2013 Defense Security+ Sensing

Technical Program

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Conferences & Courses
29 April to 3 May 2013

Exhibition
30 April to 2 May 2013

Location
Baltimore Convention Center
Baltimore, Maryland, USA

Technologies and applications for:

- Defense
- Security
- Industry
- Environment

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Contents

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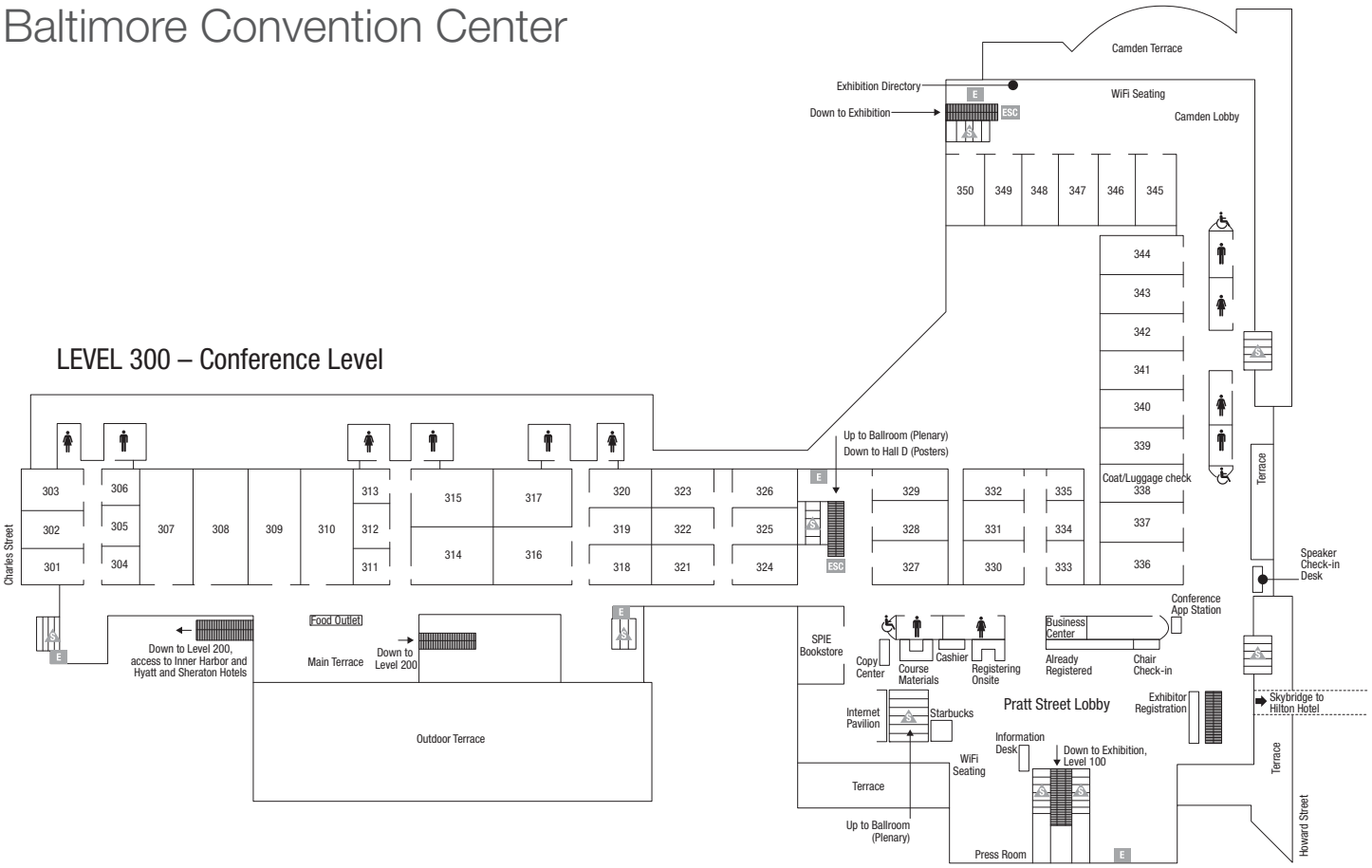
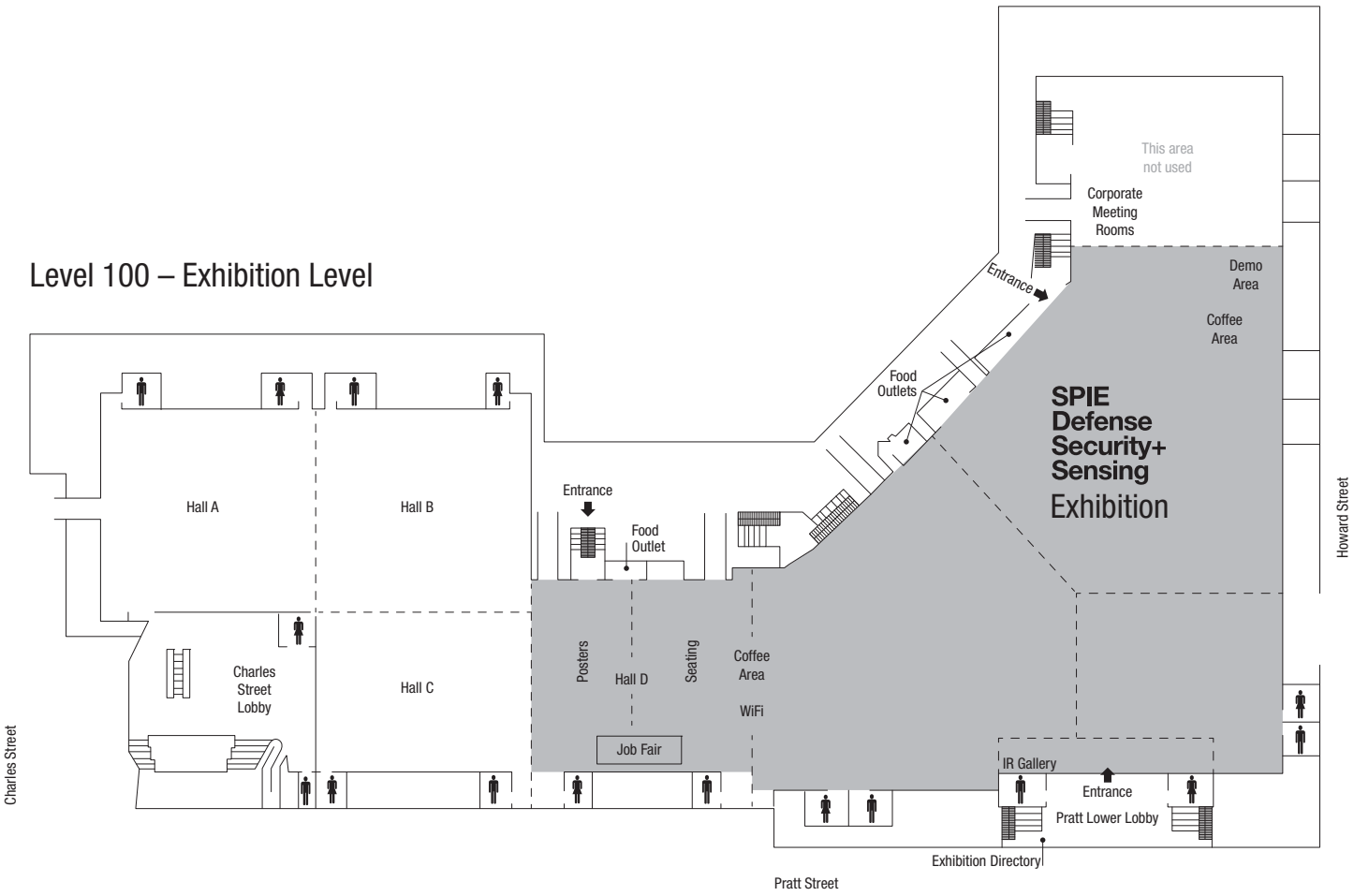
Baltimore Convention Center

LEVEL 300 – Conference Level

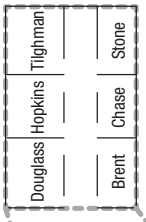


Level 100 – Exhibition Level



THIRD FLOOR

Access from 2nd floor elevators



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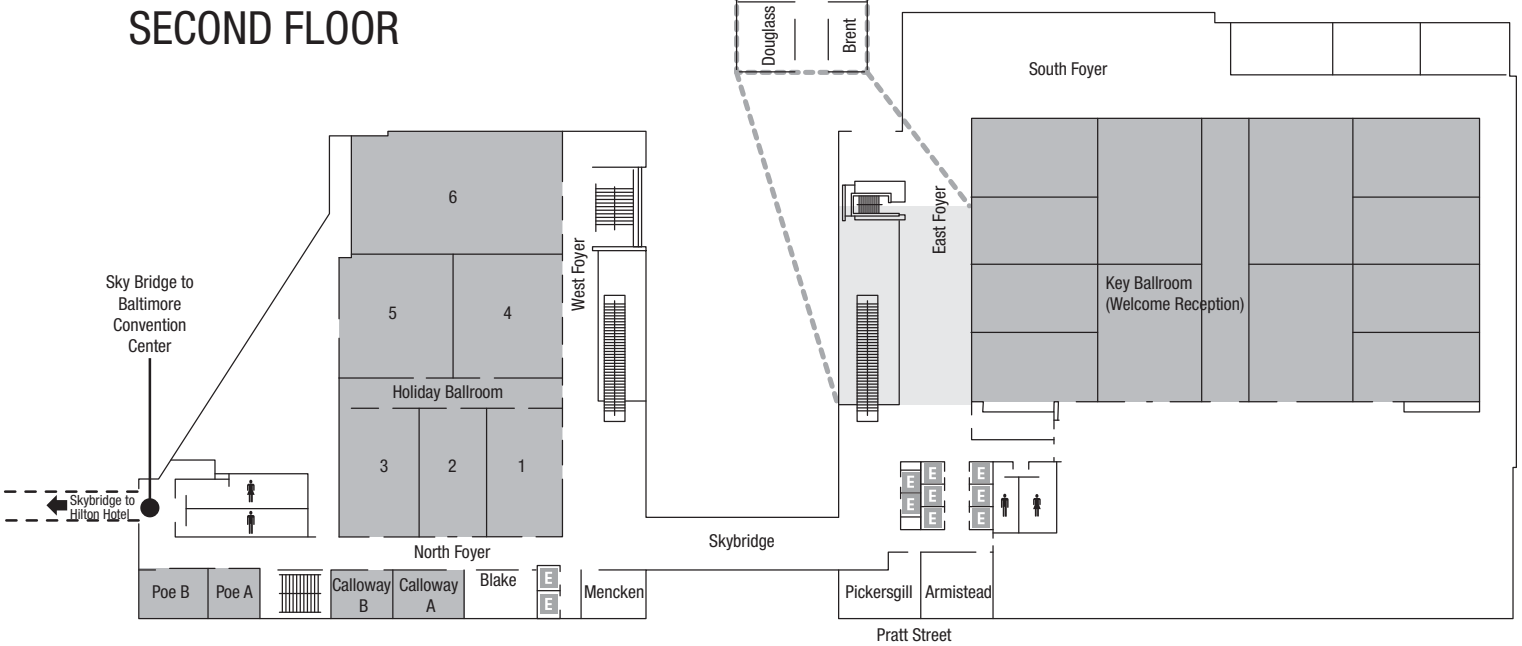

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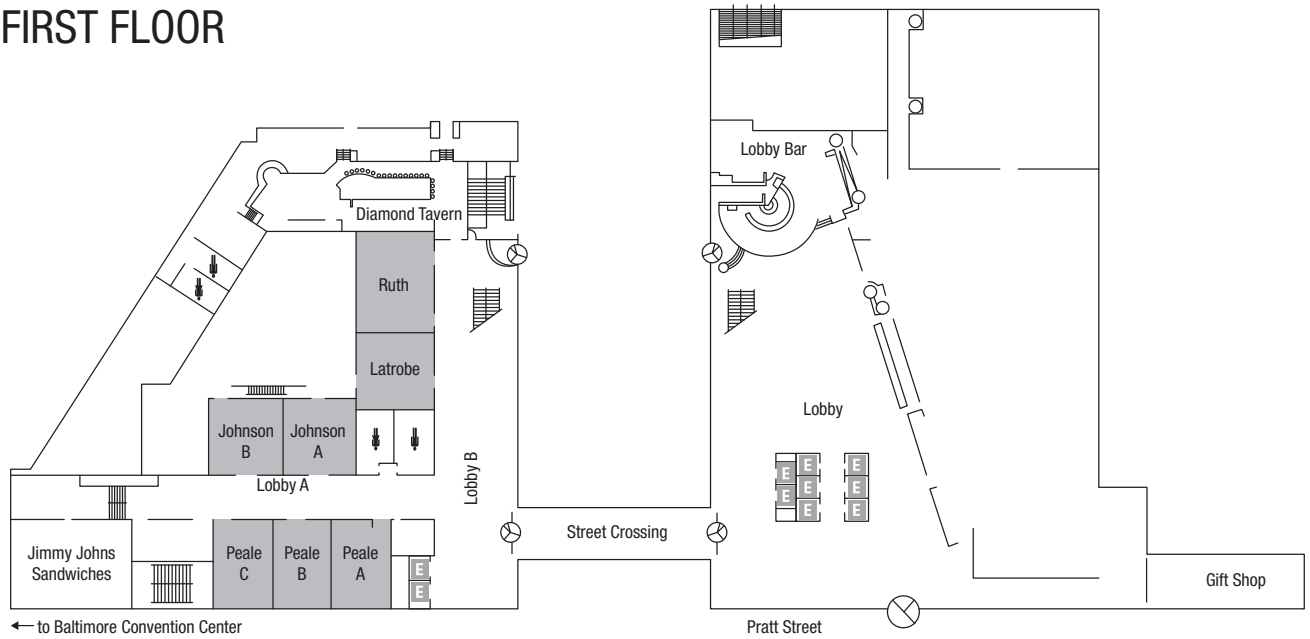

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SPIE would like to express its deepest appreciation to the symposium chairs, conference chairs, program committees, session chairs, and authors who have so generously given of their time and advice to make this symposium possible.

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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Defense, Homeland Security, and Law Enforcement

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Laser Sensors and Systems

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Technical Conference Index

Displays for Innovative Applications

Space Technologies and Operations

Unmanned, Robotic, and Layered Systems

Sensor Data and Information Exploitation

Signal, Image, and Neural Net Processing

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

Thursday, May 2, 2013 • Baltimore, Maryland • Location: Conv. Ctr. Room 314

The Electro-Optics Alliance (EOA) is a collaborative network of U.S.-based industrial, academic and government organizations that forms a critical link between research and development and the commercialization required to advance DoD critical electro-optics Manufacturing Science and Technology, transition that technology successfully to industry, and to promote U.S. preeminence in all areas of electro-optics. To meet that goal, the EOA is designed to facilitate formation of dynamic, geographically distributed teams comprised of EOA members from government, industry and academia best qualified to address specific issues and opportunities.

Get more information about the meeting online at http://www.eoc.psu.edu/events

Meeting data: http://eoc.psu.edu/events/201305_Save_the_Date.pdf
EOA Information: http://www.eoc.psu.edu/eoa/eoa_index.html
EOC Information: http://www.eoc.psu.edu

Dave Ditto, Deputy Director-Programs
Karl Harris, EOC Director

Please note that this meeting is restricted to EOA members only, but there is still time to become an Alliance member before the meeting.

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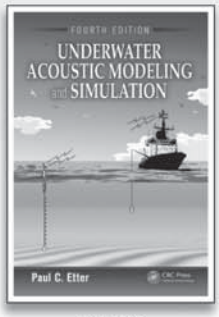

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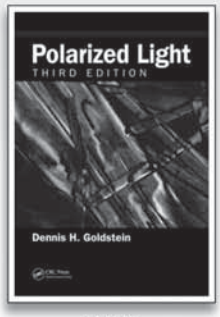

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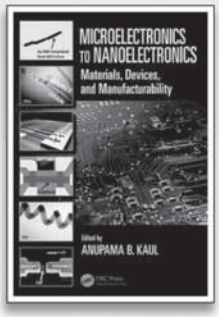

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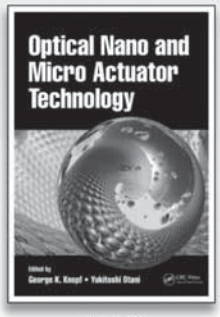

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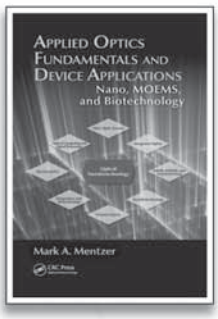

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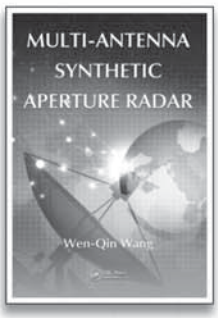

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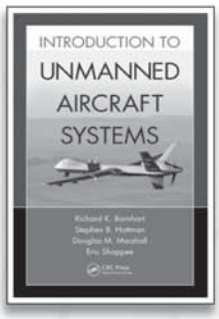

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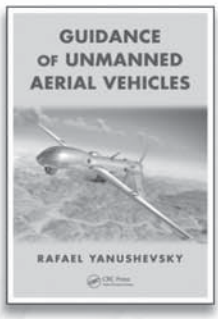

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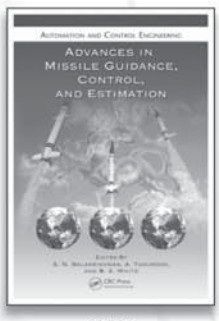

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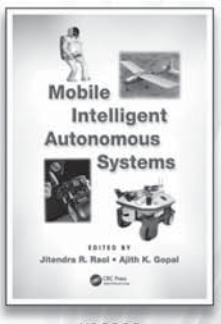

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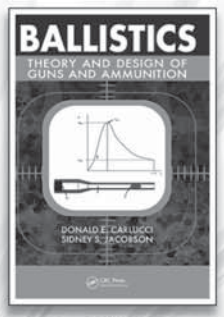

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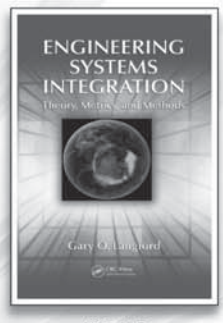

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Special Events Daily Schedule of Events

Monday · 29 April

WORKING GROUP

Infrared Materials Standards

10:00 to 11:30 am · Hilton: Holiday Ballroom 1

Workshop Chair: **Gary Wiese,** Lockheed Martin Corp. (USA)

The Infrared Materials Standards Working Group is an interactive network of scientists and engineers who manufacture, test, and use IR materials. The purpose of this group is to develop standards for properties of optical materials used in the infrared (IR) spectral region (nominally, wavelengths 0.7 – 20 microns).

Fellows Luncheon

12:00 to 1:30 pm · Hilton: Holiday Ballroom 4

Infrared Imaging: From Defense to Medicine?

Dr. Sanjay Krishna, The University of New Mexico & SKINfrared LLC

This talk will highlight some of the advances in infrared imaging and make a case for the use of infrared imaging in medicine.

Dr. Krishna is a Professor and Regents Lecturer of Electrical and Computer Engineering at the University of New Mexico's (UNM) Center for High Technology Materials.

Infrared Applications: Thermosense XXXV: Vendor Presentations and Reception

1:00 to 4:40 pm · Conv. Ctr. Room 315

Moderators: **Andrés E. Rozlosnik,** Si Termografia Infrarroja (Argentina), and **Herb Kaplan,** Honeywell Technical Co. (USA)

The Infrared Applications: ThermoSense XXXV Vendors Session will feature brief presentations from hardware and software vendors whose product lines impact thermal imaging applications. Unlike the technical sessions, there are no "commercial content" restrictions in these presentations. This event allows vendors to showcase new products on display at this year's exhibit, and provides attendees with an advance glimpse of "what's new" in thermal imaging applications.

See p. 28–29 for list of Vendors.

INVITED PANEL DISCUSSION

Real World Issues and Challenges in Big Data Processing with Applications to Information Fusion

1:30 to 4:45 pm · Conv. Ctr. Room 342

Panel Organizers**: Ivan Kadar,** Interlink Systems Sciences, Inc., **Chee-Yee Chong,** BAE Systems, Srikanta Kumar, Technology Consultant

Panel Moderators: **Srikanta Kumar,** Technology Consultant; **Chee-Yee Chong,** BAE Systems; **Ivan Kadar,** Interlink Systems Sciences, Inc.

Panelists: **Christopher White,** DARPA; **Raman Mehra,** Scientific Systems Co.; **Subrata Das,** Machine Analytics; **Kathleen Lossau,** Sotera Defense Solutions; **Erik Blasch,** Air Force Research Lab.; **Premkumar Natarajan,** Raytheon BBN Technologies; **Chee-Yee Chong,** BAE Systems; Ivan Kadar, Interlink Systems Sciences, Inc.

The panel will address real-world issues and challenges highlighting the problem of handling/processing and using big data sources. A number of invited experts will discuss current challenges of using big data sources in the fusion process and research to address these challenges.

PANEL DISCUSSION

Decision-Driven Analyst

Joint Panel with Conferences 8742 and 8758

3:40 to 4:40 pm · Conv. Ctr. Room 323

David Hall, The Pennsylvania State Univ. (USA); **James Llinas,** Univ. at Buffalo (USA); **Bhopinder Madahar,** Defence Science and Technology Laboratory (United Kingdom); **Tien Pham** (USA)

Symposium-Wide Plenary Session

5:00 to 6:00 pm · Conv. Ctr. Ballroom 1-2

DARPA: Driving Technological Surprise

Arati Prabhakar, Director of the Defense Advanced Research Projects Agency (DARPA)

Dr. Prabhakar has spent her career investing in world-class engineers and scientists to create new technologies and businesses. Her first service to national security started in 1986 when she joined DARPA as a program manager. She initiated and managed programs in advanced semiconductor technology and flexible manufacturing, as well as demonstration projects to insert new semiconductor technologies into military systems. As the founding director of DARPA's Microelectronics Technology Office, she led a team of program managers whose efforts spanned these areas, as well as optoelectronics, infrared imaging and nanoelectronics.

All-Symposium Welcome Reception

6:00 to 7:30 pm · Hilton: Key Ballroom

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

Professional Development

Spend some time focusing on your career development while you're at SPIE Defense, Security, and Sensing.
See the Course Materials Desk for workshop details.
See the SPIE Cashier in the Pratt Lobby to register.

Tuesday · 30 April

Free 500-company exhibition

30 April to 2 May 2013
Exhibition Hall

Tuesday 30 April · 10:00 am to 5:00 pm
Wednesday 1 May · 10:00 am to 5:00 pm
Thursday 2 May · 10:00 am to 2:00 pm

Lunch with the Experts

A Student Networking Event

12:30 to 1:30 pm · Hilton: Holiday Ballroom 4

Open to Student Attendees

Enjoy a casual meal with colleagues at this engaging networking opportunity. This event features experts willing to share their experience and wisdom on career paths in optics and photonics. Seating is limited and will be granted on a first-come, first-served basis.

PANEL DISCUSSION

Getting Hired in 2013 and Beyond

2:00 to 3:00 pm · Hilton: Holiday Ballroom 1

Join us for a panel discussion on optics and photonics careers in the defense sector. Learn about getting hired and working with defense contractors directly from human resource professionals.

SPECIAL WORKSHOP AND DISCUSSION

Modular Open System Architecture (MOSA) Back End for RF Systems (MBE-RF)

4:00 to 5:30 pm · Conv. Ctr. Room 334

Keynote Speaker: **Mr. Gregory Rubertus,** Air Force Research Lab. Sensors Directorate (USA)

Technical Presentation: **Dr. Gregory Twaites,** Chief Engineer, General Dynamics Advanced Information Systems

Special Introduction Provided by: **Mr. Edwin Culpepper,** Air Force Research Lab. Sensors Directorate (USA)

The Air Force Research Laboratory (AFRL) has launched a program to address this issue. The goal of the Modular Open System Architecture (MOSA) Back End for RF (MBE-RF) program is to develop a hardware-independent, open reference architecture for the back end processing of RF systems, thereby allowing a variety of suppliers to offer solutions. The objective is to drive down the life cycle cost of these systems while at the same time making it easier to upgrade systems as new technology becomes available.

Early Career Professional Presentation and Reception

A Networking Event for Early Career Professionals, Students, and Conference Attendees

5:00 to 6:30 pm · Hilton: Holiday Ballroom 1

Special Presentation
Robert Kester, Rebellion Photonics

Robert's company, Rebellion Photonics, is a start-up spun out of Rice University in 2009, commercializing a unique snap-shot hyperspectral video platform that he invented while attending graduate school. He currently leads Rebellion's technology team as it develops innovative products utilized in biological research, drone (UAV) markets, and for leak imaging in oil and gas market.

Sponsored by **SPIE Career Center**

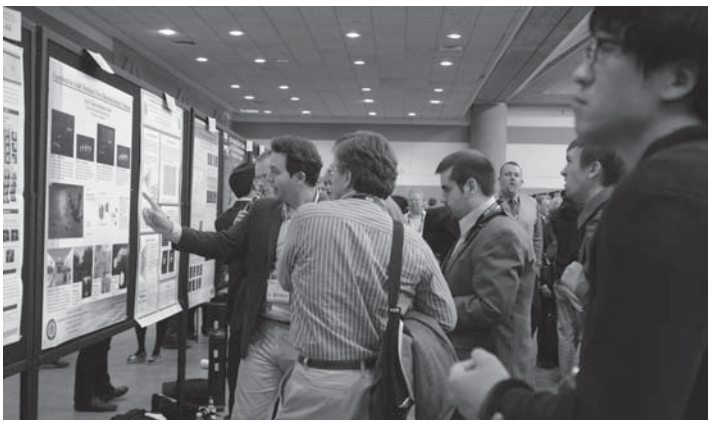
JOB FAIR

Talk with representatives from nearly 20 companies currently looking to hire.

Free Admission

Tuesday 30 April, 10:00 am to 5:00 pm
Wednesday 1 May, 10:00 am to 5:00 pm

Visit the **SPIE Career Center Booth #1869** for your chance to win a **Kindle Fire!**



Poster Session

6:00 to 7:30 pm · Conv. Ctr. Hall D

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Wednesday · 1 May

Free 500-company exhibition

30 April to 2 May 2013
Exhibition Hall

Tuesday 30 April · 10:00 am to 5:00 pm
Wednesday 1 May · 10:00 am to 5:00 pm
Thursday 2 May · 10:00 am to 2:00 pm



WORKSHOP

Early Stage Technology Commercialization

OPEN TO –ALL– Attendees

8:00 to 10:00 am · Conv. Ctr. Room 315

Moderator: **Joseph X. Montemarano,**
Executive Director, MIRTHE, Princeton Univ. (USA)

Panelists:
Thomas A. Cellucci, Executive Vice-President, ICS Nett, Inc.
Ralph E. Taylor-Smith, General Partner, Battelle Ventures
David Pustai, Program Manager, Innovation and Advanced Research and Development, Lockheed Martin Co.
Kevin Lascola, Maxion Technologies/Thorlabs

Panelists from U.S. government laboratories, venture capital community, and industry discuss ways to speed the commercialization and deployment of early-stage Defense and Homeland Security applications focused on mid-infrared technologies. Listen and interact with the leaders in the IR community, and come to share your ideas.

Technology Showcase

Start-ups and small companies will showcase their latest technologies ready and available for commercialization.

Companies include:
Redshift Systems Corp.
Sentinel Photonics

Sponsored by **SPIE Career Center**

JOB FAIR

Talk with representatives from nearly 20 companies currently looking to hire.

Free Admission

Tuesday 30 April, 10:00 am to 5:00 pm
Wednesday 1 May, 10:00 am to 5:00 pm

Visit the **SPIE Career Center Booth #1869** for your chance to win a **Kindle Fire!**

SPECIAL KEYNOTE SESSION AND PANEL DISCUSSION

Open Architecture (OA)/Open Business Model (OBM) Systems

Joint with Conferences 8741 and 8754

8:30 to 11:30 am · Conv. Ctr. Room 321

KEYNOTE PRESENTATIONS · 8:30 to 10:00 am

Modular, open, scalable architectures with applications to C4ISR systems
Bobby R. Junker, Office of Naval Research (USA)

The GDAIS journey in OA/OBM
Carlo Zaffanella, General Dynamics Advanced Information Systems (USA)

Small business perspectives on the open business model
Howard Reichel, In-Depth Engineering Corp. (USA)

PANEL DISCUSSION · 10:30 to 11:30 am

Moderator:
Dr. Raja Suresh,
General Dynamics Advanced Information Systems

Panelists:

Bobby Junker,
C4ISR Department Head, Office of Naval Research (USA)

Howard Reichel,
Senior Vice President, In-Depth Engineering Corp. (USA)

Carlo Zaffanella,
Vice President, General Dynamics Advanced Information Systems (USA)

Nick Guertin,
Director of Transformation, U.S. Navy (USA)

Microscopy for STEM Educators

8:55 am to 12:10 pm · Conv. Ctr. Room 325

Session Chairs:
Michael T. Postek, National Institute of Standards and Technology (USA)
Mary Satterfield, National Institute of Standards and Technology (USA)
Robert Gordon, Hitachi High Technologies America, Inc. (USA)

The future of our nation hinges on our ability to prepare our next generation to be innovators in science, technology, engineering and math (STEM). Excitement for STEM begins in the earliest stages of our education process. The special session is a general interest forum with several notable invited speakers discussing their successful programs implementing microscopy in STEM education to foster student interest and excitement. A hands-on session with tabletop scanning electron microscopes will be held at the end of the presentations.

Wednesday · 1 May

SPECIAL SESSION

National Security Sensor Challenges

OPEN TO ALL Attendees

3:30 to 5:30 pm · Conv. Ctr. Room 315

This Government National Security Leadership Panel will discuss the emerging sensor needs and challenge that must be overcome to provide security in the 21st century. Both long term breakthrough sensing challenges as well as nearer term cost, size and weight improvements to enable new mission capabilities will be addressed.

Session Moderator
David Whelan, Boeing Defense, Space, and Security and DSS2013 Symposium Co-Chair

Presenters:

Stefanie Tompkins, Deputy Director of Strategic Technology Office, DARPA

Walter F. Jones, Director, Office of Naval Research

Peter Highnam, Director, IARPA

PANEL DISCUSSION

Information Fusion and Robotics

Part of Conf. 8756: Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2013

2:40 to 3:20 pm · Conv. Ctr. Room 332

Panel Moderator: **Jerome J. Braun,** MIT Lincoln Lab. (USA)

PANEL DISCUSSION

Future Directions for Radiation-related Materials Research: From Research to Practical Use

4:40 to 5:40 pm · Conv. Ctr. Room 317

Moderators: **Shinji Nozaki,** Univ. of Electro-Communications (Japan); **Takeshi Ohshima,** Japan Atomic Energy Research Institute (Japan); **Hisayoshi Itoh,** Japan Atomic Energy Agency (Japan)

WORKSHOP

Night Vision-Integrated Performance Model

4:40 to 5:40 pm · Conv. Ctr. Room 319

Workshop Leaders: **Brian Teaney, Joseph Reynolds,** U.S. Army Night Vision & Electronic Sensor Directorate

The Night Vision Integrated Performance Model (NV-IPM) was recently released by NVESD. The aim of this new model is to provide a flexible and extensible engineering tool for system design which encapsulates all of the capabilities of the existing Night Vision model suite along with many new design tools and features. This workshop will introduce some common NV-IPM modeling cases and discusses the model features and capabilities in greater detail.

Banquet and Award Announcements

7:00 to 9:30 pm · Hilton: Holiday Ballroom 4-6

Tickets may be purchased for $95 until 1:00 pm Monday 29 April at the SPIE Cashier.

Introduction of the New SPIE Fellows

2013 SPIE Dennis Gabor Award Presentation

DSS Lifetime Achievement Award Presentation

Distinguished Banquet Speaker

GEOINT: Decisive Advantage for the 21st Century

Ms. Letitia A. Long
Director, National Geospatial Intelligence Agency

Ms. Letitia A. Long was appointed Director of the National Geospatial-Intelligence Agency on August 9, 2010. Prior to her appointment, Ms. Long served as Deputy Director of the Defense Intelligence Agency (DIA) from May 2006 until July 2010. Previously, she was the Deputy Under Secretary of Defense for Intelligence (Policy, Requirements, and Resources) from June 2003 until May 2006. She also served as the Deputy Director of Naval Intelligence from July 2000 to June 2003 and as the Director of Central Intelligence's Executive Director for Intelligence Community Affairs from January 1998 to June 2000, where she was responsible for community-wide policy formulation, resource planning, and program assessment and evaluation.

Thursday · 2 May

PANEL DISCUSSION

Synergistic Data Fusion through Multi-Sensing Enablement

1:20 to 2:50 pm · Conv. Ctr. Room 346

Community Perspectives and Geospatial Information Applications Needs and Challenges
Moderator: **Shiloh L. Dockstader,** ITT Exelis (USA)

Poster Session

6:00 to 7:30 pm · Conv. Ctr. Hall D

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

BEST PAPER AWARDS

BEST PAPER AWARD

Mobile Multimedia/Image Processing, Security, and Applications 2013 (Conf. 8755)

Best Paper Session . . . .Mon. 29 April 1:30 to 4:40 pm
Award Ceremony . . . . .Tue. 30 April 5:30 to 5:40 pm

The candidates for the Best Paper Award will present in this special session in Mobile Multimedia/Image Processing, Security, and Applications 2013.

BEST PAPER AWARDS

2013 Automatic Target Recognition (Conf. 8744)

Tuesday 30 April . . . . . .11:30 am to 12:00 pm

Two awards are planned: the first is the overall Best Paper Award, and the second is a Best Student Paper Award.

Sponsored by: LOCKHEED MARTIN

BEST PAPER AND BEST STUDENT PAPER AWARDS

Three-Dimensional Imaging, Visualization, and Display 2013 (Conf. 8738)

Award Ceremony. . . . . .Tuesday 5:40 to 5:50 pm

Three papers will be selected for the Best Paper Awards among the papers accepted for this conference. One of the three awards will be a Best Student Paper Award, on which a student must be author or co-author. A panel of experts will evaluate all the papers for technical quality and merit.

Daily Course Schedule

Get Professional Development with SPIE Courses

Relevant training · Proven instructors · Education you need to stay competitive in today's job market

- More than 50 courses and workshops on fundamental and current topics on lasers and applications, sensors, imaging, IR systems, optical & optomechanical engineering, and more
- Course attendees receive CEUs to fulfill continuing education requirements.

IR Sensors and Systems

Monday	Tuesday	Wednesday	Thursday	Friday
SC713 **Engineering Approach to Imaging System Design** *(Holst)* 8:30 am to 5:30 pm, $615 / $710	SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 8:30 am to 12:30 pm, $345 / $395	SC1076 **Analog-to-Digital Converters for Digital ROICs** *(Veeder)* 8:30 am to 12:30 pm, $345 / $395	SC755 **Infrared Optics and Zoom Lenses** *(Mann)* 8:30 am to 12:30 pm, $345 / $395	SC154 **Electro-Optical Imaging System Performance** *(Holst)* 8:30 am to 5:30 pm, $645 / $740
SC278 **Infrared Detectors** *(Dereniak)* 8:30 am to 12:30 pm, $545 / $595	SC950 **Infrared Imaging Radiometry** *(Richards)* 8:30 am to 5:30 pm, $565 / $660	SC835 **Infrared Systems - Technology & Design** *(Daniels)* 8:30 am to 5:30 pm, $925 / $1,195		
SC1107 **IR Atmospheric Propagation for Sensor Systems** *(Thomas)* 8:30 am to 5:30 pm, $650 / $745	SC214 **Infrared Window and Dome Materials** *(Harris)* 8:30 am to 5:30 pm, $630 / $730	SC1000 **Introduction to Infrared and Ultraviolet Imaging Technology** *(Richards)* 8:30 am to 12:30 pm, $380 / $430	SC067 **Testing and Evaluation of E-O Imaging Systems** *(Holst)* 8:30 am to 5:30 pm, $645 / $740	
SC1073 **Radiometry and its Practical Applications** *(Grant)* 8:30 am to 5:30 pm, $675 / $770	SC900 **Uncooled Thermal Imaging Detectors and Systems** *(Hanson)* 8:30 am to 5:30 pm, $605 / $700	SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $565 / $670		
SC1071 **Understanding Diffractive Optics** *(Soskind)* 8:30 am to 5:30 pm, $600 / $695	SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 pm to 5:30 pm, $425 / $475	SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* 8:30 am to 5:30 pm, $620 / $715		
SC152 **Infrared Focal Plane Arrays** *(Dereniak, Hubbs)* 1:30 pm to 5:30 pm, $345 / $395		SC1012 **Coherent Mid-Infrared Sources and Applications** *(Vodopyanov)* 1:30 pm to 5:30 pm, $345 / $395		
SC1068 **Introduction to Night Vision** *(Browne)* 1:30 pm to 5:30 pm, $345 / $395		SC1109 **Infrared Radiometric Calibration** *(Yoon, Eppeldauer, Kaplan, Gibson)* 1:30 to 5:30 pm, $345 / $395		

Registration required for courses and workshops

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Pratt St. Lobby (Level 300)

Continuing Education Units

SPIE has been approved as an authorized provider of CEUs by IACET, The International Association for Continuing Education and Training (Provider #1002091). In obtaining this approval, SPIE has demonstrated that it complies with the ANSI/IACET Standards which are widely recognized as standards of good practice.

Money-back Guarantee

We are confident that once you experience an SPIE course for yourself you will look to us for your future education needs. However, if for any reason you are dissatisfied, we will gladly refund your money. We just ask that you tell us what you did not like; suggestions for improvement are always welcome.

SPIE reserves the right to cancel a course due to insufficient advance registration.

Monday	Tuesday	Wednesday	Thursday	Friday
Optical and Optomechanical Engineering				
SC156 **Basic Optics for Engineers** *(Boreman)* 8:30 am to 5:30 pm, $605 / $700	SC950 **Infrared Imaging Radiometry** *(Richards)* 8:30 am to 5:30 pm, $565 / $660	SC254 **Integrated Opto-Mechanical Analysis** *(Genberg, Doyle)* 8:30 am to 5:30 pm, $615 / $710	SC755 **Infrared Optics and Zoom Lenses** *(Mann)* 8:30 am to 12:30 pm, $345 / $395	
SC1073 **Radiometry and its Practical Applications** *(Grant)* 8:30 am to 5:30 pm, $675 / $770	SC214 **Infrared Window and Dome Materials** *(Harris)* 8:30 am to 5:30 pm, $630 / $730	SC1000 **Introduction to Infrared and Ultraviolet Imaging Technology** *(Richards)* 8:30 am to 12:30 pm, $380 / $430	SC1052 **Optical Systems Engineering** *(Kasunic)* 8:30 am to 5:30 pm, $565 / $660	
SC1071 **Understanding Diffractive Optics** *(Soskind)* 8:30 am to 5:30 pm, $600 / $695	SC1019 **Mounting of Optical Components** *(Kasunic)* 8:30 am to 5:30 pm, $645 / $740	SC014 **Introduction to Optomechanical Design** *(Vukobratovich)* 8:30 am to 5:30 pm, $890 / $1,160		
	WS609 **Basic Optics for Non-Optics Personnel** *(Harding)* 1:30 pm to 4:00 pm, $150 / $200	SC1109 **Infrared Radiometric Calibration** *(Yoon, Eppeldauer, Kaplan, Gibson)* Wed 1:30 to 5:30 pm, $345 / $395	SC781 **Optomechanical Analysis** *(Hatheway)* 8:30 am to 5:30 pm, $565 / $660	
Defense, Homeland Security, and Law Enforcement				
SC1107 **IR Atmospheric Propagation for Sensor Systems** *(Thomas)* 8:30 am to 5:30 pm, $650 / $745	SC952 **Applications of Detection Theory** *(Carrano)* 8:30 am to 5:30 pm, $565 / $660	SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $565 / $660	SC995 **Target Detection Algorithms for Hyperspectral Imagery** *(Nasrabadi)* 8:30 am to 5:30 pm, $565 / $660	
SC1068 **Introduction to Night Vision** *(Browne)* 1:30 pm to 5:30 pm, $345 / $395		SC1075 **Methods of Energy Harvesting for Low-Power Sensors** *(Erturk)* 8:30 am to 12:30 pm, $345 / $395	SC547 **Terahertz Wave Technology and Applications** *(Zhang)* 1:30 pm to 5:30 pm, $345 / $395	
		SC1012 **Coherent Mid-Infrared Sources and Applications** *(Vodopyanov)* 1:30 pm to 5:30 pm, $345 / $395		

Daily Course Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Imaging and Sensing				
SC713 **Engineering Approach to Imaging System Design** *(Holst)* 8:30 am to 5:30 pm, $615 / $710	SC952 **Applications of Detection Theory** *(Carrano)* 8:30 am to 5:30 pm, $565 / $660	SC1076 **Analog-to-Digital Converters for Digital ROICs** *(Veeder)* 8:30 am to 12:30 pm, $345 / $395	SC995 **Target Detection Algorithms for Hyperspectral Imagery** *(Nasrabadi)* 8:30 am to 5:30 pm, $565 / $660	SC154 **Electro-Optical Imaging System Performance** *(Holst)* 8:30 am to 5:30 pm, $645 / $740
SC1107 **IR Atmospheric Propagation for Sensor Systems** *(Thomas)* 8:30 am to 5:30 pm, $650 / $745	SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 8:30 am to 12:30 pm, $345 / $395	SC1069 **GPU for Defense Applications** *(Humphrey)* 8:30 am to 12:30 pm, $345 / $395	SC067 **Testing and Evaluation of E-O Imaging Systems** *(Holst)* 8:30 am to 5:30 pm, $645 / $740	
SC1077 **Ocean Sensing and Monitoring** *(Hou)* 8:30 am to 12:30 pm, $345 / $395	SC950 **Infrared Imaging Radiometry** *(Richards)* 8:30 am to 5:30 pm, $565 / $660	SC967 **High Dynamic Range Imaging: Sensors and Architectures** *(Darmont)* 8:30 am to 5:30 pm, $610 / $705	SC547 **Terahertz Wave Technology and Applications** *(Zhang)* 1:30 pm to 5:30 pm, $345 / $395	
SC1073 **Radiometry and its Practical Applications** *(Grant)* 8:30 am to 5:30 pm, $675 / $770	SC157 **MTF in Optical and Electro-Optical Systems** *(Boreman)* 8:30 am to 5:30 pm, $605 / $700	SC1000 **Introduction to Infrared and Ultraviolet Imaging Technology** *(Richards)* 8:30 am to 12:30 pm, $380 / $430		
SC1071 **Understanding Diffractive Optics** *(Soskind)* 8:30 am to 5:30 pm, $600 / $695	SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 pm to 5:30 pm, $425 / $475	SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $565 / $660		
		SC1109 **Infrared Radiometric Calibration** *(Yoon, Eppeldauer, Kaplan, Gibson)* Wed 1:30 to 5:30 pm, $345 / $395		
Sensing for Industry, Environment, and Health				
SC1107 **IR Atmospheric Propagation for Sensor Systems** *(Thomas)* 8:30 am to 5:30 pm, $650 / $745	SC952 **Applications of Detection Theory** *(Carrano)* 8:30 am to 5:30 pm, $565 / $660	SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $565 / $660	SC1105 **Fiber Lasers and their Applications** *(Samson, Dong)* 8:30 am to 5:30 pm, $565 / $660	SC972 **Basic Laser Technology** *(Sukuta)* 8:30 am to 12:30 pm, $295 / $345
SC1077 **Ocean Sensing and Monitoring** *(Hou)* 8:30 am to 12:30 pm, $345 / $395	SC180 **Imaging Polarimetry** *(Dereniak, Miles, Sabatke)* 8:30 am to 12:30 pm, $345 / $395	SC1075 **Methods of Energy Harvesting for Low-Power Sensors** *(Erturk)* 8:30 am to 12:30 pm, $345 / $395	SC995 **Target Detection Algorithms for Hyperspectral Imagery** *(Nasrabadi)* 8:30 am to 5:30 pm, $565 / $660	
SC1106 **Laser Lab Design - Laser Safety and Practicality** *(Barat)* 1:30 pm to 5:30 pm, $345 / $395		SC1109 **Infrared Radiometric Calibration** *(Yoon, Eppeldauer, Kaplan, Gibson)* Wed 1:30 to 5:30 pm, $345 / $395	SC547 **Terahertz Wave Technology and Applications** *(Zhang)* 1:30 pm to 5:30 pm, $345 / $395	

Registration required for courses and workshops

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Monday	Tuesday	Wednesday	Thursday	Friday
Emerging Technologies				
SC1071 **Understanding Diffractive Optics** *(Soskind)* 8:30 am to 5:30 pm, $660 / $745		SC1076 **Analog-to-Digital Converters for Digital ROICs** *(Veeder)* 8:30 am to 12:30 pm, $345 / $395	SC547 **Terahertz Wave Technology and Applications** *(Zhang)* 1:30 pm to 5:30 pm, $345 / $395	
		SC1075 **Methods of Energy Harvesting for Low-Power Sensors** *(Erturk)* 8:30 am to 12:30 pm, $345 / $395		
Laser Sensors and Systems				
SC1104 **Applications and Performance of High Power Lasers in the Battlefield** *(Kalisky)* 8:30 am to 12:30 pm, $345 / $395		SC789 **Introduction to Optical and Infrared Sensor Systems** *(Shaw)* 8:30 am to 5:30 pm, $565 / $660	SC1105 **Fiber Lasers and their Applications** *(Samson, Dong)* 8:30 am to 5:30 pm, $565 / $660	SC972 **Basic Laser Technology** *(Sukuta)* 8:30 am to 12:30 pm, $345 / $395
SC1032 **Direct Detection Laser Radar Systems for Imaging Applications** *(Richmond)* 8:30 am to 5:30 pm, $605 / $700		SC1012 **Coherent Mid-Infrared Sources and Applications** *(Vodopyanov)* 1:30 pm to 5:30 pm, $345 / $395	SC997 **High Power Laser Beam Quality** *(Ross)* 8:30 am to 12:30 pm, $390 / $440	
SC1107 **IR Atmospheric Propagation for Sensor Systems** *(Thomas)* 8:30 am to 5:30 pm, $650 / $745				
SC160 **Precision Stabilized Pointing and Tracking Systems** *(Hilkert)* 8:30 am to 5:30 pm, $565 / $660				
SC1071 **Understanding Diffractive Optics** *(Soskind)* 8:30 am to 5:30 pm, $600 / $695				
SC1103 **3D Imaging Laser Radar** *(Kamerman)* 1:30 pm to 5:30 pm, $345 / $395				
SC1106 **Laser Lab Design - Laser Safety and Practicality** *(Barat)* 1:30 pm to 5:30 pm, $345 / $395				

Daily Course Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Displays for Innovative Applications				
SC1071 **Understanding Diffractive Optics** *(Soskind)* 8:30 am to 5:30 pm, $600 / $695	SC159 **Head-Mounted Displays: Design and Applications** *(Melzer, Browne)* 8:30 am to 5:30 pm, $600 / $695	SC979 **Fundamentals of Three-Dimensional Optical Microscopy** *(Javidi, Martinez-Corral)* 8:30 am to 5:30 pm, $565 / $660		
SC1068 **Introduction to Night Vision** *(Browne)* 1:30 pm to 5:30 pm, $345 / $395		SC1069 **GPU for Defense Applications** *(Humphrey)* 8:30 am to 12:30 pm, $345 / $395		
		SC967 **High Dynamic Range Imaging: Sensors and Architectures** *(Darmont)* 8:30 am to 5:30 pm, $610 / $715		
Unmanned, Robotic, and Layered Systems				
SC1077 **Ocean Sensing and Monitoring** *(Hou)* 8:30 am to 12:30 pm, $345 / $395	SC952 **Applications of Detection Theory** *(Carrano)* 8:30 am to 5:30 pm, $565 / $660	SC1075 **Methods of Energy Harvesting for Low-Power Sensors** *(Erturk)* 8:30 am to 12:30 pm, $345 / $395		
SC1068 **Introduction to Night Vision** *(Browne)* 1:30 pm to 5:30 pm, $345 / $395				
Sensor Data and Information Exploitation				
SC160 **Precision Stabilized Pointing and Tracking Systems** *(Hilkert)* 8:30 am to 5:30 pm, $565 / $660	SC994 **Multisensor Data Fusion for Object Detection, Classification and Identification** *(Klein)* 8:30 am to 5:30 pm, $635 / $730	SC1076 **Analog-to-Digital Converters for Digital ROICs** *(Veeder)* 8:30 am to 12:30 pm, $345 / $395	SC995 **Target Detection Algorithms for Hyperspectral Imagery** *(Nasrabadi)* 8:30 am to 5:30 pm, $565 / $660	SC972 **Basic Laser Technology** *(Sukuta)* 8:30 am to 12:30 pm, $345 / $395
SC1106 **Laser Lab Design - Laser Safety and Practicality** *(Barat)* 1:30 pm to 5:30 pm, $345 / $395	SC194 **Multispectral and Hyperspectral Image Sensors** *(Lomheim)* 1:30 pm to 5:30 pm, $425 / $475	SC1069 **GPU for Defense Applications** *(Humphrey)* 8:30 am to 12:30 pm, $345 / $395		
		SC181 **Predicting Target Acquisition Performance of Electro-Optical Imagers** *(Vollmerhausen)* 8:30 am to 5:30 pm, $620 / $715		

Monday	Tuesday	Wednesday	Thursday	Friday
Signal, Image, and Neural Net Processing				
SC066 **Fundamentals of Electronic Image Processing** *(Weeks)* 8:30 am to 5:30 pm, $635 / $730	SC952 **Applications of Detection Theory** *(Carrano)* 8:30 am to 5:30 pm, $565 / $660	SC1076 **Analog-to-Digital Converters for Digital ROICs** *(Veeder)* 8:30 am to 12:30 pm, $345 / $395	SC995 **Target Detection Algorithms for Hyperspectral Imagery** *(Nasrabadi)* 8:30 am to 5:30 pm, $565 / $660	
	SC994 **Multisensor Data Fusion for Object Detection, Classification and Identification** *(Klein)* 8:30 am to 5:30 pm, $635 / $730	SC1069 **GPU for Defense Applications** *(Humphrey)* 8:30 am to 12:30 pm, $345 / $395		
Information Systems and Networks: Processing, Fusion, and Knowledge Generation				
	SC952 **Applications of Detection Theory** *(Carrano)* 8:30 am to 5:30 pm, $565 / $660	SC1069 **GPU for Defense Applications** *(Humphrey)* 8:30 am to 12:30 pm, $345 / $395		
	SC994 **Multisensor Data Fusion for Object Detection, Classification and Identification** *(Klein)* 8:30 am to 5:30 pm, $635 / $730			
Business + Professional Development Workshops				
	WS609 **Basic Optics for Non-Optics Personnel** *(Harding)* 1:30 pm to 4:00 pm, $150 / $200	WS951 **Leading Successful Product Innovation** *(Carrano)* 8:30 am to 12:30 pm, $345 / $395	WS846 **Essential Skills for Engineering Project Leaders** *(Hinkle)* 1:30 pm to 5:30 pm, $345 / $395	SC972 **Basic Laser Technology** *(Sukuta)* 8:30 am to 12:30 pm, $345 / $395
		WS933 **Complying with the ITAR: A Case Study** *(Scarlott)* 1:30 pm to 5:30 pm, $345 / $395		
		WS1108 **Just Outgoing Enough: Public Speaking, Networking, and Getting What You Want for Scientists and Engineers** *(McGovern)* 1:30 pm to 5:00 pm, $100 / $150		

Registration required for courses and workshops

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Available 6 weeks after the meeting.

