: **On the development of domain specific video quality metrics**, Mark Burge, Zubin Master, Donald P. D'Amato, Noblis, Inc. (United States) . . [7351-19]

Coffee Break . . . . . 10:00 to 10:30 am

10:30 am: **Smart image resizing: approaches and applications** *(Invited Paper)*, Victor V. Bucha, Ilia V. Safonov, Michael N. Rychagov, Samsung Electronics Co., Ltd. (Russian Federation) . . . . . [7351-34]

11:00 am: **Three-dimensional fuzzy-directional processing to impulse video colour denoising in real time environment**, Alberto J. Rosales, National Polytechnic Institute of Mexico (Mexico). . . . . [7351-21]

11:20 am: **Image quality approach for adaptive face recognition**, Ali J. Abboud, Harin Sellahewa, Sabah A. Jassim, Univ. of Buckingham (United Kingdom). . . . . [7351-22]

SESSION 6

Room: San Antonio . . . . . Wed. 11:40 am to 12:40 pm

Biometrics: Templates and Their Protection II

Session Chair: **Sabah A. Jassim,** Univ. of Buckingham (United Kingdom)

11:40 am: **A new approach for direct image registration**, Guy Brodetzki, Alexander Notik, Yaakov Krips, Elisra Electronic Systems Ltd. (Israel) . . [7351-20]

12:00 pm: **A lightweight approach for biometric template protection**, Hisham Al-Assam, Harin Sellahewa, Sabah A. Jassim, Univ. of Buckingham (United Kingdom). . . . . [7351-24]

12:20 pm: **Localizing boundary pixels of non-circular iris using artificial neural networks for improved segmentation**, Randy P. Broussard, Robert W. Ives, U.S. Naval Academy (United States) . . . . . [7351-25]

Thursday-Friday 16-17 April 2009 • Part of Proceedings of SPIE Vol. 7352

Intelligent Sensing, Situation Management, and Impact Assessment

Conference Chairs: **John F. Buford,** Avaya Labs.; **Gabriel Jakobson,** Altusys Corp.

Program Committee: **Belur V. Dasarathy,** Consultant, Information Fusion Technologies; **Gabi Dreo,** Univ. of Federal Armed Forces (Germany); **Monica Farah-Stapleton,** US Army CERDEC; **Lundy M. Lewis,** Southern New Hampshire Univ.; **Raymond McGowan,** US Army CERDEC; **Bradley J. Rhodes,** BAE Systems Advanced Information Technologies; **George P. Tadda,** Air Force Research Lab.; **William A. Tagliaferri,** Alion Science and Technology Corp.; **Shanchieh Jay Yang,** Rochester Institute of Technology

Thursday 16 April

Keynote Address

Room: Crystal E . . . . . Thurs. 8:00 to 9:00 am

8:00 am: **Quantitative aspects of situation management: measuring and testing SM concepts** *(Keynote Presentation)*, James Llinas, Univ. at Buffalo (United States) . . . . . [7352A-27]

SESSION 1

Room: Crystal E. . . . . Thurs. 9:00 to 10:00 am

Situation Awareness I

Session Chairs: **Belur V. Dasarathy,** Consultant, Information Fusion Technologies; **Shanchieh Jay Yang,** Rochester Institute of Technology

9:00 am: **Enhanced situation awareness in the maritime domain, using an agent-based approach for situation management**, Christoffer Brax, Univ. of Skövde (Sweden) and Saab Microwave Systems (Sweden); Lars Niklasson, Univ. of Skövde (Sweden) . . . . . [7352A-01]

9:30 am: **Boosting intelligence analysis process and situation awareness using the self-organizing map**, Anssi P. Karkkainen, Helsinki Univ. of Technology (Finland) . . . . . [7352A-02]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 2

Room: Crystal E. . . . . Thurs. 10:30 am to 12:00 pm

Situation Awareness II

Session Chairs: **Belur V. Dasarathy,** Consultant, Information Fusion Technologies; **Shanchieh Jay Yang,** Rochester Institute of Technology

10:30 am: **Template-based situation recognition**, Anders Dahlbom, Lars Niklasson, Göran Falkman, Univ. of Skövde (Sweden) . . . . . [7352A-03]

11:00 am: **A component-based simulator for supporting research on situation recognition**, Anders Dahlbom, Lars Niklasson, Göran Falkman, Univ. of Skövde (Sweden) . . . . . [7352A-04]