Vol#	Title/Editor	Price
8704	**Infrared Technology and Applications XXXIX** (Andresen, Fulop, Hanson, Norton)	$145
8705	**Thermosense: Thermal Infrared Applications XXXV** (Stockton, Colbert)	$70
8706	**Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXIV** (Holst, Krapels)	$70
8707	**Technologies for Synthetic Environments: Hardware-in-the-Loop XVIII** (Buford, Murrer, Ballard)	$45
8708	**Window and Dome Technologies and Materials XIII** (Tustison, Zelinski)	$70
8709	**Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XVIII** (Broach, Isaacs)	$90
8710	**Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XIV** (Fountain)	$90
8711	**Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense XII** (Carapezza)	$60
8712	**Biometric and Surveillance Technology for Human and Activity Identification X** (Kakadiaris, Scheirer, Hassebrook)	$53
8713	**Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and A pplications X** (Henry)	$70
8714	**Radar Sensor Technology XVII** (Ranney, Doerry)	$80
8715	**Passive and Active Millimeter-Wave Imaging XVI** (Wikner, Luukanen)	$53
8716	**Terahertz Physics, Devices, and Systems VII: Advanced Applications in Industry and Defense** (Anwar, Crowe, Manzur)	$60
8717	**Compressive Sensing II** (Ahmad)	$60
8718	**Advanced Environmental, Chemical, and Biological Sensing Technologies X** (Vo-Dinh, Lieberman, Gauglitz)	$53
8719	**Smart Biomedical and Physiological Sensor Technology X** (Cullum, McLamore)	$60
8720	**Photonic Applications for Aerospace, Commercial, and Harsh Environments IV** (Kazemi, Kress, Thibault)	$70
8721	**Sensing for Agriculture and Food Quality and Safety V** (Kim, Tu, Chao)	$53
8722	**Fiber Optic Sensors and Applications X** (Udd, Pickrell, Du)	$60
8723	**Sensing Technologies for Global Health, Military Medicine, and Environmental Monitoring III** (Southern)	$70
8724	**Ocean Sensing and Monitoring V** (Hou, Arnone)	$70
8725	**Micro- and Nanotechnology Sensors, Systems, and Applications V** (George, Islam, Dutta)	$125
8726	**Next-Generation Spectroscopic Technologies VI** (Druy, Crocombe)	$70
8727	**Advanced Photon Counting Techniques VII** (Itzler)	$60
8728	**Energy Harvesting and Storage: Materials, Devices, and Applications IV** (Dhar, Balaya, Dutta)	$60
8729	**Scanning Microscopies 2013: Advanced Microscopy Technologies for Defense, Homeland Security, Forensic, Life, E nvironmental, and Industrial Sciences** (Postek, Newbury, Platek, Maugel)	$53
8730	**Flexible Electronics** (Allee, Forsythe)	$53
8731	**Laser Radar Technology and Applications XVIII** (Turner, Kamerman)	$70
8732	**Atmospheric Propagation X** (Thomas, Spillar)	$53
8733	**Laser Technology for Defense and Security IX** (Dubinskii, Post)	$70
8734	**Active and Passive Signatures IV** (Gilbreath, Hawley)	$53
8735	**Head- and Helmet-Mounted Displays XVIII: Design and Applications** (Marasco, Havig)	$45
8736	**Display Technologies and Applications for Defense, Security, and Avionics VII** (Desjardins, Sarma)	$45
8737	**Degraded Visual Environments: Enhanced, Synthetic, and External Vision Solutions 2013** (Bernier, Guell)	$53
8738	**Three-Dimentional Imaging, Visualization, and Display 2013** (Javidi, Son)	$60
8739	**Sensors and Systems for Space Applications VI** (Pham, Cox)	$60
8740	**Motion Imagery Technologies, Best Practices, and Workflows for Intelligence, Surveillance, and Reconnaissance (ISR), and Situational Awareness** (Self)	$53
8741	**Unmanned Systems Technology XV** (Karlsen, Gage, Shoemaker, Gerhart)	$70
8742	**Ground/Air Multisensor Interoperability, Integration, and Networking for Persistent ISR IV** (Pham)	$70
8743	**Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIX** (Shen, Lewis)	$105
8744	**Automatic Target Recognition XXIII** (Sadjadi, Mahalanobis)	$70
8745	**Signal Processing, Sensor Fusion, and Target Recognition XXII** (Kadar)	$100
8746	**Algorithms for Synthetic Aperture Radar Imagery XX** (Zelnio, Garber)	$53
8747	**Geospatial InfoFusion III** (Pellechia, Sorensen, Palaniappan)	$53
8748	**Optical Pattern Recognition XXIV** (Casasent, Chao)	$60
8749	**Quantum Information and Computation XI** (Donkor, Pirich)	$60
8750	**Independent Component Analyses, Compressive Sampling, Wavelets, Neural Net, Biosystems, and Nanoengineering XI** (Brandt)	$70
8751	**Machine Intelligence and Bio-inspired Computation: Theory and Applications VII** (Szu)	$45
8752	**Modeling and Simulation for Defense Systems and Applications VIII** (Blowers, Mendoza-Schrock)	$53
8753	**Wireless Sensing, Localization, and Processing VIII** (Kelmelis)	$53
8754	**Open Architecture/Open Business Model Net-Centric Systems and Defense Transformation 2013** (Dianat, Zoltowski)	$45
8755	**Mobile Multimedia/Image Processing, Security, and Applications 2013** (Suresh)	$70
8756	**Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2013** (Agaian, Jassim, Du)	$53
8757	**Cyber Sensing 2013** (Braun)	$53
8758	**Next-Generation Analyst** (Ternovskiy, Chin)	$53

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Meeting attendee: $135
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Defense, Security, and Sensing 2013: Sensor Data and Information Exploitation
Includes Vols. 8743-8747
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Est. pub. June 2013
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Nonattendee member price: $270
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Defense, Security, and Sensing 2013: Signal, Image, and Neural Net Processing; Information Systems and Networks: Processing, Fusion, and Knowledge Generation
Includes Vols. 8748-8758
Order No. CDS514
Est. pub. June 2013
Meeting attendee: $135
Nonattendee member price: $435
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Monday	Tuesday	Wednesday	Thursday	Friday
IR Sensors and Systems				
8704 **Infrared Technology and Applications XXXIX** *(Andresen/Fulop/Hanson/Norton)*				
8705 **Thermosense: Thermal Infrared Applications XL** *(Stockton/Colbert)*				
	8706 **Infrared Imaging Systems: Design, Analysis, Modeling, and Testing XXIV** *(Holst/Krapels)*			
			8707 **Technologies for Synthetic Environments: Hardware-in-the-Loop XVIII** *(Buford/Murrer/Ballard)*	
		8708 **Window and Dome Technologies and Materials XIII** *(Tustison/Zelinski)*		
Defense, Homeland Security, and Law Enforcement				
8709 **Detection and Sensing of Mines, Explosive Objects, and Obscured Targets XVIII** *(Broach)*				
	8710 **Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNE) Sensing XIV** *(Fountain)*			
8711 **Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense XII** *(Carapezza)*			8712 **Biometric and Surveillance Technology for Human and Activity Identification X** *(Kakadiaris/Scheirer/Hassebrook)*	
Imaging and Sensing				
		8713 **Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems Applications X** *(Henry)*		
8714 **Radar Sensor Technology XVII** *(Ranney/Doerry)*			8715 **Passive and Active Millimeter-Wave Imagery XVI** *(Wikner/Luukanen)*	
8716 **Terahertz Physics, Devices, and Systems VII: Advance Application in Industry and Defense** *(Anwar/Crowe/Manzur)*			8717 **Compressive Sensing II** *(Ahmad)*	
Sensing for Industry, Environment, and Health				
8718 **Advanced Environmental, Chemical, and Biological Sensing Technologies X** *(Vo-Dinh/Lieberman/Gauglitz)*		8719 **Smart Biomedical and Physiological Sensor Technology X** *(Cullum/McLamore)*		
8720 **Photonic Applications for Aerospace, Transportation, and Harsh Environments IV** *(Kazemi/Thibault/Kress)*			8722 **Fiber Optic Sensors and Applications X** *(Udd/Pickrell/Du)*	
	8721 **Sensing for Agriculture and Food Quality and Safety V** *(Kim/Tu/Chao)*			
8723 **Sensing Technologies for Global Health, Military Medicine, Disaster Response, and Environmental Monitoring III** *(Southern)*				
	8724 **Ocean Sensing and Monitoring V** *(Hou/Arnone)*			

55 courses and workshops
See full schedule and descriptions at or online **spie.org/dss**

Daily Conference Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Emerging Technologies				
8725 **Micro- and Nanotechnology Sensors, Systems, and Applications V** *(George/Islam/Dutta)*				
8726 **Next-Generation Spectroscopic Technologies VI** *(Druy/Crocombe)*		8727 **Advanced Photon Counting Techniques VII** *(Itzler)*		
8728 **Energy Harvesting and Storage: Materials, Devices, and Applications IV** *(Dhar/Balaya/Dutta)*				
	8729 **Scanning Microscopies 2013: Advanced Microscopy Technologies for Defense, Homeland Security, Forensic, Life, Environmental, and Industrial Sciences II** *(Postek/Newbury/Platek/Maugel)*			
		8730 **Flexible Electronics** *(Allee/Forsythe)*		
Laser Sensors and Systems				
	8731 **Laser Radar Technology and Applications XVIII** *(Turner/Kamerman)*			
	8732 **Atmospheric Propagation X** *(Wasiczko Thomas/Spillar)*			
	8733 **Laser Technology for Defense and Security IX** *(Dubinskii/Post)*			
		8734 **Active and Passive Signatures IV** *(Gilbreath/Hawley)*		
Displays for Innovative Applications				
8738 **Three-Dimensional Imaging, Visualization, and Display 2013** *(Javidi/Son)*		8735 **Head- and Helmet-Mounted Displays XVIII: Design and Applications** *(Havig/Marasco/Browne/Melzer)*	8736 **Display Technologies and Applications for Defense, Security, and Avionics VII** *(Desjardins/Sarma)*	
			8737 **Degraded Visual Environments: Enhanced, Synthetic, and External Vision Solutions 2013** *(Bernier/Güell)*	
Space Technologies and Operations				
8739 **Sensors and Systems for Space Applications VI** *(Pham/Cox)*				
Unmanned, Robotic, and Layered Systems				
	8740 **Motion Imagery Technologies, Best Practices, and Workflows for Intelligence, Surveillance, and Reconnaissance (ISR) and Situational Awareness III** *(Self)*			
		8741 **Unmanned Systems Technology XV** *(Karlsen/Gage/Shoemaker/Gerhart)*		
8742 **Ground/Air Multisensor Interoperability, Integration, and Networking for Persistent ISR IV** *(Pham)* `				

Monday	Tuesday	Wednesday	Thursday	Friday
Sensor Data and Information Exploitation				
8743 **Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIX** *(Shen/Lewis)*				
8744 **Automatic Target Recognition XXIII** *(Sadjadi/Mahalanobis)*		8746 **Algorithms for Synthetic Aperture Radar Imagery XX** *(Zelnio/Garber)*		
8745 **Signal Processing, Sensor Fusion, and Target Recognition XXII** *(Kadar)*				
			8747 **Geospatial InfoFusion III** *(Pellechia/Sorensen/Palaniappan)*	
Signal, Image, and Neural Net Processing				
8748 **Optical Pattern Recognition XXIV** *(Casasent/Chao)*			8749 **Quantum Information and Computation XI** *(Donkor/Pirich/Brandt)*	
		8750 **Independent Component Analyses, Compressive Sampling, Wavelets, Neural Net, Biosystems, and Nanoengineering XI** *(Szu)*		
Information Systems and Networks: Processing, Fusion, and Knowledge Generation				
	8752 **Modeling and Simulation for Defense Systems and Applications VIII** *(Kelmelis)*		8751 **Machine Learning and Bio-inspired Computation: Theory and Applications VII** *(Blowers/Mendoza-Schrock)*	
	8754 **Open Architecture/Open Business Model Net-Centric Systems and Defense Transformation 2013** *(Suresh)*			
8755 **Mobile Multimedia/Image Processing, Security, and Applications 2013** *(Agaian/Jassim/Du)*		8753 **Wireless Sensing, Localization, and Processing VIII** *(Dianat/Zoltowski)*		
	8756 **Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2013** *(Braun)*			
	8757 **Cyber Sensing 2013** *(Ternovskiy/Chin)*			
8758 **Next-Generation Analyst** *(Broome/Hall/Llinas)*				

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Infrared Technology and Applications XXXIX

Conference Chairs: **Bjørn F. Andresen,** Acktar Ltd. (Israel); **Gabor F. Fulop,** Maxtech International, Inc. (USA); **Charles M. Hanson,** Texas Instruments Inc. (USA); **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

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Monday 29 April

OPENING REMARKS

Room: Conv. Ctr. 343 . . . . . 8:00 am to 8:10 am

Chair: **Bjørn F. Andresen,** Acktar Ltd. (Israel)

SESSION 1

Room: Conv. Ctr. 343 . . . . . .Mon 8:10 am to 10:10 am

NIR/SWIR FPAs and Applications

Session Chairs: **Tara J. Martin,** UTC Aerospace Systems (USA); **Andrew Hood,** FLIR Electro-Optical Components (USA)

8:10 am: **SWIR InGaAs focal plane arrays in France**, Anne Rouvié, Odile Huet, Sébastien Hamard, Jean-Patrick Truffer, Maxime Pozzi, Jean Decobert, Eric M. Costard, Alcatel-Thales III-V Lab. (France); Michel Zecri, Patrick Maillart, Yann Reibel, Alexandra Pécheur, SOFRADIR (France) . . . . . [8704-2]

8:30 am: **A low-noise, extended dynamic range 1.3 Megapixel InGaAs array**, Wim Vereecken, Urbain Van Bogget, Thierry Colin, Rosa M. Vinelli, Xenics NV (Belgium); Patrick J. Merken, Xenics NV (Belgium) and Royal Military Academy (Belgium); Jan P. Vermeiren, Xenics NV (Belgium) . . . . . [8704-3]

8:50 am: **Low-power advancements for a 1.3 Mpixel SWIR imaging platform**, Michael Delamere, Robert Rozploch, Jonathan Nazemi, Andrew Eckhardt, UTC Aerospace Systems (USA) . . . . . [8704-4]

9:10 am: **Eye-safe active Vis SWIR imaging for highly portable tactical applications**, Andrew Hood, David Follman, Paula Heu, Jonathan C. Geske, Chad Wang, Falgun D. Patel, Peter Dalmatoff, Fedor Talantov, FLIR Electro-Optical Components (USA) . . . . . [8704-5]

9:30 am: **IR CMOS: infrared enhanced silicon imager**, Martin U. Pralle, James E. Carey III, Homayoon Haddad, SiOnyx Inc. (USA) . . . . . [8704-6]

9:50 am: **Epitaxially passivated mesa-isolated InGaAs photodetectors**, John F. Klem, Jin K. Kim, Michael J. Cich, Samuel D. Hawkins, Darin Leonhardt, Torben R. Fortune, Wesley T. Coon, Sandia National Labs. (USA) . . . . . [8704-1]

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

SESSION 2

Room: Conv. Ctr. 343 . . . . . .Mon 10:40 am to 12:00 pm

Army Infrared R&D I

Session Chairs: **Stefan P. Svensson,** U.S. Army Research Lab. (USA); **Mario O. Münzberg,** Cassidian Optronics GmbH (Germany); **Gil A. Tidhar,** Israel Aerospace Industries-Elta (Israel)

10:40 am: **High-performance IR detector modules for Army applications** *(Invited Paper)*, Holger Lutz, Rainer Breiter, Stefan Rutzinger, Timo Schallenberg, Joachim C. Wendler, Johann Ziegler, AIM INFRAROT-MODULE GmbH (Germany) . . . . . [8704-7]

11:00 am: **High-performance and long-range cooled IR technologies in France** *(Invited Paper)*, Yann Reibel, Thibault Augey, Sebastien Verdet, David Billon-Lanfrey, SOFRADIR (France); Gérard L. Destéfanis, CEA-LETI-Minatec (France); Eric M. Costard, Alexandru Nedelcu, SOFRADIR (France); Laurent Mollard, Francois Marion, Nicolas Baier, CEA-LETI (France); Olivier Gravrand, CEA-LETI-Minatec (France) . . . . . [8704-8]

11:20 am: **Advantages of SWIR-VIS detection means for self-protection suites** *(Invited Paper)*, Gil A. Tidhar, Elta Systems Ltd. (Israel) . . . . . [8704-9]

11:40 am: **Wide field-of-view dual-band multispectral muzzle flash detection** *(Invited Paper)*, Joseph R. Montoya, U.S. Army Research Lab. (USA); Pano Spiliotis, Lawrence A. Taplin, FluxData, Inc. (USA); Jorge Melchoor, U.S. Army Research Lab. (USA) . . . . . [8704-10]

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

SESSION 3

Room: Conv. Ctr. 343 . . . . . Mon 1:00 pm to 2:40 pm

Army Infrared R&D II

Session Chairs: **Stefan P. Svensson,** U.S. Army Research Lab. (USA); **Mario O. Münzberg,** Cassidian Optronics GmbH (Germany); **Gil A. Tidhar,** Israel Aerospace Industries-Elta (Israel)

1:00 pm: **OTHELLO: a novel SWIR dual-band detection system and its applications** *(Invited Paper)*, Gil A. Tidhar, Elta Systems Ltd. (Israel) . . . . [8704-11]

1:20 pm: **A miniature ruggedised fast frame rate infrared sensor module for hostile fire detection and industrial applications** *(Invited Paper)*, Richard M. Ash, Andrew P. Ashcroft, Peter M. Thorne, Lee Richardson, David Isgar, David Jeckells, Martin Stevens, Asim Malik, Tim Davey, SELEX Galileo Infrared Ltd. (United Kingdom) . . . . . [8704-12]

1:40 pm: **Protecting SWIR cameras from laser threats** *(Invited Paper)*, Ariela Donval, Tali Fisher, Ofir Lipman, Moshe Oron, KiloLambda Technologies, Ltd. (Israel) . . . . . [8704-13]

2:00 pm: **A modular packaging approach for upgrading tanks with thermal imagers** *(Invited Paper)*, Mario O. Münzberg, Bertram Achtner, Jörg Fritze, Dirk Weisser, Markus Welk, Cassidian Optronics GmbH (Germany) . . . . . [8704-14]

2:20 pm: **Challenges and requirements for future vehicle mounted infrared sensors** *(Invited Paper)*, John L. Miller, FLIR Systems, Inc. (USA) . . . . . [8704-15]

SESSION 4
Room: Conv. Ctr. 343 . . . . . Mon 2:40 pm to 4:35 pm

Infrared at Sea, in the Air, and Space

Session Chair: **R. Kennedy McEwen,**
SELEX Galileo Infrared Ltd. (United Kingdom)

2:40 pm: **Development of a panoramic third generation IRST: initial study and experimental work** *(Invited Paper)*, Gianni Barani, SELEX Galileo S.p.A. (Italy); Cristian Luison, Altran Italy S.p.A. (Italy); Monica Olivieri, SELEX Galileo S.p.A. (Italy); Alessandro Rossi, Marco Diani, Univ. di Pisa (Italy); Nicola Acito, Accademia Navale di Livorno (Italy) . . . . . [8704-16]

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

3:30 pm: **SEASPOTTER: a fully staring naval IRST system** *(Invited Paper)*, Michael Y. Engel, Amir Navot, Yaakov Engel, Eyal Arad, Nir Shahar, Rafael Advanced Defense Systems Ltd. (Israel). . . . . [8704-17]

3:55 pm: **Hyperspectral reconnaissance in urban environment** *(Invited Paper)*, Ingmar G. Renhorn, Maria Axelsson, Swedish Defence Research Agency (Sweden); Koen W. Benoist, TNO Defence, Security and Safety (Netherlands); Dirk Borghys, Royal Belgian Military Academy (Belgium); Yann G. Boucher, Xavier Briottet, ONERA (France); Rob J. Dekker, TNO Defence, Security and Safety (Netherlands); Alwin Dimmeler, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); Ola Friman, Swedish Defence Research Agency (Sweden); Ingebjørg Kåsen, Norwegian Defence Research Establishment (Norway); Maria Lomoro, Ctr. Interforze Studi per le Applicazioni Militari (Italy); Thomas O. Opsahl, Norwegian Defence Research Establishment (Norway); Mark van Persie, National Aerospace Lab. NLR (Netherlands); Salvatore Resta, Ctr. Interforze Studi per le Applicazioni Militari (Italy); Hendrik Schilling, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); Piet B. W. Schwering, TNO Defence, Security and Safety (Netherlands); Michal Shimoni, Royal Belgian Military Academy (Belgium) . . . . . [8704-18]

4:15 pm: **A review of the latest developments of MCT infrared technology from visible to VLWIR for space applications at Sofradir** *(Invited Paper)*, Philippe Chorier, Patricia Pidancier, Nicolas Jamin, Bruno Fièque, Cédric Leroy, SOFRADIR (France) . . . . . [8704-19]

Symposium-wide Plenary Session
Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

INTRODUCTION
Room: Conv. Ctr. 343 . . . . . 8:00 am to 8:10 am

Infrared in Future Soldier Systems Session

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

SESSION 5
Room: Conv. Ctr. 343 . . . . . Tue 8:10 am to 9:30 am

Infrared in Future Soldier Systems

Session Chair: **Wolfgang A. Cabanski,**
AIM INFRAROT-MODULE GmbH (Germany)

8:10 am: **Miniaturized day/night sight in Soldato Futuro program**, Alberto Landini, Altran Italy S.p.A. (Italy); Alessandro Cocchi, Stefano Puntri, Mirela Cojocaru, SELEX Galileo S.p.A. (Italy). . . . . [8704-20]

8:30 am: **Next-generation cooled long-range thermal sights with minimum size, weight, and power**, Rainer Breiter, Tobias Ihle, Joachim C. Wendler, Ingo Rühlich, Johann Ziegler, AIM INFRAROT-MODULE GmbH (Germany) . . . [8704-21]

8:50 am: **Recent developments in thermal infrared signature reduction on textile and related camouflage technology will be described**, Than Emery, Milliken & Co. (USA); Rene Schwarz, SSZ Camouflage Technology AG (Switzerland) . . . . . [8704-22]

9:10 am: **Aural stealth of portable HOT infrared imager**, Alexander Veprik, RICOR-Cryogenic & Vacuum Systems (Israel) . . . . . [8704-23]

SESSION 6
Room: Conv. Ctr. 343 . . . . . Tue 9:30 am to 11:50 am

Type II Superlattice FPAs I

Session Chairs: **Meimei Z. Tidrow,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Manijeh Razeghi,** Northwestern Univ. (USA); **Lucy Zheng,** Institute for Defense Analyses (USA)

9:30 am: **High-performance bias-selectable dual-band mid-/long-wavelength infrared photodetectors and focal plane arrays based on InAs/GaSb Type-II superlattices** *(Invited Paper)*, Manijeh Razeghi, Abbas Haddadi, Anh Minh Hoang, Guanxi A. Chen, Northwestern Univ. (USA) . . . . . [8704-24]

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

10:30 am: **Thiol passivation of MWIR Type II superlattice photodetectors**, Omer Salihoglu, Abdullah Muti, Bilkent Univ. (Turkey); Rasit Turan, Middle East Technical Univ. (Turkey); Atilla Aydinli, Bilkent Univ. (Turkey). . . . . [8704-26]

10:50 am: **Defects and noise in Type-II superlattice infrared detectors**, Martin Walther, Andreas Wörl, Volker Daumer, Robert H. Rehm, Lutz Kirste, Frank Rutz, Johannes Schmitz, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Ralf Scheibner, Johann Ziegler, AIM INFRAROT-MODULE GmbH (Germany) . . . . . [8704-28]

11:10 am: **Time-resolved photoluminescence spectroscopy of minority carrier lifetime in Type-II superlattice infrared detector materials**, Blair C. Connelly, Grace D. Metcalfe, Paul H. Shen, Michael Wraback, U.S. Army Research Lab. (USA) . . . . . [8704-29]

11:30 am: **Designs and characteristics of infrared nBn photodectors based on InAs/InAsSb type-II superlattices**, Zhao-Yu He, Oray O. Cellek, Shi Liu, Ha Sul Kim, Jin Fan, Zhiyuan Lin, Yong-Hang Zhang, Arizona State Univ. (USA) . [8704-30]

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

SESSION 7
Room: Conv. Ctr. 343 . . . . . Tue 1:30 pm to 4:40 pm

Type II Superlattice FPAs II

Session Chairs: **Meimei Z. Tidrow,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Manijeh Razeghi,** Northwestern Univ. (USA); **Lucy Zheng,** Institute for Defense Analyses (USA)

1:30 pm: **Electronic transport in InAs/GaSb type-II superlattices detector structures with reduced sidewall leakage**, Gilberto A. Umana-Membreno, Hemendra Kala, The Univ. of Western Australia (Australia); Brianna Klein, Ctr. for High Technology Materials (USA); Jarek Antoszewski, The Univ. of Western Australia (Australia); Nutan Gautam, Maya N. Kutty, Elena Plis, Sanjay Krishna, Ctr. for High Technology Materials (USA); Lorenzo Faraone, The Univ. of Western Australia (Australia) . . . . . [8704-31]

1:50 pm: **Low-frequency noise behaviour of MWIR Type-II InAs/GaSb superlattice photodiodes**, Tunay Tansel, Kutlu Kutluer, Middle East Technical Univ. (Turkey); Omer Salihoglu, Abdullah Muti, Atilla Aydinli, Bilkent Univ. (Turkey); Rasit Turan, Middle East Technical Univ. (Turkey) . . . . . [8704-32]

2:10 pm: **High-performance MWIR type-II superlattice detectors**, Henk Martijn, Carl Asplund, Rickard Marcks von Würtemberg, Hedda Malm, IRnova AB (Sweden) . . . . . [8704-33]

2:30 pm: **Infrared photodetectors and emitters with InAsSb bulk active region**, Ding Wang, Youxi Lin, Dmitry Donetsky, Leon Shterengas, Gela Kipshidze, Gregory Belenky, Stony Brook Univ. (USA); Stefan P. Svensson, Wendy L. Sarney, U.S. Army Research Lab. (USA) . . . . . [8704-35]

2:50 pm: **Multiwafer production of epitaxy-ready 4" GaSb: substrate performance assessments pre- and post-epitaxial growth**, Mark J. Furlong, Rebecca J. Martinez, Sasson Amirhaghi, Andrew Mowbray, Brian Smith, Wafer Technology Ltd. (United Kingdom); Dmitri Loubychev, Joel M. Fastenau, Amy W. K. Liu, IQE Inc. (USA). . . . . [8704-36]

3:05 pm: **MBE growth of Sb-based nBn photodetectors on large diameter GaAs substrates**, Dmitri Lubyshev, Joel M. Fastenau, Yueming Qiu, Amy W. K. Liu, IQE Inc. (USA). . . . . [8704-37]

Wednesday 1 May

Sessions 8, 9 run concurrently with session 11.

SESSION 8

Room: Conv. Ctr. 343 . . . . . .Wed 8:00 am to 9:20 am

Emerging Uncooled Technologies I

Session Chairs: **Colin E. Reese,**
U.S. Army Night Vision & Electronic Sensors Directorate (USA);
Charles M. Hanson, Texas Instruments, Inc. (USA)

8:00 am: **Wavelength selective wideband uncooled infrared sensor using a two-dimensional plasmonic absorber**, Shinpei Ogawa, Mitsubishi Electric Corp. (Japan); Junya Komoda, Kyohei Masuda, Masafumi Kimata, Ritsumeikan Univ. (Japan). . . . . [8704-38]

8:20 am: **Three-dimensional dual-band stacked microbolometer design using resistive dipoles and slots**, Hoo Kim, Dean P. Neikirk, The Univ. of Texas at Austin (USA) . . . . . [8704-39]

8:40 am: **Through-film conductivity of VO_x thin-films for uncooled IR imaging**, Hitesh A. Basantani, Hang-Beum Shin, Thomas N. Jackson, Mark W. Horn, The Pennsylvania State Univ. (USA). . . . . [8704-40]

9:00 am: **High-performance LWIR microbolometer with Si/SiGe quantum well thermistor and wafer level packaging**, Audun Roer, Sensonor Technologies AS (Norway) . . . . . [8704-41]

SESSION 9

Room: Conv. Ctr. 343 . . . . . .Wed 9:20 am to 12:15 pm

Uncooled FPAs and Applications I

Session Chairs: **Masafumi Kimata,** Ritsumeikan Univ. (Japan);
Chuan C. Li, DRS Technologies, Inc. (USA)

9:20 am: **Memorial Tribute for Paul Kruse**, Marion B. Reine, Photon Detector Physics, LLC (USA) . . . . . [8704-42]

9:30 am: **Uncooled infrared detector with 12µm pixel pitch video graphics array**, Tsutomu Endoh, NEC Corp. (Japan) . . . . . [8704-43]

9:50 am: **Large-format 17µm high-end VO_x µ-bolometer infrared detector**, Udi Mizrahi, Shimon Elkind, Aviho Giladi, Yoav Hirsh, Michael Labilov, Igor Pivnik, Niv Shiloah, Mchael T. Singer, SCD Semiconductor Devices (Israel); Avi Tuito, Michael Ben-Ezra, SIBAT (Israel); Naamah Argaman, Itay Shtrichman, SCD (Israel) . . . . . [8704-44]

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

10:40 am: **Temperature stability improvement of a QVGA uncooled infrared radiation FPA**, Koichi Ishii, Hiroto Honda, Hideyuki Funaki, Ikuo Fujiwara, Keita Sasaki, Hitoshi Yagi, Kazuhiro Suzuki, Honam Kwon, Masaki Atsuta, Toshiba Corp. (Japan). . . . . [8704-45]

11:00 am: **BAE Systems' 17mm LWIR camera core for civil, commercial, and military applications**, Jeffrey H. Lee, BAE Systems OASYS, LLC (USA) . [8704-46]

11:20 am: **Low-cost uncooled VO_x infrared camera development**, Chuan C. Li, DRS Technologies, Inc. (USA). . . . . [8704-47]

11:40 am: **Uncooled detector development at Raytheon**, Stephen H. Black, Raytheon Co. (USA) . . . . . [8704-48]

12:00 pm: **80×80 VPD PbSe: The first uncooled MWIR FPA monolithically integrated with a Si-CMOS ROIC**, Germán Vergara, Rodrigo Linares-Herrero, Raul Gutierrez Alvarez, Carlos Fernandez-Montojo, Luis J. Gómez, Victor Villamayor, Arturo Baldasano-Ramirez, Maria Teresa Montojo Supervielle, New Infrared Technologies, Ltd. (Spain) . . . . . [8704-99]

Lunch/Exhibition Break . . . . . Wed 12:15 pm to 1:30 pm

SESSION 11

Room: Conv. Ctr. 345 . . . . . .Wed 8:00 am to 12:00 pm

NOTE ROOM CHANGE

IR Optics I

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

8:00 am: **Nickel-oxide film as an AR coating of Si window for IR sensor packaging,** Hyunbin Shim, Dong Soo Kim, In Ku Kang, Jin Kwan Kim, Hee Chul Lee, KAIST (Korea, Republic of) . . . . . [8704-58]

8:20 am: **High-resistant multispectral optical coatings for infrared applications,** Michael Degel, Elvira Gittler, Peter Maushake, Marcus Serwazi, Tino Wagner, JENOPTIK Optical Systems GmbH (Germany) . . . . . [8704-59]

8:40 am: Dual- and triple-band AR coatings for IR systems, Daniel Cohen, Yevgeni Stolov, Amnon Azran, Mordechai Gilo, Ophir Optronics Ltd. (Israel) . . . . . [8704-60]

9:00 am: **New solutions and technologies for uncooled infrared imaging,** Joël Rollin, Frédéric Diaz, Christophe Fontaine, Thales Angénieux S.A. (France); Brigitte Loiseaux, Mane -Si Laure Lee, Christophe Clienti, Thales Research and Technology (France); Xianghua Zhang, Laurent Calvez, Université de Rennes I (France); Fabrice Lemonnier, Thales Research and Technology (France) . [8704-61]

9:20 am: **Challenges, constraints and results of lens design in 8-12 micron waveband for bolometer-FPAs having a pixel pitch ≤12micron,** Norbert Schuster, Umicore Electro-Optic Materials (Belgium) . . . . . [8704-132]

9:40 am: **A practical approach to LWIR wafer-based optics for thermal imaging systems,** Alan Symmons, Ray J. Pini, LightPath Technologies, Inc. (USA) [8704-62]

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

10:30 am: **Dewar-level integrated MWIR wavefront sensor for high-sensitivity optical quality control,** Sabrina Velghe, PHASICS S.A. (France); Serge Magli, SOFRADIR (France); Gilles Aubry, HGH Systèmes Infrarouges (France); Nicolas Guérineau, ONERA (France); Benoit F. Wattellier, William Boucher, PHASICS S.A. (France) . . . . . [8704-63]

10:50 am: **Cryogenic wafer-level MWIR camera: laboratory demonstration,** Nicolas Guérineau, Florence de la Barrière, Guillaume Druart, Mathieu Chambon, ONERA (France); Gilles Lasfargues, Manuel Fendler, Commissariat à l'Énergie Atomique (France) . . . . . [8704-64]

11:10 am: **New multiband IR imaging optics,** Shyam S. Bayya, Jasbinder S. Sanghera, Woohong R. Kim, Daniel J. Gibson, Brandon Shaw, U.S. Naval Research Lab. (USA); Michael Hunt, Univ. Research Foundation (USA); Ish D. Aggarwal, Sotera Defense Solutions, Inc. (USA); Erin F. Fleet, U.S. Naval Research Lab. (USA) . . . . . [8704-66]

11:30 am: **Dual-band infrared picture-in-picture demonstrator,** Jay N. Vizgaitis, Arthur R. Hastings Jr., U.S. Army Night Vision & Electronic Sensors Directorate (USA) . . . . . [8704-68]

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

Session 10 runs concurrently with session 12.

SESSION 10

Room: Conv. Ctr. 343 . . . . . Wed 1:30 pm to 4:50 pm

HOT: High Operating Temperature FPAs

Session Chairs: **Michael T. Eismann,** Air Force Research Lab. (USA); **Stuart B. Horn,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Antoni Rogalski,** Military Univ. of Technology (Poland); **Stefan T. Baur,** Raytheon Co. (USA)

1:30 pm: **Low SWaP MWIR detector based on XBn focal plane array** *(Invited Paper)*, Philip Klipstein, Daniel Aronov, Eyal Berkowicz, Yossi Cohen, Rami Fraenkel, Alex Glozman, Yoav Gross, Steve Grossman, Olga Klin, Inna Lukomsky, Tuvy Markovitz, Lior Shkedy, Itay Shtrichman, Noam Snapi, Michael Yassen, Eliezer Weiss, SCD Semiconductor Devices (Israel); Avi Tuito, SIBAT (Israel); Michael Ben-Ezra, IMOD (Israel) . . . . . [8704-50]

1:50 pm: **Quantum-engineered mid-infrared type-II InAs/GaSb superlattice photodetectors for high-temperature operation**, Zhaobing Tian, Theodore Schuler-Sandy, The Univ. of New Mexico (USA); Stephen A. Myers, Brianna Klein, Elena Plis, Sanjay Krishna, Ctr. for High Technology Materials (USA) . . . . [8704-51]

2:10 pm: **Fabrication of high-operating temperature (HOT), visible to MWIR, nCBn photon-trap detector arrays**, Hasan Sharifi, Mark S. Roebuck, Terrence J. De Lyon, Hung Nguyen, Margaret Cline, David T. Chang, Daniel Yap, Sarabjit Mehta, Rajesh D. Rajavel, HRL Labs., LLC (USA); Adrian C. Ionescu, Arvind I. D'Souza, Ernest W. Robinson, Daniel Okerlund, DRS Sensors & Targeting Systems, Inc. (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA) . . . . . [8704-52]

2:25 pm: **MWIR InAsSb barrier detector data and analysis**, Arvind I. D'Souza, Ernest W. Robinson, Adrian C. Ionescu, Daniel Okerlund, DRS Sensors & Targeting Systems, Inc. (USA); Terrence J. De Lyon, Rajesh D. Rajavel, Hasan Sharifi, HRL Labs., LLC (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA); Priyalal S. Wijewarnasuriya, U.S. Army Research Lab. (USA); Christoph H. Grein, Univ. of Illinois at Chicago (USA) . . . . . [8704-53]

2:40 pm: **High-performance bias-selectable dual-band short-/mid-wavelength infrared photodetectors and focal plane arrays based on InAs/GaSb/AlSb Type-II superlattices** *(Invited Paper)*, Manijeh Razeghi, Anh Minh Hoang, Abbas Haddadi, Guanxi A. Chen, Northwestern Univ. (USA). . . . . [8704-54]

Coffee Break . . . . . Wed 3:10 pm to 3:50 pm

3:50 pm: **Modeling of InAsSb/AlAsSb nBn HOT detector's performance limit** *(Invited Paper)*, Antoni Rogalski, Piotr Martyniuk, Military Univ. of Technology (Poland) . . . . . [8704-55]

4:10 pm: **Numerical simulation of lateral collection and crosstalk in back-illuminated InAs nBn detector arrays**, Marion B. Reine, Photon Detector Physics, LLC (USA); Jonathan Schuster, Benjamin Pinkie, Boston Univ. (USA); Enrico Bellotti, The Boston Univ. Photonics Ctr. (USA) . . . . . [8704-56]

4:30 pm: **Design and performance evaluation of high-aspect ratio mesa delineated HgCdTe mid-wavelength detectors for high-operating temperatures**, Kasey D. Smith, Justin Wehner, A. M. Ramirez, Roger W. Graham, Edward P. Smith, Raytheon Co. (USA); Ishwara Bhat, Rensselaer Polytechnic Institute (USA) . . . . . [8704-133]

SESSION 12

Room: Conv. Ctr. 345 . . . . . Wed 1:30 pm to 3:10 pm

NOTE ROOM CHANGE

IR Optics II

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

1:30 pm: **Wide-angle catadioptric optics for broadband applications,** Naomi Pollica, Christopher C. Alexay, StingRay Optics, LLC (USA) . . . . . [8704-67]

1:50 pm: **Optical methods for the optimization of system SWAP-C using aspheric components and advanced optical polymers**, Amy L. Zelazny, Kenneth F. Walsh, John P. Deegan, Robert Benson, Rochester Precision Optics, LLC (USA) . . . . . [8704-69]

2:10 pm: **Enhanced processability of ZBLAN glass in microgravity**, Arup K. Maji, Anthony Torres, The Univ. of New Mexico (USA); Jeffrey M. Ganley, Air Force Research Lab. (USA) . . . . . [8704-70]

2:30 pm: **Precise optomechanical characterization of assembled IR optics**, Daniel Winters, Patrik Langehanenberg, Josef Heinisch, Eugen Dumitrescu, TRIOPTICS GmbH (Germany) . . . . . [8704-71]

2:50 pm: **Very broad spectrum Echelle spectrography**, Seth H. Pappas, Infrared Labs., Inc. (USA); Burt J. Beardsley, Catalina Scientific (USA); George W. Ritchie, Rider Univ. (USA). . . . . [8704-125]

Thursday 2 May

SESSION 13
Room: Conv. Ctr. 343 . . . . . Thu 8:00 am to 9:40 am

Active Imaging

Session Chairs: **Michael D. Jack,** Raytheon Co. (USA); **Ofer Nesher,** Elbit Systems Ltd. (Israel)

8:00 am: **2.2 micron, uncooled, InGaAs photodiodes, and balanced photoreceivers up to 25 GHz bandwidth**, Abhay M. Joshi, Shubhashish Datta, Jim Rue, Discovery Semiconductors, Inc. (USA) . . . . . [8704-72]

8:20 am: **Development of high-sensitivity SWIR APD receivers**, Xiaogang Bai, Ping Yuan, James J. Chang, Rengarajan Sudharsanan, Spectrolab, Inc. (USA); Michael A. Krainak, Guangning Yang, Xiaoli Sun, Wei Lu, NASA Goddard Space Flight Ctr. (USA). . . . . [8704-73]

8:40 am: **Multifunction InGaAs detector with on-chip signal processing**, Lior Shkedy, Rami Fraenkel, Tal A. Fishman, Aviho Giladi, Dan Nussinson, Ilana Grimberg, Elad Ilan, Shay Vaserman, Alina Koifman, SCD Semiconductor Devices (Israel) . . . . . [8704-74]

9:00 am: **Long-range night/day human identification using active-SWIR imaging**, Brian E. Lemoff, Robert B. Martin, Mikhail Sluch, Kristopher M. Kafka, William B. McCormick, Robert V. Ice, West Virginia High Technology Consortium Foundation (USA) . . . . . [8704-75]

9:20 am: **A novel optical gating method for laser gated imaging**, Ofer Nesher, Ron Schneider, Eyal Zohar, Ran Ginat, Elbit Systems Ltd. (Israel). . . . . [8704-76]

SESSION 14
Room: Conv. Ctr. 343 . . . . . Thu 9:40 am to 11:50 am

HgCdTe I

Session Chairs: **Joseph G. Pellegrino,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Gérard L. Destéfanis,** CEA-LETI-Minatec (France); **Marion B. Reine,** Photon Detector Physics, LLC (USA)

9:40 am: **Large format MWIR and LWIR detectors at AIM**, Johann Ziegler, Holger Bitterlich, Rainer Breiter, Martin Bruder, Petra Fries, Richrad Wollrab, Joachim C. Wendler, Jan Wenisch, AIM INFRAROT-MODULE GmbH (Germany) . . . . [8704-77]

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

10:30 am: **Megapixel array developments at Selex Galileo**, Peter M. Thorne, Harald J. Weller, Jim Gordon, SELEX Galileo Infrared Ltd. (United Kingdom) . . . . . [8704-78]

10:50 am: **Recent progress in MCT detectors in France**, Gérard L. Destéfanis, Olivier Gravrand, CEA-LETI-Minatec (France); Michel Vuillermet, David Billon-Lanfrey, SOFRADIR (France). . . . . [8704-79]

11:10 am: **Temperature dependence of 1/f noise, defects, and dark current in small pitch MWIR and LWIR HDVIP® HgCdTe FPAs**, Roger L. Strong, Michael A. Kinch, John M. Armstrong, DRS Sensors & Targeting Systems, Inc. (USA) [8704-80]

11:30 am: **Planar p on n LWIR and VLWIR FPA made with MCT**, Nicolas Baier, Laurent Mollard, CEA-LETI (France); Olivier Gravrand, Gérard L. Destéfanis, CEA-LETI-Minatec (France); Guillaume Bourgeois, Jean-Paul Zanatta, CEA-LETI (France); Alexandre Kerlain, Laurent Rubaldo, Alain Manissadjian, SOFRADIR (France); Jean-Christophe Peyrard, Délégation Générale pour l'Armement (France) . . . . . [8704-81]

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

SESSION 15
Room: Conv. Ctr. 343 . . . . . Thu 1:30 pm to 2:10 pm

HgCdTe II

Session Chairs: **Joseph G. Pellegrino,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Gérard L. Destéfanis,** CEA-LETI-Minatec (France); **Marion B. Reine,** Photon Detector Physics, LLC (USA)

1:30 pm: **Numerical simulation of quantum efficiency and crosstalk in IR photon-trapping structures**, Jonathan Schuster, Boston Univ. (USA); Enrico Bellotti, The Boston Univ. Photonics Ctr. (USA) . . . . . [8704-57]

1:50 pm: **Analysis of propellant combustion with real-time multispectral infrared camera**, Grégory Vincent, Emilie Sakat, Sylvain Rommeluère, Charles Erades, Sidonie Lefebvre, Franck Cauty, ONERA (France); Stéphane Collin, Jean-Luc Pelouard, Lab. de Photonique et de Nanostructures (France); Riad Haïdar, ONERA (France) . . . . . [8704-82]

SESSION 16
Room: Conv. Ctr. 343 . . . . . Thu 2:10 pm to 4:40 pm

Smart Processing

Session Chairs: **Paul L. McCarley,** Air Force Research Lab. (USA); **John T. Caulfield,** Cyan Systems (USA); **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

2:10 pm: **Thermal imagers: from ancient analog video output to state-of-the-art video streaming**, Hubertus A. Haan, Cassidian Optronics GmbH (Germany) . . . . . [8704-83]

2:30 pm: **On-chip temporal multiplexing with a digital focal plane array**, Christy Fernandez-Cull, Andrew Bolstad, Brian M. Tyrrell, MIT Lincoln Lab. (USA) [8704-84]

2:50 pm: **Solid state temperature-dependent NUC (non-uniformity correction) in uncooled LWIR (long-wave infrared) microbolometer FPAs (focal plane arrays)**, Christel-Loic Tisse, Yanpeng Cao, MTech Imaging Pte. Ltd. (Singapore) . . . . . [8704-86]

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

3:40 pm: **Benefits in sensitivity and detection using oversampled imaging sensors**, John T. Caulfield, Jerry A. Wilson, Cyan Systems (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA). . . . . [8704-87]

4:00 pm: **MT3250BA: a 320 x 256 - 50µm microbolometer ROIC for high-resistance detector arrays**, Tayfun Akin, Middle East Technical Univ. (Turkey) and Mikro-Tasarim Ltd. (Turkey); Selim Eminoglu, Mikro-Tasarim San.ve Tic. Ltd. Sti. (Turkey) . . . . . [8704-88]

4:20 pm: **MT6415CA: a 640 × 512 - 15µm CTIA ROIC for SWIR InGaAs detector arrays** , Tayfun Akin, Selim Eminoglu, Mikro-Tasarim San.ve Tic. Ltd. Sti. (Turkey) . . . . . [8704-89]

POSTERS-THURSDAY
Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Impact of growth temperature on InAs/GaInSb strained layer superlattices for very long-wavelength infrared detection, Heather J. Haugan, Gail J. Brown, Air Force Research Lab. (USA); Said Elhamri, Univ. of Dayton Research Institute (USA); William C. Mitchel, Krishnamurthy Mahalingam, Mu J. Kim, Air Force Research Lab. (USA) . . . . . [8704-25]

Surface states characterization and simulation of Type-II In(Ga)Sb quantum dot structures for processing optimization of LWIR detectors, Mina Rajabi, Qin Wang, Amir Karim, Susanne Almqvist, Mietek Bakowski, Susan M. Savage, Jan Y. Andersson, Acreo AB (Sweden); Mats Göthelid, Shun Yu, Oscar Gustafsson, Mattias Hammar, Royal Institute of Technology (Sweden); Carl Asplund, IRnova AB (Switzerland). . . . . [8704-92]

Pyroelectric sensor arrays for detection and thermal imaging, Anthony J. Holden, InfraRed Integrated Systems Ltd. (United Kingdom). . . . . [8704-106]

IR and visible images registration method based on cross cumulative residual entropy, Chao Li, Qian Chen, Guohua Gu, Tian Man, Nanjing Univ. of Science and Technology (China) . . . . . [8704-107]

Design and fabrication of a MOM diode-coupled frequency-selective surface, Edward C. Kinzel, Missouri Univ. of Science and Technology (USA); Robert L. Brown, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); James C. Ginn III, Plasmonics Inc. (USA); Brian A. Lail, Florida Institute of Technology (USA); Brian A. Slovick, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Glenn D. Boreman, The Univ. of North Carolina at Charlotte (USA) . . . . . [8704-108]

Type-II superlattice N-structure operating in the mid-wavelength infrared range (MWIR), Yuksel Ergun, Anadolu Univ. (Turkey) . . . . . [8704-109]

Low-dark current structures for long-wavelength Type-II strained layer superlattice photodiodes, Eric A. DeCuir Jr., U.S. Army Research Lab. (USA); Zhaobing Tian, The Univ. of New Mexico (USA); Priyalal S. Wijewarnasuriya, U.S. Army Research Lab. (USA); Sanjay Krishna, Ctr. for High Technology Materials (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA); Roger E. Welser, Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA) . . . . [8704-112]

Crosstalk analysis in large-area, low-capacitance InGaAs quad photodiodes, Shubhashish Datta, Abhay M. Joshi, Jim Rue, Discovery Semiconductors, Inc. (USA) . . . . . [8704-113]

Low-cost and compact thermal imaging sensors for body temperature measurement, Myung-Soo Han, Seok Man Han, Hang Ju Ko, Jae Chul Shin, Hyo Jin Kim, Korea Photonics Technology Institute (Korea, Republic of); Mi Sook Ahn, Hyung Won Kim, Yong Hee Han, U Electronics (Korea, Republic of). . . . [8704-114]

Characteristic of nickel-oxide microbolometer, Gyo-Hun Koo, Kyungpook National Univ. (Korea, Republic of); Young-Chul Jung, Gyeongju Univ. (Korea, Republic of); Sung-Ho Hahm, Yong Soo Lee, Kyungpook National Univ. (Korea, Republic of) . . . . . [8704-115]

Development status of Type II superlattice infrared detector in JAXA, Haruyoshi Katayama, Junpei Murooka, Masataka Naitoh, Ryota Sato, Japan Aerospace Exploration Agency (Japan); Toshifumi Kawasaki, Yudai Itoh, Tomoko Takekawa, Syota Sugano, Masafumi Kimata, Ritsumeikan Univ. (Japan); Mikhail A. Patrashin, Iwao Hosako, National Institute of Information and Communications Technology (Japan) . . . . . [8704-116]

Nanoantenna-enabled midwave infrared detection, David W. Peters, Jin K. Kim, Darin Leonhardt, Joel R. Wendt, John F. Klem, Charles M. Reinke, Paul S. Davids, Sally Samora, Sandia National Labs. (USA) . . . . . [8704-119]

Numerical simulation of large-format reduced-pitch HgCdTe infrared detector arrays, Benjamin Pinkie, Boston Univ. (USA); Enrico Bellotti, The Boston Univ. Photonics Ctr. (USA) . . . . . [8704-120]

Nanowire grid polarizers for mid- and long-wavelength infrared applications, Matthew C. George, Hua Lee, Jonathon Bergquist, Bin Wang, MOXTEK, Inc (USA) . . . . . [8704-121]

Influence of pixel geometry on the 1/f noise coefficient, Francis R. Généreux, Jacques-Edmond Paultre, Bruno Tremblay, Francis Provençal, Christine Alain, INO (Canada) . . . . . [8704-122]

A low-noise silicon-based 20µm*20µm uncooled thermoelectric infrared detector, Mohammad J. Modarres-Zadeh, Reza Abdolvand, Oklahoma State Univ. (USA) . . . . . [8704-123]

Adaptive control system for vibration harmonics of cryocooler, Baoyu Yang, Yinong Wu, Shanghai Institute of Technical Physics (China) . . . . . [8704-124]

Study of Shockley-Read-Hall, radiative, and Auger recombination processes in InAs/InAsSb Type-II superlattices, Jin Fan, Zhiyuan Lin, Shi Liu, Oray O. Cellek, Xiaomeng Shen, David J. Smith, Yong-Hang Zhang, Arizona State Univ. (USA) . . . . . [8704-126]

Thin-film, wide-angle, design-tunable, selective absorber from near UV to far infrared, Janardan Nath, Doug Maukonen, Evan M. Smith, Pedro N. Figueiredo, Univ. of Central Florida (USA); Guy Zummo, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Deep R. Panjwani, Robert E. Peale, Univ. of Central Florida (USA); Glenn D. Boreman, The Univ. of North Carolina at Charlotte (USA); Justin W. Cleary, Kurt G. Eyink, Air Force Research Lab. (USA); Isaiah O. Oladeji, SISOM Thin Films, LLC (USA). . . . . [8704-127]

A new unit cell design with automatic input stage selection capability for increased SNR, Melik Yazici, Huseyin Kayahan, Omer Ceylan, Yasar Gurbuz, Sabanci Univ. (Turkey). . . . . [8704-128]

A fully digital readout employing extended counting method to achieve very low quantization noise, Huseyin Kayahan, Melik Yazici, Ömer Ceylan, Yasar Gurbuz, Sabanci Univ. (Turkey). . . . . [8704-129]

Design of 90x8 ROIC with pixel level digital TDI implementation for scanning type LWIR FPAs, Omer Ceylan, Huseyin Kayahan, Melik Yazici, Yasar Gurbuz, Sabanci Univ. (Turkey). . . . . [8704-130]

A plasmonic enhanced pixel structure for uncooled microbolometer detectors, Tayfun Akin, Middle East Technical Univ. (Turkey). . . . . [8704-131]

Friday 3 May

SESSION 17

Room: Conv. Ctr. 343 . . . . . Fri 8:00 am to 9:00 am

QWIP and Q-DOT

Session Chair: **Henk Martijin,** IRnova AB (Sweden)

8:00 am: **In(Ga)Sb/InAs quantum dot-based IR photodetectors with high-operating temperatures**, Amir Karim, Acreo AB (Sweden); Oscar Gustafsson, Royal Institute of Technology (Sweden); Susan M. Savage, Qin Wang, Susanne Almqvist, Acreo AB (Sweden); Carl Asplund, IRnova AB (Sweden); Mattias Hammar, Royal Institute of Technology (Sweden); Jan Y. Andersson, Acreo AB (Sweden) . . . . . [8704-93]

8:20 am: **Room-temperature SWIR sensing from monolithically integrated colloidal quantum dot photodiode arrays**, Ethan J. Klem, Jay S. Lewis, Chris Gregory, Garry Cunningham, Dorota Temple, RTI International (USA); Arvind I. D'Souza, Ernest W. Robinson, DRS Sensors & Targeting Systems, Inc. (USA); Priyalal S. Wijewarnasuriya, U.S. Army Research Lab. (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA). . . . . [8704-95]

8:40 am: **Reduction of dark current density by five orders at high bias and enhanced multicolour photo response at low bias for quaternary alloy capped InGaAs/ GaAs QDIPs, when implanted with low-energy light (H-) ions**, Arjun Mandal, Hemant Ghadi, Indian Institute of Technology Bombay (India); Arindam Basu, N. B. V. Subrahmanyam, P. Singh, Bhabha Atomic Research Ctr. (India); Subhananda Chakrabarti, Indian Institute of Technology Bombay (India) . [8704-94]

SESSION 18

Room: Conv. Ctr. 343 . . . . . Fri 9:00 am to 10:00 am

Other Advanced Photon FPAs

Session Chairs: **Paul R. Norton,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Bjørn F. Andresen,** Acktar Ltd. (Israel)

9:00 am: **Broadband enhancement of infrared photodetectors with metamaterial resonators**, John A. Montoya, The Univ. of New Mexico (USA); David W. Peters, Charles M. Reinke, Sandia National Labs. (USA); Stephen A. Myers, Pankaj Ahirwar, Sanjay Krishna, The Univ. of New Mexico (USA) . [8704-96]

9:20 am: **3 mega-pixel InSb detector with 10µm pitch**, Gal Gershon, Lior Shkedy, Omer Cohen, Zipora Calahorra, Maya Brumer, Michal Nitzani, Eran Avnon, Yossi Aghion, Igal Kogan, Niv Shiloah, Shimon Elkind, Elad Ilan, Itay Shtrichman, Asaf Albo, SCD Semiconductor Devices (Israel). . . . . [8704-97]

9:40 am: **Design and development of wafer-level short wave infrared micro-camera**, Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA); Je-Ung Lee, Univ. at Albany (USA) . . . . . [8704-98]

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

SESSION 19

Room: Conv. Ctr. 343 . . . . . Fri 10:30 am to 11:30 am

Emerging Uncooled Technologies II

Session Chairs: **Kevin C. Liddiard,** Electro-optic Sensor Design (Australia); **John L. Miller,** FLIR Systems, Inc. (USA)

10:30 am: **Performance estimations for a radiant energy imager using null switching**, Evan M. Smith, Imen Rezadad, Javaneh Boroumand Azad, Pedro N. Figueiredo, Deep R. Panjwani, Janardan Nath, Robert E. Peale, Univ. of Central Florida (USA); Oliver Edwards, ZyberTec LLC (USA) . . . . . [8704-100]

10:50 am: **High-resistivity and high-TCR vanadium oxide thin films for infrared imaging prepared by bias target ion-beam deposition**, Yao Jin, Thomas N. Jackson, Mark W. Horn, The Pennsylvania State Univ. (USA) . . . . . [8704-101]

11:10 am: **Room-temperature microphotonic bolometer based on dielectric optical resonator**, Tindaro Ioppolo, Edoardo Rubino, Southern Methodist Univ. (USA) . . . . . [8704-102]

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

SESSION 20

Room: Conv. Ctr. 343 . . . . . Fri 1:00 pm to 2:20 pm

Uncooled FPAs and Applications II

Session Chairs: **John L. Miller,** FLIR Systems, Inc. (USA); **Kevin C. Liddiard,** Electro-optic Sensor Design (Australia)

1:00 pm: **Wafer-level reliability characterization for wafer-level packaged microbolometer with ultra-small array size**, Hee Yeoun Kim, Chungmo Yang, Jae Hong Park, Ho Jung, Tae Hyun Kim, Gyung Tae Kim, Sung Kyu Lim, National Nanofab Ctr. (Korea, Republic of); Sang Woo Lee, ePack Inc. (USA); Wook Joong Hwang, Kwyro Lee, National Nanofab Ctr. (Korea, Republic of). . . . . [8704-103]

1:20 pm: **Application of mosaic pixel microbolometer technology to very high-performance, low-cost thermography, and pedestrian detection**, Kevin C. Liddiard, Electro-optic Sensor Design (Australia) . . . . . [8704-104]

1:40 pm: **A 160 × 120 microbolometer FPA for low-cost applications**, Tayfun Akin, Selim Eminoglu, Murat Tepegoz, Mikro-Tasarim San. ve Tic. Ltd. Sti. (Turkey) . . . . . [8704-105]

2:00 pm: **Development of improved NEP hybrid pyroelectric radiometers for low radiant-power measurement in the LWIR**, George P. Eppeldauer, Vyacheslav B. Podobedov, National Institute of Standards and Technology (USA); Donald Dooley, Sid E. Levingston, Gentec-EO, USA, Inc. (USA) . . . . . [8704-111]

Monday 29 April · Infrared Applications: Thermosense XXXV: Vendor Presentations
Tuesday - Wednesday 30 April - 1 May 2013 • Proceedings of SPIE Vol. 8705

Thermosense: Thermal Infrared Applications XXXV

Conference Chairs: **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc. (USA); **Fred P. Colbert,** Colbert Infrared Services (USA)

Program Committee: **Andrea Acosta,** Colbert Infrared Services (USA); **Nicolas Avdelidis,** National Technical Univ of Athens (Greece); **Jeff R. Brown,** Hope College (USA); **Douglas Burleigh,** La Jolla Cove Consulting (USA); **K. Elliott Cramer,** NASA Langley Research Ctr. (USA); **Ralph B. Dinwiddie,** Oak Ridge National Lab. (USA); **Sheng-Jen Hsieh,** Texas A&M Univ. (USA); **Herbert Kaplan,** Honeyhill Technical Co. (USA); **Timo T. Kauppinen,** VTT Technical Research Ctr. of Finland (Finland); **Dennis H. LeMieux,** Siemens Power Generation, Inc. (USA); **Monica Lopez Saenz,** IRCAM GmbH (Germany); **Xavier P. V. Maldague,** Univ. Laval (Canada); **Gary L. Orlove,** FLIR Systems, Inc. (USA); **G. Raymond Peacock,** Temperatures.com, Inc. (USA); **Piotr Pregowski,** Pregowski Infrared Services (Poland); **Ralph A. Rotolante,** Vicon Entreprises Inc (USA); **Andres E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **Morteza Safai,** The Boeing Co. (USA); **Takahide Sakagami,** Kobe Univ. (Japan); **Steven M. Shepard,** Thermal Wave Imaging, Inc. (USA); **Sami Siikanen,** VTT Technical Research Ctr. of Finland (Finland); **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russian Federation); **Xiong Yu,** Case Western Reserve Univ. (USA); **Joseph N. Zalameda,** NASA Langley Research Ctr. (USA)

ThermoSense Mission Statement

The Infrared Applications, ThermoSense conference promotes the worldwide exchange of information about the uses or applications of thermal infrared sensing, imaging and measuring instruments through papers, workshops and short-courses. Over the past Thirty Three years these activities have included topics from the fundamentals of imaging and calibration to virtually all civilian applications of infrared equipment with special emphasis on problem solving and 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 29 April

Infrared Applications: Thermosense XXXV: Vendor Presentations and Reception

Room: Conv. Ctr. 315 . . . . . 1:00 pm to 4:40 pm

NOTE ROOM CHANGE

Moderators: **Andrés E. Rozlosnik,** Si Termografia Infrarroja (Argentina), and **Herb Kaplan,** Honeywell Technical Co. (USA)

The Infrared Applications: ThermoSense XXXV Vendors Session will be held on Monday afternoon, April 29, 2013 as part of SPIE Defense, Security+ Sensing Symposium in Baltimore. The session will feature brief presentations from hardware and software vendors whose product lines impact thermal imaging applications. Unlike the technical sessions, there are no "commercial content" restrictions in these presentations. This event allows vendors to showcase new products on display at this year's exhibit, and provides attendees with an advance glimpse of "what's new" in thermal imaging applications. All exhibitors are eligible to present.

The Vendors Session was started nine years ago and has been a popular, well-attended success. It allows the busy technical conference attendees to better prioritize their time when visiting the exhibits. It also provides a relaxed atmosphere for informal conversations between vendors and conference attendees.

This year we have 17 presentation representing 10 countries. The session begins with 14-minute presentations and is followed by a reception and mixer with snacks and soft drinks.

VENDORS IN PRESENTATION ORDER:

TELOPS Inc. (Booth 1112)
Advances in infrared imaging at TELOPS
Presenter: **Vincent Farley,** Business Development Manager

New Infrared Technologies, Ltd. (Booth 1959)
The new uncooled mid IR 80x80 FPA: systems over 2000fps
Presenter: **Rodrigo Linares,** Business Development Manager

Xenics (Booth 131)
New developments at Xenics
Presenter: **Jan Vermieren,** Technical Adviser & Business Development Manager

ULIS (Booth 1516)
ULIS uncooled IR detectors and new developments
Presenter: **Ludovic Brasse,** Sales Manager

SCD USA LLC (Booth 1617)
New products for 2013 from semiconductor devices
Presenter: **Robert McDaniel,** President and Chief Executive Officer

Media Lario Technologies (Booth 1725)
A cost efficient multispectral three-mirror anastigmat imaging system for high-performance surveillance applications using electro-formed free-form mirrors
Presenter: **Guiseppe Borghi,** BU Manager

Sensors Unlimited Inc. (SUI), part of UTC Aerospace Systems (Booth 1217)
High-speed 2048 pixel InGaAs linescan cameras for biomedical and machine vision SWIR imaging
Presenter: **Doug Malchow,** Manager Business Development for Industrial Products

IR Cameras (Booth 1209)
Large-format, high-frame rate, broad-band (2-11µm) SLS camera technology
Presenter: **Mike Larson,** Director, Business Development

Magnity Electronics Co. Ltd. (Booth 1238)
Low cost thermal imager using innovative microbolometer technology
Presenter: **Chongfei Shen,** Chief Executive Officer

Thermoteknix Systems Ltd. (Booth 1900)
Announcing the new MicroCAM II thermal imaging module
Presenter: **Alistair Brown,** Product Manager, Imaging

New Imaging Technologies (Booth 911)
Innovative WDIR ROIC for IR
Presenter: **Jean-Louis Laurent,** Sales Director

DRS Technologies Inc. (Booth 1609)
Tamarisk: Affordable and easy to integrate thermal imaging solutions
Presenter: **Greg Christison,** Senior Director, Commercial Products

CI Systems, Inc. (Booth 1805)
New SR-5000N Spectroradiometer by CI Systems
Presenter: **ILya Koshkin,** Technology and Business Development

JENOPTIK Optical Systems (Booth 1549)
New stationary radiometric camera with 1024x769 pixel microbolometer detector
Presenter: **Heiko Richter,** Head of International Sales. Infrared Camera Technology

IRCAM GmbH (Booth 1817)
New products and special applications from IRCAM cameras
Presenter: **Monica Lopez,** Manager Director.1

MOOG Inc. (Booth 2030)
Commander's Gimball multisensor platform: HD thermal and beyond
Presenter: **Jon Paine,** Manager, Business Development

StingRay Optics, LLC (Booth 1754)
Standard Products: Lens Assemblies and Accessories
Presenter: **Jennifer L. Myers,** Sales and Marketing Manager

Symposium-wide Plenary Session
Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 1
Room: Conv. Ctr. 320 . . . . . Tue 8:00 am to 9:40 am

Building Applications

Session Chairs: **Timo T. Kauppinen,** VTT Technical Research Ctr. of Finland (Finland); **Xavier P. V. Maldague,** Univ. Laval (Canada)

8:00 am: **In-situ calibration of a microbolometer camera for the study of large-scale fires**, Jaap de Vries, FM Global (USA) . . . . . [8705-1]

8:20 am: **Thermographic analysis of the thermal properties of wood for wooden windows**, Alessandro Bortolin, Gianluca Cadelano, Giovanni Ferrarini, Paolo Bison, Consiglio Nazionale delle Ricerche (Italy); Fabio Peron, Univ. Ca' Foscari di Venezia (Italy) . . . . . [8705-2]

8:40 am: **High-resolution survey of buildings by lock-in IR thermography**, Alessandro Bortolin, Gianluca Cadelano, Giovanni Ferrarini, Paolo Bison, Consiglio Nazionale delle Ricerche (Italy); Fabio Peron, Univ. Ca' Foscari di Venezia (Italy); Xavier P. V. Maldague, Univ. Laval (Canada) . . . . . [8705-3]

9:00 am: **The case for using a sacrificial layer of absorbent insulation in the design of flat and low-sloped roofing**, Gregory R. Stockton, Stockton Infrared Thermographic Services, Inc. (USA) . . . . . [8705-4]

9:20 am: **Methods to attack, or defend the professional integrity and competency of an Infrared Thermographer and their work. What every Attorney and Infrared Thermographer needs to know before going into a lawsuit**, Fred P. Colbert, Colbert Infrared Services (USA) and Professional Thermographers Association (USA) and Thermal Trend (USA). . . . . [8705-5]

PANEL DISCUSSION
Room: Conv. Ctr. 320 . . . . . .Tue 9:40 am to 10:00 am

Building

Session Chairs: **Timo T. Kauppinen,** VTT Technical Research Ctr. of Finland (Finland); **Xavier P. V. Maldague,** Univ. Laval (Canada)

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

SESSION 2
Room: Conv. Ctr. 320 . . . . . Tue 10:30 am to 11:50 am

Security I

Session Chairs: **Andres E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **Morteza Safai,** The Boeing Co. (USA)

10:30 am: **Flow detection via sparse frame analysis for suspicious event recognition in infrared imagery**, Henrique C. Fernandes, Univ. Laval (Canada); Marcos A. Batista, Univ. Federal de Goiás (Brazil); Celia Z. Barcelos, Univ. Federal de Uberlândia (Brazil); Xavier P. V. Maldague, Univ. Laval (Canada) . . . . . [8705-6]

10:50 am: **Standoff laser-induced thermal emission of explosives**, Nataly Y. Galán-Freyle, Leonardo C. Pacheco-Londoño, Amanda Figueroa-Navedo, John R. Castro-Suarez, Samuel P. Hernandez-Rivera, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8705-7]

11:10 am: **Ballistic impact performance analysis using FAST infrared imagery**, Frédérick Marcotte, Vincent Farley, Simon Savary, Telops (Canada). . . . . [8705-8]

11:30 am: **Metal particles explosion in dust cloud analysis using FAST infrared imagery**, Frédérick Marcotte, Vincent Farley, Simon Savary, Telops (Canada) . . . . . [8705-9]

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

SESSION 3
Room: Conv. Ctr. 320 . . . . . Tue 1:20 pm to 2:00 pm

Security II

Session Chairs: **Andres E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **Morteza Safai,** The Boeing Co. (USA)

1:20 pm: **Fusion of active and passive infrared images for face recognition**, Moulay A. Akhloufi, Univ. Laval (Canada) and Ctr. of Robotics and Vision (Canada); Abdelhakim Bendada, Univ. Laval (Canada). . . . . [8705-10]

1:40 pm: **A multistep approach for infrared face recognition in texture space**, Moulay A. Akhloufi, Univ. Laval (Canada) and Ctr. of Robotics and Vision (Canada); Abdelhakim Bendada, Univ. Laval (Canada). . . . . [8705-11]

PANEL DISCUSSION
Room: Conv. Ctr. 320 . . . . . .Tue 2:00 pm to 2:20 pm

Security

Session Chairs: **Andres E. Rozlosnik,** SI Termografía Infrarroja (Argentina); **Morteza Safai,** The Boeing Co. (USA)

SESSION 4
Room: Conv. Ctr. 320 . . . . . Tue 2:20 pm to 4:00 pm

Research and Development

Session Chairs: **Steven M. Shepard,** Thermal Wave Imaging, Inc. (USA); **Xiong Yu,** Case Western Reserve Univ. (USA)

2:20 pm: **Compact high-speed MWIR spectrometer applied to monitor CO_2 exhaust dynamics from a turbojet engine**, Rodrigo Linares-Herrero, New Infrared Technologies, Ltd. (Spain); Victor Archilla-Prat, INTA Instituto Nacional de Técnica Aeroespacial (Spain); German Vergara, Maria Teresa Montojo Supervielle, Raul Gutierrez Alvarez, Carlos Fernandez-Montojo, Victor Villamayor, Luis J. Gomez, Arturo Baldasano-Ramirez, New Infrared Technologies, Ltd. (Spain); A. Entero, A. Gonzalez, Daniel Mercader, Ana Jimenez, INTA Instituto Nacional de Técnica Aeroespacial (Spain) . . . . . [8705-12]

2:40 pm: **Infrared images and other data acquisition station**, Marc-André Béland, Abdelhakim Bendada, Xavier P. V. Maldague, Univ. Laval (Canada); Giovanni Ferrarini, Paolo Bison, Ermanno G. Grinzato, Consiglio Nazionale delle Ricerche (Italy) . . . . . [8705-13]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

3:40 pm: **Infrared thermography inspection of glass-reinforced plastic (GRP) wind turbine blades and the concept of an automated scanning device**, Nicolas Avdelidis, Innovative Technology and Science Ltd. (United Kingdom) . . . . . [8705-14]

SESSION 5
Room: Conv. Ctr. 320 . . . . . Tue 4:00 pm to 4:40 pm

Medical

Session Chairs: **Nicolas Avdelidis,** National Technical Univ of Athens (Greece); **Sheng-Jen Hsieh,** Texas A&M Univ. (USA)

4:00 pm: **Experimental model for determining developmental stage of chicken embryo using infrared images and artificial neural networks**, Seung K. Jung, Univ. of California, Berkeley (USA); Sheng-Jen Hsieh, Che-Hao Chen, Texas A&M Univ. (USA) . . . . . [8705-16]

4:20 pm: **Thermal imaging to detect physiological indicators of stress in humans**, Carl B. Cross, Julie A. Skipper, Wright State Univ. (USA) . . . . . [8705-17]

PANEL DISCUSSION
Room: Conv. Ctr. 320 . . . . . .Tue 5:00 pm to 5:20 pm

Medical

Session Chairs: **Nicolas Avdelidis; Sheng-Jen Hsieh,** Texas A&M Univ. (USA)

PANEL DISCUSSION
Room: Conv. Ctr. 320 . . . . . .Tue 5:20 pm to 5:40 pm

Tribute to Ermanno Grinzato and Sven Sven-Ake Ljungberg

Session Chairs: **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc. (USA); **Fred P. Colbert,** Colbert Infrared Services (USA)

Tribute to Ermanno Grinzato, by Paolo Bison

Tribute to Sven Sven-Åke Ljungberg, by Timo Kauppinen

Wednesday 1 May

SESSION 6
Room: Conv. Ctr. 320 . . . . . .Wed 8:00 am to 9:30 am

Additive Manufacturing

Session Chairs: **Ralph B. Dinwiddie,** Oak Ridge National Lab. (USA); **Joseph N. Zalameda,** NASA Langley Research Ctr. (USA)

8:00 am: **Developing a successful and sustainable predictive maintenance program**, John W. Pratten III, Proactive Maintenance Consultants, LLC (USA) . . . . . [8705-18]

8:20 am: **Thermographic in-situ process monitoring of the electron-beam melting technology used in additive manufacturing**, Ralph B. Dinwiddie, Ryan R. Dehoff, Peter D. Lloyd, Larry E. Lowe, Oak Ridge National Lab. (USA) . . . [8705-19]

8:40 am: **Real-time process monitoring and temperature mapping of the 3D polymer printing process**, Ralph B. Dinwiddie, Lonnie J. Love, John C. Rowe, Oak Ridge National Lab. (USA) . . . . . [8705-20]

9:00 am: **Thermal imaging for assessment of electron-beam free form fabrication (EBF3) additive manufacturing welds** *(Invited Paper)*, Joseph N. Zalameda, Eric R. Burke, Robert A. Hafley, Karen M. Taminger, NASA Langley Research Ctr. (USA) . . . . . [8705-21]

SESSION 7
Room: Conv. Ctr. 320 . . . . . .Wed 9:30 am to 11:00 am

Materials Evaluation

Session Chairs: **Joseph N. Zalameda,** NASA Langley Research Ctr. (USA); **Ralph B. Dinwiddie,** Oak Ridge National Lab. (USA)

9:30 am: **Crack detection using induction thermography during high-temperature testing**, Marc Genest, National Research Council Canada (Canada) . . . . . [8705-22]

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

10:20 am: **Spectroradiometric calibration of sub-ambient flat plate blackbodies**, Sergey N. Mekhontsev, National Institute of Standards and Technology (USA); Vladimir B. Khromchenko, National Institute of Standards and Technology (USA) and SDL, Inc. (USA); Leonard M. Hanssen, National Institute of Standards and Technology (USA) . . . . . [8705-23]

10:40 am: **Recent developments in infrared reflectometry at NIST**, Leonard M. Hanssen, National Institute of Standards and Technology (USA); Jinan Zeng, Space Dynamics Lab. (USA); Sergey N. Mekhontsev, National Institute of Standards and Technology (USA); Vladimir B. Khromchenko, Space Dynamics Lab. (USA) . . . . . [8705-24]

PANEL DISCUSSION
Room: Conv. Ctr. 320 . . . . . Wed 11:00 am to 11:20 am

Additive Manufacturing and Materials Evaluation

Session Chairs: **Joseph N. Zalameda,** NASA Langley Research Ctr. (USA); **Ralph B. Dinwiddie,** Oak Ridge National Lab. (USA)

SESSION 8
Room: Conv. Ctr. 320 . . . . . .Wed 11:20 am to 12:00 pm

NDT (Nondestructive Testing) I

Session Chairs: **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russian Federation); **Dennis H. LeMieux,** Siemens Power Generation, Inc. (USA)

11:20 am: **Nondestructive inspection in adhesive-bonded joint CFRP using pulsed phase thermography**, Peter H. Shin, Sean C. Webb, Kara J. Peters, North Carolina State Univ. (USA) . . . . . [8705-25]

11:40 am: **Non-visible defect detection in glass using infrared thermography and artificial neural networks**, Amber Campa, Boston Univ. (USA); Sheng-Jen Hsieh, Hong J. Wang, Texas A&M Univ. (USA) . . . . . [8705-26]

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

SESSION 9

Room: Conv. Ctr. 320 . . . . . Wed 1:30 pm to 5:10 pm

NDT (Nondestructive Testing) II

Session Chairs: **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russian Federation); **Dennis H. LeMieux,** Siemens Power Generation, Inc. (USA)

1:30 pm: **Comparison of pulse phase and thermographic signal reconstruction processing methods**, Beata Oswald-Tranta, Montan Univ. Leoben (Austria); Steven M. Shepard, Thermal Wave Imaging, Inc. (USA) . . . . . [8705-27]

1:50 pm: **Evaluating quality of adhesive joints in glass-fiber plastic piping by using active thermal NDT**, Vladimir P. Vavilov, Tomsk Polytechnic Univ. (Russian Federation); Marcella Grosso, Univ. Federal do Rio de Janeiro (Brazil); Carla A. Marinho, Petrobras Brasileiro SA (Brazil); Denis A. Nesteruk, Tomsk Polytechnic Univ. (Russian Federation); Joao M. Rebello, Univ. Federal do Rio de Janeiro (Brazil); Sergio D. Soares, Petrobras Brasileiro SA (Brazil) . . . . . [8705-28]

2:10 pm: **Nondestructive testing of externally-reinforced structures for seismic retrofitting using flax fiber reinforced polymer (FFRP) composites**, Clemente Ibarra-Castanedo, Univ. Laval (Canada); Stefano Sfarra, Domenica Paoletti, Univ. degli Studi dell'Aquila (Italy); Abdelhakim Bendada, Xavier P. V. Maldague, Univ. Laval (Canada). . . . . [8705-29]

2:30 pm: **Improved sizing of impact damage in composites based on thermographic response**, William P. Winfree, Patricia A. Howell, Cara A. Leckey, Matthew D. Rogge, NASA Langley Research Ctr. (USA) . . . . . [8705-30]

2:50 pm: **Nondestructive testing and evaluation of composites by non-invasive IR Imaging techniques**, Ravibabu Mulaveesala, Indian Institute of Technology, Ropar (India); Juned A. Siddiqui, PDPM IIITDM Jabalpur (India); Vanita Arora, Indian Institute of Technology, Ropar (India); Subbarao V. Ghali, K L Univ. (India) and PDPM IIITDM Jabalpur (India); Amarnath Muniyappa, PDPM IIITDM Jabalpur (India); Masahiro Takei, Graduate School of Chiba Univ. (Japan). . . . . [8705-33]

Coffee Break . . . . . Wed 3:10 pm to 3:50 pm

3:50 pm: **Analysis of signal processing techniques in pulsed thermography**, Fernando Lopez, Univ. Federal de Santa Catarina (Brazil); Xavier P. V. Maldague, Clemente Ibarra-Castanedo, Univ. Laval (Canada); Vicente de Paulo Nicolau, Univ. Federal de Santa Catarina (Brazil). . . . . [8705-31]

4:10 pm: **Theory, modeling, and simulations for thermal wave detection and ranging**, Ravibabu Mulaveesala, Indian Institute of Technology, Ropar (India); Subbarao V. Ghali, K L Univ. (India) and PDPM IIITDM Jabalpur (India); Vanita Arora, Indian Institute of Technology, Ropar (India); Juned A. Siddiqui, Amarnath Muniyappa, PDPM IIITDM Jabalpur (India); Masahiro Takei, Graduate School of Chiba Univ. (Japan) . . . . . [8705-34]

4:30 pm: **Detection of defects in laser powder deposition (LPD) produced components by laser thermography**, S. P. Santospirito, Kamil Slyk, Bin Luo, Kingston Computer Consultancy Ltd. (United Kingdom); Rafal Lopatka, Warsaw Univ. of Technology (Poland) and Polkom Badania (Poland) . . . . . .[8705-32

4:50 pm: **Recent advances in thermal wave detection and ranging for non-destructive testing and evaluation of materials ,** Ravibabu Mulaveesala, Indian Institute of Technology, Ropar (India); Subbarao V. Ghali, K L Univ. (India) and PDPM IIITDM Jabalpur (India); Vanita Arora, Indian Institute of Technology, Ropar (India); Juned A. Siddiqui, Amarnath Muniyappa, PDPM IIITDM Jabalpur (India); Masahiro Takei, Graduate School of Chiba Univ. (Japan) . . . . . [8705-35]

PANEL DISCUSSION

Room: Conv. Ctr. 320 . . . . . Wed 5:10 pm to 5:30 pm

Panel Discussion: NDT (Nondestructive Testing)

Session Chairs: **Vladimir P. Vavilov,** Tomsk Polytechnic Univ. (Russian Federation); **Dennis H. LeMieux,** Siemens Power Generation, Inc. (USA)

SESSION 10

Room: Conv. Ctr. 320 . . . . . Wed 5:30 pm to 5:50 pm

Professionalism

Session Chairs: **Gregory R. Stockton,** Stockton Infrared Thermographic Services, Inc. (USA); **Fred P. Colbert,** Colbert Infrared Services (USA)

5:30 pm: **The Zombie Thermographer Apocalypse Preparedness 101: Zombie Thermographer Pandemic**, Fred P. Colbert, Colbert Infrared Services (USA) and Thermal Trend (USA) and Professional Thermographers Association (USA) . . . . . [8705-36]

Tuesday - Thursday 30 April - 2 May 2013 • Proceedings of SPIE Vol. 8706

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

Conference Chairs: **Gerald C. Holst,** JCD Publishing (USA); **Keith A. Krapels,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

Program Committee: **Gisele Bennett,** Georgia Institute of Technology (USA); **Piet Bijl,** TNO Defence, Security and Safety (Netherlands); **James A. Dawson,** Dynetics, Inc. (USA); **Ronald G. Driggers,** U.S. Naval Research Lab. (USA); **Richard L. Espinola,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **David P. Forrai,** L-3 Communications Cincinnati Electronics (USA); **Terrence S. Lomheim,** The Aerospace Corp. (USA); **Alan Irwin,** Santa Barbara Infrared, Inc. (USA); **Teresa L. Pace,** Lockheed Martin Corp. (USA); **Hector M. Reyes,** Raytheon Co. (USA); **Endre Repasi,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Joseph P. Reynolds,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Bernard M. Rosier,** ONERA (France); **Michael A. Soel,** FLIR Systems, Inc. (USA); **Curtis M. Webb,** Northrop Grumman Electronic Systems (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 319 . . . . . Tue 1:20 pm to 3:00 pm

Systems

Session Chairs: **Hector M. Reyes,** Raytheon Co. (USA); **David P. Forrai,** L-3 Communications Cincinnati Electronics (USA); **Gisele Bennett,** Georgia Institute of Technology (USA)

1:20 pm: **Resampling in hyperspectral cameras as an alternative to correcting keystone in hardware, with focus on benefits for the optical design and data quality**, Andrei Fridman, Norsk Elektro Optikk AS (Norway); Gudrun Høye, Norwegian Defence Research Establishment (Norway); Trond Løke, Norsk Elektro Optikk AS (Norway) . . . . . [8706-1]

1:40 pm: **Infrared camera NUC and calibration: comparison of advanced methods**, Frédérick Marcotte, Pierre Tremblay, Vincent Farley, Telops (Canada) . . . . . [8706-2]

2:00 pm: **An evaluation of image quality metrics to validate pixel uniformity and the performance of NUC methods**, Thomas Svensson, Swedish Defence Research Agency (Sweden) . . . . . [8706-3]

2:20 pm: **Development of 3D infrared imaging system using nanocarbon-based photodetectors**, Ning Xi, Michigan State Univ. (USA) . . . . . [8706-4]

Coffee/Exhibition Break. . . . . .Tue 2:40 pm to 3:30 pm

SESSION 2

Room: Conv. Ctr. 319 . . . . . Tue 3:30 pm to 5:50 pm

Testing

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

3:30 pm: **Evaluation of dome-input geometry for pyroelectric detectors**, Jinan Zeng, National Institute of Standards and Technology (USA) and Utah State Univ. (USA); Leonard M. Hanssen, George P. Eppeldauer, National Institute of Standards and Technology (USA). . . . . [8706-39]

3:50 pm: **Compensation for instrument anomalies in imaging infrared measurements**, Christopher L. Dobbins, U.S. Army Aviation & Missile Research, Development & Engineering Ctr. (USA); James A. Dawson, Jay A. Lightfoot, William D. Edwards, Ryan S. Cobb, Amanda R. Heckwolf, Dynetics, Inc. (USA) . . . [8706-7]

4:10 pm: **Characterization of domestic and foreign image intensifier tubes**, Edward J. Bender, Michael V. Wood, Dan J. Hosek, Steve D. Hart, U.S. Army RDECOM CERDEC Night Vision & Electronic Sensors Directorate (USA) . . [8706-8]

4:30 pm: **Data analysis tools for imaging infrared technology within the ImageJ environment**, Ryan K. Rogers, William D. Edwards, Dynetics, Inc. (USA); Caleb E. Waddle, Christopher L. Dobbins, Sam B. Wood, U.S. Army Research, Development and Engineering Command (USA). . . . . [8706-9]

4:50 pm: **Enhanced extended area blackbody for radiometric calibration**, Joseph D. LaVeigne, Gregory Franks, Santa Barbara Infrared, Inc. (USA) . [8706-10]

5:10 pm: **Active SWIR Laboratory testing methodology**, Curtis M. Webb, Northrop Grumman Electronic Systems (USA); Stephen G. White, Santa Barbara Infrared, Inc. (USA) . . . . . [8706-11]

5:30 pm: **Testing missile warning and countermeasure systems (MWCS): instrumentation for development, production, and maintenance of MWCS**, Dario Cabib, Adam Inbar, Tamir Barak, Doron Rozenstein, Larry Davidzon, Alon Edri, CI Systems (Israel) Ltd. (Israel) . . . . . [8706-12]

Wednesday 1 May

SESSION 3

Room: Conv. Ctr. 319 . . . . . .Wed 8:30 am to 9:30 am

Modeling I

Session Chairs: **Gisele Bennett,** Georgia Institute of Technology (USA); **Piet Bijl,** TNO Defence, Security and Safety (Netherlands); **Teresa L. Pace,** Lockheed Martin Corp. (USA)

8:30 am: **An investigation of image-based task performance prediction**, Eddie L. Jacobs, Univ. of Memphis (USA). . . . . [8706-14]

8:50 am: **Validating the time-dependent search parameter search model**, Melvin H. Friedman, U.S. Army RDECOM CERDEC Night Vision & Electronic Sensors Directorate (USA); Hee-Sue Choi, Jae H. Cha, Joseph P. Reynolds, U.S. Army Night Vision & Electronic Sensors Directorate (USA). . . . . [8706-15]

9:10 am: **Performance characterization of night-vision equipment based on triangle orientation discrimination (TOD) methodology**, Nicolas Laurent, Cédric Lejard, Geoffroy Deltel, PHOTONIS France S.A.S. (France); Piet Bijl, TNO Defence, Security and Safety (Netherlands). . . . . [8706-16]

Coffee/Exhibition Break. . . . . Wed 9:30 am to 10:30 am

SESSION 4

Room: Conv. Ctr. 319 . . . . . .Wed 10:30 am to 12:00 pm

Modeling II

Session Chairs: **Michael A. Soel,** FLIR Systems, Inc. (USA); **Piet Bijl,** TNO Defence, Security and Safety (Netherlands); **James A. Dawson,** Dynetics, Inc. (USA)

10:30 am: **Sensor performance and atmospheric effects using NvThermIP/NV-IPM and PcModWin/MODTRAN models: a historical perspective** *(Invited Paper)*, John W. Schroeder, Ontar Corp. (USA) . . . . . [8706-18]

11:00 am: **Impact of the spectral nature of signatures on targeting with broadband imagers,** Van A. Hodgkin, U.S. Army Night Vision & Electronic Sensors Directorate (USA) . . . . . [8706-19]

11:20 am: **TOD characterization of the Gatekeeper electro-optical security system**, Guido A. Gosselink, Hugo Anbeek, Thales Nederland B.V. (Netherlands); Piet Bijl, Maarten A. Hogervorst, TNO Defence, Security and Safety (Netherlands) . . . . . [8706-20]

11:40 am: **Quantitative evaluation of turbulence compensation**, Adam W. W. van Eekeren, Klamer Schutte, Judith Dijk, Piet B. W. Schwering, TNO Defence, Security and Safety (Netherlands). . . . . [8706-22]

Lunch/Exhibition Break . . . . . .Wed 12:00 pm to 2:00 pm

SESSION 5
Room: Conv. Ctr. 319 . . . . . Wed 2:00 pm to 2:40 pm

Modeling III

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

2:00 pm: **What good is SWIR? part I: passive day comparison of SWIR, NIR, and Vis**, Ronald G. Driggers, U.S. Naval Research Lab. (USA); Van A. Hodgkin, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Richard H. Vollmerhausen, Univ. of Delaware (USA) . . . . . [8706-23]

2:20 pm: **Local-area imaging of objects in near-geostationary orbits via LWIR sensing**, Paul McCall, Florida International Univ. (USA); Madeleine Naudeau, Air Force Research Lab. (USA); Thomas Farrell, Schafer Corp. (USA) and Air Force Research Lab. (USA); Marlon E. Sorge, The Aerospace Corp. (USA); Malek Adjouadi, Florida International Univ. (USA) . . . . . [8706-25]

Coffee/Exhibition Break. . . . . Wed 2:40 pm to 3:40 pm

SESSION 6
Room: Conv. Ctr. 319 . . . . . Wed 3:40 pm to 4:40 pm

Modeling IV

Session Chairs: **Hector M. Reyes,** Raytheon Co. (USA); **James A. Dawson,** Dynetics, Inc. (USA); **Michael A. Soel,** FLIR Systems, Inc. (USA)

3:40 pm: **Producing a color target acquisition metric**, Assaf Asbag, Racheli Hayoon, Ricky Shama, Neta Gadot, Stanley R. Rotman, Ben-Gurion Univ. of the Negev (Israel) . . . . . [8706-28]

4:00 pm: **Image enhancement technology research for Army applications**, Piet B. W. Schwering, Rob A. W. Kemp, Klamer Schutte, TNO Defence, Security and Safety (Netherlands) . . . . . [8706-29]

4:20 pm: **Multisensor fusion of electro-optic and infrared signals for high-resolution visible images, part I**, Xiaopeng Huang, Stevens Institute of Technology (USA); Ravi Netravali, Columbia Univ. (USA); Hong Man, Victor B. Lawrence, Stevens Institute of Technology (USA) . . . . . [8706-42]

WORKSHOP
Room: Conv. Ctr. 319 . . . . . Wed 4:40 pm to 5:40 pm

Night Vision-Integrated Performance Model (NV-IPM)

Workshop Leaders: **Brian Teaney, Joseph Reynolds,** U. S. Army Night Vision &Electronic Sensors Directorate

The Night Vision Integrated Performance Model (NV-IPM) was recently released by NVESD. The aim of this new model is to provide a flexible and extensible engineering tool for system design which encapsulates all of the capabilities of the existing Night Vision model suite along with many new design tools and features. These features include a more intuitive interface, the ability to perform trade studies, and a library of standard and user generated components. By combining the previous model architectures in one interface the new design is also better suited to capture emerging sensor modalities and technologies. This workshop will introduce some common NV-IPM modeling cases and discusses the model features and capabilities in greater detail.

Thursday 2 May

SESSION 7
Room: Conv. Ctr. 319 . . . . . Thu 8:00 am to 9:40 am

Targets/Backgrounds/ATM

Session Chairs: **Endre Repasi,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Bernard M. Rosier,** ONERA (France); **Richard L. Espinola,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

8:00 am: **Climatic data analysis for input to ShipIR**, David A. Vaitekunas, W. R. Davis Engineering, Ltd. (Canada); Yoonsik Kim, Korean Ocean Research and Development Institute (Korea, Republic of). . . . . [8706-30]

8:20 am: **Range and contrast imaging improvements using circularly polarized light in scattering environments**, John D. van der Laan, College of Optical Sciences, The Univ. of Arizona (USA); Shanalyn A. Kemme, David A. Scrymgeour, Sandia National Labs. (USA); Eustace L. Dereniak, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [8706-31]

8:40 am: **Simulation of laser-beam reflection at the sea surface modeling and validation**, Frédéric Schwenger, Endre Repasi, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . . [8706-32]

9:00 am: **IR signature management for the modern navy**, David A. Vaitekunas, W. R. Davis Engineering, Ltd. (Canada); Yoonsik Kim, Korean Ocean Research and Development Institute (Korea, Republic of). . . . . [8706-33]

9:20 am: **Hyperspectral imaging spectro-radiometer improves radiometric accuracy**, Florent M. Prel, Louis Moreau, Robert Bouchard, ABB Analytical Measurement (Canada); Ritchie D. Bullis Jr., Naval Air Warfare Ctr. (USA); Claude B. Roy, Christian A. Vallieres, Luc E. Lévesque, ABB Analytical Measurement (Canada) . . . . . [8706-34]

Coffee/Exhibition Break. . . . . Thu 9:40 am to 10:30 am

PLAN TO ATTEND
Room: Conv. Ctr. 319 . . . . . 10:30 am to 4:30 pm

Plan to attend conference of interest, Technologies for Synthetic Environments: Hardware-in-the-Loop, which begins in this room right after the Coffee Break.

POSTERS-THURSDAY
Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Simultaneous measurement of the thickness profile and refractive index distribution of silicon wafers, Jungjae Park, Korea Research Institute of Standards and Science (Korea, Republic of); Jonghan Jin, Jae Wan Kim, Korea Research Institute of Standards and Science (Korea, Republic of) and Univ. of Science and Technology (Korea, Republic of); Jong-Ahn Kim, Korea Research Institute of Standards and Science (Korea, Republic of); Chu-Shik Kang, Korea Research Institute of Standards and Science (Korea, Republic of) and Univ. of Science and Technology (Korea, Republic of) . . . . . [8706-36]

Uncertainty evaluation of the geometrical thickness and refractive index of silicon wafers, Jonghan Jin, Korea Research Institute of Standards and Science (Korea, Republic of) and Univ. of Science and Technology (Korea, Republic of); Jungjae Park, Korea Research Institute of Standards and Science (Korea, Republic of); Jae Wan Kim, Korea Research Institute of Standards and Science (Korea, Republic of) and Univ. of Science and Technology (Korea, Republic of); Jong-Ahn Kim, Korea Research Institute of Standards and Science (Korea, Republic of); Chu-Shik Kang, Korea Research Institute of Standards and Science (Korea, Republic of) and Univ. of Science and Technology (Korea, Republic of) . . . . . [8706-37]

Characterization of nonuniformity and bias self-heating for uncooled FPA detectors using simulator, Jungeon Lee, Chong-Min Kyung, KAIST (Korea, Republic of) . . . . . [8706-38]

The analysis and experiments of ghost image for solid catadioptric mid-wave IR system, Qun Wei, Changchun Institute of Optics, Fine Mechanics and Physics (China) . . . . . [8706-40]

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

Conference Chairs: **James A. Buford Jr.,** U.S. Army Aviation & Missile Research, Development and Engineering Ctr. (USA); **R. Lee Murrer Jr.,** Millennium Engineering and Integration Co. (USA); **Gary H. Ballard,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (USA) **Jeffrey P. Gareri,** Simulation Technologies, Inc. (USA)

Program Committee: **James A. Annos,** Naval Air Warfare Ctr. Weapons Div. (USA); **Dennis H. Bunfield,** The AEgis Technologies Group, Inc. (USA); **Raul Fainchtein,** Johns Hopkins Univ. Applied Physics Lab. (USA); **Kevin Fisher,** ACUTRONIC Switzerland Ltd. (Switzerland); **Hajin J. Kim,** U.S. Army Research, Development and Engineering Command (USA); **John M. Lannon Jr.,** RTI International (USA); **Heard S. Lowry,** Aerospace Testing Alliance (USA); **William M. Lowry,** U.S. Army Redstone Technical Test Ctr. (USA); **Robert W. Mitchell,** Ideal Aerosmith, Inc. (USA); **Joseph W. Morris,** U.S. Army Aviation and Missile Research, Development and Engineering Ctr. (USA); **Ronald J. Rapp,** Air Force Research Lab. (USA); **Joseph P. Rice,** National Institute of Standards and Technology (USA); **Donald R. Snyder,** Air Force Research Lab. (USA); **Florence C. Solomon,** U.S. Air Force (USA); **Leszek Swierkowski,** Defence Science and Technology Organisation (Australia); **Mark Umansky,** U.S. Army Aviation and Missile Research, Development and Engineering Command (USA); **Brian K. Woode,** Naval Air Warfare Ctr. Aircraft Div. (USA)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 319 . . . . . Thu 10:30 am to 11:50 am

Hardware-in-the-Loop I

Session Chairs: **James A. Buford Jr.,** U.S. Army Aviation & Missile Research, Development and Engineering Ctr. (USA); **R. Lee Murrer Jr.,** Millennium Engineering and Integration Co. (USA); **Gary H. Ballard,** U.S. Army Aviation & Missile Research, Development and Engineering Ctr. (USA); **Heard S. Lowry,** Aerospace Testing Alliance (USA)

10:30 am: **Analytic determination of optimal projector lens design requirements for pixilated projectors used to test pixilated imaging sensors**, Joseph P. Rice, National Institute of Standards and Technology (USA). . . . [8707-1]

10:50 am: **A 2-color 1024x1024 dynamic scene projector system**, Joseph D. LaVeigne, Gregory Franks, Santa Barbara Infrared, Inc. (USA) . . . . . [8707-2]

11:10 am: **Superlattice LED 512x512 two-dimensional infrared scene projector system**, Rodney McGee, Nicholas Waite, Fouad E. Kiamilev, Univ. of Delaware (USA); Thomas F. Boggess, The Univ. of Iowa (USA); Dennis T. Norton, Univ. of Iowa (USA). . . . . [8707-3]

11:30 am: **Scalable system for close support electronics in future large-format infrared scene projectors**, Joshua Marks, Christopher Kerwien, Kassem Nabha, Robert Haislip, Ron Reisor, Rodney McGee, Nicholas Waite, Fouad E. Kiamilev, Univ. of Delaware (USA) . . . . . [8707-4]

Lunch/Exhibition Break . . . . . .Thu 11:50 am to 1:40 pm

SESSION 2

Room: Conv. Ctr. 319 . . . . . Thu 1:40 pm to 3:00 pm

Hardware-in-the-Loop II

Session Chairs: **Dennis H. Bunfield,** The AEgis Technologies Group, Inc. (USA); **Raul Fainchtein,** Johns Hopkins Univ. Applied Physics Lab. (USA); **Kevin Fisher,** ACUTRONIC Switzerland Ltd. (Switzerland)

1:40 pm: **High-dynamic range DMD-based infrared scene projector**, David J. Mansur, Robert Vaillancourt, Ryan Benedict-Gill, Scott P. Newbry, Julia Rentz Dupuis, OPTRA Inc. (USA) . . . . . [8707-6]

2:00 pm: **Progress in LED arrays for infrared scene projection**, David Westerfeld, Sergey D. Suchalkin, Seungyong Jung, Takashi Hosoda, Gregory Belenky, Stony Brook Univ. (USA) . . . . . [8707-7]

2:20 pm: **Calibration of infrared test chambers with the missile defense transfer radiometer**, Simon G. Kaplan, Solomon I. Woods, National Institute of Standards and Technology (USA); Adriaan C. Carter, Booz Allen Hamilton Inc. (USA); Timothy M. Jung, Jung Research and Development Corp. (USA). . . [8707-8]

2:40 pm: **Precision radiometric surface temperature (PRST) sensor**, James T. Daly, Carson B. Roberts, Andrew Bodkin, Bodkin Design & Engineering, LLC (USA); Scott Beaven, Jeffrey Weinheimer, Space Computer Corp. (USA); Robert L. Sundberg, Spectral Sciences, Inc. (USA) . . . . . [8707-9]

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

SESSION 3

Room: Conv. Ctr. 319 . . . . . Thu 3:30 pm to 4:30 pm

Hardware-in-the-Loop III

Session Chairs: **Jeffrey P. Gareri,** Simulation Technologies, Inc. (USA); **Robert W. Mitchell,** Ideal Aerosmith, Inc. (USA); **Joseph P. Rice,** National Institute of Standards and Technology (USA)

3:30 pm: **Development of tools, technologies, and methodologies for imaging sensor testing**, Heard S. Lowry, Aerospace Testing Alliance (USA) . . . . . [8707-10]

3:50 pm: **Dynamic thermal signature prediction for real-time scene generation,** Chad L. Christie, Efthimios T. Gouthas, Defence Science and Technology Organisation (Australia); Owen M. Williams, Daintree Systems Pty Ltd. (Australia); Leszek Swierkowski, Defence Science and Technology Organisation (Australia). . . . . [8707-11]

4:10 pm: **The design of flight motion simulators: high accuracy versus high dynamics**, Robert W. Mitchell, Ideal Aerosmith, Inc. (USA) . . . . . [8707-14]

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Window and Dome Technologies and Materials XIII

Conference Chairs: **Randal W. Tustison,** Raytheon Integrated Defense Systems (USA); **Brian J. Zelinski,** Raytheon Missile Systems (USA)

Program Committee: **Joel Askinazi,** Goodrich Corp. (USA); **Rick Gentilman,** Raytheon Integrated Defense Systems (USA); **Daniel C. Harris,** Naval Air Warfare Ctr. Weapons Div. (USA); **Brian K. Jones,** U.S. Army Research, Development and Engineering Command (USA); **John S. McCloy,** Pacific Northwest National Lab. (USA); **Richard Porter,** Air Force Research Lab. (USA); **Michael E. Thomas,** Johns Hopkins Univ. Applied Physics Lab. (USA)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 329 . . . . . .Wed 8:00 am to 10:00 am

Advance in the Mid-Wavelength Infrared Window Technology I

Session Chair: **Daniel C. Harris,**
Naval Air Warfare Ctr. Weapons Div. (USA)

8:00 am: **Hyper hemispherical sapphire domes: remarkable breakthrough for fulfilling real market needs**, Benny Ballin, Rotem Industries Ltd. (Israel) . . [8708-1]

8:20 am: **Growth and characterization of 14"-wide sapphire plates by edge-defined, film-fed growth (EFG)**, John O. Outwater, Sapphire Systems, Inc. (USA) . . . . . [8708-2]

8:40 am: **Scale up of large ALON® windows**, Lee M. Goldman, Sreeram Balasubramanian, Uday K. Kashalikar, Robyn Foti, Suri A. Sastri, Surmet Corp. (USA) . . . . . [8708-3]

9:00 am: **Transparent ceramics for sensor applications**, Mark V. Parish, Marina R. Pascucci, Normand Corbin, Brenda Puputti, John Bonin, CeraNova Corp. (USA) . . . . . [8708-4]

9:20 am: **Large-size spinel windows and domes**, Juan L. Sepulveda, Raouf O. Loutfy, Sharly Ibrahim, Simon Bilodeau, Materials and Electrochemical Research Corp. (USA) . . . . . [8708-5]

9:40 am: **Manufacturing process scale-up of optical grade transparent spinel ceramic at ArmorLine Corporation**, Joseph Spilman, Joseph Nick, Lawrence Shaffer, John B. Voyles, ArmorLine Corp. (USA) . . . . . [8708-6]

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

SESSION 2

Room: Conv. Ctr. 329 . . . . . .Wed 10:30 am to 12:30 pm

Advance in the Mid-Wavelength Infrared Window Technology II

Session Chair: **Randal W. Tustison,** Raytheon Co. (USA)

10:30 am: **Polycrystalline yttrium aluminum garnet (YAG) for aircraft IR window applications**, Duraiswamy Ravichandran, Texas Biochemicals, Inc. (USA). [8708-7]

10:50 am: **Assessment of low-expansion tungstates for thermal-shock-resistant infrared windows**, Daniel C. Harris, Lee R. Cambrea, Naval Air Warfare Ctr. Weapons Div. (USA) . . . . . [8708-8]

11:10 am: **Transparent ceramics for spacecraft windows**, Jonathan Salem, NASA Glenn Research Ctr. (USA) . . . . . [8708-9]

11:30 am: **Multifunctional windows**, Nagendra Nag, Lee M. Goldman, Sreeram Balasubramanian, Suri A. Sastri, Surmet Corp. (USA) . . . . . [8708-10]

11:50 am: **Synthesis and characterization of large optical grade sapphire windows produced from a horizontal growth process**, Jonathan B. Levine, Timothy Burks, John Ciraldo, Matthew Montgomery, Sergey Podlozhenov, Rubicon Technology Inc. (USA). . . . . [8708-42]

12:10 pm: **New gelling systems to fabricate complex-shaped transparent ceramics**, Yiquan Wu, Alfred Univ. (USA); Yan Yang, New York College (USA) . . . . . [8708-44]

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

SESSION 3

Room: Conv. Ctr. 329 . . . . . Wed 1:30 pm to 2:50 pm

Advance in the Mid-Wavelength Infrared Window Technology III

Session Chair: **Richard Gentilman,**
Raytheon Integrated Defense Systems (USA)

1:30 pm: **Midwave-infrared-transparent yttria-magnesia nanocomposite optical ceramics**, Daniel C. Harris, Lee R. Cambrea, Linda F. Johnson, Robert Seaver, Meghan Baronowski, Naval Air Warfare Ctr. Weapons Div. (USA); Richard Gentilman, C. Scott Nordahl, Todd R. Gattusso, Stephanie R. Silberstein, Patrick S. Rogan, Thomas M. Hartnett, Raytheon Co. (USA); Brian J. Zelinski, Wayne L. Sunne, Jennifer Klose, Eric C. Fest, William H. Poisl, Raytheon Missile Systems (USA); Charles B. Willingham, Raytheon Co. (USA); Giorgio Turri, Florida Southern College (USA); Michael A. Bass, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); David E. Zelmon, Air Force Research Lab. (USA); Steven M. Goodrich, Univ. of Dayton Research Institute (USA) . . . . . [8708-11]

1:50 pm: **Optical properties of a nanocomposite material for durable infrared applications**, Michael E. Thomas, Cadence A. Martin, Andrea M. Brown, William J. Tropf, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8708-12]

2:10 pm: **Gelcasting of aluminum oxynitride (AlON) ceramics**, Jun Wang, Fang Zhang, Jian Zhang, Shiwei Wang, Shanghai Institute of Ceramics (China) [8708-43]

2:30 pm: **Optical properties of ceramic YAG**, Thomas M. Hartnett, Raytheon Co. (USA) . . . . . [8708-14]

Coffee Break . . . . . Wed 2:50 pm to 3:30 pm

SESSION 4

Room: Conv. Ctr. 329 . . . . . Wed 3:30 pm to 5:30 pm

Advances in Long-Wavelength Infrared Window and Dome Processing Technology

Session Chair: **Brian J. Zelinski,** Raytheon Missile Systems (USA)

3:30 pm: **Elemental zinc sulfide (eZnS®) provides a clear view for tri-mode seekers**, Teresa J. Clement, Raytheon Missile Systems (USA) . . . . . [8708-15]

3:50 pm: **Ceramic material with improved mechanical properties for multiband windows and domes**, Keith G. Rozenburg, David Yuhas, SCHOTT North America, Inc. (USA). . . . . [8708-16]

4:10 pm: **Large-scale production of monodispersed ZnS nanopowder for missile window applications**, Duraiswamy Ravichandran, Thomas Shi, Texas Biochemicals, Inc. (USA) . . . . . [8708-17]

4:30 pm: **Large-scale development of ZnS nanoparticles for IR windows and domes**, David Battaglia, Jeremy Lange, Brian Lewis, Lynntech, Inc. (USA)[8708-18]

4:50 pm: **Transparent zinc sulfide processed from nanocrystalline powders**, Todd S. Stefanik, De Gao, Nanocerox, Inc. (USA) . . . . . [8708-19]

5:10 pm: **Infrared-transmitting glass ceramics**, John S. McCloy, Brian J. Riley, David A. Pierce, Pacific Northwest National Lab. (USA) . . . . . [8708-20]

Thursday 2 May

SESSION 5
Room: Conv. Ctr. 329 . . . . . Thu 8:00 am to 10:00 am

Optical Surface Treatments, Coatings, and Microstructures
Session Chair: **John S. McCloy,** Pacific Northwest National Lab. (USA)

8:00 am: **ZnS/diamond composite coatings for infrared transmission applications formed by the aerosol deposition method,** Scooter D. Johnson, Gritz J. Kub, Charles R. Eddy, Jr., U.S. Naval Research Lab. (USA) . . . . . [8708-45]

8:20 am: **Challenges of developing hemispherical ZnS domes coated with a durable antireflection coating**, Shay Joseph, Doron Yadlovker, Evyatar Kassous, Avichi Levi, Orna Marcovich, Arit E. Shinman-Avraham, Hedva Zipin, Rafael Advanced Defense Systems Ltd (Israel) . . . . . [8708-22]

8:40 am: **Recent advancements in antireflective surface structures (ARSS) for mid-infrared optics**, Catalin Florea, Sotera Defense Solutions, Inc. (USA); Lynda E. Busse, Shyam S. Bayya, Brandon Shaw, U.S. Naval Research Lab. (USA); Ish D. Aggarwal, Sotera Defense Solutions, Inc. (USA); Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) . . . . . [8708-23]

9:00 am: **Performance measurements of infrared windows with surface structures providing broadband wide-angle antireflective properties**, Byron Zollars, Steve M. Savoy, Qizhen Xue, Jeremy John, Kyle Hoover, Gabriel Elpers, Roger Wood, Nanohmics, Inc. (USA) . . . . . [8708-24]

9:20 am: **AR microstructures in spinel combining optical and environmental durability in high-energy laser (HEL) exit apertures**, Douglas S. Hobbs, Bruce D. MacLeod, Ernest Sabatino III, TelAztec LLC (USA); Catalin Florea, Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA). . . . . [8708-25]

9:40 am: **AR microstructures in diamond for high-power infrared laser optics**, Bruce D. MacLeod, Douglas S. Hobbs, Ernest Sabatino III, TelAztec LLC (USA); Eugene V. Anoikin, Element Six (USA) . . . . . [8708-26]

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

SESSION 6
Room: Conv. Ctr. 329 . . . . . Thu 10:30 am to 11:30 am

Optical and Mechanical Properties: Measurement and Prediction
Session Chair: **Michael E. Thomas,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

10:30 am: **Optical properties of ZnS in terahertz regime**, Satya R. Ganti, Alfred Univ. (USA); S. K. Sundaram, New York State College of Ceramics at Alfred Univ. (USA); John S. McCloy, Pacific Northwest National Lab. (USA) . . . . [8708-27]

10:50 am: **Integrated computational materials engineering of impact damage in E/O windows and domes**, Brian J. Zelinski, Raytheon Missile Systems (USA); Stefan Bringuier, Toby Shearman, Pierre A. Deymier, Ibrahim Guven, Krishna Muralidharan, Robert G. Erdmann, The Univ. of Arizona (USA) . . . . . [8708-28]

11:10 am: **Peridynamic modeling of damage and fracture in EM windows and domes**, Ibrahim Guven, The Univ. of Arizona (USA); Brian J. Zelinski, Raytheon Missile Systems (USA). . . . . [8708-29]

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

SESSION 7
Room: Conv. Ctr. 329 . . . . . Thu 1:30 pm to 2:50 pm

Novel Applications and Characterization Tools for Optical Windows and Domes
Session Chair: **Joel Askinazi,** UTAS (USA)

1:30 pm: **Design of uniform window heating structures for electro-optical systems**, Matthew W. Pieratt, Sean N. Carney, Melissa Stout, Douglas L. Hibbard, Gregory F. Miller, Exotic Electro-Optics, Inc. (USA) . . . . . [8708-30]

1:50 pm: **Spinel domes with integrated electromagnetic interference protection**, Todd Heil, Greg Slavik, Alex Smith, Jeffrey J. Kutsch, Lynda Renomeron, Igor Vesnovsky, Evans A. LaRoche, Lawrence L. Fehrenbacher, Technology Assessment & Transfer, Inc. (USA); Brian Mayers, Mark Somers, Nano Terra, Inc . . . . . [8708-31]

2:10 pm: **Electromagnetic sensing for deterministic finishing of gridded domes**, Steve L. Galbraith, Resodyn Corp. (USA) . . . . . [8708-32]

2:30 pm: **Multimodal characterization of transparent dome blanks**, John S. Steckenrider, Jojit C. Tancredo, Jeffrey J. Kutsch, Technology Assessment & Transfer, Inc. (USA) . . . . . [8708-33]

Coffee Break . . . . . Thu 2:50 pm to 3:30 pm

SESSION 8
Room: Conv. Ctr. 329 . . . . . Thu 3:30 pm to 5:50 pm

Metrology and Finishing of Flat, Free-Form, and Conformal Optics
Session Chair: **Daniel C. Harris,**
Naval Air Warfare Ctr. Weapons Div. (USA)

3:30 pm: **Ultrasonic processing of hard materials for conformal optics**, Edward M. Fess, OptiPro Systems (USA) . . . . . [8708-35]

3:50 pm: **Deterministic manufacturing of large sapphire windows**, Teddy Lambropoulus, Scott DeFisher, OptiPro Systems (USA) . . . . . [8708-36]

4:10 pm: **Freeform and conformal optical manufacturing**, Scott DeFisher, Frank Wolfs, OptiPro Systems (USA) . . . . . [8708-37]

4:30 pm: **Interferometric tomography metrology of conformal optics**, Mikhail A. Gutin, Olga N. Gutin, Xu-Ming Wang, Dennis Ehlinger, Applied Science Innovations, Inc. (USA) . . . . . [8708-38]

4:50 pm: **Advances in freeform optics fabrication for conformal window and dome applications**, Jessica DeGroote Nelson, Alan Gould, Nathan Smith, Katherine Medicus, Michael Mandina, Optimax Systems, Inc. (USA). . . . . [8708-39]

5:10 pm: **Recent advances in high-performance window fabrication**, James B. Taylor, Richard J. Boland, Edward Gowac, Paul D. Stupik, Marc Tricard, Zygo Corporation (USA) . . . . . [8708-40]

5:30 pm: **Stencil-patterned polymer-hardened aging-resistant infrared-absorbing gold-black films**, Deep R. Panjwani, Mehmet Yasiltas, Nima Nader-Esfahani, Doug Maukonen, Imen Rezadad, Univ. of Central Florida (USA) [8708-41]