11:30 am: **Stochastic spatiotemporal event modeling and tracking for hostile activity**, Ajay Verma, Satheesh Ramachandran, Kalyan Vadakkeveedu, Perakath C. Benjamin, Knowledge Based Systems, Inc. (United States) . . . . . [7352A-05]

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

SESSION 3

Room: Crystal E. . . . . Thurs. 1:00 to 3:00 pm

Intelligent Sensing I

Session Chairs: **Raymond McGowan,** US Army CERDEC; **William S. Hortos,** Associates in Communication Engineering Research and Technology

1:00 pm: **Proactive Trust Management System (PTMS) for trusted querying in wireless sensor networks**, Zvi Topol, Harish Chandra, Bao-Hong Shen, Abhishek Tiwari, Joseph Yadegar, UtopiaCompression Corp. (United States); Mani Srivastava, Univ. of California, Los Angeles (United States); Jahn Luke, Air Force Research Lab. (United States) . . . . . [7352A-06]

1:30 pm: **Explicit solutions to analytical models of cross-layer protocol optimization in wireless sensor networks**, William S. Hortos, Associates in Communication Engineering Research and Technology (United States) . . . . . [7352A-07]

2:00 pm: **Detection and tracking of humans with a sparse network of LIDAR sensors**, Heinrich Ruser, Vladislav Pavlov, Michael Horn, Christian Kargel, Univ. der Bundeswehr München (Germany) . . . . . [7352A-08]

2:30 pm: **Radiation detection and situation management by distributed sensor networks**, Sean Brennan, Janette Frigo, Ernst Esch, Diana Jackson, Los Alamos National Lab. (United States); Vinod Kulathumani, West Virginia Univ. (United States); Edward Rosten, Cambridge Univ. (United Kingdom); Patrick R. Majerus, Adam Warniment, Angela M. Mielke, Michael Cai, Los Alamos National Lab. (United States) . . . . . [7352A-09]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 4

Room: Crystal E. . . . . Thurs. 3:30 to 5:30 pm

Threat Assessment

Session Chairs: **George P. Tadda,** Air Force Research Lab.; **Pontus Svenson,** Swedish Defence Research Agency (Sweden)

3:30 pm: **A testbed based on survivability for comparing threat evaluation algorithms**, Fredrik Johansson, Göran Falkman, Univ. of Skövde (Sweden) . . . . . [7352A-10]

4:00 pm: **Elements of impact assessment: case study with cyber attacks**, Shanchieh J. Yang, Rochester Institute of Technology (United States); Jared Holsopple, Calspan-UB Research Ctr. (United States) . . . . . [7352A-11]

4:30 pm: **On the resilience against passive attacks in wireless sensor networks**, Samee U. Khan, North Dakota State Univ. (United States) . . [7352A-12]

5:00 pm: **Countering the active attacks in wireless sensor networks**, Samee U. Khan, North Dakota State Univ. (United States) . . . . . [7352A-13]

Friday 17 April

SESSION 5

Room: Crystal E. . . . . Fri. 8:00 to 10:00 am

AI Methods in Situation Management

Session Chairs: **William A. Tagliaferri,** Alion Science and Technology Corp.; **Bradley J. Rhodes,** BAE Systems

8:00 am: **Developing neuro-fuzzy hybrid networks to aid predicting abnormal passengers and equipments behaviours inside an airplane**, Ali H. Ali, Lancaster Univ. (United Kingdom); Alex Tarter, Ultra Electronics Ltd. (United Kingdom) . . . . . [7352A-14]

8:30 am: **Toward mission-specific service utility estimation using analytic stochastic process models**, David J. Thornley, Imperial College London (United Kingdom); Robert I. Young, Defence Science and Technology Lab. (United Kingdom); James Richardson, Honeywell Automation & Control Solutions (United States) . . . . . [7352A-15]

9:00 am: **Bio-inspired method and system for actionable intelligence**, Deepak Khosla, Suhas E. Chelian, HRL Labs., LLC (United States) . . . . . [7352A-16]

9:30 am: **Unsupervised algorithms for intrusion detection and identification**, William S. Hortos, Associates in Communication Engineering Research and Technology (United States) . . . . . [7352A-17]