5:50 pm: **Novel high-performance polishing process for fabrication of sapphire windows,** Rajiv K. Singh, Kanan Balasundaram, Arul C. Arjunan, Puruhottam Kumar, Sinmat, Inc. (USA). . . . . [8708-46]

Monday - Thursday 29 April - 2 May 2013 • Proceedings of SPIE Vol. 8709

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

Conference Chairs: **J. Thomas Broach,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Jason C. Isaacs,** Naval Surface Warfare Ctr. Panama City Div. (USA)

Program Committee: **Benjamin Barrowes,** U.S. Army Engineer Research and Development Ctr. (USA); **Steven S. Bishop,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Leslie M. Collins,** Duke Univ. (USA); **Gerald J. Dobeck,** Naval Surface Warfare Ctr. Panama City Div. (USA); **James M. Keller,** Univ. of Missouri-Columbia (USA); **Aaron LaPointe,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **John E. McFee,** Defence Research and Development Canada, Suffield (Canada); **Henric Östmark,** Swedish Defence Research Agency (Sweden); **Motoyuki Sato,** Tohoku Univ. (Japan); **Waymond R. Scott Jr.,** Georgia Institute of Technology (USA); **Harold R. Suiter,** Naval Surface Warfare Ctr. Panama City Div. (USA); **Richard C. Weaver,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 336 . . . . . .Mon 8:30 am to 10:10 am

Electromagnetic Induction I

Session Chairs: **Benjamin E. Barrowes,** U.S. Army Engineer Research and Development Ctr. (USA); **Juan Pablo Fernández,** Thayer School of Engineering at Dartmouth (USA)

8:30 am: **Toward a real-time positioning system for a portable EMI sensor**, Juan Pablo Fernández, Thayer School of Engineering at Dartmouth (USA); Benjamin E Barrowes, Kevin A. O'Neill, U.S. Army Engineer Research and Development Ctr. (USA); Irma Shamatava, Fridon Shubitidze, Thayer School of Engineering at Dartmouth (USA) . . . . . [8709-1]

8:50 am: **The Pedemis Instrument: positioning, background subtraction, and APG field results**, Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); Fridon Shibitidze, Dartmouth College (USA); Tomasz M. Grzegorczyk, Delpsi, LLC (USA); Juan Pablo Fernández, Thayer School of Engineering at Dartmouth (USA) and Fernandez Consulting (USA); Kevin A. O'Neill, U.S. Army Engineer Research and Development Ctr. (USA) . . . . . [8709-2]

9:10 am: **Automatic classification of unexploded ordnance applied to Spencer Range live site for 5x5 TEMTADS sensor**, John B. Sigman, Fridon Shubitidze, Dartmouth College (USA) . . . . . [8709-3]

9:30 am: **Spencer range live-site portable EMI sensors target classification**, Irma Shamatava, Juan Pablo Fernández, Dartmouth College (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); Fridon Shubitidze, Dartmouth College (USA) . . . . . [8709-4]

9:50 am: **A new EMI system for detection and classification of challenging targets**, Fridon Shubitidze, Juan Pablo Fernández, Dartmouth College (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); Irma Shamatava, Sky Research, Inc. (USA); David George, G&G Sciences Inc. (USA) . . . . . [8709-5]

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

SESSION 2

Room: Conv. Ctr. 336 . . . . . .Mon 10:40 am to 12:00 pm

Electromagnetic Induction II

Session Chairs: **Jon Miller,** Sky Research, Inc. (USA); **Fridon Shubitidze,** Sky Research, Inc. (USA)

10:40 am: **Targets classification approach applied to active UXO sites**, Fridon Shubitidze, Dartmouth College (USA); Benjamin E. Barrowes, U.S. Army Engineer Research and Development Ctr. (USA); Juan Pablo Fernández, Dartmouth College (USA); Irma Shamatava, Sky Research, Inc. (USA) . . . . . [8709-6]

11:00 am: **Transmitter power efficiency of broadband CW electromagnetic induction sensors**, Waymond R. Scott Jr., Georgia Institute of Technology (USA) . . . . . [8709-7]

11:20 am: **Buried explosive hazard characterization using advanced magnetic and electromagnetic induction sensors**, Jon Miller, Gregory Schultz, Sky Research, Inc. (USA) . . . . . [8709-8]

11:40 am: **In-field quality control of advanced electromagnetic induction data for munitions remediation projects**, Jon Miller, Sky Research, Inc. (USA); Leonard R. Pasion, Sky Research, Inc. (Canada) . . . . . [8709-9]

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

SESSION 3

Room: Conv. Ctr. 336 . . . . . Mon 1:30 pm to 3:10 pm

Electromagnetic Induction III

Session Chairs: **Waymond R. Scott Jr.,** Georgia Institute of Technology (USA); **Daniel C. Heinz,** U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA)

1:30 pm: **Operational field evaluation of the PAC-MAG man-portable magnetometer array**, Joe Keranen, Gregory Schultz, Jon Miller, Sky Research, Inc. (USA). . . . . [8709-10]

1:50 pm: **Optimized coils for electromagnetic induction systems**, Mark A. Reed, Waymond R. Scott Jr., Georgia Institute of Technology (USA). . . . . [8709-11]

2:10 pm: **Location and continuous orientation estimation of buried targets using tensor extraction**, Kyle R. Krueger, Waymond R. Scott Jr., James H. McClellan, Georgia Institute of Technology (USA) . . . . . [8709-12]

2:30 pm: **Constant phase uniform current loop for detection of metallic objects using longitudinal magnetic field projection**, Daniel C. Heinz, Adam W. Melber, U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA); Michael L. Brennan, CACI International Inc. (USA) . . . . . [8709-13]

2:50 pm: **Computational analysis of "detectability" metrics from an EMI sensor for target detection and discrimination**, Isaac S. Chappell, Institute for Defense Analyses (USA) . . . . . [8709-67]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 4

Room: Conv. Ctr. 336 . . . . . Tue 8:30 am to 10:00 am

Sonar Processing and ATR

Session Chairs: **James Tory Cobb, Bradley Marchand,** Naval Surface Warfare Ctr. Panama City Div. (USA)

8:30 am: **Unsupervised domain transfer of latent Dirichlet allocation derived MLO topics from SAS imagery**, Jason C. Isaacs, Naval Surface Warfare Ctr. Panama City Div. (USA). . . . . [8709-14]

8:30 am: **Multi-Image texton selection for sonar image seabed co-segmentation**, James T. Cobb, Naval Surface Warfare Ctr. Panama City Div. (USA); Alina Zare, University of Missouri (USA). . . . . [8709-15]

9:10 am: **Automated detection and classification for underwater optical imagery**, Jo E. Wilbur, Robert J. McDonald, Michael P. Strand, Naval Surface Warfare Ctr. Panama City Div. (USA) . . . . . [8709-17]

9:30 am: **Seabed segmentation and environmentally adaptive ATR**, Jason C. Isaacs, James T. Cobb, Naval Surface Warfare Ctr. Panama City Div. (USA) . . . . . [8709-19]

Coffee/Exhibition Break. . . . . Tue 9:50 am to 11:00 am

SESSION 5
Room: Conv. Ctr. 336 . . . . . Tue 11:00 am to 11:40 am

Man Portable Systems

Session Chairs: **Frank Navish III,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Joe Alexander,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

11:00 am: **Electromagnetic packable (EMPACT) technology for detection and characterization of unexploded ordnance in post-conflict areas**, Gregory Schultz, Jon Miller, Sky Research, Inc. (USA). . . . . [8709-20]

11:20 am: **Deployment of dual-sensor ALIS for humanitarian demining in Cambodia**, Motoyuki Sato, Kazunori Takahashi, Tohoku Univ. (Japan) . . [8709-22]

Lunch/Exhibition Break . . . . . .Tue 11:40 am to 1:40 pm

SESSION 6
Room: Conv. Ctr. 336 . . . . . Tue 1:40 pm to 3:00 pm

Explosive Detection I

Session Chairs: **Daniel W. Pinkham,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Aaron LaPointe,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

1:40 pm: **Stand-off detection of explosives vapors by resonance-enhanced Raman spectroscopy**, Ida Johansson, Ema Ceco, Henric Östmark, Swedish Defence Research Agency (Sweden) . . . . . [8709-24]

2:00 pm: **Infrared photothermal imaging of trace explosives on relevant substrates**, Christopher A. Kendziora, Robert Furstenberg, Michael R. Papantonakis, Viet Q. Nguyen, James Borchert, Jeff M. Byers, R. Andrew McGill, U.S. Naval Research Lab. (USA). . . . . [8709-25]

2:20 pm: **Sensitive NQR techniques for explosive detection**, Georgy V. Mozzhukhin, Kazan State Technical Univ. (Russian Federation); Bulat Rameev, Kazan Physical-Technical Institute (Russian Federation) and Gebze Institute of Technology (Turkey); Oleg Snigirev, Lomonosov Moscow State Univ. (Russian Federation); Yavuz Öztürk, Perihan Aksu, Bekir Akta?, Gebze Institute of Technology (Turkey); Rustem R. Khusnutdinov, Marat Badretdinov, Kazan State Power Engineering Univ. (Russian Federation); Kev M. Salikhov, Kazan Physical-Technical Institute (Russian Federation) . . . . . [8709-26]

2:40 pm: **Low-power stimulated emission nuclear quadrupole resonance detection system utilizing Rabi transitions**, John Apostolos, William Mouyos, AMI Research and Development, LLC (USA); Judy Feng, AMI Research & Development, LLC (USA); Walter Chase, AMI Research and Development, LLC (USA) . . . . . [8709-66]

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

SESSION 7
Room: Conv. Ctr. 336 . . . . . Tue 3:30 pm to 4:10 pm

Explosive Detection II

Session Chairs: **Daniel W. Pinkham,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Aaron LaPointe,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

3:30 pm: **Fast and sensitive recognition of various explosive compounds using Raman spectroscopy and principal component analysis**, Joonki Hwang, Hanyang Univ. (Korea, Republic of); Aaron Park, Chonnam Univ. (Korea, Republic of); Jin Hyuk Chung, Agency for Defense Development (Korea, Republic of); Namhyun Choi, Hanyang Univ. (Korea, Republic of); Jun-Qyu Park, Chonnam Univ. (Korea, Republic of); Soo Gyeong Cho, Agency for Defense Development (Korea, Republic of); Sung-June Baek, Chonnam Univ. (Korea, Republic of); Jaebum Choo, Hanyang Univ. (Korea, Republic of) . . . . . [8709-27]

3:50 pm: **Standoff detection of explosive molecules using nanosecond gated Raman spectroscopy**, Jin Hyuk Chung, Soo Gyeong Cho, Agency for Defense Development (Korea, Republic of). . . . . [8709-28]

Wednesday 1 May

SESSION 8
Room: Conv. Ctr. 336 . . . . . .Wed 8:00 am to 10:20 am

A Melange of Interesting Techniques

Session Chairs: **Steven S. Bishop,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **J. Thomas Broach,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

8:00 am: **Laser driven X-ray sources, their potential for through barrier/ obscured object imaging**, David Neely, James S. Green, Rutherford Appleton Lab. (United Kingdom); Marco Borghesi, Queen's Univ. Belfast (United Kingdom); Ceri M. Brenner, Robert J. Clarke, John L. Collier, Andre Dalcher, Rutherford Appleton Lab. (United Kingdom); Robert M. Deas, Defence Science and Technology Lab. (United Kingdom); Bryan Edwards, Justin Greenhalgh, Cristina Hernandez-Gomez, Rutherford Appleton Lab. (United Kingdom); Zulfikar Najmudin, Imperial College London (United Kingdom); Dean Rusby, Paul McKenna, Univ. of Strathclyde (United Kingdom) . . . . . [8709-30]

8:20 am: **Construction of an ultra-nanocrystalline diamond-based field emitter arrays for a flat-panel x-ray source**, Edwin J. Grant, Chrystian M. Posada, Missouri Univ. of Science and Technology (USA); Ralu Divan, Anirudha V. Sumant, D. Rosenmann, L. Stan, Argonne National Lab. (USA); Aashiesh Avachat, Carlos H. Castano, Hyoung Koo Lee, Missouri Univ. of Science and Technology (USA) . . . . . [8709-31]

8:40 am: **A vehicle threat detection system using correlation analysis and synthesized x-ray images**, Yufeng Zheng, Alcorn State Univ. (USA) . . . . [8709-32]

9:00 am: **Quasi-static high-resolution magnetic-field detection based on dielectric optical resonators**, Tindaro Ioppolo, Edoardo Rubino, Southern Methodist Univ. (USA) . . . . . [8709-33]

9:20 am: **Detection of tunnel excavation using fiber optic reflectometry: experimental validation**, Raphael Linker, Assaf Klar, Technion-Israel Institute of Technology (Israel) . . . . . [8709-34]

9:40 am: **Underwater surveillance system for inspection of strategic coastal installations**, Vladivoj Valkovic, Analysis and Control Technologies, Ltd. (Croatia); Davor Sudac, Jasmina Obhodas, Institut Ruder Boškovic (Croatia). . . . . [8709-35]

10:00 am: **The development of an 'in-belt tomosynthesis' system for cost-effective (3D) baggage screening**, Selina Kolokytha, Robert D. Speller, Stuart Robson, Univ. College London (United Kingdom) . . . . . [8709-69]

Coffee/Exhibition Break. . . . . Wed 10:20 am to 11:00 am

SESSION 9
Room: Conv. Ctr. 336 . . . . . .Wed 11:00 am to 12:00 pm

Radar I

Session Chairs: **Brian C. Barlow,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Ian T. McMichael,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

11:00 am: **Modeling of currents induced in linear conducting objects located at a dielectric interface**, Scott E. Irvine, Defence Research and Development Canada, Suffield (Canada); Pradiv Sooriyadevan, Quality Engineering Test Establishment (Canada) . . . . . [8709-36]

11:20 am: **Response of RF targets to a microwave source**, David C. Heberlein, John Biddle, Bohdan Balko, Institute for Defense Analyses (USA). . . . . [8709-37]

11:40 am: **Polarimetric antenna for ground penetrating radar based on the resistive-vee dipole**, James W. Sustman, Waymond R. Scott Jr., Georgia Institute of Technology (USA) . . . . . [8709-38]

Lunch/Exhibition Break . . . . . .Wed 12:00 pm to 2:00 pm

SESSION 10
Room: Conv. Ctr. 336 . . . . . Wed 2:00 pm to 2:40 pm

Radar II

Session Chairs: **Brian C. Barlow,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Ian T. McMichael,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

2:00 pm: **Millimeter-wave detection of landmines with no-metal content**, Hilmi Ozturk, TÜBITAK National Research Institute of Electronics and Cryptology (Turkey); Hakki Nazli, TÜBITAK Marmara Research Ctr. (Turkey); Korkut Yegin, Yeditepe Univ. (Turkey); Mehmet Sezgin, TÜBITAK Marmara Research Ctr. (Turkey) . . . . . [8709-39]

2:20 pm: **A parametric analysis of time and frequency domain GPR scattering signatures from buried landmine-like targets**, Fabio Giovanneschi, Maria Antonia Gonzalez Huici, Udo Uschkerat, Fraunhofer FHR (Germany) . . . . [8709-40]

Coffee/Exhibition Break. . . . . Wed 2:40 pm to 3:40 pm

SESSION 11
Room: Conv. Ctr. 336 . . . . . Wed 3:40 pm to 5:00 pm

Infrared and Electro-Optics

Session Chairs: **John E. McFee,** Defence Research and Development Canada, Suffield (Canada); **Robert H. Luke,** U.S. Army RDECOM CERDEC NVESD (USA)

3:40 pm: **Optical detection of buried explosive threats: Longitudinal comparison of visible, SWIR, and TIR signal strengths**, James J. Staszewski, Carnegie Mellon Univ. (USA); Charles A. Hibbitts, Johns Hopkins Univ. Applied Physics Lab. (USA); Luke Davis, Carnegie Mellon Univ. (USA). . . . . [8709-42]

4:00 pm: **Comparison of broadband and hyperspectral thermal infrared imaging of buried threat objects**, John E. McFee, Defence Research and Development Canada, Suffield (Canada); Stephen Achal, Alejandra U. Diaz, ITRES Research Ltd. (Canada); Anthony A. Faust, Defence Research and Development Canada, Suffield (Canada). . . . . [8709-43]

4:20 pm: **A broad-band field portable reflectometer to characterize soils and chemical samples**, Eldon Puckrin, Defence Research and Development Canada, Valcartier (Canada); Louis Moreau, Hugo A. Bourque, Real Ouellet, Florent M. Prel, Claude B. Roy, Christian A. Vallieres, Guillaume Thériault, ABB Analytical Measurement (Canada) . . . . . [8709-44]

4:40 pm: **Thermal inertia mapping of below ground objects and voids**, Nancy K. Del Grande, Brian M. Ascough, Geo-Temp Corp. (USA); Richard L. Rumpf, Rumpf Associates International (USA) . . . . . [8709-45]

Thursday 2 May

SESSION 12
Room: Conv. Ctr. 336 . . . . . Thu 8:20 am to 10:00 am

Signal Processing: IR

Session Chairs: **Robert H. Luke III,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **James M. Keller,** Univ. of Missouri-Columbia (USA)

8:20 am: **Buried target detection in forward looking IR (FLIR) images using Shearlet features**, Mihail Popescu, Alexander T. Paino, Brian Thomson, James M. Keller, Univ. of Missouri-Columbia (USA) . . . . . [8709-46]

8:40 am: **Using evolutionary computation to optimize an SVM used in detecting buried objects in FLIR imagery**, Alexander T. Paino, Mihail Popescu, James M. Keller, Kevin E. Stone, Univ. of Missouri-Columbia (USA) . . . . . [8709-47]

9:00 am: **Automatic detection system for buried explosive hazards in FL-LWIR based on soft feature extraction using a bank of Gabor energy filters**, Stanton R. Price, Derek T. Anderson, Mississippi State Univ. (USA); Robert H. Luke, U.S. Army RDECOM CERDEC, Night Vision & Electronic Sensors Directorate (USA); Kevin E. Stone, James M. Keller, Univ. of Missouri-Columbia (USA) . . . . . [8709-48]

9:20 am: **Moving beyond flat earth: dense 3D scene reconstruction from a single FL-LWIR camera**, Kevin E. Stone, James M. Keller, Univ. of Missouri-Columbia (USA); Derek T. Anderson, Mississippi State Univ. (USA) . . . . . [8709-49]

9:40 am: **A novel framework for processing forward looking infrared imagery with application to buried threat detection**, Jordan M. Malof, Kenneth D. Morton Jr., Leslie M. Collins, Peter A. Torrione, Duke Univ. (USA) . . . . . [8709-51]

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

SESSION 13
Room: Conv. Ctr. 336 . . . . . Thu 10:30 am to 11:50 am

Signal Processing: EM Sensors

Session Chairs: **Richard C. Weaver,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Peter A. Torrione,** Duke Univ. (USA)

10:30 am: **Sparse model inversion and processing of spatial frequency-domain electromagnetic induction sensor array data for improved landmine discrimination**, Stacy L. Tantum, Kenneth A. Colwell, Duke Univ. (USA); Waymond R. Scott Jr., Georgia Institute of Technology (USA); Peter A. Torrione, Leslie M. Collins, Kenneth D. Morton Jr., Duke Univ. (USA) . . . . . [8709-52]

10:50 am: **Possibilistic K-nearest neighbor classifier for landmine discrimination**, Josephine Dula, Univ. of Missouri (USA); Alina Zare, Dominic K. Ho, Univ. of Missouri-Columbia (USA); Paul D. Gader, Univ. of Florida (USA) . . . . . [8709-53]

11:10 am: **Sweep detection and alignment**, Peter J. Dobbins, Univ. of Florida (USA) . . . . . [8709-54]

11:30 am: **Material identification reflectivity kernel (MIRK), real-time processing for in-stride sea mine countermeasures**, John D. Pearson, Prometheus Inc. (USA) . . . . . [8709-55]

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

SESSION 14
Room: Conv. Ctr. 336 . . . . . Thu 1:20 pm to 3:00 pm

Signal Processing for GPR I

Session Chairs: **Pete Howard,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Paul D. Gader,** Univ. of Florida (USA)

1:20 pm: **Detection of shallow buried objects using an autoregressive model on the ground penetrating radar signal**, Daniel Nabelek, Dominic K. Ho, Univ. of Missouri-Columbia (USA) . . . . . [8709-56]

1:40 pm: **Evaluation of landmine detection performance applying two different algorithms to GPR field data**, Roi Mendez Rial, Udo Uschkerat, Fernando Rial, Maria Antonia Gonzalez Huici, Fraunhofer FHR (Germany) . . . . . [8709-57]

2:00 pm: **A run packing technique for multiple sensor fusion**, Taylor Glenn, Joseph N. Wilson, Univ. of Florida (USA) . . . . . [8709-59]

2:20 pm: **Multiple instance learning for landmine detection with ground penetrating radar using hidden Markov models**, Achut Manandhar, Kenneth D. Morton Jr., Leslie M. Collins, Peter A. Torrione, Duke Univ. (USA). . . . . [8709-60]

2:40 pm: **Multiple instance learning for hidden Markov models: application to landmine detection**, Jeremy Bolton, Paul D. Gader, Univ. of Florida (USA) . . . . . [8709-61]

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

SESSION 15
Room: Conv. Ctr. 336 . . . . . Thu 3:30 pm to 4:50 pm

Signal Processing for GPR II

Session Chairs: **Joe Wilson,** Federal Signal Corp. (USA); **Kenneth D. Morton Jr.,** Duke Univ. (USA)

3:30 pm: **Robust entropy-guided image segmentation for ground detection in GPR**, John W. Roberts, Yakov P. Shkolnikov, Jonathan Varsanik, Timothy Chevalier, Exponent, Inc. (USA) . . . . . [8709-62]

3:50 pm: **GPR preprocessing optimization with signal-to-clutter metrics**, Jonathan Varsanik, John W. Roberts, Timothy Chevalier, Adam D. Mulliken, Exponent, Inc. (USA) . . . . . [8709-63]

4:10 pm: **Application of image categorization methods for buried threat detection in GPR data**, Rayn T. Sakaguchi, Kenneth D. Morton Jr., Leslie M. Collins, Peter A. Torrione, Duke Univ. (USA). . . . . [8709-64]

4:30 pm: **Embedding the multiple instance problem into linear classifiers: applications to landmine detection with ground penetrating radar**, Jeremy Bolton, Univ. of Florida (USA). . . . . [8709-65]

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

Conference Chair: **Augustus Way Fountain III,** U.S. Army Edgewood Chemical Biological Ctr. (USA)

Program Committee: **Jerome J. Braun,** MIT Lincoln Lab. (USA); **John C. Carrano,** Carrano Consulting (USA); **Christopher C. Carter,** Johns Hopkins Univ. Applied Physics Lab. (USA); **Harry Ing,** Bubble Technology Industries, Inc. (Canada); **Matthew T. Griffin,** General Dynamics Armament and Technical Products (USA); **Jason A. Guicheteau,** U.S. Army Edgewood Chemical Biological Ctr. (USA); **Eric J. Houser,** U.S. Dept. of Homeland Security (USA); **Harold R. McHugh,** U.S. Dept. of Energy (USA); **Aaron LaPointe,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Paul M. Pellegrino,** U.S. Army Research Lab. (USA); **Michael W. Petryk,** Defence Research and Development Canada, Suffield (Canada); **James G. Placke Jr.,** Y-12 National Security Complex (USA); **Cynthia R. Swim,** U.S. Army Edgewood Chemical Biological Ctr. (USA); **Anna Tedeschi,** Strategic Analysis, Inc. (USA), U. S. Dept. of Homeland Security {United States); **Steven W. Waugh,** Defense Threat Reduction Agency (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 337 . . . . . Tue 8:30 am to 9:40 am

Advances in Spectroscopic Chemical Detection I

Session Chair: **Christopher C. Carter,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

8:30 am: **Mid- and short- wave infrared hyperspectral imaging of hazardous liquids** *(Invited Paper)*, Chris R. Howle, Rhea Clewes, Defence Science and Technology Lab. (United Kingdom); Keith Ruxton, M Squared Lasers Ltd. (United Kingdom); Jason A. Guicheteau, Darren K. Emge, U.S. Army Edgewood Chemical Biological Ctr. (USA); Bill Miller, Gordon Robertson, Graeme P. A. Malcolm, Gareth T. Maker, M Squared Lasers Ltd. (United Kingdom). . . . . [8710-1]

9:00 am: **Standoff chemical D&Id with extended LWIR hyperspectral imaging spectroradiometer**, Florent M. Prel, Louis Moreau, ABB Analytical Measurement (Canada); Hugo Lavoie, François Bouffard, Jean-Marc Thériault, Defence Research and Development Canada, Valcartier (Canada); Christian A. Vallieres, Claude B. Roy, ABB Analytical Measurement (Canada); Denis Dubé, Defence Research and Development Canada, Valcartier (Canada) . . . . . [8710-2]

9:20 am: **Stand-off identification and mapping of liquid surface contaminations by passive hyperspectral imaging**, René Braun, Roland Harig, Bruker Optik GmbH (Germany). . . . . [8710-6]

Coffee/Exhibition Break. . . . . .Tue 9:40 am to 10:40 am

SESSION 2

Room: Conv. Ctr. 337 . . . . . Tue 10:40 am to 12:00 pm

Advances in Spectroscopic Chemical Detection II

Session Chair: **Christopher C. Carter,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

10:40 am: **Video-rate spectral imaging of gas leaks in the longwave infrared**, Nathan A. Hagen, Robert T. Kester, Christopher Morlier, Rebellion Photonics (USA) . . . . . [8710-7]

11:00 am: **Improved detection and false alarm rejection for chemical vapors using passive hyperspectral imaging**, William J. Marinelli, Physical Sciences Inc. (USA); Rex K. Miyashiro, Research Support Instruments, Inc. (USA); Christopher M. Gittins, Daisei Konno, Shing D. Chang, Physical Sciences Inc. (USA); Brad Perkins, Matt Farr, Smiths Detection Edgewood (USA) . . . . . [8710-8]

11:20 am: **Standoff chemical detection with a parts per million level calibrated detection sensitivity**, Xing Chen, Fow-Sen Choa, Univ. of Maryland, Baltimore County (USA); Ellen L. Holthoff, Paul M. Pellegrino, U.S. Army Research Lab. (USA); Jenyu Fan, Adtech Optics Inc. (USA). . . . . [8710-9]

11:40 am: **CWA stand-off detection, a new figure-of-merit: the field surface scanning rate,** Philippe F. Bernascolle, Bertin Technologies (France) . . . [8710-10]

Lunch/Exhibition Break . . . . . .Tue 12:00 pm to 2:00 pm

SESSION 3

Room: Conv. Ctr. 337 . . . . . Tue 2:00 pm to 3:00 pm

Advances in Spectroscopic Chemical Detection III

Session Chair: **Matthew T. Griffin,**
General Dynamics Armament and Technical Products (USA)

2:00 pm: **Performance comparison of microphone and reflector array structures for real-time and outdoor photoacoustic chemical sensing**, Joshua A. Lay, Univ. of Maryland, Baltimore (USA); Xing Chen, Fow-Sen Choa, Univ. of Maryland, Baltimore County (USA) . . . . . [8710-12]

2:20 pm: **LIBS plasma model validation**, Steven T. Griffin, Brandon Dent, Univ. of Memphis (USA) . . . . . [8710-13]

2:40 pm: **Methodology for the passive detection and discrimination of chemical and biological aerosols**, William J. Marinelli, Kirill N. Shokhirev, Daisei Konno, David C. Rossi, Physical Sciences Inc. (USA); Martin B. Richardson, BAE Systems, Inc. (USA). . . . . [8710-14]

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

SESSION 4

Room: Conv. Ctr. 337 . . . . . Tue 3:30 pm to 5:30 pm

Advanced in Chemical Point Detection

Session Chair: **Matthew T. Griffin,**
General Dynamics Armament and Technical Products (USA)

3:30 pm: **Sampling and analysis of chemical particulates on surfaces.**, Kenneth J. Ewing, Jas S. Sanghera, Daniel Gibson, U.S. Naval Research Lab. (USA); Fritz Miklos, Sotera Defense Solutions, Inc. (USA) . . . . . [8710-15]

3:50 pm: **Smart phones: platform enabling modular, chemical, biological, and explosives sensing**, Amethist S. Finch, Justin R. Bickford, Marvin A. Conn, Thomas J. Proctor, Dimitra N. Stratis-Cullum, U.S. Army Research Lab. (USA) . . . . . [8710-16]

4:10 pm: **Paper SERS chromatography for detection of trace analytes in complex samples**, Wei W. Yu, Ian M. White, Univ. of Maryland, College Park (USA) . . . . . [8710-17]

4:30 pm: **New SERS substrates enabled by confining gold nanoparticles in mesopores of SBA-15 for sensitive chemical detections**, Yongheng Zhu, Univ. of Washington (USA) and Shanghai Univ. (China); Jiaqiang Xu, Shanghai Univ. (China); Shaoyi Jiang, Qiuming Yu, Univ. of Washington (USA) . . . . . [8710-18]

4:50 pm: **Development of SERS monitoring of fuel markers to prevent fraud**, Timothy G. Wilkinson, John Clarkson, Peter C. White, Nicholas Meakin, DeCipher Pte Ltd. (United Kingdom); Ken McDonald, Ocean Optics (United Kingdom) . . . . . [8710-19]

5:10 pm: **Ppb detection of Sarin surrogate in liquid solutions**, Matthieu Hamel, Jennifer Hamoniaux, Licinio Rocha, Stéphane Normand, Commissariat à l'Énergie Atomique (France) . . . . . [8710-20]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

CN, C2 emission studies of methyl- and dinitro-imidazoles using femtosecond LIBS technique, Soma Venugopal Rao, Nageswar Rao Epuru, Sreedhar Sunku, Manoj Kumar Gundawar, Surya Prakash Tewari, Univ. of Hyderabad (India) . . . . . [8710-64]

Femtosecond LIBS studies of Nitropyrazoles, Soma Venugopal Rao, Nageswara Rao Epuru, Sreedhar Sunku, Manoj Kumar Gundawar, Surya Prakash Tewari, Univ. of Hyderabad (India) . . . . . [8710-65]

Controls characterization of predictor corrector-based LIBS data collection, Steven T. Griffin, Alex Sanders, Univ. of Memphis (USA) . . . . . [8710-66]

An apparatus for the measurement of re-suspension of particles from realistic surfaces, Jonathan M. Richardson, Trina R. Vian, Benjamin L. Ervin, Jason J. Han, MIT Lincoln Lab. (USA) . . . . . [8710-67]

Wednesday 1 May

SESSION 5
Room: Conv. Ctr. 337 . . . . . .Wed 8:00 am to 10:00 am

Advances in Standoff Explosives Detection I
Session Chair: **Anna Tedeschi,** Strategic Analysis, Inc. (USA)

8:00 am: **Infrared hyperspectral standoff detection of explosives**, Frank Fuchs, Stefan Hugger, Jan P. Jarvis, Verena Blattmann, Michel Kinzer, Quankui K. Yang, Ralf Ostendorf, Wolfgang Bronner, Rachid Driad, Rolf Aidam, Joachim H. Wagner, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) . . . . . [8710-22]

8:20 am: **Quantum cascade laser (QCL) FM spectroscopy of explosives**, Zach Gutmann, Trocia Clasp, Taylor Ingle, Roger Buchanan, Scott Reeve, Arkansas State Univ. (USA) . . . . . [8710-23]

8:40 am: **Active infrared hyperspectral imaging of solid particles on surfaces**, Anish K. Goyal, Travis Myers, Melissa Spencer, Matthew Aernecke, Rod R. Kunz, Stella Park, Bryan E. Tipton, Michael W. Kelly, MIT Lincoln Lab. (USA); Ellen L. Holthoff, Mikella E. Farrell, Paul M. Pellegrino, U.S. Army Research Lab. (USA) . . . . . [8710-24]

9:00 am: **Hazardous material analysis using mid-wave infrared hyperspectral imagining techniques**, Keith Ruxton, Gordon Robertson, Bill Miller, Graeme P. A. Malcolm, Gareth T. Maker, M Squared Lasers Ltd. (United Kingdom) . . . . [8710-25]

9:20 am: **Thz Raman™ spectroscopy for explosives, chemical, and biological detection**, James T. Carriere, Frank Havermeyer, Randy A. Heyler, Ondax, Inc. (USA) . . . . . [8710-26]

9:40 am: **Chemical explosives threat analyzer**, Andrey V. Muraviev, Doug Maukonen, Christopher J. Fredricksen, Gautam Medhi, EMX International, LLC (USA); Pedro N. Figueiredo, Robert E. Peale, Univ. of Central Florida (USA); Dan Graybeal, Veracity Labs, Inc. (USA) . . . . . [8710-27]

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

SESSION 6
Room: Conv. Ctr. 337 . . . . . .Wed 10:30 am to 12:10 pm

Advances in Standoff Explosives Detection II
Session Chair: **Anna Tedeschi,** Strategic Analysis, Inc. (USA)

10:30 am: **LightGuard: hyperspectral imaging detector for explosives, chemical threats, and narcotics**, Matthew P. Nelson, ChemImage Corp. (USA) . . . . . [8710-28]

10:50 am: **Investigation of short cavity CRDS noise terms by optical correlation**, Steven T. Griffin, Jason Fathi, Univ. of Memphis (USA) . . . . . [8710-29]

11:10 am: **Next-generation hazard detection via ultrafast coherent anti-Stokes Raman spectroscopy**, John J. Brady, Paul M. Pellegrino, U.S. Army Research Lab. (USA) . . . . . [8710-30]

11:30 am: **Rejection of fluorescence from Raman spectra of explosives by picosecond optical Kerr gating**, Ida Johansson, Markus Nordberg, Henric Östmark, Swedish Defence Research Agency (Sweden) . . . . . [8710-31]

11:50 am: **Spatiotemporal evolution of plasma molecular emission following laser ablation of explosive analogs**, Jonathan A. Merten, Arkansas State Univ. (USA); Christian G. Parigger, The Univ. of Tennessee Space Institute (USA); Cheyenne J. Sheppard, Matthew P. Jones, Arkansas State Univ. (USA); Susan D. Allen, Embry-Riddle Aeronautical Univ. (USA) . . . . . [8710-32]

Lunch/Exhibition Break . . . . . Wed 12:10 pm to 2:00 pm

SESSION 7
Room: Conv. Ctr. 337 . . . . . Wed 2:00 pm to 3:00 pm

Applications of Explosives Detection I
Session Chair: **Anna Tedeschi,** Strategic Analysis, Inc. (USA)

2:00 pm: **Real-world particulate explosives test coupons for optical detection applications**, Viet Q. Nguyen, Michael R. Papantonakis, Robert Furstenberg, Christopher A. Kendziora, R. Andrew McGill, U.S. Naval Research Lab. (USA) . . . . . [8710-33]

2:20 pm: **Optimized aerodynamic sampling of shoes to support trace explosives detection**, Matthew Staymates, Greg Gillen, Jessica Grandner, National Institute of Standards and Technology (USA); Stefan R. Lukow, U.S. Dept. of Homeland Security (USA) . . . . . [8710-35]

2:40 pm: **Infrared (1-10 µm) atomic and molecular emission signatures from energetic materials using laser-induced breakdown spectroscopy**, Eric Kumi-Barimah, Uwe H. Hommerich, EiEi Brown, Hampton Univ. (USA); Clayton S. Yang, Battelle East Science and Technology Ctr. (USA); Sudhir B. Trivedi, Brimrose Corp. of America (USA); Alan C. Samuels, Arnold P. Snyder, Battelle East Science and Technology Ctr. (USA) . . . . . [8710-36]

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

SESSION 8
Room: Conv. Ctr. 337 . . . . . Wed 3:30 pm to 5:50 pm

Applications of Explosives Detection II
Session Chair: **Anna Tedeschi,** Strategic Analysis, Inc. (USA)

3:30 pm: **Feasibility studies on explosive detection and homeland security applications using a combined neutron and x-ray computed tomography system**, Vaibhav Sinha, Hyoung K. Lee, Missouri Univ. of Science and Technology (USA) . . . . . [8710-37]

3:50 pm: **A review of sensor data fusion for explosives and weapons detection**, Michael C. Kemp, Iconal Technology Ltd. (United Kingdom) . . . . . [8710-38]

4:10 pm: **A simulation study of detection of weapon of mass destruction based on radar**, Ershad Sharifahmadian, Yoonsuk Choi, Shahram Latifi, Univ. of Nevada, Las Vegas (USA) . . . . . [8710-39]

4:30 pm: **Dual-excitation-wavelength resonance-Raman explosives detector**, Balakishore Yellampalle, Mikhail Sluch, Hai-Shan Wu, Robert B. Martin, William B. McCormick, Robert V. Ice, Brian E. Lemoff, West Virginia High Technology Consortium Foundation (USA) . . . . . [8710-40]

4:50 pm: **Explosives detection using quantum cascade laser spectroscopy**, John R. Castro-Suarez, Yadira S. Pollock, Samuel P. Hernandez, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8710-41]

5:10 pm: **Explosive vapor detection payload for small robots**, Phil J. Stimac, Michael Pettit, John P. Wetzel, John W. Haas III, Applied Research Associates, Inc. (USA) . . . . . [8710-42]

5:30 pm: **Investigation of molecular and elemental species dynamics in NTO, TNT, and ANTA using femtosecond LIBS**, Soma Venugopal Rao, Sreedhar Sunku, Nageswars R. Epuru, Manoj Kumar Gundawar, Surya Prakash Tewari, Univ. of Hyderabad (India) . . . . . [8710-43]

Thursday 2 May

SESSION 9
Room: Conv. Ctr. 337 . . . . . Thu 8:00 am to 10:00 am

Advances in Biological Detection I
Session Chair: **Jerome J. Braun,** MIT Lincoln Lab. (USA)

8:00 am: **Models to support active sensing of biological aerosol clouds**, Andrea M. Brown, Jeffrey M. Kalter, Elizabeth C. Corson, Jerome U. Gilberry, Zahra Chaudhry, Nathan T. Boggs, David M. Brown, Michael E. Thomas, Christopher C. Carter, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8710-44]

8:20 am: **System to study the effects of atmospheric environmental conditions on bioaerosol viability and fluorescence spectra**, Yongle Pan, U.S. Army Research Lab. (USA); Joshua L. Santarpia, Sandia National Labs. (USA); Don Collins, Texas A&M Univ. (USA); Shanna A. Ratnesar-Shumate, Johns Hopkins Univ. Applied Physics Lab. (USA); Nathan Taylor, Carlos Antonietti, Jill Matus, Texas A&M Univ. (USA); Steven C. Hill, Mark Coleman, Chatt Williamson, U.S. Army Research Lab. (USA); Christopher Bare, Sean Kinahan, Johns Hopkins Univ. Applied Physics Lab. (USA); Andres Sanchez, Crystal Reed, Sandia National Labs. (USA) . . . . . [8710-45]

8:40 am: **The multiwavelength aerosol signature testbed for BSL3 (MAST-3)**, Jonathan M. Richardson, Robert Martinez, Joseph J. Lacirignola, Edward Froehlich, Andreas Gennis, Tiffany S. Ko, MIT Lincoln Lab. (USA); Richard G. Vanderbeek, Mary M. Wade, Todd M. Sickler, Amber M. Prugh, U.S. Army Edgewood Chemical Biological Ctr. (USA) . . . . . [8710-46]

9:00 am: **Spectroscopic detection of microorganisms**, Iris Vazquez-Ayala, Naval Explosive Ordnance Disposal Technology Div. (USA); Amira C. Padilla-Jiménez, Univ. de Puerto Rico Mayagüez (USA); Jorge Castellanos, Univ. of Puerto Rico Mayagüez (USA); William Ortiz-Rivera, Nataly Y. Galán-Freyle, Carlos Ríos-Velázquez, Univ. de Puerto Rico Mayagüez (USA); Kathrine Burns, Ryan S. Mackie, Naval Surface Warfare Ctr. Dahlgren Div. (USA); Samuel P. Hernandez-Rivera, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8710-47]

9:20 am: **Understanding water uptake in bioaerosols using laboratory measurements, field tests, and modeling**, Zahra Chaudhry, Shanna A. Ratnesar-Shumate, Thomas J. Buckley, Jeffrey M. Kalter, Jerome U. Gilberry, Jonathan P. Eshbaugh, Christopher C. Carter, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8710-48]

9:40 am: **Wavelength resolved polarized elastic scatter measurements from micron-sized single particles**, Vasanthi Sivaprakasam, Jozsef Czege, Jay D. Eversole, U.S. Naval Research Lab. (USA) . . . . . [8710-49]

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

SESSION 10
Room: Conv. Ctr. 337 . . . . . Thu 10:30 am to 11:30 am

Advances in Biological Detection II
Session Chair: **Jerome J. Braun,** MIT Lincoln Lab. (USA)

10:30 am: **Micro-organisms detection on different substrates using quantum cascade laser spectroscopy**, Amira C. Padilla Jiménez, Univ. de Puerto Rico Mayagüez (USA); Iris Vazquez-Ayala, Naval Explosive Ordnance Disposal Technology Div. (USA); John R. Castro-Suarez, Carlos Ríos-Velázquez, Nataly Y. Galán-Freyle, Leonardo C. Pacheco-Londoño, Univ. de Puerto Rico Mayagüez (USA); Ryan S. Mackie, Kathrine Burns, Naval Surface Warfare Ctr. Dahlgren Div. (USA); Samuel P. Hernandez-Rivera, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8710-50]

10:50 am: **Metaproteomics analyses as diagnostic tool for differentiation of Escherichia coli strains in outbreaks**, Rabih E. Jabbour, U.S. Army Edgewood Chemical Biological Ctr. (USA) . . . . . [8710-51]

11:10 am: **Advances in synthetic peptides reagent discovery**, Dimitra N. Stratis-Cullum, Bryn L. Adams, Deborah A. Sarkes, Amethist S. Finch, Margaret M. Hurley, Michael S. Sellers, Matthew B. Coppock, U.S. Army Research Lab. (USA); Candice R. Warner, U.S. Army Edgewood Chemical Biological Ctr. (USA) . . . . . [8710-52]

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

SESSION 11
Room: Conv. Ctr. 337 . . . . . Thu 1:30 pm to 3:10 pm

Advances in Radiological and Nuclear Detection I
Session Chair: **James G. Placke,** Y-12 National Security Complex (USA)

1:30 pm: **The MODES_SNM project**, Alessandro Curioni, ETH Zurich (Switzerland) . . . . . [8710-54]

1:50 pm: **Combined, solid-state molecular property and gamma spectrometers for CBRN&E detection**, Ben S. Rogers, Nevada Nanotech Systems, Inc. (USA); Jay W. Grate, Pacific Northwest National Lab. (USA); Brett Pearson, Nevada Nanotech Systems, Inc. (USA); Neal B. Gallagher, Barry M. Wise, Eigenvector Research, Inc. (USA); Ralph Whitten, Jesse D. Adams, Nevada Nanotech Systems, Inc. (USA). . . . . [8710-55]

2:10 pm: **Design and performance of the radiation observations with communications (ROC) sensor**, Dimosthenis C. Katsis, Athena Energy Corp. (USA); David A. Burns, Marc S. Litz, John A. Russo, James J. Carroll, U.S. Army Research Lab. (USA) . . . . . [8710-56]

2:30 pm: **Study and understanding of n/γ discrimination processes in organic plastic scintillators**, Matthieu Hamel, Pauline Blanc, Licinio Rocha, Stéphane Normand, Commissariat à l'Énergie Atomique (France); Robert B. Pansu, Ecole Normale Supérieure de Cachan (France) . . . . . [8710-57]

2:50 pm: **Probing the gamma-scintillation process in semiconductor nanomaterials using ultrafast transient cathodoluminescence**, Jeffrey M. Pietryga, Lazaro A. Padilha, Wan Ki Bae, Victor I. Klimov, Los Alamos National Lab. (USA); Richard D. Schaller, Argonne National Lab. (USA) and Northwestern Univ. (USA) . . . . . [8710-58]

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

SESSION 12
Room: Conv. Ctr. 337 . . . . . Thu 3:40 pm to 5:40 pm

Advances in Radiological and Nuclear Detection II
Session Chair: **Harry Ing,** Bubble Technology Industries, Inc. (Canada)

3:40 pm: **Understanding the polymorphic nature of UO3 to infer process history**, Lucas E. Sweet, Thomas A. Blake, James E. Szecsody, David E. Meier, Jon M. Schwantes, Timothy J. Johnson, Pacific Northwest National Lab. (USA) . . . . . [8710-59]

4:00 pm: **Large-area high-efficiency self-powered solid state neutron detector**, Rajendra Dahal, Kuan-Chih Huang, James J. Q. Lu, Yaron Danon, Ishwara Bhat, Rensselaer Polytechnic Institute (USA) . . . . . [8710-60]

4:20 pm: **Continuous P-N junction with extremely-low leakage current for solid state neutron detector applications**, Kuan-Chih Huang, Rajendra Dahal, James J. Q. Lu, Yaron Danon, Ishwara Bhat, Rensselaer Polytechnic Institute (USA)[8710-61]

4:40 pm: **Neutron/gamma pulse shape discrimination (PSD) in plastic scintillators with digital PSD electronics**, Duane L. Simonson, Anthony L. Hutcheson, Marc Christophersen, Bernard F. Phlips, Nicholas A. Charipar, Alberto Piqué, U.S. Naval Research Lab. (USA) . . . . . [8710-62]

5:00 pm: **An imaging neutron/gamma-ray spectrometer**, Amanda Madden, Peter F. Bloser, The Univ. of New Hampshire (USA); Dominique Fourguette, Liane Larocque, Michigan Aerospace Corp. (USA); Jason S. Legere, The Univ. of New Hampshire (USA); Matt Lewis, Michigan Aerospace Corp. (USA); Mark L. McConnell, Marissa Rousseau, James M. Ryan, The Univ. of New Hampshire (USA) . . . . . [8710-63]

5:20 pm: **Progress in the development of CdMnTe nuclear radiation detectors**, Ramin Rafiei, The Uni.v of Western Australia (Australia); Mark Reinhard, Australian Nuclear Science and Technology Organisation (Australia); K. H. Kim, Univ. of Korea (Korea, Republic of); Dale A. Prokopovich, Australian Nuclear Science and Technology Organisation (Australia); David Boardman, Australian Nuclear Science and Technology Organisation (United Kingdom); Adam Sarbutt, Australian Nuclear Science and Technology Organisation (Australia); Aleksey E. Bolotnikov, Ralph B. James, Brookhaven National Lab. (USA) . . . . . [8710-68]

Friday 3 May

SESSION 13
Room: Conv. Ctr. 317 . . . . . Fri 8:30 am to 9:50 am

NOTE ROOM CHANGE

Novel Micro/Nano Approaches to the CBRNE Detection Problem

Joint Session with Conferences 8725 and 8710

Session Chairs: **Joan A. Hoffmann, Stergios J. Papadakis,** Johns Hopkins Univ. Applied Physics Lab. (USA)

8:30 am: **Biointerfaced graphene nanosensors** *(Invited Paper)*, Michael C. McAlpine, Princeton Univ. (USA). . . . . [8725-74]

9:10 am: **Energy-transfer based nanocomposites for radiation detection** *(Invited Paper)*, Wei Chen, The Univ. of Texas at Arlington (USA) . . . . . [8725-76]

9:30 am: **SpinDx™: a rapid, sensitive, and deployable platform for diagnostics of biological and radiological threats** *(Invited Paper)*, Chung-Yan Koh, Stanley A. Langevin, Matthew E. Piccini, Anup K. Singh, Sandia National Labs., California (USA) . . . . . [8725-77]

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

SESSION 14
Room: Conv. Ctr. 317 . . . . . Fri 10:30 am to 12:00 pm

NOTE ROOM CHANGE

Micro- and Nanotechnologies for Standoff Detection I

Joint Session with Conferences 8725 and 8710

Session Chairs: **Michael K. Rafailov,** Univ. of Alberta (Canada); **Thomas G. Thundat,** Univ. of Alberta (Canada)

10:30 am: **Non-intrusive telemetry applications in the oilsands: from visible light and x-ray video, to acoustic imaging and spectroscopy** *(Keynote Presentation)*, John M. Shaw, Univ. of Alberta (Canada) . . . . . [8725-78]

11:00 am: **Micro- and nanostructure of asphaltene aggregates in situ characterization via monochromatic x-ray microtomography** *(Invited Paper)*, Michael K. Rafailov, Univ. of Alberta (Canada) and The Reger Group (USA); Victor E. Asadchikov, Alexei V. Buzmakov, Denis A. Zolotov, Anna S. Osadchaya, Arsen E. Muslimov, A.V. Shubnikov Institute of Crystallography (Russian Federation); Svetlana A. Rubtsova, Ctr. for Nano-Technology (Russian Federation) . . . [8725-79]

11:20 am: **Chemical sensing and imaging in microfluidic pore network structures relevant to natural carbon cycling and industrial carbon sequestration** *(Invited Paper)*, Jay W. Grate, Changyong Zhang, Michael Wilkins, Marvin G. Warner, Norman C. Anheier Jr., Jonathan D. Suter, Ryan Kelly, Mart Oostrom, Pacific Northwest National Lab. (USA) . . . . . [8725-80]

11:40 am: **Intercalation of Asphaltene nano-aggregates into natural and artificial substrates** *(Invited Paper)*, Michael K. Rafailov, Univ. of Alberta (Canada); Vladimir F. Sapega, A.P. Karpinsky Russian Geological Research Institute (Russian Federation) . . . . . [8725-81]

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

SESSION 15
Room: Conv. Ctr. 317 . . . . . Fri 1:00 pm to 2:30 pm

NOTE ROOM CHANGE

Micro- and Nanotechnologies for Standoff Detection II

Joint Session with Conferences 8725 and 8710

Session Chairs: **Michael K. Rafailov,** Univ. of Alberta (Canada); **Thomas G. Thundat,** Univ. of Alberta (Canada)

1:00 pm: **Micro- and nanodevices in millimetre and sub-millimetre imaging systems** *(Keynote Presentation)*, Roger Appleby, Queen's Univ. Belfast (United Kingdom) . . . . . [8725-82]

1:30 pm: **Airborne nanoparticle detection with nanomechanical string resonators** *(Invited Paper)*, Silvan Schmid, Maksymilian Kurek, Anja Boisen, Technical Univ. of Denmark (Denmark). . . . . [8725-83]

1:50 pm: **Antenna coupled detectors for 2D staring focal plane arrays** *(Invited Paper)*, Michael A. Gritz, Leonard P. Chen, Robert Burkholder, Raytheon Co. (USA); Brian A. Lail, Florida Institute of Technology (USA); Borys P. Kolasa, Raytheon Co. (USA) . . . . . [8725-84]

2:10 pm: **Diffraction limit investigation with sub-wavelength pixels** *(Invited Paper)*, Alain Bergeron, Marc Terroux, Linda Marchese, Denis G. Dufour, Loic Le Noc, Claude Chevalier, INO (Canada). . . . . [8725-85]

SESSION 16
Room: Conv. Ctr. 317 . . . . . Fri 2:30 pm to 3:50 pm

NOTE ROOM CHANGE

Micro- and Nanotechnologies for Standoff Detection III

Joint Session with Conferences 8725 and 8710

Session Chairs: **Michael K. Rafailov,** Univ. of Alberta (Canada); **Thomas G. Thundat,** Univ. of Alberta (Canada)

2:30 pm: **Raman and photothermal spectroscopies for explosive detection** *(Invited Paper)*, Eric Finot, Thibault Brulé, Padmnabh Rai, Alexandre Bouhélier, Univ. de Bourgogne (France); Thomas G. Thundat, Univ. of Alberta (Canada) . . . . . [8725-87]

2:50 pm: **Comparison of thermal and laser sources in standoff IR detection experiments** *(Invited Paper)*, Samuel P. Hernandez-Rivera, Leonardo C. Pacheco-Londoño, Univ. de Puerto Rico Mayagüez (USA); Iris Vazquez-Ayala, Naval Explosive Ordnance Disposal Technology Div. (USA); Carlos A. Ortega-Zúñiga, Nataly Y. Galán-Freyle, John R. Castro-Suarez, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8725-88]

3:10 pm: **Data analysis of multilaser standoff chem-bio detection** *(Invited Paper)*, Ali Passian, Oak Ridge National Lab. (USA). . . . . [8725-89]

3:30 pm: **Recent advances in quantum cascade lasers for standoff detection** *(Invited Paper)*, Timothy O. Day, William B. Chapman, David B. Arnone, Allen Priest, David B. Caffey, Michael Pushkarsky, Alex Whitmore, Vivek Kamath, David Ruiz, Justin Kane, Christopher Armacost, Leigh J. Bromley, Daylight Solutions Inc. (USA) . . . . . [8725-90]

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

Conference Chair: **Edward M. Carapezza,** EMC Consulting, LLC (USA)

Program Committee: **Zoraida P. Aguilar,** Ocean NanoTech (USA); **John G. Blitch,** Colorado State Univ. (USA); **George Cybenko,** Thayer School of Engineering at Dartmouth (USA); **Panos George Datskos,** Oak Ridge National Lab. (USA); **Michael J. DeWeert,** BAE Systems (USA); **Susan F. Hallowell,** Transportation Security Lab., Dept. of Homeland Security (USA); **Todd M. Hintz,** Space and Naval Warfare Systems Command (USA); **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Ivan Kadar,** Interlink Systems Sciences, Inc. (USA); **Pradeep K. Khosla,** Carnegie Mellon Univ. (USA); **Han Q. Le,** Univ. of Houston (USA); **Daniel Lehrfeld,** Blue Marble Group LLC (USA); **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA); **Jordan Wexler,** Raytheon Applied Signal Technology, Inc. (USA)

Monday 29 April

SESSION 1
Room: Conv. Ctr. 331 . . . . . Mon 8:30 am to 9:00 am

Keynote Session I

Session Chairs: **Edward M. Carapezza,** EMC Consulting, LLC (USA); **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

8:30 am: **Superhydrophobic materials for homeland security applications** *(Keynote Presentation)*, Panos George Datskos, Oak Ridge National Lab. (USA) . . . . . [8711-1]

SESSION 2
Room: Conv. Ctr. 331 . . . . . .Mon 9:00 am to 10:20 am

Sensor Signal Processing I

Session Chairs: **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Sachi V. Desai,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

9:00 am: **Real-time algorithms for human versus animal classification using a pyroelectric sensor**, Jakir Hossen, Eddie L. Jacobs, Srikant Chari, Univ. of Memphis (USA) . . . . . [8711-2]

9:20 am: **Applying matching pursuit decomposition to UGS footstep classification**, Brett W. Larsen, Hugh Chung, Alfonso Dominguez, Jacob Sciacca, Narayan Kovvali, Antonia Papandreou, David R. Allee, Arizona State Univ. (USA) . . . . . [8711-3]

9:40 am: **Integrated algorithm for footstep detection in countermeasures conditions and in complicated tactical situations**, Alexander A. Pakhomov, General Sensing Systems LLC (USA) . . . . . [8711-4]

10:00 am: **Evaluation of sensor hardware and signal processing algorithms jointly for human/animal discrimination**, Ranga Narayanaswami, Scientific Systems Co., Inc. (USA) . . . . . [8711-5]

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

SESSION 3
Room: Conv. Ctr. 331 . . . . . .Mon 10:50 am to 12:10 pm

Sensor Signal Processing II

Session Chairs: **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Sachi V. Desai,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

10:50 am: **Optimization of phase mask-based iris imaging system through the optical characteristics**, Yuqing He, Jiaqi Li, Jing Pan, Yingjiao Li, Beijing Institute of Technology (China) . . . . . [8711-6]

11:10 am: **Angular dependence of source-target-detector in active mode standoff infrared detection**, Leonardo C. Pacheco-Londoño, John R. Castro-Suarez, Univ. de Puerto Rico Mayagüez (USA); Joaquín A. Aparicio-Bolanos, Univ. Puerto Rico (USA); Carlos A. Ortega-Zúñiga, Samuel P. Hernandez-Rivera, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8711-7]

11:30 am: **A multiband spectral subtraction based algorithm for real-time noise cancellation applied to gunshot acoustics**, Antonio L. Ramos, Hogskolen i Buskerud (Norway) . . . . . [8711-8]

11:50 am: **The multipath propagation effect in gunshot acoustics and its impact on the design of sniper positioning systems**, Antonio L. Ramos, Hogskolen i Buskerud (Norway) . . . . . [8711-9]

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

SESSION 4
Room: Conv. Ctr. 331 . . . . . Mon 1:10 pm to 4:50 pm

Security and Surveillance

Session Chairs: **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Sachi V. Desai,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

1:10 pm: **Recognition and localization of relevant human behavior in videos**, Henri Bouma, Gertjan Burghouts, Leo de Penning, Patrick Hanckmann, Johan-Martijn ten Hove, Sanne Korzec, Maarten Kruithof, Sander Landsmeer, Coen van Leeuwen, Sebastiaan van den Broek, Arvid Halma, Richard J. den Hollander, Klamer Schutte, TNO Defence, Security and Safety (Netherlands) . . . . . [8711-10]

1:30 pm: **Advanced low-power personnel/vehicle detecting radar for smart unattended ground sensor/munitions systems**, Mark A. Winston, Thomas Plummer, Steven W. Brady, Robert Raines, McQ, Inc. (USA). . . . . [8711-11]

1:50 pm: **Detection of dismounts from ground-based surveillance systems**, William D. Reynolds Jr., Kenji Tashiro, Teledyne Scientific Co. (USA) . . . . [8711-12]

2:10 pm: **A study by SWOT analysis method for the aerostats that used for surveillance in counter terrorism**, Huseyin Cetin, Turkish Air Force Academy (Turkey) . . . . . [8711-13]

2:30 pm: **The cross-border exchange of hyperspectral materials in anti-terroristic and forensic investigations**, Jaana R. Kuula, Univ. of Jyvaskyla (Finland); Tapani Reinikainen, National Bureau of Investigation (Finland). . [8711-14]

Coffee Break . . . . . Mon 2:50 pm to 3:30 pm

3:30 pm: **OptaSense® distributed acoustic and seismic sensing using COTS fiber optic cables for infrastructure protection and counter terrorism**, Gregory L. Duckworth, Emery M. Ku, OptaSense (USA) . . . . . [8711-15]

3:50 pm: **Assessment of risks of electromagnetic interference for personal medical electronic devices (PMEDs) from emissions of millimeter-wave security screening systems**, Don Witters, Howard Bassen, Joshua Guag, U.S. Food and Drug Administration (USA) . . . . . [8711-43]

4:10 pm: **A field test of mobile x-ray back-scattering screening system for joint multi-agency operation for detection of IED and other dangerous organic substances in the nordic conditions**, Andre Samberg, Sec-Control Finland Ltd. (Finland). . . . . [8711-44]

4:30 pm: **Dynamic data-driven sensor network adaptation for border control**, Doina Bein, Bharat B. Madan, Shashi Phoha, Sara M. Rajtmajer, Anna C. Rish, The Pennsylvania State Univ. (USA). . . . . [8711-46]

Symposium-wide Plenary Session
Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 331 . . . . . .Tue 8:00 am to 8:30 am

Keynote Session II

Session Chairs: **Edward M. Carapezza,** EMC Consulting, LLC (USA); **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

8:00 am: **Advanced video analytics for criminal justice applications** *(Keynote Presentation)*, Mark Greene, National Institute of Justice (USA) . . . . . [8711-16]

SESSION 6
Room: Conv. Ctr. 331 . . . . . Tue 8:30 am to 9:50 am

Perimeter and Remote Security

Session Chairs: **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Sachi V. Desai,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

8:30 am: **Plasma-field barrier sentry**, Ernesto Gonzaga, Plasma Technologies Inc. (USA) . . . . . [8711-17]

8:50 am: **Adaptive sequential methods for detecting network intrusions**, Xinjia Chen, Ernest L. Walker, Southern Univ. and A&M College (USA). . . . . [8711-18]

9:10 am: **Automated night/day standoff detection, tracking, and identification of personnel for installation protection**, Brian E. Lemoff, Robert B. Martin, Mikhail Sluch, Kristopher M. Kafka, William B. McCormick, Robert V. Ice, West Virginia High Technology Consortium Foundation (USA) . . . . . [8711-20]

9:30 am: **Robust and compact infrared video motion stabilization for long-range surveillance**, Kenji Tashiro, William D. Reynolds Jr., Teledyne Scientific Co. (USA) . . . . . [8711-21]

Coffee/Exhibition Break. . . . . .Tue 9:50 am to 10:40 am

SESSION 7
Room: Conv. Ctr. 331 . . . . . Tue 10:40 am to 11:40 am

System Architecture and Tools

Session Chairs: **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Sachi V. Desai,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

10:40 am: **Scaling issues in the selection of an approach for sensor network configuration design**, Thomas A. Wettergren, Russell Costa, Naval Undersea Warfare Ctr. (USA). . . . . [8711-22]

11:00 am: **Robotic disaster recovery efforts with ad-hoc deployable cloud computing**, Jeremy Straub, Atif Mohammad, The Univ. of North Dakota (USA) . . . . . [8711-23]

11:20 am: **Novel mechanism of sensitive information protection on personal mobile devices**, Alexander Milovanov, Leonid Bukshpun, Ranjit D. Pradhan, Physical Optics Corp. (USA) . . . . . [8711-47]

Lunch/Exhibition Break . . . . . .Tue 11:40 am to 1:00 pm

SESSION 8
Room: Conv. Ctr. 331 . . . . . Tue 1:00 pm to 2:40 pm

Sensor Fusion, Networks, and Applications

Session Chairs: **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Sachi V. Desai,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

1:00 pm: **Estimation of target size using two passive infrared sensors**, Thyagaraju Damarla, U.S. Army Research Lab. (USA); James M. Sabatier, Univ. of Mississippi (USA). . . . . [8711-26]

1:20 pm: **Searching social networks for subgraph pattern occurrences**, Kirk Ogaard, Heather Roy, Sue E. Kase, U.S. Army Research Lab. (USA); Rakesh Nagi, Kedar Sambhoos, Moises Sudit, Univ. at Buffalo (USA). . . . . [8711-27]

1:40 pm: **Unattended ground sensors, countermeasure, and counter-countermeasure: abilities, techniques, and effectiveness**, Alexander A. Pakhomov, Secuirty & Defense Research LLC (USA). . . . . [8711-28]

2:00 pm: **Electric and magnetic-field sensor system for small unmanned aerial vehicles**, John Matthews, Leonid Bukshpun, Ranjit D. Pradhan, Physical Optics Corp. (USA) . . . . . [8711-29]

2:20 pm: **Cost and effectiveness analyse on unmanned air vehicle (UAV) use at border security**, Bahadir Yilmaz, Turkish War College (Turkey) . . . . . [8711-30]

Coffee/Exhibition Break. . . . . .Tue 2:40 pm to 3:20 pm

SESSION 9
Room: Conv. Ctr. 331 . . . . . Tue 3:20 pm to 5:00 pm

Communication, Control, and Enabling Technologies

Session Chairs: **Myron E. Hohil,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Sachi V. Desai,** U.S. Army Armament Research, Development and Engineering Ctr. (USA)

3:20 pm: **Directional antenna array for communications, control and data link protection**, Pavlo A. Molchanov, Ampac Inc. (USA); Vincent M. Contarino, R Cubed Inc. (USA). . . . . [8711-31]

3:40 pm: **On a robust soft-input soft-output demodulator for OFDM systems: when unreliable channel state information is present**, Chulong Chen, Michael D. Zoltowski, Purdue Univ. (USA) . . . . . [8711-32]

4:00 pm: **Modeling emergent border-crossing behaviors during pandemics**, Eunice E. Santos, The Univ. of Texas at El Paso (USA); Eugene S. Santos Jr., Thayer School of Engineering at Dartmouth (USA); John Korah, The Univ. of Texas at El Paso (USA); Jeremy E. Thompson, Qi Gu, Keumjoo Kim, Deqing Li, Jacob A. Russell, Thayer School of Engineering at Dartmouth (USA); Suresh Subramanian, The Univ. of Texas at El Paso (USA); Yuxi Zhang, Yan Zhao, Thayer School of Engineering at Dartmouth (USA) . . . . . [8711-33]

4:20 pm: **StunRay technology: nonlethal weapons for law enforcement, homeland security, and anti-piracy**, Carlton W. Carroll, EOVERM Consulting LLC (USA) and Genesis Illumination, Inc. (USA). . . . . [8711-34]

4:40 pm: **Development of an Intercom: an undergraduate case study**, J. Alejandro Betancur Ramírez, Nelson Fernandez, Francisco Cardona, Univ. EAFIT (Colombia) . . . . . [8711-35]

Wednesday 1 May

SESSION 10
Room: Conv. Ctr. 331 . . . . . Wed 8:30 am to 9:30 am

Keynote Session III

Session Chairs: **Edward M. Carapezza,** EMC Consulting, LLC (USA); **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA)

8:30 am: **Pre-deployed distributed systems** *(Keynote Presentation)*, Andrew Coon, Defense Advanced Research Projects Agency (USA) . [8711-45]

9:00 am: **Technologies to enhance next-generation sensing for near shore and harbor security** *(Keynote Presentation)*, Pierre J. Corriveau, Naval Undersea Warfare Ctr. (USA) . . . . . [8711-36]

SESSION 11
Room: Conv. Ctr. 331 . . . . . .Wed 9:30 am to 12:00 pm

Harbor, Coastal, and Undersea Distributed Security Systems

Session Chairs: **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA); **Daniel Lehrfeld,** Blue Marble Group LLC (USA)

9:30 am: **Electron dynamics for uncooled MWIR SiC detector for digital imaging**, John W. Zeller, Tariq Manzur, Naval Undersea Warfare Ctr. (USA); Aravinda Kar, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [8711-37]

9:50 am: **Near-marine boundary layer atmospheric and turbulence testing and modeling**, Olaleye A. Aina, Epitaxial Technologies, LLC (USA); Tariq Manzur, Naval Undersea Warfare Ctr. (USA) . . . . . [8711-38]

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

10:40 am: **ZnO nanowire UV detector technology for marine boundary layer**, Abdiel Rivera, Mehdi F. Anwar, Univ. of Connecticut (USA); John W. Zeller, Tariq Manzur, Naval Undersea Warfare Ctr. (USA); Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA). . . . . [8711-39]

11:00 am: **Atmospheric modeling near-marine boundary layer for high-energy beam propagation**, Eric P. Magee, MZA Associates Corp. (USA); John W. Zeller, Tariq Manzur, Naval Undersea Warfare Ctr. (USA) . . . . . [8711-40]

11:20 am: **Electron dynamics for uncooled MWIR SiC detector for digital imaging**, Aravinda Kar, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); John W. Zeller, Tariq Manzur, Naval Undersea Warfare Ctr. (USA) . . . . . [8711-41]

11:40 am: **Laser sensing of mid-wave infrared radiation with wavelength selective dopant in silicon carbide**, Geunsik Lim, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Tariq Manzur, Naval Undersea Warfare Ctr. (USA); Aravinda Kar, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [8711-42]

Thursday 2 May 2013 • Proceedings of SPIE Vol. 8712

Biometric and Surveillance Technology for Human and Activity Identification X

Conference Chairs: **Ioannis Kakadiaris,** Univ. of Houston (USA); **Walter J. Scheirer,** Harvard Univ. (USA); **Laurence G. Hassebrook,** Univ. of Kentucky (USA)

Program Committee: **Ross Beveridge,** Colorado State Univ. (USA); **Jean-Francois Bonastre,** Univ. d'Avignon et des Pays du Vaucluse (France); **Terrance E. Boult,** Univ. of Colorado at Colorado Springs (USA); **Rama Chellappa,** Univ. of Maryland, College Park (USA); **Sen Ching Cheung,** Univ. of Kentucky (USA); **Bernadette Dorizzi,** TELECOM & Management SudParis (France); **Julian Fierrez,** Univ. Autónoma de Madrid (Spain); **Patrick J. Flynn,** Univ. of Notre Dame (USA); **Brian Heflin,** Univ. of Colorado at Colorado Springs (USA); **Ajay Kumar,** The Hong Kong Polytechnic Univ. (Hong Kong, China); **Daniel P. Lopresti,** Lehigh Univ. (USA); **Norman Poh,** Univ. of Surrey (United Kingdom); **Salil Prabhakar,** Consultant (USA); **Nalini K. Ratha,** IBM Thomas J. Watson Research Ctr. (USA); **Anderson Rocha,** Univ. Estadual de Campinas (Brazil); **Arun A. Ross,** West Virginia Univ. (USA); **Marios Savvides,** Carnegie Mellon Univ. (USA); **Natalia A. Schmid,** West Virginia Univ. (USA); **Stephanie Schuckers,** Clarkson Univ. (USA); **William Robson Schwartz; Shishir Shah,** Wayne State Univ. (USA); **Elham Tabassi,** National Institute of Standards and Technology (USA); **Kar-Ann Toh,** Yonsei Univ. (Korea, Republic of); **Raymond N. J. Veldhuis,** Univ. Twente (Netherlands); **Ruigang Yang,** Univ. of Kentucky (USA)

Thursday 2 May

CONFERENCE WELCOME
Room: Conv. Ctr. 332 . . . . . Thu 8:15 am to 8:20 pm

Session Chair: **Walter J. Scheirer,** Harvard Univ. (USA)

SESSION 1
Room: Conv. Ctr. 332 . . . . . Thu 8:20 am to 9:40 am

Fingerprints

Session Chair: **Walter J. Scheirer,** Harvard Univ. (USA)

8:20 am: **Advanced biometric technologies for homeland security applications** *(Keynote Presentation)*, Arun Vemury, U.S. Dept. of Homeland Security (USA) . . . . . [8712-1]

8:55 am: **A novel hand-type detection technique with fingerprint sensor**, Narishige Abe, Takashi Shinzaki, Fujitsu Labs., Ltd. (Japan) . . . . . [8712-2]

9:10 am: **Security analysis for fingerprint fuzzy vaults**, Jesse L. Hartloff, Maxwell Bileschi, Sergey Tulyakov, Jimmy Dobler, Atri Rudra, Venu Govindaraju, Univ. at Buffalo (USA) . . . . . [8712-3]

9:25 am: **Performance characterization of structured light-based fingerprint scanner**, Laurence G. Hassebrook, Raymond C Daley, Univ. of Kentucky (USA) . . . . . [8712-4]

POSTER OVERVIEWS I
Room: Conv. Ctr. 332 . . . . . Thu 9:40 am to 10:15 am

Session Chair: **Laurence G. Hassebrook,** Univ. of Kentucky (USA)

Poster authors are asked to give 3-4 minute oral overview of their posters in the order they appear in poster session-Posters-Thursday I.

Coffee Break . . . . . Thu 10:15 am to 10:45 am

SESSION 2
Room: Conv. Ctr. 332 . . . . . Thu 10:45 am to 11:50 am

Biometric Systems

Session Chair: **Ioannis Kakadiaris,** Univ. of Houston (USA)

10:45 am: **RDT&E for criminal justice applications: operational challenges, technical solutions, and managing expectations in the future** *(Keynote Presentation)*, Mark Greene, National Institute of Justice, Office of Science and Technology (USA) . . . . . [8712-5]

11:20 am: **Privacy information management for video surveillance**, Ying Luo, Sen-ching S. Cheung, Univ. of Kentucky (USA) . . . . . [8712-6]

11:35 am: **Eyebrow segmentation using active shape models**, Karen P. Hollingsworth, Samuel Clark, Joseph Thompson, Patrick J. Flynn, Kevin W. Bowyer, Univ. of Notre Dame (USA) . . . . . [8712-7]

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

SESSION 3
Room: Conv. Ctr. 332 . . . . . Thu 1:20 pm to 2:40 pm

Face Recognition

Session Chair: **Walter J. Scheirer,** Harvard Univ. (USA)

1:20 pm: **Machines better than humans for general face recognition?** *(Keynote Presentation)*, Jonathon Philips, National Institute of Standards and Technology (USA) . . . . . [8712-8]

1:55 pm: **Encoding and selecting features for boosted multispectral face recognition: matching SWIR versus color**, Sirisha Boothapati, Natalia A. Schmid, West Virginia Univ. (USA) . . . . . [8712-9]

2:10 pm: **Using crypts as iris minutiae**, Feng Shen, Patrick J. Flynn, Univ. of Notre Dame (USA) . . . . . [8712-10]

2:25 pm: **Automatic detection of non-cosmetic soft contact lenses in ocular images**, Gizem Erdogan, Arun A. Ross, West Virginia Univ. (USA) . . . . . [8712-11]

POSTER OVERVIEWS II
Room: Conv. Ctr. 332 . . . . . Thu 2:40 pm to 3:00 pm

Poster authors are asked to give 3-4 minute oral overview of their posters in the order they appear in poster session- Posters-Thursday II.

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

SESSION 4
Room: Conv. Ctr. 332 . . . . . Thu 3:30 pm to 4:35 pm

Non-traditional Biometrics

Session Chair: **Ioannis Kakadiaris,** Univ. of Houston (USA)

3:30 pm: **Challenges and opportunities in active authentication** *(Keynote Presentation)*, Richard Guidorizzi, DARPA/DoD (USA) . . . . . [8712-12]

4:05 pm: **Securing iris recognition systems against masquerade attacks**, Javier Galbally-Herrero, Marta Gomez-Barrero, Univ. Autónoma de Madrid (Spain); Arun A. Ross, West Virginia Univ. (USA); Julian Fierrez, Javier Ortega-Garcia, Univ. Autónoma de Madrid (Spain). . . . . [8712-13]

4:20 pm: **Gaze estimation for off-angle iris recognition based on the biometric eye model**, Mahmut Karakaya, Del Barstow, Hector J. Santos-Villalobos, Joseph Thompson, David S. Bolme, Christopher B. Boehnen, Oak Ridge National Lab. (USA) . . . . . [8712-14]

CLOSING REMARKS
Room: Conv. Ctr. 332 . . . . . Thu 4:35 pm to 4:45 pm

POSTERS I-THURSDAY

Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Infrared enhanced imaging for security/surveillance, Martin U. Pralle, Homayoon Haddad, Stephen Noble, SiOnyx Inc. (USA). . . . . [8712-18]

Detection of latent fingerprints by ultraviolet spectral imaging, Wei Huang, Guiqiang Wang, Xiaojing Xu, Institute of Forensic Science (China) . . . . . [8712-20]

The relationship between 2D static features and 2D dynamic features used in gait recognition, Hamad Alawar, Hassan Ugail, Mumtaz Kamala, David R. Connah, Univ. of Bradford (United Kingdom) . . . . . [8712-22]

Investigating gait recognition in the short-wave infrared (SWIR) spectrum: dataset and challenges, Brian DeCann, Arun A. Ross, Jeremy M. Dawson, West Virginia Univ. (USA) . . . . . [8712-23]

An effective method of palm vein recognition based on 2D Gabor filter, Jiadan Zhu, Yuqing He, Xinru Gao, Jixing Wang, Beijing Institute of Technology (China); Yongsheng Cui, Zhejiang Univ. (China). . . . . [8712-24]

Effects of mascara on iris recognition, Jay Doyle, Patrick J. Flynn, Kevin W. Bowyer, Univ. of Notre Dame (USA) . . . . . [8712-25]

A red-eye detector for iris segmentation using shape context, Changpeng Ti, Univ. of Kentucky (USA); Xinyu Huang, Alade Tokuta, North Carolina Central Univ. (USA); Ruigang Yang, Univ. of Kentucky (USA) . . . . . [8712-26]

Ear recognition: a complete system, Ayman A. Abaza, Mary Ann F. Harrison, West Virginia High Technology Consortium Foundation (USA) . . . . . [8712-27]

An efficient visualization method for analyzing biometric data, Mark D. Rahmes, Michael D. McGonagle, John H. Yates, Ronda R. Henning, Jay K. Hackett, Harris Corp. (USA) . . . . . [8712-28]

Secure voice based authentication for mobile devices: vaulted voice verification, R. C. Johnson, Univ. of Colorado at Colorado Springs (USA); Walter J. Scheirer, Harvard Univ. (USA); Terrance E. Boult, Univ. of Colorado at Colorado Springs (USA) . . . . . [8712-29]

POSTERS II-THURSDAY

Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

How reliable are your visual attributes?, Walter J. Scheirer, Univ. of Colorado at Colorado Springs (USA); Neeraj Kumar, University of Washington (USA); Vijay Iyer, Securics, Inc. (USA); Peter Belhumeur, Columbia University (USA); Terrance Boult, Securics, Inc. (USA). . . . . [8712-15]

Local gradient Gabor pattern (LGGP) with applications in face recognition, cross-spectral matching, and soft biometrics, Cunjian Chen, Arun A. Ross, West Virginia Univ. (USA) . . . . . [8712-16]

Color constancy in 3D-2D face recognition, Manuel Meyer, Christian Riess, Elli Angelopoulou, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Georgios Evangelopoulos, Ioannis Kakadiaris, Univ. of Houston (USA) . . . . . [8712-17]

The impact of specular highlights on 3D-2D face recognition, Vincent Christlein, Christian Riess, Elli Angelopoulou, Friedrich-Alexander-Univ. Erlangen-Nürnberg (Germany); Georgios Evangelopulos, Ioannis Kakadiaris, Univ. of Houston (USA) . . . . . [8712-19]

ASIE: application specific image enhancement for face recognition, Emil Bilgazyev, Uday Kurkure, Shishir Shah, Ioannis Kakadiaris, Univ. of Houston (USA) . . . . . [8712-21]

Airborne Intelligence, Surveillance, Reconnaissance (ISR) Systems and Applications X

Conference Chair: **Daniel J. Henry,** Rockwell Collins, Inc. (USA)

Conference Co-Chairs: **Davis A. Lange,** UTC Aerospace Systems (USA); **Dale Linne von Berg,** U.S. Naval Research Lab. (USA); **S. Danny Rajan,** Exelis Visual Information Solutions (USA); **Thomas J. Walls,** U.S. Naval Research Lab. (USA); **Darrell L. Young,** Raytheon Intelligence & Information Systems (USA)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 340 . . . . . .Wed 8:00 am to 10:00 am

ISR Vision, Missions, and Tactics

Session Chair: **Daniel J. Henry,** Rockwell Collins, Inc. (USA)

8:00 am: **What's on the horizon for ISR?** *(Keynote Presentation)*, Jay Harrison, Mav6, LLC (USA) . . . . . [8713-1]

8:40 am: **Sensor and payload considerations for future unmanned vehicles**, Harry Koper, John Lehman, Navmar Applied Sciences Corp. (USA) . . . . . [8713-2]

9:00 am: **Gadget: a new model for tactical manned reconnaissance**, Bekir Arapsun, Turkish Air Force (Turkey) . . . . . [8713-3]

9:20 am: **Solution space exploration of vision surveillance systems using a general taxonomy**, Naeem Ahmad, Muhammad Imran, Khursheed Khursheed, Najeem Lawal, Mattias O'Nils, Mid Sweden Univ. (Sweden) . . . . . [8713-45]

9:40 am: **Validating a UAV artificial intelligence control system using an autonomous test case generator**, Jeremy Straub, The Univ. of North Dakota (USA) . . . . . [8713-5]

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

SESSION 2

Room: Conv. Ctr. 340 . . . . . .Wed 10:30 am to 11:50 am

ISR Sensors I: Systems, Optics, and Gimbals

Session Chair: **Davis A. Lange,** UTC Aerospace Systems (USA)

10:30 am: **Advanced metal mirror processing for tactical ISR systems**, John Schaefer, Raytheon EO Innovations (USA) . . . . . [8713-6]

10:50 am: **Cost effective multispectral three-mirror anastigmat imaging system for high-performance surveillance applications using electroformed free-form mirrors**, Fabio E. Zocchi, Robert Banham, Media Lario Technologies (Italy); Davide Blandino, Optec S.p.A. (Italy); Giuseppe Borghi, Ivan Ferrario, Media Lario Technologies (Italy); Roberto Formaro, Agenzia Spaziale Italiana (Italy); Wolf C. Glage, Raytheon ELCAN Optical Technologies (Canada); Nadia Missaglia, Stefano Moretti, Media Lario Technologies (Italy); Iain A. Neil, ScotOptix (Switzerland); Antonio Ritucci, Massimiliano Rossi, Media Lario Technologies (Italy); Antonio Sposito, Agenzia Spaziale Italiana (Italy); Viktor P. Syvokin, Raytheon ELCAN Optical Technologies (Canada); Giuseppe Valsecchi, Paolo Zago, Media Lario Technologies (Italy). . . . . [8713-7]

11:10 am: **Gimbal system configurations and line-of-sight control techniques for small UAV applications**, Rick Miller, Greg Mooty, Ascendant Engineering Solutions LLC (USA); James M. Hilkert, Alpha-Theta Technologies (USA). . [8713-8]

11:30 am: **A lightweight and wide-swath UAV camera for high-resolution surveillance missions**, Bavo Delauré, VITO NV (Belgium). . . . . [8713-46]

SESSION 3

Room: Conv. Ctr. 340 . . . . . .Wed 11:50 am to 12:30 pm

ISR Sensors II: Lasercom and Acoustics

Session Chair: **Davis A. Lange,** UTC Aerospace Systems (USA)

11:50 am: **LaserCom in UAS missions: benefits and operational aspects**, Wolfgang Griethe, Frank F. Heine, Tesat-Spacecom GmbH & Co. KG (Germany); Lester L. Begg, Detao Du, General Atomics Aeronautical Systems, Inc. (USA) . . . . . [8713-9]

12:10 pm: **An autonomous surveillance system for blind sources localization and separation**, Sean F. Wu, Raghavendra Kulkarni, Wayne State Univ. (USA) . . . . . [8713-10]

Lunch/Exhibition Break . . . . . Wed 12:30 pm to 2:00 pm

SESSION 4

Room: Conv. Ctr. 340 . . . . . Wed 2:00 pm to 3:00 pm

ISR Sensors III: Hyper/Multispectral Imaging

Session Chair: **Dale Linne von Berg,** U.S. Naval Research Lab. (USA)

2:00 pm: **AV Sentry®: a high-dynamic range, ultra-low noise ROIC for the visible through the infrared bandwidths**, John C. Liobe, ADVIS, Inc. (USA); Zhe Gao, Zeljko Ignjatovic, Mark F. Bocko, Univ. of Rochester (USA) . . . . . [8713-11]

2:20 pm: **A long-wave infrared hyperspectral sensor for Shadow class UAVs**, Paul G. Lucey, Univ. of Hawai'i (USA); Jason T. Akagi, John L. Hinrichs, Spectrum Photonics, Inc. (USA); Sarah T. Crites, Univ. of Hawai'i (USA) . . . . . [8713-14]

2:40 pm: **Novel compact airborne platform for Hyper-Cam infrared hyperspectral imager for intelligence, surveillance, and reconnaissance**, Caroline S. Turcotte, Eldon Puckrin, Defence Research and Development Canada, Valcartier (Canada); Marc-André Gagnon, Jean-Alexis Boulet, Francoys Aube, Vincent Farley, Martin Chamberland, Telops (Canada). . . . . [8713-15]

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

SESSION 5

Room: Conv. Ctr. 340 . . . . . Wed 4:00 pm to 5:00 pm

ISR Sensors IV: CMOS and SAR

Session Chair: **Thomas J. Walls,** U.S. Naval Research Lab. (USA)

4:00 pm: **Low-light NV-CMOS™ image sensors for day/night imaging**, Thomas L. Vogelsong, John Tower, Thomas Senko, Peter A. Levine, Judy Zhu, David C. Zhang, Gooitzen S. van der Wal, SRI International Sarnoff (USA) [8713-17]

4:20 pm: **The capability of time- and frequency-domain algorithms for bistatic SAR processing**, Viet T. Vu, Thomas K. Sjögren, Mats I. Pettersson, Blekinge Institute of Technology (Sweden) . . . . . [8713-18]

4:40 pm: **Another possibility to focus moving targets by normalized relative speed in UWB SAR**, Viet T. Vu, Thomas K. Sjögren, Mats I. Pettersson, Blekinge Tekniska Högskola (Sweden) . . . . . [8713-19]

Thursday 2 May

SESSION 6

Room: Conv. Ctr. 340 . . . . . Thu 8:00 am to 10:00 am

ISR Processing I: Image Correction/Enhancement

Session Chair: **S. Danny Rajan,** Exelis Visual Information Solutions (USA)

8:00 am: **Real-time focal-plane wavefront sensing for compact imaging phased-array telescopes: numerical and experimental demonstration**, Bertrand Denolle, Frédéric Cassaing, Joseph Montri, ONERA (France); Jean-Philippe Amans, Observatoire de Paris à Meudon (France). . . . . [8713-20]

8:20 am: **Computational imaging for aberrated optics (CIAO): experimental results**, Robert Saperstein, Eliseo Ranalli, Patrick C. Mock, Anis Husain, Ziva Corp. (USA) . . . . . [8713-21]

8:40 am: **ATCOM: accelerated image processing for terrestrial long-range imaging through atmospheric effects**, Petersen F. Curt, Aaron L. Paolini, EM Photonics, Inc. (USA) . . . . . [8713-22]

9:00 am: **A comparison of the mean square error performance of speckle and MFBD image reconstruction techniques under anisoplanatic, long horizontal-path imaging**, Glen E. Archer, Jeremy P. Bos, Michael C. Roggemann, Michigan Technological Univ. (USA). . . . . [8713-23]

9:20 am: **A simple yet effective real-time solution to reduce total information loss in highly-compressed video**, Amber D. Fischer, 21st Century Systems, Inc. (USA) . . . . . [8713-24]

9:40 am: **A comparative analysis of dynamic range compression techniques in IR images for maritime applications**, Cristian Luison, Altran Italy S.p.A. (Italy); Monica Olivieri, Gianni Barani, SELEX Galileo S.p.A. (Italy); Alessandro Rossi, Univ. di Pisa (Italy); Nicola Acito, Accademia Navale di Livorno (Italy); Marco Diani, Univ. di Pisa (Italy) . . . . . [8713-25]

Coffee Break . . . . . .Thu 10:00 am to 10:20 am

SESSION 7
Room: Conv. Ctr. 340 . . . . . Thu 10:20 am to 12:00 pm

ISR Processing II: Image Exploitation
Session Chair: **S. Danny Rajan,** Exelis Visual Information Solutions (USA)

10:20 am: **Material characterization using passive multispectral polarimetric imagery**, Melissa Sawyer, Milo W. Hyde IV, Air Force Institute of Technology (USA) . . . . . [8713-26]

10:40 am: **An estimation of geometric transformation parameters of the multispectral image based on multiple reference area tracking**, Valery V. Strotov, Boris A. Alpatov, Ryazan State Radio Engineering Univ. (Russian Federation) . . . . . [8713-27]

11:00 am: **OREOS: a new EO-IR modeling and simulation tool for US Coast Guard search and rescue applications**, Sarah E. Lane, C. Spencer Nichols, Alan M. Thomas, J. Michael Cathcart, Georgia Tech Research Institute (USA) . [8713-28]

11:20 am: **Situational awareness investigation using tracking and enhancement of imagery with highly dynamic lighting conditions**, Andrey V. Kanaev, Christopher W. Miller, U.S. Naval Research Lab. (USA); Collin J. Seanor, Jeremy Murray-Krezan, Air Force Research Lab. (USA) . . . . . [8713-29]

11:40 am: **Parallax visualization plug-in toolset for pursuer WAMI data**, Christopher A. Mayhew, Craig M. Mayhew, Mark B. Forgues, Vision III Imaging, Inc. (USA) . . . . . [8713-30]

Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:10 pm

SESSION 8
Room: Conv. Ctr. 340 . . . . . Thu 1:10 pm to 1:50 pm

ISR Processing III: Image Exploitation (cont.)
Session Chair: **Darrell L. Young,**
Raytheon Intelligence & Information Systems (USA)

1:10 pm: **Meta-image navigation augmenters for unmanned aircraft systems (MINA for UAS)**, Koray Celik, Arun K. Somani, Iowa State Univ. (USA); Bernard A. Schnaufer, Patrick Y. Hwang, Gary A. McGraw, Jeremy Nadke, Rockwell Collins, Inc. (USA). . . . . [8713-31]

1:30 pm: **Density estimation in aerial images of large crowds for automatic people counting**, Christian Herrmann, Juergen Metzler, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . . [8713-32]

SESSION 9
Room: Conv. Ctr. 340 . . . . . Thu 1:50 pm to 2:30 pm

ISR Processing IV: Image Stabilization
Session Chair: **Darrell L. Young,**
Raytheon Intelligence & Information Systems (USA)

1:50 pm: **Electronic image stabilization algorithms based on flight characteristics of the small UAV**, Sijie Liu, Hongying Zhao, Lu Wang, Ying Mai, Peking Univ. (China) . . . . . [8713-33]

2:10 pm: **A method of intentional movement estimation of oblique Small-UAV videos stabilized based on homograph model**, Shiyi Guo, Peking Univ. (China) and China Univ. of Mining and Technology (China); Ying Mai, Hongying Zhao, Peking Univ. (China) . . . . . [8713-34]

SESSION 10
Room: Conv. Ctr. 340 . . . . . Thu 2:30 pm to 3:30 pm

ISR Processing V: Motion Video
Session Chair: **Darrell L. Young,**
Raytheon Intelligence & Information Systems (USA)

2:30 pm: **Cognitive video quality analyst**, Darrell L. Young, Raytheon Intelligence & Information Systems (USA) . . . . . [8713-35]

2:50 pm: **Real-time video image quality estimation supports enhanced tracker performance**, John M. Irvine, Richard J. Wood, Draper Lab. (USA) . . . . . [8713-36]

3:10 pm: **MASI-HDR (motion adaptive signal integration-high dynamic range) video processing for dynamic platforms**, Michael R. Piacentino, David C. Zhang, Gooitzen S. van der Wal, Sek M. Chai, SRI International Sarnoff (USA). . . [8713-37]

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

SESSION 11
Room: Conv. Ctr. 340 . . . . . Thu 4:00 pm to 5:40 pm

ISR Processing VI: Detection and Tracking
Session Chair: **Darrell L. Young,**
Raytheon Intelligence & Information Systems (USA)

4:00 pm: **3D target tracking using a pan and tilt stereovision system**, Moulay A. Akhloufi, Ayann Regent, Ctr. of Robotics and Vision (Canada) . . . . . [8713-38]

4:20 pm: **Reliable ISR algorithms for a very low power approximate computer**, Ross S. Eaton, Jonah C. McBride, Charles River Analytics, Inc. (USA); Joseph Bates, Singular Computing LLC (USA) . . . . . [8713-39]

4:40 pm: **Real-time low-power neuromorphic hardware for autonomous object recognition**, Yang Chen, Deepak Khosla, David J. Huber, Darrel J. Van Buer, Kyungnam Kim, Shinko Y. Cheng, HRL Labs., LLC (USA) . . . . . [8713-40]

5:00 pm: **An integrated multitarget tracking system for interacting target scenarios**, Hongwei Mao, Arizona State Univ. (USA); Glen P. Abousleman, General Dynamics C4 Systems (USA); Jennie Si, Arizona State Univ. (USA). . . . . [8713-41]

5:20 pm: **Object detection and tracking under planar constraints**, Qiang He, Mississippi Valley State Univ. (USA); Henry Chu, Univ. of Louisiana at Lafayette (USA); Aldo Camargo, The Univ. of North Dakota (USA) . . . . . [8713-42]

POSTERS-THURSDAY
Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Efficient parallel implementation of real-time airborne target tracking system on heterogeneous multicore SoC, Xiang Gao, Arizona State Univ. (USA); Hongwei Mao, Arizona State Univ. (USA) and Arizona State Univ. (USA); Eric Munson, Arizona State Univ. (USA); Glen P. Abousleman, General Dynamics C4 Systems (USA); Jennie Si, Arizona State Univ. (USA) . . . . . [8713-44]

A wireless sensor network design and impliementation for vehicle detection, classification, and tracking, Anwar Al-Assaf, King Abdullah II Design and Development Bureau (Jordan). . . . . [8713-47]

Monday - Wednesday 29 April - 1 May 2013 • Proceedings of SPIE Vol. 8714

Radar Sensor Technology XVII

Conference Chairs: **Kenneth I. Ranney,** U.S. Army Research Lab. (USA); **Armin Doerry,** Sandia National Labs. (USA)

Program Committee: **Fauzia Ahmad,** Villanova Univ. (USA); **Joseph C. Deroba,** U.S. Army CERDEC Intelligence and Information Warfare Directorate (USA); **Benjamin C. Flores,** The Univ. of Texas at El Paso (USA); **Mark Govoni,** U.S. Army Research, Development and Engineering Command (USA); **Majeed Hayat,** The Univ. of New Mexico (USA); **Chandra Kambhamettu,** Univ. of Delaware (USA); **Seong-Hwoon Kim,** Raytheon Space & Airborne Systems (USA); **James L. Kurtz,** Univ. of Florida (USA); **Changzhi Li,** Texas Tech Univ. (USA); **Jenshan Lin,** Univ. of Florida (USA); **David G. Long,** Brigham Young Univ. (USA); **Jia-Jih Lu,** General Atomics Aeronautical Systems, Inc. (USA); **Neeraj Magotra,** The Univ. of New Mexico (USA); **Anthony F. Martone,** U.S. Army Research Lab. (USA); **George J. Moussally,** Mirage Systems (USA); **Ram M. Narayanan,** The Pennsylvania State Univ. (USA); **Lam H. Nguyen,** U.S. Army Research Lab. (USA); **Hector A. Ochoa,** The Univ. of Texas at Tyler (USA); **Ann M. Raynal,** Sandia National Labs. (USA); **Jerry Silvious,** U.S. Army Research Lab. (USA); **Brian Smith,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Helmut H. Suess,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **David Tahmoush,** U.S. Army Research Lab. (USA)

Monday 29 April

OPENING REMARKS

Room: Conv. Ctr. 322 . . . . . 8:30 am to 8:40 am

Opening remarks by Armin Doerry and Kenneth Ranney.

SESSION 1

Room: Conv. Ctr. 322 . . . . . .Mon 8:40 am to 10:00 am

Special Session: Noise Radar I

Session Chair: **Ram M. Narayanan,** The Pennsylvania State Univ. (USA)

8:40 am: **Detection of concealed metal objects and human targets in defilade using a wideband millimeter-wave noise radar**, Kyle A. Gallagher, Ram M. Narayanan, The Pennsylvania State Univ. (USA) . . . . . [8714-1]

9:00 am: **FPGA implementation of a software-defined radar processor**, Hernan A. Suarez, Yan (Rockee) Zhang, The Univ. of Oklahoma (USA) . . . . [8714-2]

9:20 am: **A compressive radar system with chaotic-based FM signals using the Bernoulli map**, Hector A. Ochoa, Charan Teja Enugula, The Univ. of Texas at Tyler (USA) . . . . . [8714-3]

9:40 am: **Influence of signal parameters in noise radar sensor technologies used for sensing through dispersive media**, Ana V. Alejos, New Mexico State Univ. (USA) and Univ. de Vigo (Spain); Muhammad Dawood, Zir Zeeshan, New Mexico State Univ. (USA) . . . . . [8714-4]

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

SESSION 2

Room: Conv. Ctr. 322 . . . . . .Mon 10:30 am to 11:50 am

Special Session: Noise Radar II

Session Chair: **Yan Zhang,** The Univ. of Oklahoma (USA)

10:30 am: **Comparative analysis of transfer function measurements on various lossy media using an ultrawideband S-Band noise radar**, Sonny Smith, Ram M. Narayanan, The Pennsylvania State Univ. (USA) . . . . . [8714-7]

10:50 am: **GNSS-based passive radar sensing using hybrid-aperture system**, Randy S. Silver, Univ. of Oklahoma (USA); Yan (Rockee) Zhang, Hernan Suarez, Yu Pan, Yih-Ru Huang, The Univ. of Oklahoma (USA). . . . . [8714-8]

11:10 am: **Demonstration of detection and ranging using solvable chaos**, Jonathan N. Blakely, U.S. Army Research, Development and Engineering Command (USA); Ned J. Corron, U.S. Army Aviation and Missile Command (USA); Mark T. Stahl, NASA Marshall Space Flight Ctr. (USA). . . . . [8714-5]

11:30 am: **Initial experimental results using the noise correlation radar**, Mark A. Govoni, U.S. Army Research, Development and Engineering Command (USA); John Clark, Jerry Silvious, U.S. Army Research Lab. (USA) . . . . . [8714-6]

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

SESSION 3

Room: Conv. Ctr. 322 . . . . . Mon 1:00 pm to 3:00 pm

Applications: Concealed Targets I

Session Chair: **Jerry Silvious,** U.S. Army Research Lab. (USA)

1:00 pm: **Detection and depth estimation of shallow buried non-metallic dummy landmines without explosives using Independent Component Analysis (ICA) of multipolarization data in microwave X band region**, Kailash C. Tiwari, Delhi Technological Univ. (India); Dharmendra P. Singh, Manoj K. Arora, Indian Institute of Technology Roorkee (India). . . . . [8714-9]

1:20 pm: **Design of spectrally versatile forward-looking ground-penetrating radar for detection of concealed targets**, Brian R. Phelan, The Pennsylvania State Univ. (USA); Marc A. Ressler, Gregory J. Mazzaro, Kelly D. Sherbondy, U.S. Army Research Lab. (USA); Ram M. Narayanan, The Pennsylvania State Univ. (USA) . . . . . [8714-10]

1:40 pm: **Development of a longer range standoff millimetre wave radar concealed threat detector**, Nicholas J. Bowring, Matthew J. Southgate, David A. Andrews, Nacer D. Rezgui, Stuart W. Harmer, Manchester Metropolitan Univ. (United Kingdom). . . . . [8714-11]

2:00 pm: **Testing a transmission line model for buried targets using ground penetrating radar**, Berta Rodriguez Hervas, The Univ. of Texas at El Paso (USA) . . . . . [8714-14]

2:20 pm: **Emulation of forward-looking radar technology for threat detection in rough terrain environments: a scattering and imaging study**, DaHan Liao, Traian V. Dogaru, U.S. Army Research Lab. (USA). . . . . [8714-12]

2:40 pm: **Multitone harmonic radar**, Gregory J. Mazzaro, Anthony F. Martone, U.S. Army Research Lab. (USA) . . . . . [8714-13]

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

SESSION 4

Room: Conv. Ctr. 322 . . . . . Mon 3:30 pm to 4:30 pm

Emerging Technologies

Session Chair: **Gregory J. Mazzaro,** U.S. Army Research Lab. (USA)

3:30 pm: **Noisy stepped frequency (NSF) waveform in three-dimensional RF tomography**, Russell Vela, Air Force Research Lab. (USA) . . . . . [8714-67]

3:50 pm: **Cognitive processing for nonlinear radar**, Anthony F. Martone, Kenneth Ranney, Abigail Hedden, David McNamara, Gregory Mazzaro, U.S. Army Research Lab. (USA) . . . . . [8714-57]

4:10 pm: **Scattering and imaging of nonlinearly loaded antenna structures in half-space environments**, DaHan Liao, U.S. Army Research Lab. (USA) . . . . . [8714-70]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 322 . . . . . Tue 8:30 am to 10:10 am

Applications: Concealed Targets II
Session Chair: **Ann M. Raynal,** Sandia National Labs. (USA)

8:30 am: **Effect of pulse fidelity on detection of landmines**, Hilmi Ozturk, Hakki Nazli, Hasan Belikli, TÜBITAK National Research Institute of Electronics and Cryptology (Turkey); Korkut Yegin, Yeditepe Univ. (Turkey); Mehmet Sezgin, TÜBITAK National Research Institute of Electronics and Cryptology (Turkey) . . . . . [8714-19]

8:50 am: **Buried target radar imaging with an ultra-wideband, vehicle-mounted antenna array**, Kenneth I. Ranney, DaHan Liao, Traian V. Dogaru, Lam H. Nguyen, U.S. Army Research Lab. (USA) . . . . . [8714-20]

9:10 am: **Through-the-wall radar human detection via spectral characteristics**, Travis D. Bufler, Ram M. Narayanan, The Pennsylvania State Univ. (USA); Traian V. Dogaru, U.S. Army Research Lab. (USA); Erik H. Lenzing, The Pennsylvania State Univ. (USA) . . . . . [8714-22]

9:30 am: **Textural feature based target detection in through-the-wall radar imagery**, Abdulkadir Sengur, Firat Univ. (Turkey); Moeness G. Amin, Fauzia Ahmad, Villanova Univ. (USA); Pascale Sevigny, David J. DiFilippo, Defence Research and Development Canada, Ottawa (Canada). . . . . [8714-23]

9:50 am: **Three-dimensional radar imaging of buildings based on computer models**, Traian V. Dogaru, DaHan Liao, Calvin Le, U.S. Army Research Lab. (USA) . . . . . [8714-21]

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

SESSION 6
Room: Conv. Ctr. 322 . . . . . Tue 10:40 am to 12:00 pm

Special Session: MIMO Radar
Session Chair: **Mark Govoni,** U.S. Army Research, Development and Engineering Command (USA)

10:40 am: **SIRE: a MIMO radar for landmine/IED detection**, Jian Li, Ode Ojowu Jr., Yue I. Wu, Univ. of Florida (USA); Lam H. Nguyen, U.S. Army Research Lab. (USA) . . . . . [8714-24]

11:00 am: **Robust adaptive beamforming for MIMO monopulse radar**, William T. Rowe, Jian Li, Univ. of Florida (USA) . . . . . [8714-26]

11:20 am: **New distributed radar technology based on UAV or UGV application**, Pavlo A. Molchanov, AMPAC Inc. (USA); Vincent M. Contarino, R Cubed Inc. (USA) . . . . . [8714-27]

11:40 am: **Tomographic imaging of ultra-wideband noise radar using time-domain data**, Hee Jung Shin, Ram M. Narayanan, The Pennsylvania State Univ. (USA); Muralidhar Rangaswamy, Air Force Research Lab. (USA). . . . . [8714-28]

Lunch/Exhibition Break . . . . . .Tue 12:00 pm to 1:50 pm

SESSION 7
Room: Conv. Ctr. 322 . . . . . Tue 1:50 pm to 3:10 pm

Programs and Systems I
Session Chair: **Seong-Hwoon Kim,**
Raytheon Space & Airborne Systems (USA)

1:50 pm: **Concealed target detection using augmented reality with SIRE radar**, Philip J. Saponaro Jr., Chandra Kambhamettu, Univ. of Delaware (USA) . [8714-29]

2:10 pm: **Lightweight SAR GMTI radar technology development**, John C. Kirk Jr., Goleta Star, LLC (USA) . . . . . [8714-30]

2:30 pm: **SAR and LIDAR fusion: experiments and applications**, Matthew C. Edwards, Evan C. Zaugg, Joshua P. Bradley, Ryan D. Bowden, ARTEMIS, Inc. (USA) . . . . . [8714-31]

2:50 pm: **High-efficiency switching power amplifiers for P, L, S, and X Band**, Jarred W. Lawler, Justin S. Wells, Salvador W. Mendez, Timothy J. Wurth, NuWaves Engineering (USA) . . . . . [8714-32]

Coffee Break . . . . . .Tue 3:10 pm to 3:50 pm

SESSION 8
Room: Conv. Ctr. 322 . . . . . Tue 3:50 pm to 5:30 pm

Programs and Systems II
Session Chair: **Anthony F. Martone,** U.S. Army Research Lab. (USA)

3:50 pm: **Calibration methods for phased array radars**, Ilgin Seker, Erdinc Ercil, Can B. Top, ASELSAN Inc. (Turkey) . . . . . [8714-33]

4:10 pm: **Real-time beyond the horizon vessel detection**, Hugh J. Roarty, Michael Smith, Rutgers Coastal Ocean Observation Lab. (USA); Donald E. Barrick, CODAR Ocean Sensors (USA); Scott Glenn, Rutgers Coastal Ocean Observation Lab. (USA) . . . . . [8714-36]

4:30 pm: **Remote concealed threat detection by novel classification algorithms applied to multi-polarimetric UWB radar**, Dean O'Reilly, Nicholas Bowring, David Andrews, Nacer D. Rezgui, Stuart Harmer, Manchester Metropolitan Univ. (United Kingdom) . . . . . [8714-37]

4:50 pm: **Cognitive nonlinear radar test-bed**, Abigail S. Hedden, David A. Wikner, Anthony F. Martone, David M. McNamara, U.S. Army Research Lab. (USA) . . . . . [8714-34]

5:10 pm: **Compact, autonomous, multi-mission synthetic aperture radar**, Thomas J. Walls, Michael L. Wilson, U.S. Naval Research Lab. (USA); Chad Knight, David Madsen, Mark Jensen, Scott A. Anderson, Space

e Dynamics Lab. (USA); Mike Addario, SRC Inc. (USA) . . . . . [8714-35]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

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A comparison of interferometric SAR antenna options, Armin Doerry, Douglas L. Bickel, Sandia National Labs. (USA) . . . . . [8714-48]

Random-phase radar waveforms with shaped spectrum, Armin Doerry, Sandia National Labs. (USA); Brandeis Marquette, General Atomics Aeronautical Systems, Inc. (USA). . . . . [8714-49]

Compound radar waveforms with multiple frames, Armin Doerry, Sandia National Labs. (USA); Brandeis Marquette, General Atomics Aeronautical Systems, Inc. (USA). . . . . [8714-50]

Effect of bistatic angle on bistatic ISAR image resolution, Sung-Taek Chun, U.S. Naval Research Lab. (USA); Keunha Lee, U.S. Naval Research Lab. (USA) and U.S. Naval Research Lab. (USA); Ronald D. Lipps, U.S. Naval Research Lab. (USA) . . . . . [8714-51]

A mathematical observation on synthetic aperture radar, Yufeng Cao, Juan Lopez, Alejandro Martinez, Zhijun G. Qiao, The Univ. of Texas-Pan American (USA) . . . . . [8714-53]

Platform for research and education on ground penetrating radar, Michelle J. Salvador, Virginia Jimenez, Rafael G. Lopez, Ricardo von Borries, The Univ. of Texas at El Paso (USA) . . . . . [8714-54]

Lynx multi-mode SAR in support of NATO Unified Vision 2012 trial, Ralf Dunkel, Tobias Verge, Robert Linnehan, General Atomics Aeronautical Systems, Inc. (USA); Armin W. Doerry, Sandia National Labs. (USA). . . . . [8714-55]

An anisotropic SAR model incorporating aspect and spatial filters, Chad Knight, Space Dynamics Lab. (USA); Jacob Gunther, Todd Moon, Utah State Univ. (USA) . . . . . [8714-56]

Wednesday 1 May

SESSION 9
Room: Conv. Ctr. 322 . . . . . .Wed 8:00 am to 10:00 am

Algorithms and Processing I

Session Chair: **Lam H. Nguyen,** U.S. Army Research Lab. (USA)

8:00 am: **Transforming optical image data into a SAR system's range based image space**, Harald Anglberger, Helmut Suess, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [8714-38]

8:20 am: **Rejection of interference and near-field coupled LNA-noise on FPA-fed multibeam dish antennas using 3-D analog filters**, Arjuna Madanayake, The Univ. of Akron (USA); Leonid Belostotski, Univ. of Calgary (Canada); Chamith Wijenayake, The Univ. of Akron (USA); Yongsheng Xu, Len Bruton, Thushara Gunaratne, Univ. of Calgary (Canada). . . . . [8714-39]

8:40 am: **A method to evaluate residual phase error for polar formatted synthetic aperture radar systems**, Cameron Musgrove, Richard M Naething, Sandia National Labs. (USA) . . . . . [8714-40]

9:00 am: **Analysis of SAR autofocus performance**, Richard M. Naething, Roger D. West, Sandia National Labs. (USA) . . . . . [8714-41]

9:20 am: **Air target position estimation for track declaration using air-to-air radar**, Liu Guoqing, Jordan Ramrus, General Atomics Aeronautical Systems, Inc. (USA) . . . . . [8714-42]

9:40 am: **A global review of optronic synthetic aperture radar/ladar processing**, Linda Marchese, Michel Doucet, Pascal Bourqui, INO (Canada); Bernd Harnisch, Martin Suess, European Space Research and Technology Ctr. (Netherlands); Mathieu Legros, Nochola Desnoyers, Simon Turbide, Sandra Turgeon, Luc Mercier, Maxime Savard, Anne Martel, Francois Chateauneuf, Alai Bergeron, INO (Canada) . . . . . [8714-43]

Coffee Break . . . . . Wed 10:00 am to 10:20 am

SESSION 10
Room: Conv. Ctr. 322 . . . . . .Wed 10:20 am to 12:00 pm

Algorithms and Processing II

Session Chair: **Chandra Kambhamettu,** Univ. of Delaware (USA)

10:20 am: **Comparison of filtering and smoothing algorithms for airborne radars**, Bhashyam Balaji, Anthony Damini, Defence Research and Development Canada, Ottawa (Canada); Kai Wang, MDA Systems Ltd. (Canada); Martie Goulding, Kurt Hagen, MacDonald, Dettwiler and Associates Ltd. (Canada) . . . . . [8714-44]

10:40 am: **Instantaneous frequency and time-frequency signature estimation using compressive sensing**, Branka Jokanovic, Univ. of Montenegro (Montenegro); Moeness Amin, Villanova Univ. (USA); Srdjan Stankovic, Univ. of Montenegro (Montenegro). . . . . [8714-45]

11:00 am: **Riemannian mean and space-time adaptive processing using projection and inversion algorithms**, Bhashyam Balaji, Defence Research and Development Canada, Ottawa (Canada); Frederic Barbaresco, Thales Air Systems SA (France) . . . . . [8714-46]

11:20 am: **3D wavelets-based denoising of high-frequency ultra-wideband synthetic aperture radar images**, Anna Brook, Edison Cristofani, Marijke Vandewal, Royal Belgian Military Academy (Belgium); Carsten Matheis, Joachim Jonuscheit, Rene Beigang, Fraunhofer-Institut für Physikalische Messtechnik (Germany) . . . . . [8714-47]

11:40 am: **High-resolution computation of electrical field propagation in land mine detection**, Yury A. Gryazin, Idaho State Univ. (USA) . . . . . [8714-18]