Coffee Break . . . . . 10:00 to 10:30 am

SESSION 6

Room: Crystal E. . . . . Fri. 10:30 am to 12:00 pm

Intelligent Sensing II

Session Chairs: **Lundy M. Lewis,** Southern New Hampshire Univ.; **Howard E. Michel,** Univ. of Massachusetts

10:30 am: **Development of an intelligent wireless sensor network with mobile nodes**, Howard E. Michel, Joseph St. Pierre, Univ. of Massachusetts (United States) . . . . . [7352A-18]

11:00 am: **The use of IEEE 802.11 in wearable body area sensor networks**, Jack L. Burbank, William Kasch, Dennis Moy, Julia Andrusenko, The Johns Hopkins Univ. Applied Physics Lab. (United States) . . . . . [7352A-19]

11:30 am: **Improving sensor data analysis through diverse data source integration**, Jennifer Casper, Ronald Albuquerque, Peter Leveille, Jing Hu, Eddy Cheung, Barry Lai, The MITRE Corp. (United States) . . . . . [7352A-20]

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

SESSION 7

Room: Crystal E. . . . . Fri. 1:00 to 3:00 pm

Situation Modeling

Session Chair: **Anssi P. Karkkainen,** Helsinki Univ. of Technology (Finland)

1:00 pm: **Information supply for high-level fusion services**, Pontus Svenson, Christian Mårtenson, Swedish Defence Research Agency (Sweden) . . . [7352A-21]

1:30 pm: **Correlating spatial-temporal event likelihood to security objectives and detection**, Matthew T. Altman, Altman Consulting and Technology Inc. (United States) . . . . . [7352A-22]

2:00 pm: **Ontology and rule based knowledge representation for situation management and decision support**, Neelakantan Kartha, Aaron Novstrup, Stottler Henke Associates, Inc. (United States) . . . . . [7352A-23]

2:30 pm: **Situation resolution with context-sensitive fuzzy relations**, Gabriel Jakobson, Altusys Corp. (United States); John F. Buford, Avaya Inc. (United States); Lundy M. Lewis, Southern New Hampshire Univ. (United States) . . . . . [7352A-24]

Coffee Break . . . . . 3:00 to 3:30 pm

SESSION 8

Room: Crystal E. . . . . Fri. 3:30 to 4:30 pm

Special Topics

Session Chair: **William A. Tagliaferri,** Alion Science and Technology Corp.

3:30 pm: **Effectiveness metrics and cost benefit analysis methodology for machine-to-machine interoperability standards**, Wolfgang Baer, Naval Postgraduate School (United States) . . . . . [7352A-25]

4:00 pm: **Adaptive controllability of omni-directional vehicle over unpredictable terrain,** Ka C. Cheok, Micho Radovnikovich, Oakland Univ. (United States); Gregory R. Hudas, James L. Overholt, U.S. Army RDECOM-TARDEC (United States); Paul Fleck, Dataspeed Inc. (United States) . . [7352A-26]

PANEL DISCUSSION

Room: Crystal E . . . . . Fri. 4:30 to 5:30 pm

Situation Management as a Research Field: Issues and Challenges

Panel Moderator: **Lundy M. Lewis,** Southern New Hampshire Univ.

Panelists: **Anssi P. Karkkainen,** Helsinki Univ. of Technology (Finland); **Shanchieh Jay Yang,** Rochester Institute of Technology; **William S. Hortos,** Associates in Communication Engineering Research and Technology; **George P. Tadda,** Air Force Research Lab.

Wednesday 15 April 2009 • Part of Proceedings of SPIE Vol. 7352

Cyber Sensing Hot Topics

Conference Chair: **Stephen Mott,** Sensors Directorate, Air Force Research Lab.*Conference Co-Chair:* **Michael J. Mendenhall,** Air Force Institute of Technology

Program Committee: **John Erickson,** Sensors Directorate, Air Force Research Lab; **Les Guice,** Louisiana Tech University; **Richard A. Raines,** Air Force Cyberspace Technical Ctr. of Excellence; **Steven K. Rogers,** Air Force Research Lab.; **John Volmer,** Argonne National Labs.; **Terry Wilson,** Sensors Directorate, Air Force Research Lab; **Charles Wright,** MIT-Lincoln Labs.

Wednesday 15 April

INTRODUCTION

Room: Crystal J1. . . . . Wed. 8:30 to 9:00 am

Session Chair: **Steven K. Rogers,** Air Force Research Lab.