Lunch/Exhibition Break . . . . . Wed 12:00 pm to 1:20 pm

SESSION 11
Room: Conv. Ctr. 322 . . . . . Wed 1:20 pm to 3:00 pm

Micro-doppler Radar I

Joint Session between Conferences 8714 and 8734

Session Chairs: **David Tahmoush,** U.S. Army Research Lab. (USA); **Ram M. Narayanan,** The Pennsylvania State Univ. (USA)

1:20 pm: **Micro-doppler and vibrometry at millimeter and submillimeter wavelengths**, Duncan A. Robertson, Scott L. Cassidy, Univ. of St. Andrews (United Kingdom) . . . . . [8714-15]

1:40 pm: **Initial measurements of the angular velocity of walking humans using an active millimeter-wave correlation interferometer**, Kojo S. Zilevu, Jeffrey A. Nanzer, Johns Hopkins Univ. Applied Physics Lab. (USA); Kelly L. Kammerman, Syracuse Univ. (USA) . . . . . [8714-17]

2:00 pm: **Simulation and signal processing of through wall UWB radar for human being's periodic motions detection**, Jing Li, Delaware State Univ. (USA) . . . . . [8734-1]

2:20 pm: **Micro-range micro-doppler for dismount classification**, David Tahmoush, U.S. Army Research Lab. (USA). . . . . [8714-16]

2:40 pm: **Wideband radar micro-doppler applications**, David Tahmoush, U.S. Army Research Lab. (USA) . . . . . [8734-2]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 12
Room: Conv. Ctr. 322 . . . . . Wed 3:40 pm to 5:20 pm

Micro-doppler Radar II

Joint Session between Conferences 8714 and 8734

Session Chair: **Ram M. Narayanan,** The Pennsylvania State Univ. (USA)

3:40 pm: **Micro-doppler radars for human gait analysis using joint range-time-frequency representation**, Aly E. Fathy, Yazhou Wang, The Univ. of Tennessee Knoxville (USA) . . . . . [8734-3]

4:00 pm: **A measurement approach based on micro-doppler maps for signature and motion analysis**, Roberto Ricci, Alessandro Sona, Univ. degli Studi di Padova (Italy) . . . . . [8734-4]

4:20 pm: **An image-based approach for classification of human micro-doppler radar signatures**, Fok Hing Chi Tivive, Abdesselam Bouzerdoum, Son Lam Phung, Univ. of Wollongong (Australia) . . . . . [8734-5]

4:40 pm: **Radar classification of human motions under various training scenarios**, Dustin P. Fairchild, Ram M. Narayanan, The Pennsylvania State Univ. (USA) . . . . . [8734-6]

5:00 pm: **Multi-aspect angle classification of human radar signatures**, Cesur Karabacak, TOBB Univ. of Economics and Technology (Turkey); Sevgi Z. Gurbuz, TOBB Univ. of Economics and Technology (Turkey) and TÜBITAK UZAY (Turkey); Mehmet B. Guldogan, Turgut Özal Univ. (Turkey); Ali Cafer Gurbuz, TOBB Univ. of Economics and Technology (Turkey). . . . . [8734-7]

Passive and Active Millimeter-Wave Imaging XVI

Conference Chairs: **David A. Wikner,** U.S. Army Research Lab. (USA); **Arttu R. Luukanen,** VTT Technical Research Ctr. of Finland (Finland)

Program Committee: **Roger Appleby,** Queen's Univ. Belfast (United Kingdom); **Erich N. Grossman,** National Institute of Standards and Technology (USA); **Christopher A. Martin,** Trex Enterprises Corp. (USA); **Duncan A. Robertson,** Univ. of St. Andrews (United Kingdom); **Bruce Wallace,** Defense Advanced Research Projects Agency (USA)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 320 . . . . . Thu 8:00 am to 10:00 am

Enabling Technology

Session Chair: **David A. Wikner,** U.S. Army Research Lab. (USA)

8:00 am: **140-220 GHz imaging front-ends based on 250 nm InP/InGaAs/InP DHBT process**, Vessen Vassilev, Herbert Zirath, Rumen Kozhuharov, Yogesh Karandikar, Vedran Furtula, Chalmers Univ. of Technology (Sweden) . . . . . [8715-1]

8:20 am: **Enabling technologies for mmw and THz imaging systems**, Bryan Bothwell, TriQuint Semiconductor, Inc. (USA) . . . . . [8715-2]

8:40 am: **A SiGe BiCMOS W-band passive imaging receiver using lossless flicker-noise cancellation**, Vipul Jain, Farbod Behbahani, SaberTek, Inc. (USA) . . . . . [8715-3]

9:00 am: **Recent developments using TowerJazz SiGe BiCMOS platform for mmWave and THz applications**, Arjun Kar-Roy, David Howard, Edward J. Preisler, Marco Racanelli, Jazz Semiconductor, Inc. (USA) . . . . . [8715-4]

9:20 am: **Near-field measurements of submillimeter-wave reflectarrays**, Aleksi A. Tamminen, Juha Ala-Laurinaho, Sampo Mäkelä, Aalto Univ. School of Science and Technology (Finland); David Gomes-Martins, Päivi Koivisto, Pekka

a Rantakari, Jussi Säily, Reijo Tuovinen, Arttu R. Luukanen, VTT Technical Research Ctr. of Finland (Finland); Antti V. Räisänen, Aalto Univ. School of Science and Technology (Finland); Markku Sipilä, VTT Technical Research Ctr. of Finland (Finland). . . . . [8715-6]

9:40 am: **Backscattering of ground terrain and building materials at terahertz frequencies**, David A. DiGiovanni, Andrew J. Gatesman, Robert H. Giles, Univ. of Massachusetts Lowell (USA); William E. Nixon, National Ground Intelligence Ctr. (USA) . . . . . [8715-24]

Coffee/Exhibition Break. . . . . .Thu 10:00 am to 10:50 am

SESSION 2

Room: Conv. Ctr. 320 . . . . . Thu 10:50 am to 11:50 am

Security Imaging I

Session Chair: **Arttu R. Luukanen,**
VTT Technical Research Ctr. of Finland (Finland)

10:50 am: **Wide-bandwidth, wide-beamwidth, high-resolution, millimeter-wave imaging for concealed weapon detection**, David M. Sheen, Justin L. Fernandes, Jonathan R. Tedeschi, Douglas L. McMakin, Mark Jones, Wayne M. Lechelt, Ronald H. Severtsen, Pacific Northwest National Lab. (USA). . . . . [8715-7]

11:10 am: **Submillimeter-wave imaging radar utilizing transceiver arrays**, Ken B. Cooper, Jet Propulsion Lab. (USA). . . . . [8715-8]

11:30 am: **Personnel screening with advanced multistatic imaging technology**, Sherif S. Ahmed, Rohde & Schwarz GmbH & Co. KG (Germany). . . . . [8715-9]

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

SESSION 3

Room: Conv. Ctr. 320 . . . . . Thu 1:20 pm to 3:00 pm

Security Imaging II

Session Chair: **Roger Appleby,** Queen's Univ. Belfast (United Kingdom)

1:20 pm: **Three-dimensional millimeter-wave imaging for concealed threat detection in shoes**, Justin L. Fernandes, Douglas L. McMakin, Jonathan R. Tedeschi, David M. Sheen, Pacific Northwest National Lab. (USA) . . . . . [8715-11]

1:40 pm: **Environmental control for improved Passive Millimeter Wave concealed object detection**, Thomas D. Williams, Millivision Technologies, Inc. (USA) . . . . . [8715-12]

2:00 pm: **Development of passive submillimeter-wave video imaging systems**, Erik Heinz, Torsten May, Detlef Born, Gabriel Zieger, Katja Peiselt, Anika Brömel, Solveig Anders, Vyacheslav Zakosarenko, Torsten Krause, André Krüger, Marco Schulz, Hans-Georg Meyer, Institut für Photonische Technologien e.V. (Germany) . . . . . [8715-13]

2:20 pm: **Passive three-colour submillimetre-wave video camera**, Arttu R. Luukanen, Leif Grönberg, VTT Technical Research Ctr. of Finland (Finland); Markus Grönholm, Asqella Oy (Finland); Mikko M. Leivo, Anssi Rautiainen, Hans Toivanen, VTT Technical Research Ctr. of Finland (Finland) . . . . . [8715-14]

2:40 pm: **Fully polarimetric differential intensity W-band imager**, Bruce E. Bernacki, Jonathan R. Tedeschi, James F. Kelly, David M. Sheen, Thomas E. Hall, Patrick L. J. Valdez, Wayne M. Lechelt, Douglas L. McMakin, Pacific Northwest National Lab. (USA) . . . . . [8715-15]

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

SESSION 4

Room: Conv. Ctr. 320 . . . . . Thu 3:30 pm to 5:50 pm

Systems and Phenomenology

Session Chair: **David A. Wikner,** U.S. Army Research Lab. (USA)

3:30 pm: **SUMIRAD: a low-cost fast millimeter-wave radiometric imaging system**, Markus Peichl, Stephan Dill, Daniel Rudolf, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [8715-16]

3:50 pm: **Realization of a video-rate distributed aperture millimeter-wave imaging system using optical upconversion**, Christopher A. Schuetz, Richard D. Martin, Thomas E. Dillon, Peng Yao, Daniel Mackrides, Charles Harrity, Alicia Zablocki, Kevin Shreve, Phase Sensitive Innovations, Inc. (USA); James Bonnett, Petersen F. Curt, EM Photonics, Inc. (USA); Dennis W. Prather, Univ. of Delaware (USA) . . . . . [8715-18]

4:10 pm: **VESAS: a novel concept for fully-electronic passive MW imaging**, Eric Schreiber, Markus Peichl, Helmut H. Suess, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [8715-19]

4:30 pm: **Development of a sparse mm-wave imaging array for cm-level imaging at 100-m standoffs**, Jonathan Y. Suen, Philip M. Lubin, Acumen Scientific (USA) . . . . . [8715-20]

4:50 pm: **Passive and active imaging at 94 GHz for environmental remote sensing**, David G. Macfarlane, Duncan A. Robertson, Scott L. Cassidy, Univ. of St. Andrews (United Kingdom); Henry M. Odbert, Univ. of Bristol (United Kingdom); Mike R. James, Harry Pinkerton, Lancaster Univ. (United Kingdom); Geoff Wadge, The Univ. of Reading (United Kingdom) . . . . . [8715-21]

5:10 pm: **Nonlinearity and phase noise effects in 340 GHz 3D imaging radar**, Duncan A. Robertson, Scott L. Cassidy, David R. Bolton, Univ. of St. Andrews (United Kingdom). . . . . [8715-22]

5:30 pm: **Missile tracking and range safety: Tracking Interferometer Pathfinder System (TIPS)**, David Dowgiallo, U.S. Naval Research Lab. (USA) . . . . . [8715-17]

POSTERS-THURSDAY

Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Dynamic beam steering at submm- and mm-wave frequencies using an optically controlled lens antenna, Tom F. Gallacher, Duncan A. Robertson, Graham M. Smith, Univ. of St. Andrews (United Kingdom) . . . . . [8715-5]

20 meters standoff MMW imaging system based on Glow Discharge Detector focal plane array, Daniel Rozban, Ariel Univ. Ctr. of Samaria (Israel); Natan S. Kopeika, Ben-Gurion Univ. of the Negev (Israel); Amir Abramovich, Ariel Univ. Ctr. of Samaria (Israel); Assaf Levanon, Avihai Aharon Akram, Ben-Gurion Univ. of the Negev (Israel). . . . . [8715-23]

Embedded electronics for a video-rate distributed aperture passive millimeter-wave imager, Petersen F Curt, James Bonnett, EM Photonics, Inc. (USA); Christopher A. Schuetz, Richard D. Martin, Phase Sensitive Innovations, Inc. (USA) . . . . . [8715-25]

Monday - Tuesday 29 - 30 April 2013 • Proceedings of SPIE Vol. 8716

Terahertz Physics, Devices, and Systems VII: Advanced Applications in Industry and Defense

Conference Chairs: **Mehdi F. Anwar,** Univ. of Connecticut (USA); **Thomas W. Crowe,** Virginia Diodes, Inc. (USA); **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA)

Program Committee: **Giles Davies,** Univ. of Leeds (United Kingdom); **Gottfried H. Döhler,** Max Planck Institute for the Science of Light (Germany); **Achyut K. Dutta,** Banpil Photonics, Inc. (USA); **M. Saif Islam,** Univ. of California, Davis (USA); **Hiroshi Ito,** Kitasato Univ. (Japan); **Peter Uhd Jepsen,** Technical Univ. of Denmark (Denmark); **Edmund H. Linfield,** Univ. of Leeds (United Kingdom); **Amir Hamed Majedi,** Univ. of Waterloo (Canada); **Taiichi Otsuji,** Tohoku Univ. (Japan); **Azizur Rahman,** The City Univ. (United Kingdom); **Victor Ryzhii,** Univ. of Aizu (Japan); **Ashok K. Sood,** Magnolia Optical Technologies, Inc. (USA); **Sigfrid K. Yngvesson,** Univ. of Massachusetts Amherst (USA); **Weili Zhang,** Oklahoma State Univ. (USA)

Monday 29 April

SESSION 1
Room: Conv. Ctr. 340 . . . . . .Mon 8:30 am to 10:10 am

THz Generation I

Session Chairs: **Thomas W. Crowe,** Virginia Diodes, Inc. (USA); **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA)

8:30 am: **Broadband photonic terahertz-wave emitter integrating UTC-PD and novel planar antenna** *(Invited Paper)*, Hiroshi Ito, Kitasato Univ. (Japan); Toshihide Yoshimatsu, Nippon Telegraph and Telephone Corp. (Japan); Hiroshi Yamamoto, Kitasato Univ. (Japan); Tadao Ishibashi, NTT Electronics Corp. (Japan) . . . [8716-1]

9:10 am: **Palm-size and real-time terahertz camera, and its application to development of terahertz sources**, Naoki Oda, Tsutomu Ishi, Seiji Kurashina, Takayuki Sudou, Takao Morimoto, Masaru Miyoshi, Tokuhito Sasaki, NEC Corp. (Japan). . . . . [8716-3]

9:30 am: **Widely tunable (1-20 THz) narrowband (100 GHz) THz source for spectroscopy and imaging**, Mojca Jazbinsek, Tobias Bach, Blanca Ruiz, Carolina C. Medrano, Peter Günter, Rainbow Photonics AG (Switzerland) . . . . . [8716-4]

9:50 am: **Nb5N6 microbolometer array for detecting radiation at around 0.3 THz and 0.6 THz**, Lin Kang, Xue-Cou Tu, Jian Chen, Pei-Heng Wu, Nanjing Univ. (China) . . . . . [8716-2]

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

SESSION 2
Room: Conv. Ctr. 340 . . . . . .Mon 10:40 am to 12:00 pm

THz Spectroscopy I

Session Chairs: **Mehdi F. Anwar,** Univ. of Connecticut (USA); **Taiichi Otsuji,** Tohoku Univ. (Japan)

10:40 am: **Terahertz spectroscopy and imaging toward future medical and chemical applications** *(Invited Paper)*, Chiko Otani, Hiromichi Hoshina, RIKEN (Japan); Shinya Ishii, RIKEN (Japan) and Miyagi Univ. of Education (Japan); Hal Suzuki, RIKEN (Japan); Koji Uematsu, RIKEN (Japan) and Tohoku Univ. (Japan). . . . . [8716-5]

11:20 am: **Terahertz atmospheric attenuation and continuum effects**, David Slocum, Thomas M. Goyette, Univ. of Massachusetts Lowell (USA); Elizabeth J. Slingerland, Univ. of Massachusetts Lowell (USA) and Metron, Inc. (USA); Robert H. Giles, Univ. of Massachusetts Lowell (USA); William E. Nixon, National Ground Intelligence Ctr. (USA) . . . . . [8716-7]

11:40 am: **Detection of covered materials in the TDS-THz setup**, Norbert Palka, Military Univ. of Technology (Poland) . . . . . [8716-6]

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

SESSION 3
Room: Conv. Ctr. 340 . . . . . Mon 1:30 pm to 3:10 pm

THz Imaging I

Session Chairs: **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA); **Mehdi F. Anwar,** Univ. of Connecticut (USA)

1:30 pm: **Scanning laser THz emission imaging system** *(Invited Paper)*, Masayoshi Tonouchi, Osaka Univ. (Japan) . . . . . [8716-8]

2:10 pm: **Compact THz imaging detector with an integrated antennae array matrix**, J. Daniel Newman, Paul P. Lee, Andrew P. Sacco, ITT Exelis (USA); Dave Willems, ITT Communications Systems (USA); Robert D. Fiete, ITT Exelis (USA); Mark F. Bocko, Zeljko Ignjatovic, Xi-Cheng Zhang, Univ. of Rochester (USA) . . . . . [8716-9]

2:30 pm: **THz-vision system with extended functionality**, Janez Trontelj, Aleksander Sešek, Andrej Švigelj, Univ. of Ljubljana (Slovenia) . . . . . [8716-10]

2:50 pm: **Spectral lines dynamics as an effective tool for the identification of substance using reflected THz signal**, Vyacheslav A. Trofimov, Nikolay V. Peskov, Lomonosov Moscow State Univ. (Russian Federation). . . . . [8716-11]

Coffee Break . . . . . Mon 3:10 pm to 3:30 pm

SESSION 4
Room: Conv. Ctr. 340 . . . . . Mon 3:30 pm to 4:50 pm

THz Advanced Concepts I

Session Chairs: **Thomas W. Crowe,** Virginia Diodes, Inc. (USA); **Ashok K. Sood,** Magnolia Optical Technologies, Inc. (USA)

3:30 pm: **Response of plasmonic terahertz detector to large signals: theory and experiment** *(Invited Paper)*, Sergey Rudin, Greg Rupper, U.S. Army Research Lab. (USA); Alexey Gutin, Michael S. Shur, Rensselaer Polytechnic Institute (USA) . . . . . [8716-12]

4:10 pm: **Broadband THz generation and detection at 10-nm scale**, Yanjun Ma, Mengchen Huang, Univ. of Pittsburgh (USA); ChungWung Bark, Gachon Univ. (Korea, Republic of); Chad Folkman, Argonne National Lab. (USA); Chang-Beom Eom, Univ. of Wisconsin-Madison (USA); Jeremy Levy, Univ. of Pittsburgh (USA) . . . . . [8716-13]

4:30 pm: **New modeling techniques for terahertz metamaterials**, Mayer A. Landau, Air Force Research Lab. (USA) . . . . . [8716-14]

Symposium-wide Plenary Session
Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 340 . . . . . Tue 8:00 am to 9:55 am

THz Generation II

Session Chairs: **Mehdi F. Anwar,** Univ. of Connecticut (USA); **Azizur Rahman,** City Univ. London (United Kingdom)

8:00 am: **Widely tunable THz sources and security applications** *(Invited Paper)*, Kodo Kawase, Saroj R. S. R. Tripathi, Nagoya Univ. (Japan); Shin'ichiro Hayashi, RIKEN (Japan) . . . . . [8716-15]

8:35 am: **Room temperature terahertz quantum cascade laser sources based on difference-frequency generation**, Karun Vijayraghavan, The Univ. of Texas at Austin (USA); Frederic Demmerle, Walter Schottky Institut (Germany); Min Jang, Aiting Jiang, The Univ. of Texas at Austin (USA); Gerhard Boehm, Augustinas Vizbaris, Markus C. Amann, Walter Schottky Institut (Germany); Mikhail A. Belkin, The Univ. of Texas at Austin (USA) . . . . . [8716-16]

8:55 am: **FDTD analysis of terahertz plasmonic ring resonators**, Mustafa Karabiyik, Nezih Pala, Florida International Univ. (USA) . . . . . [8716-17]

9:15 am: **THz transmission and detection through glow discharge detectors**, Hakan Altan, Kamil Cinar, Middle East Technical Univ. (Turkey) . . . . . [8716-18]

9:35 am: **Frequency tunable narrowband THz time domain source**, Masayoshi Tonouchi, Caihong Zhang, Osaka Univ. (Japan); Yuri H. Avetisyan, Osaka Univ. (Japan) and Yerevan State Univ. (Armenia); Iwao Kawayama, Hiro Murakami, Osaka Univ. (Japan) . . . . . [8716-19]

Coffee Break . . . . . .Tue 9:55 am to 10:25 am

SESSION 6
Room: Conv. Ctr. 340 . . . . . Tue 10:25 am to 11:45 am

THz Spectroscopy II

Session Chairs: **Azizur Rahman,** City Univ. London (United Kingdom); **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA)

10:25 am: **Ceramic photonic crystals for THz applications**, Bradley T. Willis, Satya R. Ganti, S. K. Sundaram, New York State College of Ceramics at Alfred Univ. (USA) . . . . . [8716-20]

10:45 am: **Employing phase modulation and second harmonic nulling to eliminate interference fringes from the spectrum of a portable coherent frequency-domain THz spectrometer**, Joseph R. Demers, K.K. Wong, Bryon Kasper, EMCORE Corp. (USA) . . . . . [8716-21]

11:05 am: **Subterahertz resonance spectroscopy of biological macromolecules and cells**, Tatiana Globus, Univ. of Virginia (USA); Aaron Moyer, Vibratess, LLC (USA); Boris L. Gelmont, Igor Sizov, Univ. of Virginia (USA); Tatyana Khromova, Vibratess, LLC (USA); Jerome P. Ferrance, Univ. of Virginia (USA) . . . . . [8716-22]

11:25 am: **Comparisons between continuous wave and time-domain terahertz spectroscopy in carbon nanostructures**, Ehsan Dadrasnia, Sujitha Puthukodan, Horacio Lamela Rivera, Univ. Carlos III de Madrid (Spain); Guillaume Ducournau, Jean-François Lampin, Univ. des Sciences et Technologies de Lille (France); Mohan-Babu Kuppam, Frédéric Garet, Jean-Louis Coutaz, IMEP-LAHC (France) . . . . . [8716-23]

Lunch Break . . . . . .Tue 11:45 am to 1:15 pm

SESSION 7
Room: Conv. Ctr. 340 . . . . . Tue 1:15 pm to 3:00 pm

THz Advanced Concepts II

Session Chairs: **Mehdi F. Anwar,** Univ. of Connecticut (USA); **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA)

1:15 pm: **Graphene active plasmonic metamaterials for new types of terahertz lasers** *(Invited Paper)*, Taiichi Otsuji, Takayuki Watanabe, Akira Satou, Tohoku Univ. (Japan); Viacheslav V. Popov, Institute of Radio Engineering and Electronics (Russian Federation); VIctor Ryzhii, Tohoku Univ. (Japan) . . . . . [8716-24]

1:50 pm: **Micromachined probes for characterization of submillimeter-wave on-wafer components** *(Invited Paper)*, Robert M. Weikle II, N. Scott Barker, Arthur W. Lichtenberger, Matthew F. Bauwens, Univ. of Virginia (USA) . . . . . [8716-25]

2:25 pm: **Low-loss waveguides and devices for compact THz systems** *(Invited Paper)*, Azizur Rahman, Mohammad Uthman, Anita Quadir, Namassivaye Kejalakshmy, Christos Markides, Christos Themistos, City Univ. London (United Kingdom) . . . . . [8716-26]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

SESSION 8
Room: Conv. Ctr. 340 . . . . . Tue 3:40 pm to 5:00 pm

THz Imaging II

Session Chairs: **Thomas W. Crowe,** Virginia Diodes, Inc. (USA); **Tariq Manzur,** Naval Undersea Warfare Ctr. (USA)

3:40 pm: **Optically switchable matematerials in the terahertz regime** *(Invited Paper)*, Ekmel Özbay, Mutlu Gökkavas, Bilkent Univ. (Turkey) . . . [8716-27]

4:00 pm: **Heterodyne detection at 300 GHz using glow discharge detectors with efficient quasi-optical design**, Avihai Aharon Akram, Daniel Rozban, Assaf Levanon, Ben-Gurion Univ. of the Negev (Israel); Amir Abramovich, Ariel Univ. Ctr. of Samaria (Israel); Natan S. Kopeika, Ben-Gurion Univ. of the Negev (Israel). . . . . [8716-28]

4:20 pm: **Realtime terahertz imaging for laser beam profiling and medical imaging**, Lei Zhang, Matthew Erdtmann, Shankar Radhakrishnan, Ning Xue, Jack P. Salerno, Agiltron, Inc. (USA); Sigfrid K. Yngvesson, Amulya Gullapali, Kan Fu, Paul R. Siqueira, Univ. of Massachusetts Amherst (USA) . . . . . [8716-29]

4:40 pm: **Terahertz 3D imaging with a CW source and phase-shifting interferometry**, Yoshiaki Sasaki, Chiko Otani, Hiroshi Kasuga, Hitoshi Ohmori, RIKEN (Japan); Masayuki Suga, Tetsuya Yuasa, Yamagata Univ. (Japan). [8716-30]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

> Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Polar synthetic imaging, Jonathan George, The George Washington Univ. (USA) . . . . . [8716-31]

Terahertz spectra of materials measured by an OPO-based system, Norbert Palka, Mieczyslaw Szustakowski, Tomasz Trzcinski, Military Univ. of Technology (Poland) . . . . . [8716-32]

Thursday - Friday 2 - 3 May 2013 • Proceedings of SPIE Vol. 8717

Compressive Sensing II

Conference Chair: **Fauzia Ahmad,** Villanova Univ. (USA)

Program Committee: **Gonzalo R. Arce,** Univ. of Delaware (USA); **Moeness G. Amin,** Villanova Univ. (USA); **Abdesselam Salim Bouzerdoum,** Univ. of Wollongong (Australia); **Rabinder N. Madan,** Office of Naval Research (USA); **Eric L. Mokole,** U.S. Naval Research Lab. (USA); **Ram M. Narayanan,** The Pennsylvania State Univ. (USA); **Dimitris A. Pados,** Univ. at Buffalo (USA); **Athina P. Petropulu,** Rutgers, The State Univ. of New Jersey (USA)

Thursday 2 May

OPENING REMARKS

Room: Conv. Ctr. 325 . . . . . 9:10 am to 9:20 am

Fauzia Ahmad, Villanova Univ. (USA)

SESSION 1

Room: Conv. Ctr. 325 . . . . . Thu 9:20 am to 10:00 am

Compressive Measurements and Signal Modeling

Session Chair: **Dimitris A. Pados,** Univ. at Buffalo (USA)

9:20 am: **Array geometries, signal type, and sampling conditions for the application of compressed sensing in MIMO radar**, Juan Lopez, Zhijun G. Qiao, The Univ. of Texas-Pan American (USA). . . . . [8717-2]

9:40 am: **Rate-adaptive compressive video acquisition with sliding-window total-variation-minimization reconstruction**, Ying Liu, Duke Univ. (USA); Dimitris A. Pados, Univ. at Buffalo (USA) . . . . . [8717-3]

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

SESSION 2

Room: Conv. Ctr. 325 . . . . . Thu 10:30 am to 11:50 am

Hardware Implementation of CS Systems

Session Chair: **Abdesselam Bouzerdoum,** Univ. of Wollongong (Australia)

10:30 am: **Compressive motion detection techniques based on optical Radon projections**, Adrian Stern, Yuval Kashter, Ofer Levi, Ben-Gurion Univ. of the Negev (Israel) . . . . . [8717-6]

10:50 am: **Compressive sensing underwater line scan imaging system**, Bing Ouyang, Florida Atlantic Univ. (USA); Fraser R. Dalgleish, Anni K. Vuorenkoski Dalgleish, Harbor Branch Oceanographic Institute (USA); Frank M. Caimi, Walter Britton, Florida Atlantic Univ. (USA) . . . . . [8717-7]

11:10 am: **A higher-speed compressive sensing camera through multi-diode design**, Matthew A. Herman, James Tidman, Donna Hewitt, Tyler Weston, Lenore McMackin, InView Technology Corp. (USA) . . . . . [8717-8]

11:30 am: **Measurement kernel design for compressive imaging under device constraints**, Robert R. Muise, Richard Shilling, Lockheed Martin Missiles and Fire Control (USA). . . . . [8717-9]

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

SESSION 3

Room: Conv. Ctr. 325 . . . . . Thu 1:20 pm to 3:00 pm

Efficient and Robust CS Algorithms

Session Chair: **Gonzalo R. Arce,** Univ. of Delaware (USA)

1:20 pm: **An efficient sparse microwave imaging algorithm based on range-azimuth decoupled Lq regularization method**, Bingchen Zhang, Chenglong Jiang, Zhe Zhang, Yao Zhao, Wen Hong, Yirong Wu, Institute of Electronics (China) . . . . . [8717-10]

1:40 pm: **Multistatic compressive imaging under quasi-invariant occlusion models**, Raghu G. Raj, U.S. Naval Research Lab. (USA) . . . . . [8717-11]

2:00 pm: **Compressive Sensing for Sparse Time-Frequency Representation of Nonstationary Signals in the Presence of Impulsive Noise**, Irena Orovic, Srdjan Stankovic, Univ. of Montenegro (Montenegro); Moeness G. Amin, Villanova Univ. (USA) . . . . . [8717-12]

2:20 pm: **Approximate message passing algorithm for compressive sensing with random circulant system matrices**, Mahesh C. Shastry, Ram M. Narayanan, The Pennsylvania State Univ. (USA); Muralidhar Rangaswamy, Air Force Research Lab. (USA) . . . . . [8717-13]

2:40 pm: **High-efficiency imaging via system compression**, Xiteng Liu, Univ. of Toronto (Canada). . . . . [8717-14]

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

SESSION 4

Room: Conv. Ctr. 325 . . . . . Thu 3:30 pm to 4:50 pm

Compressive Sensing for Spectral Imaging

Session Chair: **Mahesh C. Shastry,** The Pennsylvania State Univ. (USA)

3:30 pm: **Optimization of pseudorandom coded apertures for spectrally selective compressive imaging**, Henry Arguello, Univ. of Delaware (USA) and Univ. Industrial de Santander (Colombia); Gonzalo R. Arce, Alejandro Parada, Univ. of Delaware (USA) . . . . . [8717-15]

3:50 pm: **Accurate reconstruction of hyperspectral images from compressive sensing measurements**, Justin C. Flake, Booz Allen Hamilton Inc. (USA); John B. Greer, National Geospatial-Intelligence Agency (USA) . . . . . [8717-16]

4:10 pm: **Block-based reconstructions for compressive spectral imaging**, Claudia V. Correa, Henry Arguello, Univ. of Delaware (USA) and Univ. Industrial de Santander (Colombia); Gonzalo R. Arce, Univ. of Delaware (USA) . . . . . [8717-17]

4:30 pm: **Spatial versus spectral compression ratio in compressive sensing of hyperspectral imaging**, Yitzhak August, Chaim Z. Vachman, Adrian Stern, Ben-Gurion Univ. of the Negev (Israel) . . . . . [8717-18]

POSTERS-THURSDAY

Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

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Information theoretic bounds for compressed sensing in SAR imaging, Jingxiong Zhang, Ke Yang, Wuhan Univ. (China); Jianzhong Guo, Wuhan Textile Univ. (China) . . . . . [8717-29]

Color-dependent PRNU (photo response non-uniformity) on CMOS image sensor, Changhui Ye, Sungsu Lee, Pixelplus Co., Ltd. (Korea, Republic of) . . . . . [8717-30]

Friday 3 May

SESSION 5

Room: Conv. Ctr. 325 . . . . . Fri 8:00 am to 10:00 am

Compressive Sensing for Radar

Session Chair: **Moeness G. Amin,** Villanova Univ. (USA)

8:00 am: **Sparse microwave imaging radar: initial system design and performance analysis**, Yirong Wu, Wen Hong, Bingchen Zhang, Zhe Zhang, Chenglong Jiang, Institute of Electronics (China) . . . . . [8717-19]

8:20 am: **Enhanced through-the-wall radar imaging using Bayesian compressive sensing**, Van Ha Tang, Abdesselam Bouzerdoum, Son Lam Phung, Fok Hing Chi Tivive, Univ. of Wollongong (Australia) . . . . . [8717-20]

8:40 am: **A capon beamforming method for clutter suppression in colocated compressive sensing based MIMO radar**, Shunqiao Sun, Yao Yu, Athina P. Petropulu, Rutgers, The State Univ. of New Jersey (USA) . . . . . [8717-21]

9:00 am: **Improved interior wall detection using designated dictionaries in compressive urban sensing problems**, Eva Lagunas, Univ. Politècnica de Catalunya (Spain); Moeness G. Amin, Fauzia Ahmad, Villanova Univ. (USA); Montse Najar, Univ. Politècnica de Catalunya (Spain) . . . . . [8717-22]

9:20 am: **Detection performance and hardware complexity analysis of radar compressive sensing**, Asmita Korde, Jerome L. V. M. Stanislaus, Tinoosh Mohsenin, Univ. of Maryland, Baltimore County (USA); Damon Bradley, NASA Goddard Space Flight Ctr. (USA) . . . . . [8717-23]

9:40 am: **UWB radar echo signal detection based on compressive sensing**, Shugao Xia, Jeffrey Sichina, Fengshan Liu, Delaware State Univ. (USA) . . [8717-24]

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

SESSION 6

Room: Conv. Ctr. 325 . . . . . Fri 10:30 am to 11:50 am

Compressive Signal Processing

Session Chair: **Ram M. Narayanan,** The Pennsylvania State Univ. (USA)

10:30 am: **Towards the use of learned dictionaries and compressive sensing in wideband signal detection**, Jerry Carreon, Novita Research Labs Corp. (USA); Sergio D. Cabrera, The Univ. of Texas at El Paso (USA) . . . . . [8717-25]

10:50 am: **Improved signal representation using a combined L-estimate and compressive sensing approach**, Ljubisa Stankovic, Srdjan Stankovic, Irena Orovic, Univ. of Montenegro (Montenegro); Moeness G. Amin, Villanova Univ. (USA) . . . . . [8717-26]

11:10 am: **Compressive detection of frequency-hopping spread spectrum signals**, Feng Liu, BIO5 Institute (USA); Michael W. Marcellin, The Univ. of Arizona (USA); Nathan A. Goodman, The Univ. of Oklahoma (USA); Ali Bilgin, The Univ. of Arizona (USA) . . . . . [8717-27]

11:30 am: **How to find real-world applications of compressive sensing**, Leslie N. Smith, U.S. Naval Research Lab. (USA) . . . . . [8717-28]

Monday - Tuesday 29 - 30 April 2013 • Proceedings of SPIE Vol. 8718

Advanced Environmental, Chemical, and Biological Sensing Technologies X

Conference Chairs: **Tuan Vo-Dinh,** Fitzpatrick Institute for Photonics, Duke Univ. (USA); **Robert A. Lieberman,** Intelligent Optical Systems, Inc. (USA); **Günter G. Gauglitz,** Eberhard Karls Univ. Tübingen (Germany)

Program Committee: **Zane A. Arp,** GlaxoSmithKline (USA); **Francesco Baldini,** Istituto di Fisica Applicata Nello Carrara (Italy); **Luigi Campanella,** Univ. degli Studi di Roma La Sapienza (Italy); **Jesus Delgado Alonso,** Intelligent Optical Systems, Inc. (USA); **Franz Ludwig Dickert,** Univ. Wien (Austria); **Dennis K. Killinger,** Univ. of South Florida (USA); **Heinz-Detlef Kronfeldt,** Technische Univ. Berlin (Germany); **Robert Lascola,** Savannah River National Lab. (USA); **Edgar A. Mendoza,** Redondo Optics, Inc. (USA); **Anna Grazia Mignani,** Istituto di Fisica Applicata Nello Carrara (Italy); **Klaus Schäfer,** Karlsruher Institut für Technologie (Germany)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 349 . . . . . .Mon 9:00 am to 9:40 am

Water Monitoring Systems

Session Chair: **Robert A. Lieberman,**
Intelligent Optical Systems, Inc. (USA)

9:00 am: **Innovative Raman spectroscopic concepts for in situ monitoring of chemicals in sea-water**, Kay Sowoidnich, Maria Fernandez Lopez, Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany). . . . . [8718-1]

9:20 am: **THz absorption spectra and stability of Fe water complexes calculated by density functional theory**, Lulu Huang, Samuel G. Lambrakos, U.S. Naval Research Lab. (USA); Andrew Shabaev, George Mason Univ. (USA); Lou Massa, Hunter College (USA); Constantine Yapijakis, The Cooper Union for the Advancement of Science and Art (USA) . . . . . [8718-3]

SESSION 2

Room: Conv. Ctr. 349 . . . . . .Mon 9:40 am to 11:40 am

SERS Plasmonic Sensing Systems

Session Chair: **Tuan Vo-Dinh,**
Fitzpatrick Institute for Photonics, Duke Univ. (USA)

9:40 am: **A paper-based inkjet-fabricated substrate for SERS detection and differentiation of PCR products**, Eric P. Hoppmann, Ian M. White, Univ. of Maryland, College Park (USA) . . . . . [8718-4]

Coffee Break . . . . . Mon 10:00 am to 10:40 am

10:40 am: **UV spectral behavior of Ag-coated Al plasmonic band gap surface nanostructures**, Hande Cavus, TÜBITAK Marmara Research Ctr. (Turkey) and Istanbul Univ. (Turkey); Ibrahim Yusufoglu, Istanbul Univ. (Turkey); Mustafa M. Aslan, TÜBITAK Marmara Research Ctr. (Turkey). . . . . [8718-5]

11:00 am: **SERS barcoding for quick identification of pathogens enabled by engineered plasmonic nanostructure arrays**, Qiuming Yu, Jiajie Xu, Univ. of Washington (USA); Jeffrey Turner, Mark Strom, Northwest Fisheries Science Ctr. (USA) . . . . . [8718-6]

11:20 am: **SERS plasmonic systems for environmental, biodefesnse, and food safety applications**, Hsin-Neng Wang, Tuan Vo-Dinh, Duke Univ. (USA) . . [8718-7]

Lunch Break . . . . . Mon 11:40 am to 1:10 pm

SESSION 3

Room: Conv. Ctr. 349 . . . . . Mon 1:10 pm to 2:55 pm

Advanced Sensing Methodologies and Techniques I

Session Chair: **Heinz-Detlef Kronfeldt,** Technische Univ. Berlin (Germany)

1:10 pm: **Monolithic Y-branch dual wavelength DBR diode laser at 671 nm for Shifted Excitation Raman Difference Spectroscopy (SERDS)** *(Invited Paper)*, Martin Maiwald, Jörg Fricke, Arnim Ginolas, Johannes Pohl, Bernd Sumpf, Götz Erbert, Günther Tränkle, Ferdinand-Braun-Institut (Germany) . . . . . [8718-8]

1:35 pm: **Threefold enhancement in refractive index sensitivity of internally bent long period grating**, Francesco Chiavaioli, Francesco Baldini, Cosimo Trono, Ambra Giannetti, Sara Tombelli, Riccardo Falciai, Istituto di Fisica Applicata Nello Carrara (Italy) . . . . . [8718-9]

1:55 pm: **Optical properties of plasmonic sensor structures consist of gold coated over nanostructured alumina films**, Mustafa M. Aslan, TÜBITAK Marmara Research Ctr. (Turkey). . . . . [8718-10]

2:15 pm: **Rapid prototyping via 3D-printing of solar-powered, battery-operated microplasmas on sugar-cube sized chips used either as a light source or for elemental analysis by portable optical spectrometer**, X. Zhang, D. Devathasan, Vassili Karanassios, Univ. of Waterloo (Canada). . . . . [8718-11]

2:35 pm: **Integrated electrophoretic capillary nanofluidic biochip (ECField-Nanochip) for the fast-throughput separation and analysis of biological molecules**, Edgar A. Mendoza, Redondo Optics, Inc. (USA). . . . . [8718-12]

Coffee Break . . . . . Mon 2:55 pm to 3:25 pm

SESSION 4

Room: Conv. Ctr. 349 . . . . . Mon 3:25 pm to 4:50 pm

Advanced Sensing Methodologies and Techniques II

Session Chair: **Heinz-Detlef Kronfeldt,** Technische Univ. Berlin (Germany)

3:25 pm: **Miniaturized diode laser-based light sources for in-situ shifted excitation Raman difference spectroscopy** *(Invited Paper)*, Bernd Sumpf, Martin Maiwald, Ferdinand-Braun-Institut (Germany); Kay Sowoidnich, Heinz-Detlef Kronfeldt, Technische Univ. Berlin (Germany). . . . . [8718-13]

3:50 pm: **High-performance orthogonal spectroscopic sensing system and algorithm for identification of molecular fingerprints**, Samar K. Guharay, The MITRE Corp. (USA) . . . . . [8718-14]

4:10 pm: **Toward aerosols LiDAR scattering plots classification and analysis**, Amr H. Yousef, Khan M. Iftekharuddin, Mohammad A. Karim, Old Dominion Univ. (USA) . . . . . [8718-15]

4:30 pm: **A multimodal image reconstruction method using ultrasonic waves and electrical impedance tomography**, Mahmoud Meribout, The Petroleum Institute (United Arab Emirates). . . . . [8718-27]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 349 . . . . . Tue 8:40 am to 10:00 am

Gas Sensing Systems I

Session Chair: **Robert A. Lieberman,**
Intelligent Optical Systems, Inc. (USA)

8:40 am: **Polarized imaging nephelometer for field and aircraft measurements of aerosol phase function**, Gergely Dolgos, Jose V. Martins, Univ. of Maryland, Baltimore County (USA); Andreas J. Beyersdorf, NASA Langley Research Ctr. (USA); Jan D. Cieslak, Reed W. Espinosa, Univ. of Maryland, Baltimore County (USA); Johnathan W. Hair, NASA Langley Research Ctr. (USA); Eric Meyer, Haotian Sun, Bryant Szelistowski, Univ. of Maryland, Baltimore County (USA); Luke D. Ziemba, NASA Langley Research Ctr. (USA) . . . . . [8718-17]

9:00 am: **H_2S sensing characteristics of Au: Fe_2O_3 thin films deposited using electron beam evaporation method**, Vishal Baloria, Guru Nanak Dev Univ. (India); Niranjan S. Ramgir, Ajay Singh, Anil K. Debnath, Bhabha Atomic Research Ctr. (India); Aman Mahajan, Ratish K. Bedi, Guru Nanak Dev Univ. (India); Dinesh K. Aswal, Shiv K. Gupta, Bhabha Atomic Research Ctr. (India) . . . . . [8718-18]

9:20 am: **Ambient detection of CH4 and N2O by Quantum Cascade Laser**, Paulo C. Castillo, Ihor Sydoryk, Barry M. Gross, Fred Moshary, The City College of New York (USA). . . . . [8718-19]

9:40 am: **Recent progress in extended-length fiber optic carbon dioxide monitoring**, Robert A. Lieberman, Jesus Delgado-Alonso, Intelligent Optical Systems, Inc.. . . . . [8718-20]

Coffee Break . . . . . .Tue 10:00 am to 10:45 am

SESSION 6
Room: Conv. Ctr. 349 . . . . . Tue 10:45 am to 12:25 pm

Gas Sensing Systems II

Session Chair: **Francesco Baldini,**
Istituto di Fisica Applicata Nello Carrara (Italy)

10:45 am: **Comparative analysis of alternative spectral bands of CO_2 and O_2 for the sensing of CO_2 mixing ratios**, Denis V. Pliutau, Narasimha S. Prasad, NASA Langley Research Ctr. (USA) . . . . . [8718-21]

11:05 am: **Studies on sensitive Raman gas detectors**, Duluo Zuo, Yongyue Xu, Xingbing Wang, Huazhong Univ. of Science and Technology (China); Youhui Xiong, Wuhan Cubic Optoelectronics Co., Ltd. (China). . . . . [8718-22]

11:25 am: **Fast response cavity-enhanced ozone monitor**, Anthony Gomez, Elias P. Rosen, Southwest Sciences, Inc. (USA). . . . . [8718-23]

11:45 am: **Relaxation of photoconductivity in porous silicon for gas sensing**, Liubomyr S. Monastyrsky, Ivan Franko National Univ. of L'viv (Ukraine) . . [8718-24]

12:05 pm: **Miniature and non-invasive multiparameter integrated optic respiratory monitor (ResHealth™) device**, Edgar A. Mendoza, Yan Esterkin, Connie Kempen, Sonjian Sun, Redondo Optics, Inc. (USA). . . . . [8718-25]

Smart Biomedical and Physiological Sensor Technology X

Conference Chairs: **Brian M. Cullum,** Univ. of Maryland, Baltimore County (USA); **Eric S. McLamore,** Univ. of Florida (USA)

Program Committee: **Troy A. Alexander,** U.S. Army Research Lab. (USA); **Christopher Anton,** Episensors, Inc. (USA); **Karl S. Booksh,** Univ. of Delaware (USA); **Amethist S. Finch,** U.S. Army Research Lab. (USA); **Claudia Gärtner,** microfluidic ChipShop GmbH (Germany); **Christopher D. Geddes,** Univ. of Maryland, Baltimore (USA); **Ilko K. Ilev,** U.S. Food and Drug Administration (USA); **Lori Kamemoto,** Univ. of Hawai'i (USA); **Chang-Soo Kim,** Missouri Univ. of Science and Technology (USA); **Nicole Y. Morgan,** NIBIB/National Institutes of Health (USA); **Joshua Pfefer,** U.S. Food and Drug Administration (USA); **Marcin Ptaszek,** Univ. of Maryland, Baltimore County (USA); **Adam M. Rawlett,** U.S. Army Research Lab. (USA); **Shiv K. Sharma,** Univ. of Hawai'i (USA); **Narsingh B. Singh,** Univ. of Maryland, Baltimore County (USA); **Ryan J. White,** Univ. of Maryland, Baltimore County (USA)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 348 . . . . . .Wed 8:10 am to 10:00 am

Smart Biosensing Strategies at the Cellular and Bacterial Level

Session Chairs: **Christopher Anton,** Episensors, Inc. (USA); **Brian M. Cullum,** Univ. of Maryland, Baltimore County (USA)

8:10 am: **Fitness approach for inferring intent in markerless mutated genomes**, Dontcho V. Jelev, Mia Hunt, Anna Le, Christopher Dupuis, Suelynn Ren, U.S. Army Research Lab. (USA); Henry S. Gibbons, U.S. Army Edgewood Chemical Biological Ctr. (USA). . . . . [8719-1]

8:30 am: **Developing a cell-based sensor for the detection of Autoinducer-2**, Matthew D. Servinsky, Patrick C. Allen, U.S. Army Research Lab. (USA); Chen-Yu Tsao, Univ. of Maryland, College Park (USA); Christopher M. Byrd, Christian J. Sund, U.S. Army Research Lab. (USA); William E. Bentley, Univ. of Maryland, College Park (USA); Katherine Germane, U.S. Army Research Lab. (USA) . [8719-2]

8:50 am: **Quantum dot FRET-based rapid detection of biological pathogens**, Christopher Anton, Episensors, Inc. (USA) . . . . . [8719-3]

9:10 am: **Zinc oxide nanorod platforms in highly sensitive biodetection** *(Invited Paper)*, Jong-in Hahm, Georgetown Univ. (USA) . . . . . [8719-4]

9:40 am: **Surface functionalization for sensitive detection of glucose in complex medium using SERS**, Fang Sun, Shaoyi Jiang, Qiuming Yu, Univ. of Washington (USA) . . . . . [8719-5]

Coffee Break . . . . . Wed 10:00 am to 10:20 am

SESSION 2

Room: Conv. Ctr. 317 . . . . . .Wed 10:20 am to 12:20 pm

NOTE ROOM CHANGE

Micro- and Nanotechnology for Health Care

Joint Session with Conference 8725 and 8719

Session Chairs: **Brian M. Cullum,** Univ. of Maryland, Baltimore County (USA); **Eric S. McLamore,** Univ. of Florida (USA); **Noriko Satake,** UC Davis Medical Ctr. (USA); **Scott D. Collins,** Univ. of Maine (USA); **Thomas George,** Zyomed Corp. (USA)

10:50 am: **Microscale technologies for imaging endogenous gene expression in individual cells within 3D tissues** *(Invited Paper)*, Nitin Nitin, Univ. of California, Davis (USA) . . . . . [8725-38]

11:10 am: **Biological engineering approaches for cellular and biomolecular detection and sensing** *(Invited Paper)*, D. Marshall Porterfield, NASA Headquarters (USA) and Purdue Univ. (USA) . . . . . [8719-6]

11:50 am: **NIBIB activities in the areas of sensing, molecular sensing, mobile health and systems** *(Keynote Presentation)*, William Heetderks, National Institutes of Health (USA) . . . . . [8725-40]

Lunch/Exhibition Break . . . . . Wed 12:20 pm to 2:00 pm

SESSION 3

Room: Conv. Ctr. 348 . . . . . Wed 2:00 pm to 3:20 pm

Smart Materials for Biorecognition and Biosensing

Session Chairs: **Amethist S. Finch,** U.S. Army Research Lab. (USA); **Ryan J. White,** Univ. of Maryland, Baltimore County (USA)

2:00 pm: **Optical fiber nanotips coated with molecular beacons for mRNA detection in cells**, Ambra Giannetti, Andrea Barucci, Sara Tombelli, Cosimo Trono, Franco Cosi, Istituto di Fisica Applicata Nello Carrara (Italy); Giancarlo C. Righini, Istituto di Fisica Applicata Nello Carrara (Italy) and Enrico Fermi Ctr. (Italy); Stefano Pelli, Francesco Baldini, Istituto di Fisica Applicata Nello Carrara (Italy) . . . [8719-7]

2:20 pm: **Biodiscovery of aluminum binding peptides**, Bryn L. Adams, Deborah A. Sarkes, Amethist S. Finch, Margaret M. Hurley, Dimitra N. Stratis-Cullum, U.S. Army Research Lab. (USA) . . . . . [8719-9]

2:40 pm: **XPairIt: novel toolkit design for smart reagent development**, Margaret M. Hurley, Michael S. Sellers, U.S. Army Research Lab. (USA) . . . . . [8719-10]

3:00 pm: **Modeling of CdZnTe single crystals growth for detectors and sensors** *(Invited Paper)*, Liliana Braescu, Institut National de la Recherche Scientifique (Canada) and West Univ. of Timisoara (Romania). . . . . [8719-11]

Coffee Break . . . . . Wed 3:20 pm to 4:00 pm

SESSION 4

Room: Conv. Ctr. 348 . . . . . Wed 4:00 pm to 5:40 pm

Lab-on-a-Chip Technologies for Biological Sensing

Session Chairs: **Claudia Gärtner,** microfluidic ChipShop GmbH (Germany); **Brian M. Cullum,** Univ. of Maryland, Baltimore County (USA)

4:00 pm: **From microfluidic modules to an integrated Lab-on-a-Chip system for the detection of Francisella tularensis**, Nadine Hlawatsch, Marco Krumbholz, Anna Prüfer, Christian Moche, Holger Becker, Claudia Gärtner, microfluidic ChipShop GmbH (Germany) . . . . . [8719-12]

4:20 pm: **Effect of surface structuring onto the efficiency of the in- and out-coupling of light from a chip in Lab-on-a-chip approaches with optical detection**, Ines Frese, Rainer Gransee, Institut für Mikrotechnik Mainz GmbH (Germany) . . . . . [8719-13]

4:40 pm: **Purification of Bacillus thuringiensis DNA with polymer-based microfluidic lab-on-a-chip systems**, Sandra Julich, Friedrich-Loeffler-Institute (Germany); Nadine Hlawatsch, microfluidic ChipShop GmbH (Germany); Rok Kopinc, Ales Lapanje, Institute of Physical Biology (Slovenia); Herbert Tomaso, Friedrich-Loeffler-Institute (Germany) . . . . . [8719-14]

5:00 pm: **Microchannel impedance for quasi Newtonian fluids with spatial modulated viscosity**, Tatiana Tabares, Univ. EAFIT (Colombia) . . . . . [8719-15]

5:20 pm: **Cylindrical matrix device with a circular release area with inhomogeneous diffusivity** *(Invited Paper)*, Carlos A. Cuartas, Univ. EAFIT (Colombia) . . . . . [8719-16]

Thursday 2 May

SESSION 5
Room: Conv. Ctr. 348 . . . . . Thu 8:00 am to 10:00 am

Electrochemical and Noninvasive Sensing for Rapid Patient Monitoring

Session Chairs: **Ryan J. White,** Univ. of Maryland, Baltimore County (USA); **Eric S. McLamore,** Univ. of Florida (USA)

8:00 am: **Facile bionanocomposite platforms for development of electrochemical biosensors**, Eric S. McLamore, Zhaohui Tong, Univ. of Florida (USA) . . . . . [8719-17]

8:20 am: **Compatibly interfacing electrochemical sensors with biology**, Lauren Schoukroun, Samiullah Wagan, Ryan J. White, Univ. of Maryland, Baltimore County (USA) . . . . . [8719-18]

8:40 am: **Utilizing metalized fabrics for liquid and rip detection and localization**, Stephen Holland, The Univ. of Tennessee Knoxville (USA) and Oak Ridge National Lab. (USA); Cody Mahan, Western Kentucky Univ. (USA); Michael Kuhn, Nathan Rowe, Oak Ridge National Lab. (USA). . . . . [8719-19]

9:00 am: **Noninvasive mechanical properties estimation of embedded objects using tactile imaging sensor**, Firdous Saleheen, Vira Oleksyuk, Amrita Sahu, Chang-Hee Won, Temple Univ. (USA) . . . . . [8719-20]

9:20 am: **Ambulatory EEG neuromonitor platform for engagement studies of children with development delays**, Ruhi Mahajan, Sergi Consul-Pacareu, Mohammed Abu Saude, Md Nazmus Sahadat, Bashir I. Morshed, Univ. of Memphis (USA) . . . . . [8719-21]

9:40 am: **Remote sensing of heart rate using millimeter-wave interferometry and probabilistic interpolation**, Ilya V. Mikhelson, Northwestern Univ. (USA); Sasan Bakhtiari Sr., Thomas W. Elmer, Shaolin Liao, Argonne National Lab. (USA); Alan V. Sahakian, Northwestern Univ. (USA) . . . . . [8719-22]

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

SESSION 6
Room: Conv. Ctr. 348 . . . . . Thu 10:30 am to 12:30 pm

Smart Sensing Platforms and Technologies

Session Chairs: **Amethist S. Finch,** U.S. Army Research Lab. (USA); **Christopher Anton,** Episensors, Inc. (USA)

10:30 am: **Self-referencing microsensors for studying physiological transport**, Stephanie L. Burrs, Diana Vanegas, Masashige Taguchi, Prachee Chaturvedi, Eric S. McLamore, Univ. of Florida (USA). . . . . [8719-23]

10:50 am: **A multiplexing fiber optic microsensor system for monitoring oxygen concentration in plants during simulated climate change**, Prachee Chaturvedi, Bernie Hauser, Eric S. McLamore, Univ. of Florida (USA); Eric Karplus, Science Wares, Inc. (USA); L. H. Allen, U.S. Dept. of Agriculture (USA); K. J. Boote, Univ. of Florida (USA) . . . . . [8719-24]

11:10 am: **Towards a modular, robust, and portable sensing platform for biological and point of care diagnostics**, Amethist S. Finch, Justin R. Bickford, Marvin A. Conn, Matthew B. Coppock, Deborah A. Sarkes, Dimitra N. Stratis-Cullum, U.S. Army Research Lab. (USA). . . . . [8719-25]

11:30 am: **High-sensitivity pulsed laser vibrometer for detection of biological life signatures and microphone applications** *(Invited Paper)*, Narasimha S. Prasad, NASA Langley Research Ctr. (USA); Chen-Chia Wang, Sudhir B. Trivedi, Brimrose Corp. of America (USA). . . . . [8719-26]

11:50 am: **Nanowire-nanocluster hybrid sensor technology for environmental, industrial, and security monitoring** *(Invited Paper)*, Abhishek Motayed, National Institute of Standards and Technology (USA) and Univ. of Maryland (USA); Geetha S. Aluri, Ritu Bajpai, Albert V. Davydov, National Institute of Standards and Technology (USA); Rao V. Mulpuri, George Mason Univ. (USA); Mona Zaghloul, The George Washington Univ. (USA). . . . . [8719-27]

12:10 pm: **Tunable graphene-based SPR sensors**, Ergun Simsek, The George Washington Univ. (USA) . . . . . [8719-28]

Lunch Break . . . . . Thu 12:30 pm to 2:00 pm

SESSION 7
Room: Conv. Ctr. 348 . . . . . Thu 2:00 pm to 3:40 pm

Multispectral Imaging Agents and Systems for Tissue Diagnostics

Session Chairs: **Mohan Singh,** Purvanchal Univ. (India); **Marie-Christine F. Daniel,** Univ. of Maryland, Baltimore County (USA)

2:00 pm: **Development and characterization of two-photon fluorescent miniemulsion nanoparticles for targeted drug delivery**, Suproteem K. Sarkar, Conestoga High School (USA) and Univ. of Massachusetts Lowell (USA); Soumitra Satapathi, Lian Li, Univ. of Massachusetts Lowell (USA); Marina V. Backer, Joseph M. Backer, SibTech, Inc. (USA); Jayant Kumar, Univ. of Massachusetts Lowell (USA) . . . . . [8719-29]

2:20 pm: **Bifunctional gold nanoparticles for targeted dual imaging of angiotensin converting enzyme** *(Invited Paper)*, Marie-Christine F. Daniel, William E. Ghann, Univ. of Maryland, Baltimore County (USA) . . . . . [8719-30]

2:40 pm: **Imaging spectral techniques with applications to biomedical science** *(Invited Paper)*, Richard G. Madonna, Andrew Paylor, Northrop Grumman Electronic Systems (USA). . . . . [8719-31]

3:00 pm: **Performance of acousto-optical imagers for chemical and biological detection**, Narsingh B. Singh, Bradley Arnold, Univ. of Maryland, Baltimore County (USA); Mohan Singh, Veer Bahadur Singh Purvanchal Univ. (India); Milton Gottlieb, Dennis Suhre, DRS Scientific, Inc. (USA) . . . . . [8719-32]

3:20 pm: **Hyperspectral imaging system to discern malignant and benign canine mammary tumors**, Amrita Sahu, Temple Univ. (USA); Cushla McGoverin, Temple Univ. (USA) and Temple Univ. (USA); Nancy Pleshko, Temple Univ. (USA); Karin Sorenmo, Univ. of Pennsylvania (USA); Chang-Hee Won, Temple Univ. (USA) . . . . . [8719-33]

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

SESSION 8
Room: Conv. Ctr. 348 . . . . . Thu 4:10 pm to 5:30 pm

Biophotonic Imaging of Tissue and Tissue Phantoms

Session Chairs: **Joshua Pfefer,** U.S. Food and Drug Administration (USA); **Narsingh B. Singh,** Univ. of Maryland, Baltimore County (USA)

4:10 pm: **Modeling photothermal safety for pulsed laser diagnostic systems: experimental validation and applications**, Taylor Gould, Quanzeng Wang, Do-Hyun Kim, Joshua Pfefer, U.S. Food and Drug Administration (USA) . . . . [8719-34]

4:30 pm: **Characterization and application of 3D-printed phantoms for biophotonic imaging**, Jianting Wang, Univ. of Maryland, College Park (USA) and U.S. Food and Drug Administration (USA); Du V. N. Le, The Catholic Univ. of America (USA) and U.S. Food and Drug Administration (USA); James Coburn, U.S. Food and Drug Administration (USA); Nicholas C. Woolsey, Yu Chen, Univ. of Maryland, College Park (USA) and U.S. Food and Drug Administration (USA); Jessica C. Ramella-Roman, The Catholic Univ. of America (USA) and U.S. Food and Drug Administration (USA); Joshua Pfefer, U.S. Food and Drug Administration (USA) . . . . . [8719-35]

4:50 pm: **Biomimetic self-assembly of polymer-inorganic hybrid nanocompartments with biomedical applications**, Zhihong Nie, Univ. of Maryland, College Park (USA). . . . . [8719-36]

5:10 pm: **Characterization and determination of endogenous species involved in brain tumors using multiphoton photoacoustic spectroscopy**, Sudhir Dahal, Brian M. Cullum, Univ. of Maryland, Baltimore County (USA) . . . . . [8719-37]

Monday - Wednesday 29 April - 1 May 2013 • Proceedings of SPIE Vol. 8720

Photonic Applications for Aerospace, Commercial, and Harsh Environments IV

Conference Chairs: **Alex A. Kazemi,** The Boeing Co. (USA); **Bernard C. Kress,** Google (USA); **Simon Thibault,** Univ. Laval (Canada)

Conference Co-Chairs: **Henry J. White,** BAE Systems (United Kingdom); **Edgar A. Mendoza,** Redondo Optics, Inc. (USA); **Nicolas Javahiraly,** Univ. de Strasbourg (France); **Michael J. Hayduk,** Air Force Research Lab. (USA)

Program Committee: **Frank Abdi,** AlphaSTAR Corp. (USA); **Mathieu Aubailly,** Univ. of Maryland, College Park (USA); **Shyam S. Bayya,** U.S. Naval Research Lab. (USA); **Lynda E. Busse,** U.S. Naval Research Lab. (USA); **Sandy Cherian,** Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); **George Cummings III,** The Boeing Co. (USA); **Niloy K. Dutta,** Univ. of Connecticut (USA); **Mark Falkingham,** GigaCom (Sweden); **Michael L. Fanto,** Air Force Research Lab. (USA); **Fumio Futami,** Tamagawa Univ. (Japan); **Leo R. Gauthier Jr.,** Johns Hopkins Univ. Applied Physics Lab. (USA); **Lei Ge,** Mitsubishi International Corp. (USA); **Sangyoun Gee,** Raydiance, Inc. (USA); **Szymon Gladysz,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Søren Grinderslev,** TE Connectivity Ltd. (USA); **Bruno Huttner,** Luciol Instruments SA (Switzerland); **Melissa E. Jansen,** Johns Hopkins Univ. Applied Physics Lab. (USA); **Abhay M. Joshi,** Discovery Semiconductors, Inc. (USA); **Peter Kiesel,** Palo Alto Research Center, Inc. (USA); **Philipp G. Kornreich,** Syracuse Univ. (USA); **Jony Jiang Liu,** U.S. Army Research Lab. (USA); **Mark A. Messer,** Carlislie Interconnect Technologies (USA); **Patrick P. Meyrueis,** Ecole Nationale Supérieure de Physique de Strasbourg (France); **Nezih Mrad,** Defence Research and Development Canada, Ottawa (Canada); **Syed H. Murshid,** Florida Institute of Technology (USA); **Kazuki Nakamura,** Mitsubishi Rayon Co., Ltd. (Japan); **Juock S. Namkung,** Naval Air Warfare Ctr. Aircraft Div. (USA); **Sudarshan Rao Nelatury,** Penn State Erie, The Behrend College (USA); **Robert A. Nye,** The Boeing Co. (USA); **Mike O'Farrell,** Cinch Connectors Ltd. (United Kingdom); **Kayo Ogawa,** Japan Women's Univ. (Japan); **Valentin Ortega Clavero,** Hochschule Offenburg (Germany); **Allen S. Panahi,** Pentair Inc. (USA); **Douglas A. Parker,** Deutsch UK (USA); **Roger Rutz,** Experior Laboratories, Inc. (USA); **Khaled Sarayeddine,** OPTINVENT S.A. (France); **Thierry F. Taunay,** OFS Labs. (USA); **Lei Wang,** Tyco Electronics (USA); **Yana Z. Williams,** Atlas Material Testing Technology LLC (USA); **Frank Weiss,** EMCORE Corp. (USA); **Bryant Wysocki,** Air Force Research Lab. (USA); **Indu F. Saxena,** DynamedX (USA)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 330 . . . . . .Mon 8:50 am to 10:20 am

Fiber Optic Sensors Systems

Session Chair: **Alex A. Kazemi,** The Boeing Co. (USA)

8:50 am: **Fiber optic oxygen sensor detection system for harsh environment of aerospace applications** *(Invited Paper)*, Alex A. Kazemi, The Boeing Co. (USA); Edgar A. Mendoza, Redondo Optics, Inc. (USA); Kishology Goswami, InnoSense LLC (USA); Lothar U. Kempen, Hochschule Ruhr West (Germany) . . . . . [8720-1]

9:20 am: **Translucent triboluminescent coatings for particle detection**, Melissa E. Jansen, Leo R. Gauthier Jr., David R. Bisson, John R. Meyer, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8720-2]

9:40 am: **Study of a fiber optic sensor for hydrogen leak detection**, Nicolas Javahiraly, Univ. de Strasbourg (France) . . . . . [8720-4]

10:00 am: **Distributed fiber optic fuel leak detection system**, Edgar A. Mendoza, Yan Esterkin, Sunjian Sun, Redondo Optics, Inc. (USA). . . . . [8720-5]

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

SESSION 2

Room: Conv. Ctr. 330 . . . . . .Mon 10:50 am to 12:10 pm

Imaging Sensors

Session Chair: **Bernard C. Kress,** Google (USA)

10:50 am: **No-reference image quality assessment for horizontal-path imaging scenarios**, Carlos Rios, Szymon Gladysz, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . . [8720-6]

11:10 am: **Rugged spinel windows and optics for harsh environments**, Shyam S. Bayya, Guillermo Villalobos, Woohong R. Kim, Lynda E. Busse, Jasbinder Sanghera, U.S. Naval Research Lab. (USA); Ish D. Aggarwal, Sotera Defense Solutions, Inc. (USA) . . . . . [8720-7]

11:30 am: **Image enhancement for deep turbulence propagation scenario using hybrid adaptive optics and image processing compensation: preliminary experimental results**, Mathieu Aubailly, Univ. of Maryland, College Park (USA); Gary W. Carhart, Jony J. Liu, U.S. Army Research Lab. (USA); Mikhail A. Vorontsov, Univ. of Dayton (USA) . . . . . [8720-8]

11:50 am: **Recent development in cryogenic optical and mechanical design**, Simon Thibault, Univ. Laval (Canada) . . . . . [8720-9]

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

SESSION 3

Room: Conv. Ctr. 330 . . . . . Mon 1:40 pm to 3:30 pm

See-through Wearable Displays/Vision-based Sensors

Session Chair: **Simon Thibault,** Univ. Laval (Canada)

1:40 pm: **A review of head-mounted displays (HMD) technologies and applications for consumer electronics** *(Invited Paper)*, Bernard C. Kress, Google, Inc. (USA). . . . . [8720-10]

2:10 pm: **Hardware acceleration of lucky-region fusion (LRF) algorithm for image acquisition and processing**, William Maignan, David Koeplinger, Univ. of Delaware (USA); Gary W. Carhart, U.S. Army Research Lab. (USA); Mathieu Aubailly, Univ. of Maryland, College Park (USA); Fouad Kiamilev, Univ. of Delaware (USA); Jony J. Liu, U.S. Army Research Lab. (USA) . . . . . [8720-11]

2:30 pm: **Optical gesture sensing and depth mapping technologies for head-mounted displays: an overview**, Bernard C. Kress, USI Photonics Inc. (USA) . . . . . [8720-12]

2:50 pm: **Key challenges to affordable see-through wearable displays: the missing link for mobile AR mass deployment**, Khaled Sarayeddine, OPTINVENT S.A. (France) . . . . . [8720-13]

3:10 pm: **Real-time polarization difference imaging (rPDI) reveal surface details and textures in harsh environments**, Denis Brousseau, Univ. Laval (Canada); Jim Plant, Q5 Innovations, Inc. (Canada); Simon Thibault, Univ. Laval (Canada) . . . . . [8720-14]

Coffee Break . . . . . Mon 3:30 pm to 3:50 pm

SESSION 4

Room: Conv. Ctr. 330 . . . . . Mon 3:50 pm to 4:50 pm

Photonics in Aviation and Commercial Industries

Session Chair: **Henry J. White,** BAE Systems (United Kingdom)

3:50 pm: **Using high-power LED in harsh environment**, Simon Thibault, Sébastien Bouchard, Univ. Laval (Canada). . . . . [8720-15]

4:10 pm: **LED-based solid state lighting: challenges and opportunities**, Allen S. Panahi, Pentair Inc. (USA) . . . . . [8720-16]

4:30 pm: **Use of formal derivative for extremizing real-valued functions of complex variables**, Sudarshan R. Nelatury, Penn State Erie, The Behrend College (USA); Charles F. Nelatury, Charles W. Nelatury, The Pennsylvania State Univ. (USA) . . . . . [8720-17]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 330 . . . . . Tue 8:20 am to 10:10 am

Optical Sensors and Interconnect for Harsh Environment

Session Chair: **Edgar A. Mendoza,** Redondo Optics, Inc. (USA)

8:20 am: **Micro-packaging in high-power LED**, Alex A. Kazemi, The Boeing Co. (USA); Allen Panahi, Pentair (USA) . . . . . [8720-18]

8:40 am: **Damage-tolerant modeling validation of wireless sensory composite panel of structural health monitoring system**, Frank Abdi, AlphaSTAR Corp. (USA) . . . . . [8720-19]

9:00 am: **In-flight fiber optic acoustic emission sensor (FAESense™) system for the real time detection, localization, and classification of damage in composite aircraft structures.** *(Invited Paper)*, Edgar A. Mendoza, Yan Esterkin, Connie Kempen, John Prohaska, Sunjian Sun, Redondo Optics, Inc. (USA) . . . . . [8720-20]

9:30 am: **Performance impact of optical interconnects as a result of mechanical and environmental testing**, Roger Rutz, Experior Labs., Inc. (USA) . . . . . [8720-21]

9:50 am: **Selection of fiber optic system passive components and installation training**, Douglas A. Parker, Deutsch UK (USA) . . . . . [8720-22]

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

SESSION 6
Room: Conv. Ctr. 330 . . . . . Tue 10:40 am to 12:10 pm

Speciality Sensors/Communication Networking

Session Chair: **Nicolas Javahiraly,**
Ecole Nationale Supérieure de Physique de Strasbourg (France)

10:40 am: **Optical latches using optical amplifiers**, Wenbo Li, Hongyu Hu, Niloy K. Dutta, Univ. of Connecticut (USA) . . . . . [8720-23]

11:00 am: **Improved packaging of hermetic seal mini-dual inline laser diode module for harsh environments of aerospace applicaitons**, Alex A. Kazemi, Eric Y. Chan, Dennis G. Koshinz, The Boeing Co. (USA) . . . . . [8720-47]

11:20 am: **Compact wavelength monitor for remote sensing applications suitable to precisely measure the wavelength of individual laser pulses** *(Invited Paper)*, Peter Kiesel, Palo Alto Research Center, Inc. (USA). . . . . [8720-25]

11:50 am: **Spectral observation of fuel additives in gasoline-ethanol blends using a Fourier-transform Raman spectrometer prototype**, Valentin Ortega Clavero, Hochschule Offenburg (Germany) and Univ. Of Strasbourg (France); Andreas Weber, Werner W. Schröder, Hochschule Offenburg (Germany); Patrick P. Meyrueis, Nicolas Javahiraly, Ecole Nationale Supérieure de Physique de Strasbourg (France). . . . . [8720-26]

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

SESSION 7
Room: Conv. Ctr. 330 . . . . . Tue 1:40 pm to 3:30 pm

Speciality Fiber Deveopment and Application of Optical Polymer

Session Chair: **Peter Kiesel,** Palo Alto Research Center, Inc. (USA)

1:40 pm: **Depth perception camera for autonomous vehicle application**, Philipp G. Kornreich, Syracuse Univ. (USA) . . . . . [8720-27]

2:00 pm: **Novel polyimides for optical applications**, Lei Wang, Frank W. Harris, TE Circuit Protection (USA) . . . . . [8720-28]

2:20 pm: **Thermal and vibration testing of ruggedized IR-transmitting fiber cables**, Lynda E. Busse, U.S. Naval Research Lab. (USA); Frederic H. Kung, Univ. Research Foundation (USA); Brandon Shaw, U.S. Naval Research Lab. (USA); Ish D. Aggarwal, Sotera Defense Solutions, Inc. (USA); Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) . . . . . [8720-29]

2:40 pm: **Fiber optic sensor for angular position measurement: application for an electrical power-assisted steering system**, Nicolas Javahiraly, Univ. de Strasbourg (France). . . . . [8720-30]

3:00 pm: **Developing aircraft photonic networks for airplane systems** *(Invited Paper)*, Henry J. White, BAE Systems (United Kingdom); Nick Brownjohn, Airbus Deutschland (Germany); João Baptista, GMV (Portugal); Vincent Foucal, Radiall (France); Anders Clausen, Technical Univ. of Denmark (Denmark); Luis Pessoa, INESC Porto (Portugal); Thomas Pistner, EADS Astrium (Germany); Mark Farries, Gooch & Housego (Torquay) Ltd. (United Kingdom); Stéphane Gauchy, Draka (France); Ilja Kopacek, SQS Vláknová optika a.s. (Czech Republic); Andrew Lee, AVoptics Ltd. (United Kingdom); Bruce Napier, Vivid Components (Germany); Massimo Traversone, SELEX Galileo S.p.A. (Italy); James Vincent, AgustaWestland (United Kingdom); Armin Zimmermann, Technische Univ. Ilmenau (Germany) . . . . . [8720-31]

Coffee Break . . . . . Tue 3:30 pm to 4:10 pm

SESSION 8
Room: Conv. Ctr. 330 . . . . . Tue 4:10 pm to 6:00 pm

Monitoring and Spectrum Systems/POF Systems

Session Chair: **Allen S. Panahi,** Pentair Inc. (USA)

4:10 pm: **Contamination effects on single-mode optical fibre connectors**, Henry J. White, Geoff M. Proudley, BAE Systems (United Kingdom). . . . . [8720-32]

4:40 pm: **Fiber-based full-spectral monitoring (FSM) system for weathering testing**, Yana Z. Williams, Atlas Material Testing Technology LLC (USA) . [8720-33]

5:00 pm: **Plastic optical fiber (POF) technology for transportation systems**, Kazuki Nakamura, Mitsubishi Rayon Corp. (Japan) . . . . . [8720-34]

5:20 pm: **A new double FFT-based filter to reduce the effect of 1/f noise spectrum in a tunable diode laser spectrometer (TDLS)**, Samira Mahdi, Univ. of Arkansas at Little Rock (USA); Youhua Chen, Gary Anderson, Univ. of Arkansas (USA) . . . . . [8720-48]

5:40 pm: **Enabling aspects of fiber optic sensing in harsh environments**, Indu F. Saxena, DynamedX (USA). . . . . [8720-49]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Intersatellite laser communication systems, Alex A. Kazemi, The Boeing Co. (USA) . . . . . [8720-35]

Propagation characteristics considering modulation and type of wavefront in free-space laser communications, Kayo Ogawa, Maiko Sakamoto, Japan Women's Univ. (Japan) . . . . . [8720-44]

Wednesday 1 May

SESSION 9
Room: Conv. Ctr. 330 . . . . . .Wed 8:20 am to 10:00 am

Communication Systems and Components
Session Chair: **Syed H. Murshid,** Florida Institute of Technology (USA)

8:20 am: **High-power-handling linear-integrated coherent photoreceivers for RF photonics**, Abhay M. Joshi, Shubhashish Datta, Jim Rue, Sruti Rajagopalan, Shaun Lemke, Discovery Semiconductors, Inc. (USA) . . . . . [8720-36]

8:40 am: **High-dynamic-range and high-capacity RF and microwave fiber optic links**, Frank Weiss, EMCORE Corp. (USA) . . . . . [8720-37]

9:00 am: **Optical access system by Y-00 protocol at 2.5-Gb/s data rate for secure fiber communications**, Fumio Futami, Osamu Hirota, Tamagawa Univ. (Japan). . . . . [8720-38]

9:20 am: **Architecture of an all optical de-multiplexer for spatially multiplexed channels**, Syed H. Murshid, Gregory L. Lovell, Michael F. Finch, Florida Institute of Technology (USA) . . . . . [8720-39]

9:40 am: **Omnidirectional free-space optical receiver architecture**, Syed H. Murshid, Michael F. Finch, Gregory L. Lovell, Florida Institute of Technology (USA) . . . . . [8720-40]

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

SESSION 10
Room: Conv. Ctr. 330 . . . . . .Wed 10:30 am to 12:10 pm

Optical Systems, Sources, and Components
Session Chairs: **Syed H. Murshid,** Florida Institute of Technology (USA); **Philipp G. Kornreich,** Syracuse Univ. (USA)

10:30 am: **Miniature, compact laser system for ultracold atom sensors**, Juan M. Pino, Mike A. Anderson, Benjamin Luey, Vescent Photonics Inc. (USA) [8720-41]

10:50 am: **Infrared light emitting quantum dots for defense applications**, Matthew Stevenson, Zhaoqun Zhou, James Perkins, Melanie Bunda, Justin Kamplain, Peter Kazlas, QD Vision, Inc. (USA) . . . . . [8720-42]

11:10 am: **Fiber optic-based laser systems for terahertz frequency-comb spectroscopy**, Yevhen Rutovytskyy, Kimberly Kaltenecker, Fahad A. Althowibi, Eric Donkor, Univ. of Connecticut (USA). . . . . [8720-43]

11:30 am: **Phase-shifted fiber-Bragg-grating-based humidity sensor**, Nezih Mrad, Defence Research and Development Canada, Ottawa (Canada). . . [8720-46]

11:50 am: **Experimental demonstration of all-optical memory based on wave mixing in a semiconductor optical amplifier**, Kimberly Kaltenecker, Yevhen Rutovytskyy, Fahad A. Althowibi, Eric Donkor, Univ. of Connecticut (USA) . . . . . [8720-45]

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Sensing for Agriculture and Food Quality and Safety V

Conference Chairs: **Moon S. Kim,** USDA Agricultural Research Service (USA); **Shu-I Tu,** USDA Agricultural Research Service (USA); **Kuanglin Chao,** USDA Agricultural Research Service (USA)

Program Committee: **Arun K. Bhunia,** Ctr. for Food Safety Engineering, Purdue Univ. (USA); **Suming Chen,** National Taiwan Univ. (Taiwan); **Bryan A. Chin,** Auburn Univ. (USA); **Byoung-Kwan Cho,** Chungnam National Univ. (Korea, Republic of); **Stephen R. Delwiche,** USDA Agricultural Research Service (USA); **Ki-Bok Kim,** Korea Research Institute of Standards and Science (Korea, Republic of); **Naoshi Kondo,** Kyoto Univ. Graduate School of Agriculture (Japan); **Kurt C. Lawrence,** USDA Agricultural Research Service (USA); **Kangjin Lee,** National Academy of Agricultural Science (Korea, Republic of); **Alan M. Lefcourt,** USDA Agricultural Research Service (USA); **Changying (Charlie) Li,** The Univ. of Georgia (USA); **Renfu Lu,** USDA Agricultural Research Service (USA); **Bosoon Park,** USDA Agricultural Research Service (USA); **Yankun Peng,** China Agricultural Univ. (China); **Gang Yao,** Univ. of Missouri-Columbia (USA); **Haibo Yao,** Mississippi State Univ. (USA); **Yibin Ying,** Zhejiang Univ. (China); **Seungchul Yoon,** USDA Agricultural Research Service (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 349 . . . . . Tue 2:00 pm to 3:00 pm

Raman for Food Quality and Safety

Session Chair: **Kuanglin Chao,** Agricultural Research Service (USA)

2:00 pm: **Development of a Raman chemical image detection algorithm for authenticating dry milk**, Jianwei Qin, Kuanglin Chao, Moon S. Kim, Agricultural Research Service (USA) . . . . . [8721-1]

2:20 pm: **Rapid identification and quantitative detection of pesticides and pathogens using surface-enhanced Raman scattering (SERS) spectroscopy**, Qiuming Yu, Univ. of Washington (USA); Yan Deng, Univ. of Washington (USA) and Tsinghua Univ. (China). . . . . [8721-2]

2:40 pm: **Detection of pesticide residues at paprika surface based on Raman spectroscopy**, Namkyoung Choi, Korea Research Institute of Standards and Science (Korea, Republic of); Changyeun Mo, National Academy of Agricultural Sciences (Korea, Republic of); Hyun Geun Oh, Korea Research Institute of Standards and Science (Korea, Republic of); Sukwon Kang, National Academy of Agricultural Sciences (Korea, Republic of); Kangjin Lee, National Academy of Agricultural Sciences (Korea, Republic of); Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Ki-Bok Kim, Yong-Il Kim, Korea Research Institute of Standards and Science (Korea, Republic of) . . . . . [8721-3]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

SESSION 2

Room: Conv. Ctr. 349 . . . . . Tue 3:40 pm to 4:40 pm

Spectral Sensing for Foods

Session Chair: **Sukwon Kang,**
National Academy of Agricultural Science (Korea, Republic of)

3:40 pm: **Development of a multi-spectral imaging system for the detection of bruises on apples**, Wenqian Huang, National Engineering Research Ctr. for Information Technology in Agriculture (China) and Beijing Institute of Technology (China); Chunjiang Zhao, Qingyan Wang, Chi Zhang, Jiangbo Li, National Engineering Research Ctr. for Information Technology in Agriculture (China)[8721-5]

4:00 pm: **Rapid nondestructive assessment of pork edibility by using Vis/NIR spectroscopic rechnique**, Leilei Zhang, Yankun Peng, China Agricultural Univ. (China) . . . . . [8721-6]

4:20 pm: **Development and evaluation of a vision based poultry debone line monitoring system**, Colin T. Usher, Wayne D. Daley, Georgia Tech Research Institute (USA) . . . . . [8721-7]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Optical instrument development for detection of pesticide residue in apple surface, Sagar Dhakal, Yongyu Li, Yankun Peng, China Agricultural Univ. (China); Kuanglin Chao, Jianwei Qin, Agricultural Research Service (USA) . . . . . [8721-22]

Development of VIS/NIR spectroscopic system for real-time prediction of fresh meat water content, Haiyun Zhang, Yankun Peng, China Agricultural Univ. (China) . . . . . [8721-23]

Development of noninvasive real-time detection of bruises in apple surface based on machine vision, Juan Zhao, Yankun Peng, China Agricultural Univ. (China) . . . . . [8721-24]

Hyserspectral imaging for different geographical origin of red pepper powder, Sukwon Kang, Kangjin Lee, Changyeun Mo, Jongguk Lim, Jongryul Park, National Academy of Agricultural Sciences (Korea, Republic of) . . . . . [8721-25]

Hyperspectral fluorescence imaging for measuring responses of drought and salt stresses in rice crop, Park Eunsoo, Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Moon S. Kim, Agricultural Research Service (USA); Jin-Won Kim, Do-Sun Kim, Seoul National Univ. (Korea, Republic of) . . . . . [8721-26]

Cross-correlation of temperature-dependent Raman and NIR data for glycine, Julie Nguyen, Walter F. Schmidt, Agricultural Research Service (USA) . . . [8721-27]

Raman spectroscopy and imaging to detect contaminants for food safety applications, Kuanglin Chao, Jianwei Qin, Moon S. Kim, Agricultural Research Service (USA); Yankun Peng, China Agricultural Univ. (China); Diane E. Chan, Yuche Cheng, Agricultural Research Service (USA) . . . . . [8721-28]

PLSR model development for prediction of melamine concentration in milk powder by NIR hyperspectral reflectance imaging, Jongguk Lim, National Academy of Agricultural Sciences (Korea, Republic of); In-Suck Baek, Chungnam National Univ. (Korea, Republic of); Moon S. Kim, Hoyoung Lee, Agricultural Research Service (USA); Sang Ha Noh, Seoul National Univ. (Korea, Republic of); Xiaping Fu, Zhejiang Univ. (China) . . . . . [8721-29]

Detection of liquid hazardous molecules using linearly focused Raman spectroscopy, Soo Gyeong Cho, Jin Hyuk Chung, Agency for Defense Development (Korea, Republic of). . . . . [8721-30]

Rapid and sensitive determination of benzo[a]pyrene in black ginseng using fluorescence detector and high-performance liquid chromatography-tandem mass spectrometry, Hyun-jeong Cho, Hye-jin Kim, Byeong-cheol Son, Dong-geun Cho, National Agricultural Products Quality Management Service (Korea, Republic of) . . . . . [8721-31]

A multifrequency, self-calibrating, in-situ soil sensor with energy-efficient wireless interface, Gunjan Pandey, Ratnesh Kumar, Robert J Weber, Iowa State Univ. (USA) . . . . . [8721-37]

Wednesday 1 May

SESSION 3
Room: Conv. Ctr. 349 . . . . . .Wed 9:00 am to 10:00 am

Fluorescence Sensing
Session Chair: **Haibo Yao,** Mississippi State Univ. (USA)

9:00 am: **Determination of optimal excitation and emission wavebands for detection of defect cherry tomato by using fluorescence emission and excitation matrix**, In-Suck Baek, Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Moon S. Kim, Agricultural Research Service (USA); Young-Sik Kim, SangMyung Univ. (Korea, Republic of) . . . . . [8721-8]

9:20 am: **Development of fluorescence-based handheld imaging devices for food safety inspection**, Hoyoung Lee, Moon S. Kim, Kuanglin Chao, Diane E. Chan, Agricultural Research Service (USA). . . . . [8721-9]

9:40 am: **Time efficient methods for scanning a fluorescent membrane with a fluorescent microscopic imager for the quality assurance of food**, Steffen Lerm, Silvio Holder, Mathias Schellhorn, Peter Brückner, Gerhard Linss, Technische Univ. Ilmenau (Germany) . . . . . [8721-10]

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

SESSION 4
Room: Conv. Ctr. 349 . . . . . .Wed 10:30 am to 11:50 am

Sensing for Pathogens
Session Chair: **Bryan A. Chin,** Auburn Univ. (USA)

10:30 am: **A new wireless detection device for the in-situ identification of Salmonella Typhimurium on food surfaces**, Yating Chai, Suiqiong Li, Shin Horikawa, Bryan A. Chin, Auburn Univ. (USA) . . . . . [8721-11]

10:50 am: **Novel approach for Salmonella detection in soil using phage-based magnetoelastic biosensors**, Mi-Kyung Park, Suiqiong Li, Kanchana Weerakoon, Shin Horikawa, Yating Chai, Nitil Hirematha, Bryan A. Chin, Auburn Univ. (USA) . . . . . [8721-12]

11:10 am: **Automatic colony detection and counting using hyperspectral imaging for pathogen detection**, Seung-Chul Yoon, William R. Windham, Scott Ladely, Bosoon Park, Kurt C. Lawrence, Agricultural Research Service (USA) . . . . . [8721-13]

11:30 am: **Development of hyperspectral imaging technique for detecting Salmonella on agar media**, Youngwook Seo, Seung-Chul Yoon, Bosoon Park, Arthur Hinton Jr., Willian R. Windham, Kurt C. Lawrence, Agricultural Research Service (USA). . . . . [8721-14]

Lunch Break . . . . . Wed 11:50 am to 1:40 pm

SESSION 5
Room: Conv. Ctr. 349 . . . . . Wed 1:40 pm to 3:00 pm

Hyperspectral Imaging I
Session Chair: **Seun-Chul Yoon,** Agricultural Research Service (USA)

1:40 pm: **Investigation of NIR hyperspectral imaging for discriminating melamine in milk powders**, Xiaping Fu, Zhejiang Univ. (China); Moon S. Kim, Agricultural Research Service (USA) . . . . . [8721-15]

2:00 pm: **The development of a line-scan imaging algorithm for the detection of fecal contamination on leafy geens**, Chun-Chieh Yang, Moon S. Kim, Agricultural Research Service (USA); Yung-Kun Chuang, National Taiwan Univ. (Taiwan) . . . . . [8721-16]

2:20 pm: **Hyperspectral imaging system for whole corn ear surface inspection**, Haibo Yao, Russell Kincaid, Zuzana Hruska, Mississippi State Univ. (USA); Robert Brown, Deepak Bhatnagar, Thomas Cleveland, Agricultural Research Service (USA) . . . . . [8721-17]

2:40 pm: **Wavelength-configurable hyperspectral imaging system and image-guided robot for detecting foreign material in food products**, Seung-Chul Yoon, Agricultural Research Service (USA); Richard Driver, Blair Simon, Sam Hill, Headwall Photonics Inc. (USA); Gerald W. Heitschmidt, Kurt C. Lawrence, Bosoon Park, William R. Windham, Agricultural Research Service (USA) . . . . . [8721-18]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 6
Room: Conv. Ctr. 349 . . . . . Wed 3:40 pm to 4:40 pm

Hyperspectral Imaging II
Session Chair: **Byoung-Kwan Cho,**
Chungnam National Univ. (Korea, Republic of)

3:40 pm: **Geographical classification of apple based on hyperspectral imaging**, Zhiming Guo, Wenqian Huang, Liping Chen, National Engineering Research Ctr. for Information Technology in Agriculture (China); Chunjiang Zhao, National Engineering Research Center of Intelligen Equipment for Agriculture (China); Yankun Peng, China Agricultural Univ. (China) . . . . . [8721-19]

4:00 pm: **A study on germination characteristics of pumpkin seed using hyperspectral reflectance imaging**, Kangjin Lee, Changyeun Mo, Sukwon Kang, Jongguk Lim, Jongryul Park, National Academy of Agricultural Sciences (Korea, Republic of) . . . . . [8721-20]

4:20 pm: **Whole-surface produce inspection using hyperspectral line-scan imaging**, Moon S. Kim, Agricultural Research Service (USA); Hyun Jeong Cho, Univ. of Michigan (USA); In-Suck Baek, Chungnam National Univ. (Korea, Republic of); Hoyoung Lee, Agricultural Research Service (USA); Byoung-Kwan Cho, Chungnam National Univ. (Korea, Republic of); Kuanglin Chao, Diane E. Chan, Agricultural Research Service (USA) . . . . . [8721-21]

Thursday - Friday 2 - 3 May 2013 • Proceedings of SPIE Vol. 8722

Fiber Optic Sensors and Applications X

Conference Chairs: **Eric Udd,** Columbia Gorge Research (USA); **Gary Pickrell,** Virginia Polytechnic Institute and State Univ. (USA); **Henry H. Du,** Stevens Institute of Technology (USA)

Conference Co-Chairs: **Jerry J. Benterou,** Lawrence Livermore National Lab. (USA); **Xudong Fan,** Univ. of Michigan (USA); **Alexis Mendez,** MCH Engineering LLC (USA); **Stephen J. Mihailov,** Communications Research Ctr. Canada (Canada); **Anbo Wang,** Virginia Polytechnic Institute and State Univ. (USA); **Hai Xiao,** Missouri Univ. of Science and Technology (USA)

Program Committee: **Christopher S. Baldwin,** Aither Engineering, Inc. (USA); **Ole Bang,** Technical Univ. of Denmark (Denmark); **Eric A. Bergles,** BaySpec Inc. (USA); **Jeff Bush,** Optiphase, Inc. (USA); **Kevin Peng Chen,** Univ. of Pittsburgh (USA); **Brian Culshaw,** Univ. of Strathclyde (United Kingdom); **Abdessama Elyamani,** Northrop Grumman Navigation Systems (USA); **Yoel Fink,** Massachusetts Institute of Technology (USA); **Eric Lee Goldner,** US Sensor Systems, Inc. (USA); **Tom W. Graver,** Micron Optics, Inc. (USA); **Ming Han,** Univ. of Nebraska-Lincoln (USA); **Hajime Haneda,** National Institute for Materials Science (Japan); **Kazuo Hotate,** The Univ. of Tokyo (Japan); **Jiri Kanka,** Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic); **Victor I. Kopp,** Chiral Photonics, Inc. (USA); **Katerina Krebber,** Bundesanstalt für Materialforschung und -prüfung (Germany); **Steven T. Kreger,** Luna Innovations Inc. (USA); **David A. Krohn,** Light Wave Venture Consulting, LLC (USA); **Paul Lefebvre,** LxDATA (Canada); **Thomas D. Monte,** KVH Industries, Inc. (USA); **Glen A. Sanders,** Honeywell Technology (USA); **Dennis J. Trevor,** OFS Labs. (USA); **Xingwei Wang,** Univ. of Massachusetts Lowell (USA); **Reinhardt Willsch,** Institut für Photonische Technologien e.V. (Germany); **Younan Xia,** Georgia Institute of Technology (USA); **Hai Xiao,** Missouri Univ. of Science and Technology (USA)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 350 . . . . . Thu 8:00 am to 10:00 am

Fiber Bragg Grating Sensors I

Session Chair: **Alexis Mendez,** MCH Engineering LLC (USA)

8:00 am: **A personal review of 25 years of fiber grating sensor development** *(Invited Paper)*, Eric Udd, Columbia Gorge Research (USA) . . . . . [8722-1]

8:30 am: **The use of fiber Bragg gratings in acoustic sensing applications** *(Invited Paper)*, Anthony Dandridge, Clay Kirkendall, Geoff A. Cranch, U.S. Naval Research Lab. (USA) . . . . . [8722-2]

9:00 am: **Fiber Bragg grating sensing of detonation and shock experiments at Los Alamos National Laboratory** *(Invited Paper)*, George Rodriguez, Richard L. Sandberg, Scott I. Jackson, Dana M. Dattelbaum, Quinn McCulloch, Samuel W. Vincent, Los Alamos National Lab. (USA); Eric Udd, Columbia Gorge Research (USA) . . . . . [8722-3]

9:30 am: **Development of high-speed fiber grating sensor solutions for measuring velocity, position, pressure and temperature during burn, deflagration, and detonation of highly energetic material** *(Invited Paper)*, Eric Udd, Columbia Gorge Research (USA); Jerry J. Benterou, Lawrence Livermore National Lab. (USA) . . . . . [8722-4]

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

SESSION 2

Room: Conv. Ctr. 350 . . . . . Thu 10:30 am to 12:00 pm

Fiber Bragg Grating Sensors II

Session Chair: **Eric Udd,** Columbia Gorge Research (USA)

10:30 am: **Analysis, compensation, and correction of temperature effects on FBG strain sensors** *(Invited Paper)*, Todd C. Haber, Steve Ferguson, Dan Guthrie, Tom W. Graver, Micron Optics, Inc. (USA); Alexis Mendez, MCH Engineering LLC (USA) . . . . . [8722-5]

11:00 am: **Nondestructive inspection of CFRP adhesively bonded joints using embedded FBG sensors**, Sean C. Webb, Peter H. Shin, Kara J. Peters, North Carolina State Univ. (USA); Stephen Schultz, Richard Selfridge, Brigham Young Univ. (USA) . . . . . [8722-6]

11:20 am: **Distributed fiber optic laser ultrasound generation**, Ming Han, Jiajun Tian, Qi Zhang, Univ. of Nebraska-Lincoln (USA) . . . . . [8722-7]

11:40 am: **Engine test for wavelength-multiplexed fiber Bragg grating temperature sensor**, Li Yu, Dorothy Y. Wang, Yunmiao K. Wang, Christopher M. Collins, William C. Schneck III, Justin M. Bailey, Walter F. O'Brien Jr., Anbo Wang, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [8722-8]

Lunch/Exhibition Break . . . . . Thu 12:00 pm to 1:50 pm

SESSION 3

Room: Conv. Ctr. 350 . . . . . Thu 1:50 pm to 3:00 pm

Fiber Bragg Grating Sensors III

Session Chair: **Gary Pickrell,**
Virginia Polytechnic Institute and State Univ. (USA)

1:50 pm: **Draw tower fiber Bragg gratings in polarization-maintaining fibers for the independent measurement of strain and temperature** *(Invited Paper)*, Eric Lindner, Julia Mörbitz, Christoph Chojetzki, FBGS Technologies GmbH (Germany); Alexander Hartung, Manfred Rothhardt, Kay Schuster, Institut für Photonische Technologien e.V. (Germany) . . . . . [8722-9]

2:20 pm: **Distributed vibration and temperature sensing using fiber optics, a technology whose time has come with the automation of the Femto second laser grating writing process**, Peter Kung, QPS Photronics Inc. (Canada) . . . . . [8722-10]

2:40 pm: **Isolation of thermal and strain responses in composites using embedded fiber Bragg grating temperature sensors**, Kyle Elam, Brian Jenkins, Peter Joyce, Deborah Mechtel, U.S. Naval Academy (USA). . . . . [8722-12]

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

SESSION 4

Room: Conv. Ctr. 350 . . . . . Thu 3:30 pm to 5:00 pm

Distributed Sensing

Session Chair: **Henry H. Du,** Stevens Institute of Technology (USA)

3:30 pm: **High-resolution, high-sensitivity, dynamic distributed structural monitoring using optical frequency domain reflectometry** *(Invited Paper)*, Stephen T. Kreger, Alex K. Sang, Dawn K. Gifford, Mark E. Froggatt, Luna Innovations Inc. (USA) . . . . . [8722-13]

4:00 pm: **Fully-distributed fiber optic high-temperature sensing based on stimulated Brillouin scattering**, Jing Wang, Di Hu, Dorothy Y. Wang, Anbo Wang, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [8722-14]

4:20 pm: **Novel optical fibers for Brillouin-based distributed sensing**, Peter D. Dragic, Univ. of Illinois at Urbana-Champaign (USA); John Ballato, Stephanie Morris, Alex Evert, Clemson Univ. (USA); Robert R. Rice, Dreamcatchers Consulting (USA); Thomas Hawkins, Clemson Univ. (USA) . . . . . [8722-15]

4:40 pm: **Improved distributed fiber optic sensing system based on single-ended double-pulse input Brillouin scattering**, Tianying Chang, Ruijuan Yang, Jilin Univ. (China); Yongliang Wang, Beijing Pegasus, Ltd (China); David Y. Li, L.C. Pegasus Corp. (USA); Lei Jia, Shandong Univ. (China); Hong-Liang Cui, Jilin Univ. (China) . . . . . [8722-16]

POSTERS-THURSDAY
Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

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Development of polymer Bragg grating based strain, temperature, and chemical sensors, Sebastiampillai G. Raymond, Adam J. Swanson, Mohamed D. H. Bhuiyan, Andrew J. Kay, Industrial Research Ltd. (New Zealand) . . . . . [8722-11]

The semi-explicit formulation of U-shape optical fiber for sensing applications, Jau-Sheng Wang, Yen-Hsiu Wu, National Sun Yat-Sen Univ. (Taiwan) . . . . . [8722-21]

Large-area, vertically-aligned GaN n-core/p-shell arrays for UV photodetectors, Jong-Yoon Ha, Sergiy Krylyuk, National Institute of Standards and Technology (USA) and Univ. of Maryland (USA); Dipak Paramanik, Albert V. Davydov, National Institute of Standards and Technology (USA); Matthew King, Northrop Grumman Electronic Systems (USA); Abhishek Motayed, National Institute of Standards and Technology (USA) and Univ. of Maryland (USA) . . . . . [8722-33]

A process for co-molding a visible-wavelength photonic crystal and microfluidic channel for biosensing applications, Maurya Srungarapu, Chloe E. Snyder, Anand Kadiyala, Jeremy M. Dawson, West Virginia Univ. (USA). . [8722-34]

Quantum dot photoemission optic sensors, Subhamoy Singha Roy, JIS College of Engineering (India) . . . . . [8722-35]

Effect of extrinsic perturbation by transverse pressure, bending, and tension birefringence, Chandrakant M. Jadhao, Mauli College Of Engineering & Technology, Shegaon (India) . . . . . [8722-36]

Strain response of metal-encapsulated regenerated grating strain sensors for structural health monitoring under high-temperature environments, Yun Tu, Yi-Hua Qi, ShanTung Tu, East China Univ. of Science and Technology (China) . . . . . [8722-37]

Position determination of disturbance along a modified saganac interferometer, Pang Bian, Yuan Wu, Bo Jia, Qian Xiao, Fudan Univ. (China) . . . . . [8722-39]

Friday 3 May

SESSION 5
Room: Conv. Ctr. 350 . . . . . Fri 8:20 am to 10:20 am

Physical and Chemical Sensors I
Session Chair: **Eric Udd,** Columbia Gorge Research (USA)

8:20 am: **Long-period gratings in photonic crystal fiber for layer-by-layer assembly of pH responsive polyelectrolytes**, Fei Tian, Stevens Institute of Technology (USA); Jiri Kanka, Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic); Svetlana A. Sukhishvili, Henry H. Du, Stevens Institute of Technology (USA) . . . . . [8722-17]

8:40 am: **Mode coupling and mode-field distribution in long period gratings tri-directionally and uni-directionally inscribed in photonic crystal fiber**, Fei Tian, Stevens Institute of Technology (USA); Jiri Kanka, Institute of Photon

nics and Electronics of the ASCR, v.v.i. (Czech Republic); Kin-Seng Chiang, City Univ. of Hong Kong (Hong Kong, China); Henry H. Du, Stevens Institute of Technology (USA) . . . . . [8722-18]

9:00 am: **Compact, fiber-based, fast-light enhanced optical gyroscope**, Caleb A. Christensen, Anton Zavriyev, MagiQ Technologies, Inc. (USA); Mark Bashkansky, U.S. Naval Research Lab. (USA); Craig Beal, MagiQ Technologies, Inc. (USA) . . . . . [8722-19]

9:20 am: **Impact time measurement by using the fiber optic sensor in the pendulum ball collision**, Jongkil Lee, Andong National Univ. (Korea, Republic of); Alex Vakakis, Larry Bergman, Univ. of Illinois at Urbana-Champaign (USA); Hee-keun Cho, Andong National Univ. (Korea, Republic of) . . . . . [8722-20]

9:40 am: **An integrated theoretical and experimental study of SERS nanotags on competitive Raman gain and signal attenuation in PCF**, Polina Pinkhasova, Svetlana A. Sukhishvili, Stevens Institute of Technology (USA); Jiri Kanka, Institute of Photonics and Electronics of the ASCR, v.v.i. (Czech Republic); Henry H. Du, Stevens Institute of Technology (USA) . . . . . [8722-22]

10:00 am: **Fabry-Perot microstructured polymer optical fiber sensors for ultrasonic and optoacoustic endoscopic biomedical applications**, Daniel C. Gallego, Horacio Lamela, Univ. Carlos III de Madrid (Spain); David Saez-Rodriquez, Aston Univ. (United Kingdom); Kristian Nielsen, Technical Univ. of Denmark (Denmark); David J. Webb, Aston Univ. (United Kingdom); Ole Bang, Technical Univ. of Denmark (Denmark) . . . . . [8722-23]

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

SESSION 6
Room: Conv. Ctr. 350 . . . . . Fri 10:50 am to 12:10 pm

Physical and Chemical Sensors II
Session Chair: **Jerry J. Benterou,** Lawrence Livermore National Lab. (USA)

10:50 am: **Temperature sensing in high-voltage transmission lines using fiber Bragg grating and free-space-optics**, Joao B. Rosolem, Claudio Floridia, Ariovaldo A. Leonardi, Claudio A. Hortencio, CpqD Foundation (Brazil); Romeu F. Fonseca, Rodrigo O. C. Moreira, Giovani C. L. Souza, Altair L. Melo, Carlos Alexandre M. Nascimento, Companhia Energetica de Minas Gerais (Brazil) . . . . . [8722-24]

11:10 am: **Single fiber Bragg grating for the measurement of liquid level and Temperature**, Srimannarayana Kamineni, Dipankar Sengupta, Sai S. Madhuvarasu, National Institute of Technology, Warangal (India) . . . . . [8722-25]

11:30 am: **Design and sensing research of the stepped metal film on optical fiber**, Wenhua Cheng, Luoyang Ship Material Research Institute (China) . [8722-26]

11:50 am: **Escherichia coli biosensors for environmental, food industry and biological warfare agent detection**, Regina C. Allil, Ctr. Tecnological of Brazilian Army (Brazil) . . . . . [8722-27]

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

SESSION 7
Room: Conv. Ctr. 350 . . . . . Fri 1:30 pm to 3:10 pm

Photonic Microdevices/Microstructures for Sensing
Session Chair: **Hai Xiao,** Missouri Univ. of Science and Technology (USA)

1:30 pm: **Fiber optic refractive index sensors based on etched pi-phase-shifted fiber Bragg gratings**, Ming Han, Qi Zhang, Univ. of Nebraska-Lincoln (USA) . . . . . [8722-28]

1:50 pm: **Integration of thin films with fiber microstructures for sensing applications**, Minghong Yang, MIn Wang, Guilin Zhang, Wuhan Univ. of Technology (China) . . . . . [8722-29]

2:10 pm: **A hybrid plasmonic whispering gallery mode sensor for single bionanoparticle detection**, Stephen Holler, Fordham Univ. (USA); Venkata R. Dantham, Polytechnic Institute of New York Univ. (USA); Vasily Kolchenko, New York City College of Technology (USA); Zhenmao Wan, Hunter College (USA); Stephen Arnold, Polytechnic Institute of New York Univ. (USA). . . . . [8722-30]

2:30 pm: **Novel compact architecture for high-resolution sensing with plasmonic gratings in conical mounting**, Gianluca Ruffato, Univ. degli Studi di Padova (Italy) and Veneto Nanotech s.c.p.a. (Italy); Elisabetta Pasqualotto, Univ. degli Studi di Padova (Italy); Agnese Sonato, Univ. degli Studi di Padova (Italy) and Veneto Nanotech s.c.p.a. (Italy); Gabriele Zacco, Veneto Nanotech s.c.p.a. (Italy) and Consiglio Nazionale delle Ricerche (Italy); Davide Silvestri, Margherita Morpurgo, Alessandro De Toni, Univ. degli Studi di Padova (Italy); Filippo Romanato, Il LaNN - Lab. di ricerca per la Nanofabbricazione e i Nanodispositivi (Italy) and Univ. degli Studi di Padova (Italy) and Consiglio Nazionale delle Ricerche (Italy) . . . . . [8722-31]

2:50 pm: **Multiplexed detection of aquaculture fungicides using a pump-free optofluidic SERS microsystem**, Soroush Yazdi, Ian M. White, Univ. of Maryland, College Park (USA) . . . . . [8722-32]

Sensing Technologies for Global Health, Military Medicine, and Environmental Monitoring III

Conference Chair: **Šárka O. Southern,** Gaia Medical Institute (USA)

Conference Co-Chairs: **Daniel Malamud,** New York Univ. (USA); **Mark A. Mentzer,** U.S. Army Research Lab. (USA); **Isaac Rodriguez-Chavez,** National Institute of Dental and Craniofacial Research (USA)

Program Committee: **Samuel N. Cheuvront,** U.S. Army Research Institute of Environmental Medicine (USA); **James Delehanty,** U.S. Naval Research Lab. (USA); **Theresa G. Evans-Nguyen,** Draper Lab. (USA); **Peter Kiesel,** Palo Alto Research Center, Inc. (USA); **Baochuan Lin,** U.S. Naval Research Lab. (USA); **Igor Medintz,** U.S. Naval Research Lab. (USA); **Christopher Myers,** Naval Health Research Ctr. (USA); **Richard M. Ozanich,** Pacific Northwest National Lab. (USA); **Ava M. Puccio,** Univ. of Pittsburgh Medical Ctr. (USA); **Steven A. Ripp,** The Univ. of Tennessee (USA); **Albert Skip Rizzo III,** The Univ. of Southern California (USA); **Kim E. Sapsford,** U.S. Food and Drug Administration (USA); **Shadrian B. Strong,** Johns Hopkins Univ. Applied Physics Lab. (USA); **David E. Wolf,** Radiation Monitoring Devices, Inc. (USA); **Aurel Ymeti,** Ostendum R&D BV (Netherlands); **David T. Wong,** Univ. of California, Los Angeles (USA)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 324 . . . . . .Mon 8:10 am to 12:00 pm

Global Health I: Saliva: A New Sample for Disease Diagnostics

Session Chairs: **Sárka O. Southern,** Gaia Medical Institute (USA); **Isaac Rodriguez-Chavez,** National Institute of Dental and Craniofacial Research (USA); **Daniel Malamud,** New York Univ. (USA)

8:10 am: **NIDCR overview on salivary biology and oral fluid-based diagnostics for diseases** *(Invited Paper)*, Isaac Rodriguez-Chavez, Penny Wung Burgoon, National Institute of Dental and Craniofacial Research (USA). . . . . [8723-58]

9:10 am: **The oral-systemic connection: role of salivary diagnostics** *(Invited Paper)*, Daniel Malamud, New York Univ. (USA). . . . . [8723-1]

9:40 am: **Detection of herpesviruses and papillomaviruses in saliva**, Jennifer Webster-Cyriaque, The Univ. of North Carolina at Chapel Hill (USA) . . . . . [8723-8]

10:00 am: **Oral microbiome in health and disease: lessons from HIV**, Mahmoud Ghannoum, Case Western Reserve Univ. (USA). . . . . [8723-57]

Coffee Break . . . . . Mon 10:20 am to 10:40 am

10:40 am: **Detection of congenital cytomegalovirus infection using real-time polymerase chain reaction of saliva**, Shannon A. Ross, Masako Shimamura, The Univ. of Alabama at Birmingham (USA); April Palmer, The Univ. of Mississippi Medical Ctr. (USA); Amina Ahmed, Levine Childrens Hospital (USA); Marian Michaels, Univ. of Pittsburgh School of Medicine (USA); Pablo Sanchez, Univ. de Cantabria (Spain); David Bernstein, Cincinnati Children's Hospital Medical Ctr. (USA); Robert Tolan, Saint Peter's Healthcare System (USA); Novak Zdenek, Nazma Chowdhury, William Britt, Karen Fowler, Suresh Boppana, The Univ. of Alabama at Birmingham (USA) . . . . . [8723-6]

11:00 am: **Diagnostic microRNA profiling distinguishes infection types**, Dirk P. Dittmer, Pauline E. Chugh, Sang-Hoon Sin, Seonjoo Lee, Haiping Shen, Lineberger Comprehensive Cancer Ctr., The Univ. of North Carolina at Chapel Hill (USA) . . . . . [8723-13]

11:20 am: **Therapeutic monitoring of HIV/AIDS using saliva biomarkers**, Šárka Southern, Gaia Medical Institute (USA). . . . . [8723-11]

11:40 am: **Computing Tutte polynomials of contact networks in classrooms**, Doracelly Hincapie-Palacio, Univ. de Antioquia (Colombia); Juan Ospina, Univ. EAFIT (Colombia). . . . . [8723-7]

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

SESSION 2

Room: Conv. Ctr. 324 . . . . . Mon 1:00 pm to 5:00 pm

Global Health II: Saliva Diagnostics: From Lab to Marketplace

Session Chairs: **Jacqueline W. Mays,** National Institute of Dental and Craniofacial Research, National Institutes of Health (USA); **Charles F. Streckfus,** The Univ. of Texas Dental Branch at Houston (USA); **Timothy J. Griffin,** Univ. of Minnesota, Twin Cities (USA)