SESSION 1

Room: Crystal J1. . . . . Wed. 9:00 to 11:00 am

Cyber Sensing

9:00 am: **A chipless sensor tag based RFID technology for cyber-oriented environment sensing applications**, Sudhir Shrestha, Mangilal Agarwal, Vir V. Phoha, Kody Varahramyan, Louisiana Tech Univ. (United States) . . . . .[7352B-01]

9:30 am: **An immunological model for detecting bot activities**, Md E. Karim, Vir V. Phoha, Kiran S. Balagani, Louisiana Tech Univ. (United States) . . . .[7352B-02]

10:00 am: **Decentralized detection and patching of coverage holes in wireless sensor networks**, Jixing Yao, Guyu Zhang, Jinko Kanno, Rastko R. Selmic, Louisiana Tech Univ. (United States) . . . . . .[7352B-03]

10:30 am: **Using Qualia and novel representations in malware detection**, Bobby D. Birrer, Richard A. Raines, Rusty O. Baldwin, Mark E. Oxley, Air Force Institute of Technology (United States); Steven K. Rogers, Air Force Research Lab. (United States). . . . . .[7352B-05]

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General Information

Registration

SPIE Defense, Security + Sensing

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Registration Hours

Orlando World Center Marriott Resort & Convention Center
Arrival Concourse next to Canary Ballroom

Sunday 12 April . . . . . 5:00 to 8:00 pm
Monday 13 April . . . . . 7:00 am to 4:00 pm
Tuesday 14 April . . . . . 7:30 am to 6:00 pm
Wednesday 15 April . . . . . 7:30 am to 5:00 pm
Thursday 16 April . . . . . 7:30 am to 4:00 pm
Firday 17 April . . . . . 7:30 to 11:00 am

Exhibition Hours

Orlando World Center Marriott Resort & Convention Center · Cypress Ballroom

Tuesday 14 April . . . . . 10:00 am to 6:00 pm
Wednesday 15 April . . . . . 10:00 am to 5:00 pm
Thursday 16 April . . . . . 10:00 am to 2:00 pm

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Palms Ballroom Foyer

Tuesday 14 April · *Palms Ballroom Foyer* . . . . . 6:00 to 7:30 pm

Thursday 16 April · *Crystal M* . . . . . 6:00 to 7:30 pm

Poster presenters may set up between 10:00 am and 5:00 pm Tuesday ands Thursday. Poster presenters who have not set up by 5:00 pm on Tuesday or Thursday 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.

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Sago/Sabal Ballroom

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Press & Media Center

Crystal Foyer

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.

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Guests of attendees are invited to meet, relax, and enjoy a cup of coffee and breakfast breads in the SPIE Guest Hospitality Suite. The Suite will be open Monday 10:00 to 11:30 am and Tuesday through Thursday from 8:30 to 10:00 am. This event is for guests of Defense+Security attendees only.

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Crystal Foyer

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Tuesday and Wednesday

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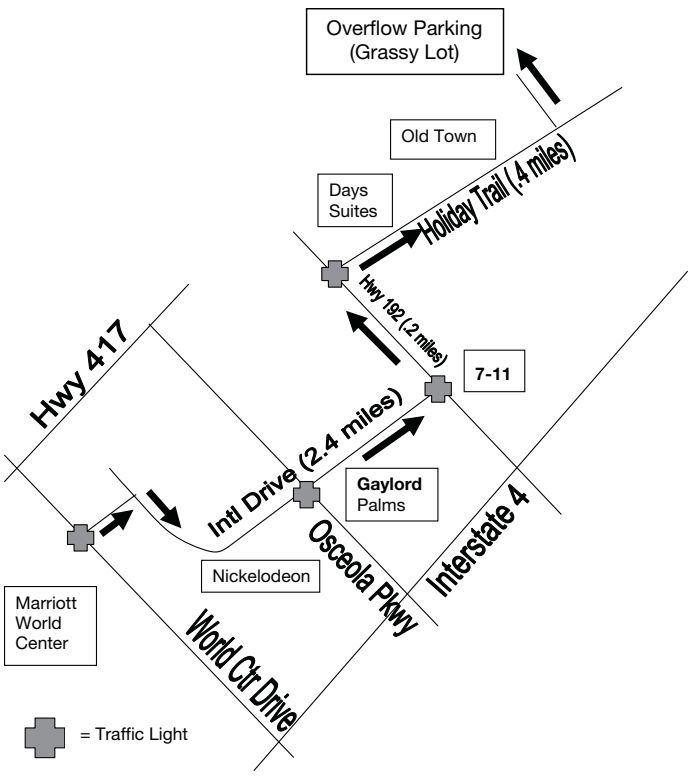

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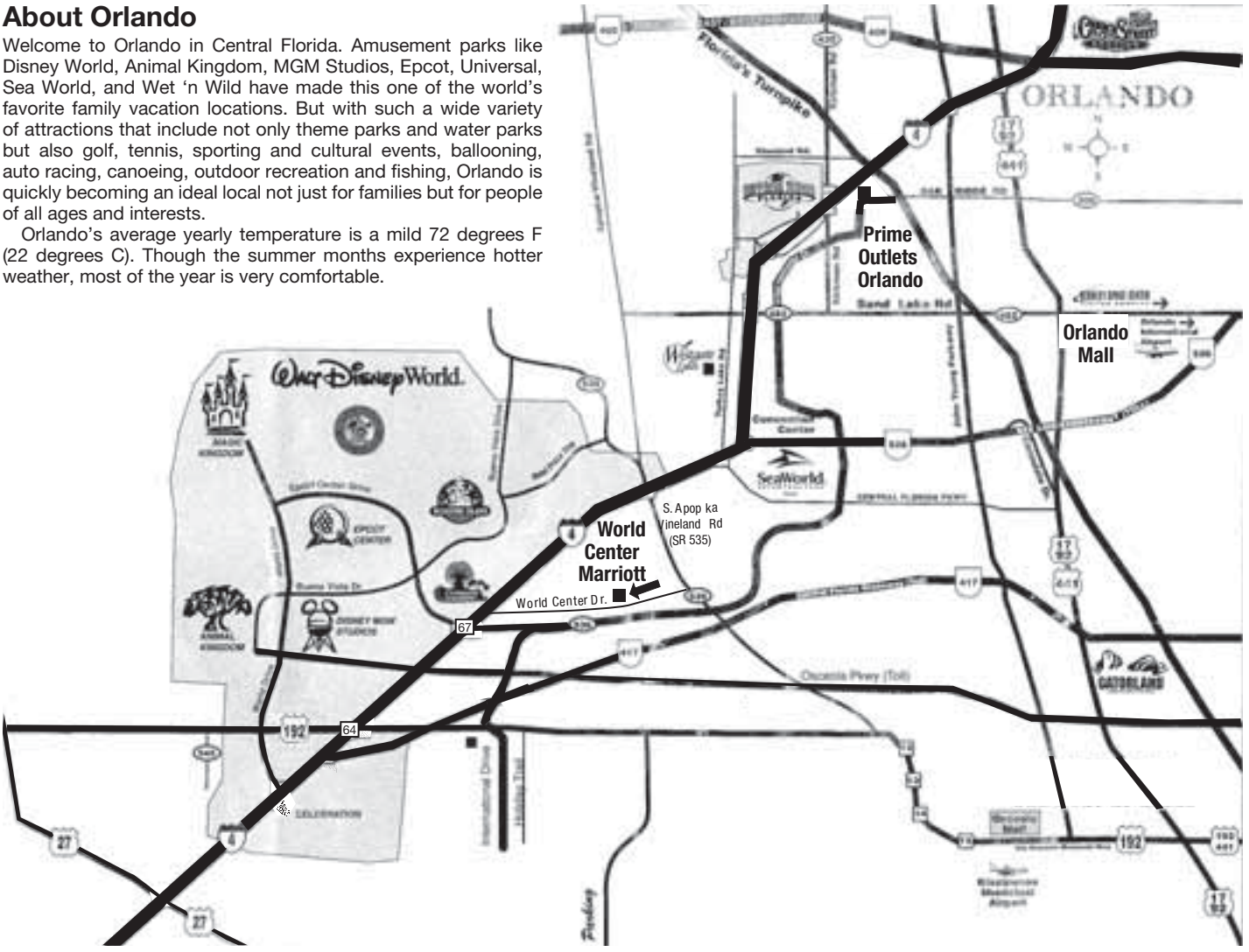

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