1:00 pm: **The proteome of human saliva** *(Invited Paper)*, Timothy J. Griffin, Pratik Jagtap, Univ. of Minnesota (USA); Sricharan Bandhakavi, Bio-Rad Labs., Inc. (USA); Susan K. Van Riper, Univ. of Minnesota, Rochester (USA); Ebbing de Jong, Nelson L. Rhodus, John V. Carlis, Univ. of Minnesota (USA); Joel D. Rudney, Univ. of Minnesota School of Dentistry (USA) . . . . . [8723-9]

1:30 pm: **Update on a lab-on-a-chip system for saliva diagnostics: link to oral cancer**, Pierre N. Floriano, Rice Univ. (USA); A. Ross Kerr, Brian L. Schmidt, Patricia Corby, Ismael El Khouly Castilla, New York Univ. College of Dentistry (USA); Martin H. Thornhill, Katy D'Apice, Craig Murdoch, Paul Speight, The Univ. of Sheffield (United Kingdom); Spencer Redding, Stan McGuff, Chih-Ko Yeh, Steve Westbrook, Mark Diburro, Stephanie Rowan, The Univ. of Texas Health Science Ctr. at San Antonio (USA); Nadarajah Vigneswaran, Etan Y. Weinstock, Nagi Demian, Tammy Tran, Maga Sanchez, The Univ. of Texas Dental Branch at Houston (USA); Nicolaos Christodoulides, Surabhi Gaur, Kailash Karthikeyan, Humberto Talavera, Michael Nguyen, Cathy Le, Leander Taylor, John McDevitt, Rice Univ. (USA) . . . . . [8723-4]

1:50 pm: **Saliva diagnostics for respiratory diseases using an automated integrated device**, Shuai Nie, Huaibin Zhang, David R. Walt, Tufts Univ. (USA) . . . . . [8723-5]

2:10 pm: **Salivary proteome as an in vivo model to study breast cancer progression** *(Invited Paper)*, Charles F. Streckfus, The Univ. of Texas Dental Branch at Houston (USA) . . . . . [8723-12]

2:40 pm: **Salivary analytes for interdisciplinary biomedical research and diagnostics** *(Invited Paper)*, Douglas A. Granger, Johns Hopkins Univ. (USA) . . . . . [8723-2]

Coffee Break . . . . . Mon 3:10 pm to 3:20 pm

3:20 pm: **Emerging technologies for salivary diagnostics: lessons from chronic graft-versus-host disease** *(Invited Paper)*, Jacqueline W. Mays, National Institute of Dental and Craniofacial Research, National Institutes of Health (USA) . [8723-10]

3:50 pm: **Cell phone-based imaging and sensing architectures** *(Invited Paper)*, Aydogan Ozcan, Univ. of California, Los Angeles (USA). . . . . [8723-15]

4:20 pm: **Saliva-based testing for malaria**, Sungano Mharakurwa, Johns Hopkins Univ. (USA) . . . . . [8723-59]

4:40 pm: **Nanosensor for saliva-based glucose monitoring**, Jonathan C. Claussen, U.S. Naval Research Lab. (USA) . . . . . [8723-14]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 3

Room: Conv. Ctr. 324 . . . . . Tue 8:00 am to 12:00 pm

Military Medicine I: Traumatic Brain Injury and PTSD

Session Chairs: **Geoffrey S. F. Ling M.D.,** Uniformed Services Univ. of the Health Sciences (USA); **Kevin K. W. Wang,** Univ. of Florida (USA)

8:00 am: **Prevention and reduction of injuries in soldiers: current and future challenges** *(Invited Paper)*, Richard Shoge, U.S. Army Medical Research and Material Command (USA) . . . . . [8723-20]

8:30 am: **The military's approach to TBI and PTSD** *(Invited Paper)*, Geoffrey S. F. Ling M.D., Uniformed Services Univ. of the Health Sciences (USA); Jason S. Hawley, Walter Reed National Military Medical Ctr. (USA) . . . . . [8723-18]

9:00 am: **Blast-induced TBI: recovery and rehabilitation**, Yelena Bogdanova, Boston Univ. (USA) . . . . . [8723-50]

9:20 am: **Clinical detection of brain damage in military and civilian TBI**, Ava M. Puccio, UPMC Presbyterian (USA) . . . . . [8723-23]

9:40 am: **Intelligent mouthguard: new technology to measure head impact in soldiers and athletes**, Adam Bartsch, Cleveland Clinic (USA) . . . . . [8723-61]

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

10:30 am: **Systems biomarkers as acute diagnostics and chronic monitoring tools for traumatic brain injury** *(Invited Paper)*, Kevin K.W. Wang, Univ. of Florida (USA) . . . . . [8723-24]

11:00 am: **Mechanisms of traumatic and degenerative brain injury and repair**, Vassilis Koliatsos, Johns Hopkins Univ. (USA) . . . . . [8723-60]

11:20 am: **A review of glutamates role in traumatic brain injury mechanisms**, Cameron Good, U.S. Army Research Lab. (USA) . . . . . [8723-53]

11:40 am: **Circulating exosomes as new biomarkers for brain disease and injury**, Michael W. Graner, Univ. of Colorado Denver (USA); Laura M. Epple, Univ. of Colorado Denver (USA) and Colorado State Univ. (USA); Nathaniel L. Dusto, Alex M. Lencioni, Univ. of Colorado Denver (USA) . . . . . [8723-65]

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

SESSION 4

Room: Conv. Ctr. 324 . . . . . Tue 1:30 pm to 5:20 pm

Military Medicine II: Physiology of Extreme Environments

Session Chairs: **Peter D. Wagner,** Univ. of California, San Diego (USA); **Virginia E. Wotring,** NASA Johnson Space Ctr. (USA); **Šárka O. Southern,** Gaia Medical Institute (USA)

1:30 pm: **High-altitude physiology: Lessons from Tibet** *(Invited Paper)*, Peter D. Wagner, T. S. Simonson, Univ. of California, San Diego (USA); G. Wei, Qinghai Univ. Medical School (China); H. Wagner, Univ. of California, San Diego (USA); T. Wuren, Qinghai Univ. School of Medicine (China); M. Yan, G. Qin, R. L. Ge, Qinghai Univ. Medical School (China) . . . . . [8723-29]

2:00 pm: **Monitoring astronaut health in space** *(Invited Paper)*, Virginia Wotring, NASA Johnson Space Ctr. (USA) . . . . . [8723-28]

2:30 pm: **How cells detect and survive osmotic stress caused by dehydration** *(Invited Paper)*, Maurice Burg, National Heart, Lung, and Blood Institute (USA) . . . . . [8723-62]

3:00 pm: **Molecular diagnostics of osmotic stress and dehydration,** Šárka O. Southern, Gaia Medical Institute (USA) . . . . . [8723-30]

Coffee Break . . . . . .Tue 3:20 pm to 4:00 pm

4:00 pm: **Integrative environmental physiology and fluid regulation**, Nina S. Stachenfeld, Yale Univ. (USA) . . . . . [8723-63]

4:20 pm: **Thermal physiology: research approaches and clinical applications**, Thad Wilson, Ohio Univ. (USA) . . . . . [8723-31]

4:40 pm: **Exercise science: research to sustain and enhance performance**, Jonathan Wingo, The Univ. of Alabama System (USA). . . . . [8723-32]

5:00 pm: **Energy-aware Activity Classification using Wearable Sensor Networks,** Bo Dong, Alexander Montoye, Rebecca Moore, Karin Pfeiffer, Subir Biswas, Michigan State Univ. (USA) . . . . . [8723-33]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Reducing satellite biases of aerosol optical thickness over urban areas for improved PM2.5 monitoring, Adam Atia, Lina Cordero, Chowdhury Nazmi, Barry M. Gross, Fred Moshary, The City College of New York (USA) . . . . . [8723-40]

Generalized Mathematical-computational-electronic model of MPTP- induced Parkinsonism, Daniela Jaramillo Raquejo, Univ. EAFIT (Colombia) . . . . . [8723-44]

Processing of medical images using maple, Veronica Toro, Univ. EAFIT (Colombia) . . . . . [8723-45]

Application of the diffusion-convection equation to modeling the infection by histoplasmacapsulatum, Sergio A. Jaime, Univ. EAFIT (Colombia) . . . . . [8723-46]

Refining environmental satellite data using a statistical approach, Md. Z. Rahman, LaGuardia Community College (USA); Leonid Roytman, The City College of New York (USA); Abdel Hamid Kadik, LaGuardia Community College (USA) . . . . . [8723-47]

Health hazards of cell phone radiation and the zebrafish as a model in this study, Mary C. Vagula, Ryan V. Harkless, Gannon Univ. (USA) . . . . . [8723-48]

The toxic effects of flame retardants: The gene expression study in elucidating their carcinogenicity, Mary C. Vagula, Ali Al-Dhumani, Sajaad Al-Dhumani, Alexandra Mastro, Gannon Univ. (USA) . . . . . [8723-49]

Integrative paradigms bridging defense and bioscience, George C. Giakos, Suman Shrestha, Yinan Li, Chaya Narayan, Aditi Deshpande, Tannaz Farrahi, Chris Mela, Ryan Koglin, The Univ. of Akron (USA) . . . . . [8723-54]

Polymer nanostructure materials for space defense applications, George C. Giakos, Tannaz Farrahi, Diya Bandopadhayay, Alamgir Karim, Suman Shrestha, Yinan Li, Chaya Narayan, Aditi Deshpande, Mohit Kumar Agarwal, The Univ. of Akron (USA) . . . . . [8723-55]

Bio-inspired polarization navigation sensor for autonomous munitions systems, George C. Giakos, The Univ. of Akron (USA) . . . . . [8723-56]

Wednesday 1 May

SESSION 5

Room: Conv. Ctr. 324 . . . . . .Wed 8:30 am to 12:00 pm

Sensing Platforms: From Lab to Marketplace

Session Chairs: **Kelly B. Gemmill,** U.S. Naval Research Lab. (USA); **Ellen Goldman,** U.S. Naval Research Lab. (USA)

8:30 am: **Aptamer functionalized metal oxide nanostructures for optical microbe sensing** *(Invited Paper)*, Shayla Sawyer, Irina Barash, Kethia Matieu, Sydney Halperin, Dali Shao, Rensselaer Polytechnic Institute (USA); Stephan Weeks, Kevin Kyle, National Security Technologies, LLC (USA) . . . . . [8723-34]

9:10 am: **Continuous, real-time bioimaging of chemical bioavailability and toxicology using autonomously bioluminescent human cell lines**, Tingting Xu, The Univ. of Tennessee (USA); Dan Close, The Univ. of Tennessee (USA) and 490 BioTech Inc. (USA); James Webb, The Univ. of Tennessee (USA); Sarah Price, The Univ. of Tennessee Knoxville (USA); Steven Ripp, Gary Sayler, The Univ. of Tennessee (USA) . . . . . [8723-35]

9:30 am: **Biosensing with semiconductor quantum dots** *(Invited Paper)*, Kelly B. Gemmill, James B. Delehanty III, Kimihiro Susumu, Michael Stewart, Eunkeu Oh, Igor Medintz, Alan Huston, U.S. Naval Research Lab. (USA) . [8723-36]

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

10:30 am: **Development of a field-deployable prototype device for the rapid point-of-care detection of cyanide in whole blood** *(Invited Paper)*, Hans Boehringer, Winnie Tong, Roy Chung, Diagnostic Consulting Network (USA); Gerry Boss, Univ. of California, San Diego (USA); Sari Mahon, Beckman Laser Institute and Medical Clinic (USA); Matthew Brenner, Univ. of California, Irvine (USA); Brendan O'Farrell, Diagnostic Consulting Network (USA) . . . . . [8723-37]

11:10 am: **Engineering single domain antibodies to expand their utility in bioassays** *(Invited Paper)*, Ellen Goldman, George Anderson, Scott Walper, Dan Zabetakis, Jinny L. Liu, U.S. Naval Research Lab. (USA); Audrey Lee, Nova Research, Inc. (USA) . . . . . [8723-38]

11:40 am: **Machine Learning Based Diet Monitoring Through Breathing Signal**, Bo Dong, Subir Biswas, Michigan State Univ. (USA) . . . . . [8723-39]

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

SESSION 6

Room: Conv. Ctr. 324 . . . . . Wed 1:00 pm to 3:20 pm

Environmental Monitoring

Session Chairs: **Ratnesh Kumar,** Iowa State Univ. (USA); **Giovanni Franco Crosta,** Univ. degli Studi di Milano-Bicocca (Italy)

1:00 pm: **A multifrequency, self-calibrating, in-situ soil sensor with energy-efficient wireless interface** *(Invited Paper)*, Ratnesh Kumar, Gunjan Pandey, Robert J. Weber, Iowa State Univ. (USA) . . . . . [8723-51]

1:30 pm: **Determination of soil ionic concentration using impedance spectroscopy** *(Invited Paper)*, Gunjan Pandey, Ratnesh Kumar, Robert J. Weber, Iowa State Univ. (USA) . . . . . [8723-52]

2:00 pm: **Discrimination of airborne material particles from light scattering (TAOS) patterns** *(Invited Paper)*, Giovanni F. Crosta, Caterina Casati, Univ. degli Studi di Milano-Bicocca (Italy); Yong-Le Pan, Gorden W. Videen, U.S. Army Research Lab. (USA); Kevin B. Aptowicz, West Chester Univ. of Pennsylvania (USA); Richard K. Chang, Yale Univ. (USA). . . . . [8723-41]

2:30 pm: **Combining satellite AOD and WRF/CMAQ outputs to improve PM2.5 observations** *(Invited Paper)*, Lina Cordero, Chowdhury Nazmi, Yonghua Wu, Barry M. Gross, Fred Moshary, The City College of New York (USA) . . . . . [8723-64]

3:00 pm: **Optical remote sensing: a potential tool for forecasting malaria in Orissa, India**, Mohammad Nizamuddin, The City College of New York (USA); Kawsar A. Akhand, The City Univ. of New York (USA); Leonid Roytman, The City College of New York (USA); Felix Kogan, National Environmental Satellite, Data, and Information Service (USA); Mitch Goldberg, National Oceanic and Atmospheric Administration (USA) . . . . . [8723-42]

Tuesday - Wednesday 30 April - 1 May 2013 • Proceedings of SPIE Vol. 8724

Ocean Sensing and Monitoring V

Conference Chairs: **Weilin W. Hou,** U.S. Naval Research Lab. (USA); **Robert A. Arnone,** Univ. of Southern Mississippi (USA)

Program Committee: **Mitchell A. Roffer,** Roffer's Ocean Fishing Forecasting Service, Inc. (USA); **Todd E. Bowers,** Naval Oceanographic Office (USA); **Kendall L. Carder,** SRI International (USA), Univ. of South Florida {United States); **James Churnside,** National Oceanic and Atmospheric Administration (USA), Univ. of South Florida {United States); **Percy Donaghay,** The Univ. of Rhode Island (USA); **Stephan D. Howden,** The Univ. of Southern Mississippi (USA); **Linda J. Mullen,** Naval Air Systems Command (USA); **Jon Schoonmaker,** Advanced Coherent Technologies LLC (USA); **Charles C. Trees,** NATO Undersea Research Ctr. (USA); **Michael Twardowski,** WET Labs., Inc. (USA); **Alan Weidemann,** U.S. Naval Research Lab. (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 350 . . . . . Tue 9:00 am to 10:00 am

Underwater Imaging and Sensing I

Session Chair: **Weilin W. Hou,** U.S. Naval Research Lab. (USA)

9:00 am: **State-of-the-art tools for next-generation underwater optical imaging systems**, Linda J. Mullen, Shawn O'Connor, Brandon Cochenour, Naval Air Systems Command (USA); Fraser R. Dalgleish, Harbor Branch Oceanographic Institute (USA) . . . . . [8724-1]

9:20 am: **Polarimetric imaging of underwater targets**, Alex Gilerson, Alberto Tonizzo, Carlos Carrizo, Ahmed El Habashi, Samir Ahmed, The City College of New York (USA) . . . . . [8724-5]

9:40 am: **An undersea free space laser communications and imaging network simulator**, Fraser R. Dalgleish, Harbor Branch Oceanographic Institute (USA); David Rashkin, Univ. of Florida (USA); Bing Ouyang, Florida Atlantic Univ. (USA); Anni K. Vuorenkoski, Harbor Branch Oceanographic Institute (USA); Mihaela Cardei, Ionut Cardei, Florida Atlantic Univ. (USA) . . . . . [8724-7]

Coffee Break . . . . . .Tue 10:00 am to 10:40 am

SESSION 2

Room: Conv. Ctr. 350 . . . . . Tue 10:40 am to 12:00 pm

Underwater Imaging and Sensing II

Session Chair: **Weilin W. Hou,** U.S. Naval Research Lab. (USA)

10:40 am: **Measurements of turbulent dissipation during the Bahamas Optical Turbulence Experiment**, Silvia Matt, Weilin W. Hou, U.S. Naval Research Lab. (USA); Sarah Woods, SPEC, Inc. (USA); Ewa Jarosz, Wesley Goode, Alan Weidemann, U.S. Naval Research Lab. (USA) . . . . . [8724-9]

11:00 am: **Characterization of optical communication in a leader-follower unmanned underwater vehicle formation**, Firat Eren, Shachak Pe'eri, May-Win Thein, The Univ. of New Hampshire (USA) . . . . . [8724-8]

11:20 am: **Using computer vision to analyze the images obtained from ocean mapping**, Irene Fernandez Florez, Univ. EAFIT (Colombia) . . . . . [8724-11]

11:40 am: **Multiuser sonar watermarking and detection in an underwater acoustic channel**, Bijan G. Mobasseri, Villanova Univ. (USA); Robert S. Lynch, Naval Undersea Warfare Ctr. (USA); David Andiario, Villanova Univ. (USA) [8724-10]

Lunch/Exhibition Break . . . . . .Tue 12:00 pm to 1:20 pm

SESSION 3

Room: Conv. Ctr. 350 . . . . . Tue 1:20 pm to 3:20 pm

LIDAR and Ocean Processes

Session Chair: **James H. Churnside,** National Oceanic and Atmospheric Administration (USA)

1:20 pm: **Effect of surface roughness on lidar overlap function**, James H. Churnside, National Oceanic and Atmospheric Administration (USA) . . . . [8724-12]

1:40 pm: **CZMIL (coastal zone mapping and imaging lidar): from first flights to first mission through system validation**, Viktor Feygels, Joong Yong Park, Optech International, Inc. (USA); Jennifer M. Wozencraft, U.S. Army Corps of Engineers (USA); Jennifer Aitken, Optech International, Inc. (USA); Christopher L. Macon, U.S. Army Corps of Engineers (USA); Abhinav Mathur, Andy Payment, Vinod Ramnath, Optech International, Inc. (USA) . . . . . [8724-13]

2:00 pm: **Sea floor classification with satellite data and airborne lidar bathymetry**, H. Michael Tulldahl, Swedish Defence Research Agency (Sweden); Petra Philipson, Brockmann Geomatics Sweden AB (Sweden); Hans Kautsky, Stockholm Univ. (Sweden); Sofia A. Wikström, AquaBiota Water Research (Sweden) . . . . . [8724-14]

2:20 pm: **Circulation on the continental shelf within the Mississippi Bight**, Stephan D. Howden, The Univ. of Southern Mississippi (USA); Amy Kern, Univ. of Southern Mississippi (USA) . . . . . [8724-16]

2:40 pm: **Active laser sensing of mixed layer turbulence**, Fraser R. Dalgleish, Anni K. Vuorenkoski, Harbor Branch Oceanographic Institute (USA); Bing Ouyang, Florida Atlantic Univ. (USA); Gero Nootz, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Weilin W. Hou, U.S. Naval Research Lab. (USA) . . . . . [8724-15]

3:00 pm: **Assimilation of bio-optical properties into coupled physical, bio-optical coastal model**, Igor Shulman, Sergey Frolov, Stephanie Anderson, Bradley Penta, Richard W. Gould Jr., Peter Sakalaukus, Sherwin Ladner, U.S. Naval Research Lab. (USA) . . . . . [8724-17]

Coffee Break . . . . . .Tue 3:20 pm to 4:00 pm

SESSION 4

Room: Conv. Ctr. 350 . . . . . Tue 4:00 pm to 5:20 pm

Future Sensing Capabilities

Session Chair: **Stephan D. Howden,**
The Univ. of Southern Mississippi (USA)

4:00 pm: **Optical backscattering in water: measurements and uncertainties**, James M. Sullivan, Michael S. Twardowski, J. Ronald V. Zaneveld, Casey C. Moore, WET Labs., Inc. (USA) . . . . . [8724-19]

4:20 pm: **On the eigenvalue analysis using HH-VV dual-polarization SAR sata and its applications to monitoring of coastal oceans**, Mitsunobu Sugimoto, Kazuo Ouchi, National Defense Academy (Japan); Chan-Su Yang, Korea Institute of Ocean Science & Technology (Korea, Republic of) . . . . . [8724-20]

4:40 pm: **Estimating oil layer thickness: a vibrational spectroscopic approach**, Lance E. Besaw, Gregory F. Hewitt, John W. Haas III, Applied Research Associates, Inc. (USA); Neal E Van Wyck, Applied Research Associates Inc (USA); Ryan C. Langlois, Applied Research Associates, Inc. (USA); David W. Sweeten, BP p.l.c. (USA) . . . . . [8724-21]

5:00 pm: **Colombian ocean waves and coasts modeled by special functions**, Simon Duque, Univ. EAFIT (Colombia) . . . . . [8724-22]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

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Assessment of spectral stability of the Libya 4 CEOS reference test site using hyperspectral EO-1 hyperion data, Taeyoung Choi, Sigma Space Corp. (USA); Xiaxiong Xiong, NASA Goddard Space Flight Ctr. (USA); Amit Angal, Science Systems and Applications, Inc. (USA); Gyanesh Chander, U.S. Geological Survey (USA) . . . . . [8724-43]

Design of integrated ship monitoring system using SAR, RADAR, and AIS, Chan-Su Yang, Korea Institute of Ocean Science & Technology (Korea, Republic of) and Univ. of Science and Technology (Korea, Republic of); Danbee Hong, Hyung-Wook Ahn, Korea Institute of Ocean Science & Technology (Korea, Republic of); Tae-ho Kim, Univ. of Science & Technology (Korea, Republic of) . . . . . [8724-45]

Long-term band-to-band calibration stability of MODIS thermal emissive bands, Brian N. Wenny, Sigma Space Corp. (USA); Xiaoxiong Xiong, NASA Goddard Space Flight Ctr. (USA); Aisheng Wu,

Yonghong Li, Sigma Space Corp. (USA) . . . . . [8724-44]

Sea surface signature of tropical cyclones using microwave remote sensing, Bumjun Kil, The Univ. of Southern Mississippi (USA); Derek M. Burrage, Joel Wesson, U.S. Naval Research Lab. (USA); Stephan D. Howden, The Univ. of Southern Mississippi (USA) . . . . . [8724-46]

Wednesday 1 May

SESSION 5

Room: Conv. Ctr. 350 . . . . . .Wed 8:20 am to 10:00 am

Visible Remote Sensing I

Session Chairs: **Robert A. Arnone,** U.S. Naval Research Lab. (USA); **Samir Ahmed,** The City College of New York (USA)

8:20 am: **Evaluating VIIRS ocean color products for West Coast and Hawaiian waters**, Curtiss O. Davis, Nicholas Tufillaro, Jasmine Nahorniak, Oregon State Univ. (USA); Burt H. Jones, The Univ. of Southern California (USA); Robert A. Arnone, Univ. of Southern Mississippi (USA) . . . . . [8724-24]

8:40 am: **Analyzing radiometric requirements for diurnal observations of coastal/oceanic waters from geostationary orbits**, Nima Pahlevan, Zhongping Lee, Univ. of Massachusetts Boston (USA); Chuanmin Hu, Univ. of South Florida (USA); John R. Schott, Rochester Institute of Technology (USA) . . . . . [8724-25]

9:00 am: **Evaluation of VIIRS ocean color data using measurements from the AERONET-OC sites**, Samir Ahmed, Alex Gilerson, Soe Hlaing, The City College of New York (USA); Ionnis Ioannou, The City Univ. of New York (USA); Alberto Tonnizo, The City College of New York (USA); Menghua Wang, NOAA / NESDIS (USA) and The City College of New York (USA); Alan Weidemann, U.S. Naval Research Lab. (USA); Robert A. Arnone, The Univ. of Southern Mississippi (USA) . . . . . [8724-26]

9:20 am: **The Navy's focus on future remote sensing capabilities**, Todd E. Bowers, Naval Oceanographic Office (USA) . . . . . [8724-23]

9:40 am: **Bathymetry estimations using HOPE on vicariously calibrated HICO data**, Mark D. Lewis, Richard W. Gould Jr., Alan Weidemann, Sherwin Ladner, U.S. Naval Research Lab. (USA); ZhongPing Lee, Univ. of Massachusetts Boston (USA) . . . . . [8724-27]

Coffee/Exhibition Break. . . . . Wed 10:00 am to 10:50 am

SESSION 6

Room: Conv. Ctr. 350 . . . . . .Wed 10:50 am to 11:50 am

Visible Remote Sensing II

Session Chairs: **Robert A. Arnone,** Univ. of Southern Mississippi (USA); **Samir Ahmed,** The City College of New York (USA)

10:50 am: **Monitoring bio-optical processes in coastal and lake waters using high spatial resolution channels on the NPP-VIIRS sensor**, Ryan A. Vandermeulen, Robert A. Arnone, The Univ. of Southern Mississippi (USA); Sherwin Ladner, U.S. Naval Research Lab. (USA); Paul M. Martinolich, Qinetiq North America, Inc. (USA) . . . . . [8724-29]

11:10 am: **Neural network approach for the derivation of chlorophyll concentration from ocean color sensors**, Ioannis Ioannou, The City Univ. of New York (USA); Alex Gilerson, Barry M. Gross, Fred Moshary, Samir Ahmed, The City College of New York (USA) . . . . . [8724-30]

11:30 am: **Monitoring bio-optical processes using VIIRS: NPP and MODIS ocean color products**, Robert A. Arnone, Univ. of Southern Mississippi (USA); Sherwin Ladner, U.S. Naval Research Lab. (USA); Ryan A. Vandermeulen, The Univ. of Southern Mississippi (USA); Paul M. Martinolich, Giuletta S. Fargion, Jennifer Bowers, QinetiQ North America, Inc (USA); Adam Lawson, U.S. Naval Research Lab. (USA) . . . . . [8724-32]

Lunch/Exhibition Break . . . . . Wed 11:50 am to 1:40 pm

SESSION 7

Room: Conv. Ctr. 350 . . . . . Wed 1:40 pm to 3:00 pm

Thermal Remote and In-Situ Sensing I

Session Chair: **Alexander Ignatov,** National Oceanic and Atmospheric Administration (USA)

1:40 pm: **Improvements of Satellite SST Retrievals at Full Swath**, Walton McBride, U.S. Naval Research Lab. (USA); Bob A. Arnone, Univ. of Southern Mississippi (USA); Jean-Francois P. Cayula, QinetiQ North America (USA) [8724-36]

2:00 pm: **VIIRS derived SST at the Naval Oceanographic Office: From evaluation to operation.**, Jean-Francois Cayula, Qinetiq North America (USA); Doug May, Bruce Mckenzie, Naval Oceanographic Office (USA). . . . . [8724-35]

2:20 pm: **OSI-SAF operational NPP/VIIRS SST chain**, Pierre Le Borgne, Gérard Legendre, Anne Marsouin, Sonia Péré, Hervé Roquet, Meteo-France (France) . . . . . [8724-37]

2:40 pm: **S-NPP/VIIRS SST and Radiance products: accuracy, stability, and consistency with AVHRR/MODIS**, Alexander Ignatov, National Oceanic and Atmospheric Administration (USA); Xingming Liang, National Oceanic and Atmospheric Administration (USA) and Cooperative Institute for Research in the Atmosphere/Colorado State Univ. (USA); Prasanjit Dash, National Environmental Satellite, Data, and Information Service (USA) and Cooperative Institute for Research in the Atmosphere/Colorado State Univ. (USA); John Stroup, National Oceanic and Atmospheric Administration (USA) and STG, Inc (USA); Yury Kihai, Boris Petrenko, National Environmental Satellite, Data, and Information Service (USA) and Global Science & Technology, Inc. (USA); John Sapper, National Environmental Satellite, Data, and Information Service (USA) . . . . . [8724-34]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 8

Room: Conv. Ctr. 350 . . . . . Wed 3:40 pm to 5:20 pm

Thermal Remote and In-Situ Sensing II

Session Chair: **Alexander Ignatov,** National Oceanic and Atmospheric Administration (USA)

3:40 pm: **Evaluation and selection of regression equations for SST retrieval from NPP VIIRS**, Boris Petrenko, NOAA/NESDIS/STAR (USA) and Global Science & Technology, Inc. (USA); Alex Ignatov, NOAA/NESDIS/STAR (USA); Yury Kihai, NOAA/NESDIS/STAR (USA) and Global Science & Technology, Inc. (USA); XingMing Liang, NOAA/NESDIS/STAR (USA) and Cooperative Institute for Research in the Atmosphere (USA); John Stroup, NOAA/NESDIS/STAR (USA) and Science Systems and Applications, Inc. (USA). . . . . [8724-38]

4:00 pm: **Reduction of stripe noise in ACSPO clear-sky radiances and SST**, Marouan Bouali, Alexander Ignatov, National Oceanic and Atmospheric Administration (USA) . . . . . [8724-39]

4:20 pm: **Evaluating the calibration of MODIS thermal emissive bands using infrared atmospheric sounding interferometer measurements**, Yonghong Li, Aisheng Wu, Sigma Space Corp. (USA); Xiaoxiong Xiong, NASA Goddard Space Flight Ctr. (USA). . . . . [8724-40]

4:40 pm: **On-orbit spectral characterization for MODIS reflective solar bands**, Taeyoung J. Choi, Sigma Space Corp. (USA); Xiaoxiong Xiong, NASA Goddard Space Flight Ctr. (USA); Zhipeng Wang, Daniel Link, Sigma Space Corp. (USA) . . . . . [8724-41]

5:00 pm: **Simultaneous measurement of temperature and pressure sensor for oceanography using Bragg gratings**, Parne Saidi Reddy, I. V. Anudeep Kumar Reddy, Sandeep M., G. R. C. Reddy, Sanjeev Afzulpurkar, National Institute of Technology, Goa (India) . . . . . [8724-42]

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Micro- and Nanotechnology Sensors, Systems, and Applications V

Monday 29 April

SESSION 1

Room: Conv. Ctr. 317 . . . . . .Mon 8:00 am to 10:10 am

Frontiers in Nanoelectronics Research

Session Chair: **Thomas George,** Zyomed Corp. (USA)

8:00 am: **Nano-electro-mechanical-systems (NEMS) and Energy-efficient Electronics and The Emergence of Two-dimensional Layered Materials Beyond Graphene** *(Keynote Presentation)*, Anupama B. Kaul, National Science Foundation (USA) . . . . . [8725-1]

8:30 am: **Twisted bilayer graphene: synthesis, Raman scattering, and highly sensitive tunable photodetector** *(Invited Paper)*, Jiming Bao, Univ. of Houston (USA) . . . . . [8725-2]

8:50 am: **Graphene-Si heterogeneous nanotechnology** *(Invited Paper)*, Deji Akinwande, Li Tao, The Univ. of Texas at Austin (USA). . . . . [8725-3]

9:10 am: **Heterojunctions of silicon with graphene and carbon nanotubes for tunable, high-response photodetection, photometry, imaging, and digital optoelectronics** *(Invited Paper)*, Fangze Liu, Younglae Kim, Xiaohong An, Yung Joon Jung, Swastik Kar, Northeastern Univ. (USA) . . . . . [8725-4]

9:30 am: **Band gap and correlated phenomena in bilayer and trilayer graphene** *(Invited Paper)*, Chun Ning Lau, Yongjin Lee, Jairo Velasco Jr., Kevin Myhro, Nathaniel Gilgren, David Tran, Univ. of California, Riverside (USA) . . . . . [8725-5]

9:50 am: **New generation transistor technologies enabled by 2D crystals** *(Invited Paper)*, Debdeep Jena, Univ. of Notre Dame (USA) . . . . . [8725-6]

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

SESSION 2

Room: Conv. Ctr. 317 . . . . . .Mon 10:30 am to 11:40 am

Multifunctional and Adaptive Structural Materials I

Session Chair: **Andre U. Sokolnikov,**
Visual Solutions and Applications (USA)

10:30 am: **Surface confined assemblies and polymers for sensing and molecular logic** *(Invited Paper)*, Milko E. van der Boom, Weizmann Institute of Science (Israel) . . . . . [8725-106]

11:00 am: **Adaptive frequency selective surfaces** *(Invited Paper)*, Walter R. Buchwald, Univ. of Massachusetts Boston (USA); Joshua R. Hendrickson, Air Force Research Lab. (USA); Junpeng Guo, The Univ. of Alabama in Huntsville (USA). . . . . [8725-8]

11:20 am: **Adaptive multifunctional composites** *(Invited Paper)*, Daniel J. Inman, Ya D. Wang, Univ. of Michigan (USA) . . . . . [8725-9]

Lunch Break . . . . . Mon 11:40 am to 12:50 pm

SESSION 3

Room: Conv. Ctr. 317 . . . . . Mon 12:50 pm to 2:30 pm

Multifunctional and Adaptive Structural Materials II

Session Chair: **Andre U. Sokolnikov,**
Visual Solutions and Applications (USA)

12:50 pm: **Materials research at DARPA addressing multifunctional and adaptive structural materials** *(Invited Paper)*, Brian C. Holloway, Defense Advanced Research Projects Agency (USA). . . . . [8725-10]

1:10 pm: **Adaptive quantum-dot based materials for detection and broadband photovoltaic conversion** *(Invited Paper)*, Vladimir V. Mitin, Nizami Z. Vagidov, Univ. at Buffalo (USA); Kimberly A. Sablon, U.S. Army Research Lab. (USA); Andrei V. Sergeev, Univ. at Buffalo (USA) . . . . . [8725-11]

1:30 pm: **Functional supramolecular nanomaterials: robust yet adaptive** *(Invited Paper)*, Boris Rybtchinski, Weizmann Institute of Science (Israel) . . . . . [8725-12]

1:50 pm: **Emission and detection of terahertz radiation using two-dimensional plasmons in semiconductor nano-heterostructures for nondestructive evaluations** *(Invited Paper)*, Taiichi Otsuji, Takayuki Watanabe, Stephane Albon Boubanga Tombet, Akira Satou, Victor Ryzhii, Tohoku Univ. (Japan); Vyacheslav V. Popov, Institute of Radio Engineering and Electronics (Russian Federation); Wojciech Knap, Univ. Montpellier 2 (France) . . . . . [8725-13]

2:10 pm: **Graphene based integrated electronic, photonic, and spintronic circuit** *(Invited Paper)*, Pawel Hawrylak, National Research Council Canada (Canada) . . . . . [8725-14]

SESSION 4

Room: Conv. Ctr. 317 . . . . . Mon 2:30 pm to 4:40 pm

Micro-/Nanosensing for Harsh Environment Energy Applications and Environmental Control

Session Chair: **Bilge Saruhan-Brings,**
Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany)

2:30 pm: **Harsh environment sensor development for advanced energy systems** *(Keynote Presentation)*, Robert R. Romanosky, Susan M. Maley, National Energy Technology Lab. (USA) . . . . . [8725-15]

3:00 pm: **Chemical sensor systems for environmental and emission control** *(Invited Paper)*, Anita Lloyd Spetz, Linköping Univ. (Sweden); Christian Bur, Univ. des Saarlandes (Germany); Joni Huotari, Univ. of Oulu (Finland); Robert Bjorklund, Linköping Univ. (Sweden); Jyrki Lappalainen, Univ. of Oulu (Finland); Andreas Schütze, Univ. des Saarlandes (Germany); Mike Andersson, Linköping Univ. (Sweden) . . . . . [8725-16]

Coffee Break . . . . . Mon 3:20 pm to 3:40 pm

3:40 pm: **Miniaturized resonant sensors for harsh environments** *(Invited Paper)*, Holger Fritze, Denny Richter, Jan Sauerwald, Silja Schmidtchen, Technische Univ. Clausthal (Germany) . . . . . [8725-17]

4:00 pm: **III-N nanostructures for optical gas detection and pH sensing in liquids** *(Invited Paper)*, Sumit Paul, EADS Deutschland GmbH (Germany); Konrad Maier, EADS Innovation Works (Germany); Aparna Das, Commissariat à l'Énergie Atomique (France); Florian Furtmayer, Justus-Liebig-Univ. Giessen (Germany); Andreas Helwig, EADS Deutschland GmbH (Germany); Jörg Teubert, Justus-Liebig-Univ. Giessen (Germany); Eva Monroy, Commissariat à l'Énergie Atomique (France); Gerhard Müller, EADS Deutschland GmbH (Germany); Martin H. Eickhoff, Justus-Liebig-Univ. Giessen (Germany) . . . . . [8725-18]

4:20 pm: **Metal oxide nanowire gas sensors for indoor and outdoor environmental monitoring** *(Invited Paper)*, Anton Köck, Elise Brunet, Thomas Maier, Giorgio C. Mutinati, Stephan Steinhauer, AIT Austrian Institute of Technology GmbH (Austria); Franz Schrank, Jochen Kraft, Jordi Teva, Joerg Siegert, austriamicrosystems AG (Austria) . . . . . [8725-19]

Symposium-wide Plenary Session
Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 317 . . . . . Tue 8:30 am to 10:40 am

Scanning Probe-Based Nanopatterning and Dip-Pen Nanolithography

Joint Session with Conferences 8725 and 8729

Session Chairs: **Ronald G. Dixson,** National Institute of Standards and Technology (USA); **Debjyoti Banerjee,** Texas A&M Univ. (USA)

8:30 am: **Emerging approaches for nanopatterning of soft, hard, and hybrid structures** *(Keynote Presentation)*, Vinayak P. Dravid, Northwestern Univ. (USA) . . . . . [8725-20]

9:00 am: **Dip-pen nanolithography on inorganic and biological surfaces: challenges and opportunities** *(Invited Paper)*, Albena Ivanisevic, North Carolina State Univ. (USA). . . . . [8725-21]

9:20 am: **Humidity effects in dip-pen nanolithography: multiple inks and hollow features** *(Invited Paper)*, Brandon L. Weeks, Texas Tech Univ. (USA). . . . [8725-22]

9:40 am: **Nanoelectromechanical systems fabricated using tip-based nanofabrication** *(Invited Paper)*, Huan Hu, Parsian K. Mohseni, Xiuling Li, Mark A. Shannon, William P. King, Univ. of Illinois at Urbana-Champaign (USA) . . [8725-23]

10:00 am: **Using heatable AFM probes for the nanolithography of graphene, polymers, and nanoparticles** *(Invited Paper)*, Paul E. Sheehan, Woo K. Lee, U.S. Naval Research Lab. (USA); William P. King, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [8725-24]

10:20 am: **Tip-induced nanolithography on semiconductors** *(Invited Paper)*, Thomas G. Thundat, Ravi Gaikwad, Stojan Djokic, Univ. of Alberta (Canada) . . . . . [8725-25]

Extended Lunch/Exhibition Break. . . . . .Tue 10:40 am to 1:00 pm

SESSION 6
Room: Conv. Ctr. 317 . . . . . Tue 1:00 pm to 3:10 pm

Novel Adaptive Optics Techniques and Applications

Session Chair: **Christopher C. Wilcox,** U.S. Naval Research Lab. (USA)

1:00 pm: **How adaptive optics may have won the cold war** *(Keynote Presentation)*, Robert K. Tyson, The Univ. of North Carolina at Charlotte (USA) . . . . . [8725-26]

1:30 pm: **The use of MEMs and other micro-technology devices for adaptive optics** *(Invited Paper)*, Sergio R. Restaino, Christopher C. Wilcox, Jonathan R. Andrews, Ty Martinez, U.S. Naval Research Lab. (USA) . . . . . [8725-27]

1:50 pm: **Adaptive optics for fiber-fed interferometers** *(Invited Paper)*, Michael Hart, Hart Scientific Consulting International L.L.C. (USA); Thomas E. Stalcup Jr., Olivier Durney, Nicholas Emerson, Keith B. Powell, Jeffery Hagen, Michael Ward, The Univ. of Arizona (USA) . . . . . [8725-28]

2:30 pm: **High-actuator-count MEMS deformable mirrors** *(Invited Paper)*, Michael A. Helmbrecht, Min He, Carl J. Kempf, Iris AO, Inc. (USA) . . . . . [8725-30]

Wednesday 1 May

SESSION 7
Room: Conv. Ctr. 317 . . . . . .Wed 8:00 am to 9:50 am

Nano-/Microstructured Materials for Photovoltaic and Photoelectrochemical Energy Harvesting

Joint Session with Conference 8725 and 8728

Session Chair: **Jongseung Yoon,** The Univ. of Southern California (USA)

8:00 am: **Nanostructured black silicon for photovoltaics and photoelectrochemistry** *(Keynote Presentation)*, Howard M. Branz, Todd G. Deutsch, Hao-Chih Yuan, Jihun Oh, National Renewable Energy Lab. (USA) . . . . . [8725-32]

8:30 am: **Semiconductor nanorods in energy devices** *(Invited Paper)*, Paul D. Dapkus, Ting-Wei Yeh, Yen-Ting Lin, Chun-Yung Chi, Maoqing Yao, Chongwu Zhao, The Univ. of Southern California (USA). . . . . [8725-33]

8:50 am: **Towards low-cost high-efficiency GaAs photovoltaics and photoelectrodes grown via vapor transport from a solid source** *(Invited Paper)*, Shannon W. Boettcher, Andrew Ritenour, Univ. of Oregon (USA); Jason Boucher, University of Oregon (USA) . . . . . [8725-34]

9:10 am: **Direct-bandgap nanopillar photovoltaics based on patterned catalyst-free epitaxy** *(Invited Paper)*, Diana L. Huffaker, Univ. of California, Los Angeles (USA). . . . . [8725-35]

9:30 am: **Emerging nanomaterials for photovoltaic energy harvesting** *(Invited Paper)*, Silvija Gradecak, Massachusetts Institute of Technology (USA) . . . . . [8725-36]

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

SESSION 8
Room: Conv. Ctr. 317 . . . . . .Wed 10:20 am to 12:20 pm

Micro- and Nanotechnology for Health Care

Joint Session with Conference 8725 and 8719

Session Chairs: **Brian M. Cullum,** Univ. of Maryland, Baltimore County (USA); **Eric S. McLamore,** Univ. of Florida (USA); **Noriko Satake,** UC Davis Medical Ctr. (USA); **Scott D. Collins,** Univ. of Maine (USA); **Thomas George,** Zyomed Corp. (USA)

10:50 am: **Microscale technologies for imaging endogenous gene expression in individual cells within 3D tissues** *(Invited Paper)*, Nitin Nitin, Univ. of California, Davis (USA) . . . . . [8725-38]

11:10 am: **Biological engineering approaches for cellular and biomolecular detection and sensing** *(Invited Paper)*, D. Marshall Porterfield, NASA Headquarters (USA) and Purdue Univ. (USA) . . . . . [8719-6]

11:50 am: **NIBIB activities in the areas of sensing, molecular sensing, mobile health and systems** *(Keynote Presentation)*, William Heetderks, National Institutes of Health (USA) . . . . . [8725-40]

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

SESSION 9
Room: Conv. Ctr. 317 . . . . . Wed 1:20 pm to 4:40 pm

Interaction of Semiconductors and High-Energy Particles

Session Chairs: **Takeshi Ohshima,** Japan Atomic Energy Research Institute (Japan); **Shinji Nozaki,** The Univ. of Electro-Communications (Japan)

1:20 pm: **Present status and prospects of R&D of radiation-resistant semiconductor devices at JAEA** *(Keynote Presentation)*, Hisayoshi Itoh, Japan Atomic Energy Agency (Japan) . . . . . [8725-41]

2:10 pm: **Radiation effects in solar cells** *(Invited Paper)*, Mitsuru Imaizumi, Japan Aerospace Exploration Agency (Japan); Takeshi Ohshima, Japan Atomic Energy Research Institute (Japan) . . . . . [8725-43]

2:30 pm: **Radiation tolerance of silicon and diamond detectors exposed to MeV ion beams: characterization using IBIC technique** *(Invited Paper)*, Milko Jaksic, Natko Skukan, Veljko Grilj, Rugjer Boskovic Institute (Croatia); Tomihiro Kamiya, Wataru Kada, Japan Atomic Energy Agency (Japan); Michal Pomorski, CEA-Ctr. de Saclay (France) . . . . . [8725-44]

2:50 pm: **Radiation-tolerant microprocessors in Japanese scientific space vehicles: how to maximize the benefits of commercial SOI technologies** *(Invited Paper)*, Daisuke Kobayashi, Hirose Kazuyuki, Hirobumi Saito, Institute of Space and Astronautical Science (Japan) and Japan Aerospace Exploration Agency (Japan) . . . . . [8725-45]

3:10 pm: **Results of the CEASE instrument onboard TacSat-4 with associated solar cell experiment damage calculations** *(Invited Paper)*, Scott R. Messenger, U.S. Naval Research Lab. (USA); Chadwick D. Lindstrom, William Johnston, Air Force Research Lab. (USA); Stu Huston, Atmospheric and Environmental Research, Inc. (USA); Phillip P. Jenkins, Jeffrey H. Warner, U.S. Naval Research Lab. (USA) . . . . . [8725-46]

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

4:00 pm: **Error-rate prediction for programmable circuits: methodology, tools and studied cases** *(Invited Paper)*, Raoul Velazco, TIMA Lab. (France) . . [8725-47]

4:20 pm: **Ion beam-induced charge analysis of radiation damage in semiconductors** *(Invited Paper)*, Ettore Vittone, Univ. degli Studi di Torino (Italy) . . . . . [8725-48]

PANEL DISCUSSION

Room: Conv. Ctr. 317 . . . . . Wed 4:40 pm to 5:40 pm

Future Directions for Radiation-related Materials Research: From Research to Preactial Use

Moderators: **Shinji Nozaki**, Univ. of Electro-Communications (Japan); **Takeshi Ohshima,** Japan Atomic Energy Research Institute (Japan); **Hisayoshi Itoh,** Japan Atomic Energy Agency (Japan)

Thursday 2 May

SESSION 10

Room: Conv. Ctr. 317 . . . . . Thu 8:00 am to 10:20 am

MAST: Software

Joint Session with Conferences 8725 and 8741

Session Chair: **Paul D. Samuel,** Daedalus Flight Systems, LLC (USA)

8:00 am: **Reduction and identification for hybrid dynamical models of terrestrial locomotion** *(Invited Paper)*, Sam Burden, S. Shankar Sastry, Univ. of California, Berkeley (USA) . . . . . [8725-49]

8:20 am: **Flight of the fruit fly** *(Invited Paper)*, Itai Cohen, Cornell Univ. (USA) . . . . . [8725-50]

8:40 am: **Stochastic receding horizon control: application to an octopedal robot** *(Invited Paper)*, Shridhar K. Shah, Herbert G. Tanner, Univ. of Delaware (USA) . . . . . [8725-51]

9:00 am: **Robust multi-robot mapping and exploration** *(Invited Paper)*, Henrik I. Christensen, John G. Rogers III, Carlos P. Nieto, Georgia Institute of Technology (USA) . . . . . [8725-52]

9:20 am: **Bio-inspired multimode optic flow sensors for micro air vehicles** *(Invited Paper)*, Seokjun Park, Jaehyuk Choi, Jihyun Cho, Euisik Yoon, Univ. of Michigan (USA) . . . . . [8725-53]

9:40 am: **Structure from motion in computationally constrained systems** *(Invited Paper)*, Joseph Conroy, William D. Nothwang, U.S. Army Research Lab. (USA) . . . . . [8725-54]

10:00 am: **Low power analog odometry circuit for miniature robotics** *(Invited Paper)*, Pamela A. Abshire, Michael J. Kuhlman, Tsung Hsueh Lee, Univ. of Maryland, College Park (USA) . . . . . [8725-55]

Extended Lunch/Exhibition Break . . . . . Thu 10:20 am to 12:30 pm

SESSION 11

Room: Conv. Ctr. 317 . . . . . Thu 12:30 pm to 3:10 pm

Flexible and Wearable Electronics for Defense Applications

Joint Session with Conference 8725 and 8730

Session Chairs: **Muhammad M. Hussain,** King Abdullah Univ. of Science and Technology (Saudi Arabia); **Ali Javey,** Univ. of California, Berkeley (USA)

12:30 pm: **Bio-integrated electronics and sensor systems** *(Invited Paper)*, John A. Rogers, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [8725-58]

12:50 pm: **Carbon nanotube macroelectronics: toward system-on-plastic** *(Invited Paper)*, Chuan Wang, Ali Javey, Univ. of California, Berkeley (USA)[8725-59]

1:10 pm: **Heterogeneously integrated multifunctional systems via high-throughput transfer printing of micro/nano devices** *(Invited Paper)*, M. Saif Islam, Hakan Karaagac, Mark Triplett, Logeeswaran Veerayah Jayaraman, Univ. of California, Davis (USA) . . . . . [8725-60]

1:30 pm: **Skin-inspired sensor sheets for touch, chemical, and biological sensing** *(Invited Paper)*, Zhenan Bao, Stanford Univ. (USA). . . . . [8725-61]

1:50 pm: **Mechanically flexible optically transparent silicon fabric with high thermal budget devices from bulk silicon (100)** *(Invited Paper)*, Muhammad M. Hussain, Jhonathan P. Rojas, Galo Torres Sevilla, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [8725-62]

2:10 pm: **Transferable single-crystalline semiconductor nanomembranes and their versatile applications** *(Invited Paper)*, Zhenqiang Ma, Univ. of Wisconsin-Madison (USA); Weidong Zhou, The Univ. of Texas at Arlington (USA) . . . [8725-63]

2:30 pm: **Biointerfaced nanopiezoelectrics** *(Invited Paper)*, Michael C. McAlpine, Princeton Univ. (USA) . . . . . [8725-64]

2:50 pm: **Ultraflexible and stretchable organic transistor integrated circuits for medical sensors** *(Invited Paper)*, Takao Someya, Tsuyoshi Sekitani, The Univ. of Tokyo (Japan) . . . . . [8725-65]

Coffee Break . . . . . Thu 3:10 pm to 3:30 pm

SESSION 12

Room: Conv. Ctr. 317 . . . . . Thu 3:30 pm to 6:20 pm

Novel Transparent Conductors and Carbon-based Technologies

Session Chair: **Kyung-Ah Son,** HRL Labs., LLC (USA)

3:30 pm: **Graphene scaled up and down** *(Keynote Presentation)*, Chagaan Baatar, Office of Naval Research (USA). . . . . [8725-66]

4:00 pm: **Controlling growth of large area graphene on SiC** *(Invited Paper)*, D. K. Gaskill, Luke O. Nyakiti, Virginia D. Wheeler, Rachael L. Myers-Ward, Nelson Y. Garces, Charles R. Eddy Jr., U.S. Naval Research Lab. (USA) . [8725-67]

4:20 pm: **Single-walled carbon nanotubes and graphene for transparent electronics** *(Invited Paper)*, John A. Rogers, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [8725-68]

4:40 pm: **Monodisperse carbon nanomaterials for electronic, optoelectronic, and energy conversion technologies** *(Invited Paper)*, Mark C. Hersam, Northwestern Univ. (USA) . . . . . [8725-69]

5:20 pm: **Flexible transparent conducting networks of metal nanowires** *(Invited Paper)*, Benjamin Wiley, Aaron Rathmell, Duke Univ. (USA) . . . . . [8725-71]

5:40 pm: **Graphene-based hybrid films for high-performance transparent electrode applications** *(Invited Paper)*, Iskandar Kholmanov, Rodney Ruoff, The Univ. of Texas at Austin (USA) . . . . . [8725-72]

6:00 pm: **Graphene and nanowire-based tunable and transparent RF front end** *(Invited Paper)*, Kyung-Ah Son, H. C. Seo, David W. Barnes, Hyok J. Son, James H. Schaffner, Jeong S. Moon, HRL Labs., LLC (USA) . . . . . [8725-73]

POSTERS-THURSDAY
Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Ion irradiation effects on electric properties of hydrogenated amorphous silicon thin films, Shin-ichiro Sato, Takeshi Ohshima, Japan Atomic Energy Agency (Japan) . . . . . [8725-91]

Effects of x-ray and gamma-ray irradiation on the optical properties of quantum dots immobilized in porous silicon, Girija Gaur, Dmitry S. Koktysh, Sharon M. Weiss, Vanderbilt Univ. (USA) . . . . . [8725-92]

Nonlinear-optical up and down frequency-converting backward-wave metasensors and metamirrors, Alexander K. Popov, Univ. of Wisconsin-Stevens Point (USA); Igor S. Nefedov, Aalto Univ. School of Science and Technology (Finland); Sergey A. Myslivets, Kirensky Institute of Physics (Russian Federation); Mikhail I. Shalaev, Vitaly V. Slabko, Siberian Federal Univ. (Russian Federation) . . . . . [8725-93]

Advanced nanoelectromechanical switches with longevity in ambient and extreme conditions, Philip Feng, Case Western Reserve Univ. (USA) . . . [8725-95]

Impacts of radiation-induced defects on charge collection efficiencies of silicon carbide particle detectors, Naoya Iwamoto, Shinobu Onoda, Takahiro Makino, Takeshi Ohshima, Japan Atomic Energy Agency (Japan); Kazutoshi Kojima, National Institute of Advanced Industrial Science and Technology (Japan); Shinji Nozaki, The Univ. of Electro-Communications (Japan) . . . . . [8725-96]

Subwavelength resonant nanostructured films for sensing, Kyle J. Alvine, Bruce E. Bernacki, Wendy D. Bennett, Danny J. Edwards, Albert M. Mendoza, Jonathan D. Suter, Pacific Northwest National Lab. (USA). . . . . [8725-97]

Cross-spectrum noise spectroscopy of silicon nanowire transistors, Deepak K. Sharma, National Institute of Standards and Technology (USA) and George Mason Univ. (USA); Sergiy Krylyuk, Univ. of Maryland (USA); Abhishek Motayed, Univ. of Maryland (USA) and National Institute of Standards and Technology (USA); Qiliang Li, George Mason Univ. (USA) and National Institute of Standards and Technology (USA); Albert V. Davydov, National Institute of Standards and Technology (USA) . . . . . [8725-98]

Energy and power balance at interaction of ultrafast laser pulse train with a bandgap material, Michael K. Rafailov, Univ. of Alberta (Canada) . . . . . [8725-100]

Development of a versatile lab-on-a-ohip enzyme assay platform for pathogen detection in CBRNE scenarios, Richard Klemm, Sebastian Schattschneider, Tobias Jahn, Nadine Hlawatsch, Holger Becker, Claudia Gärtner, microfluidic ChipShop GmbH (Germany) . . . . . [8725-101]

Radiation detection with CdTe quantum dots in silica-glass and polymer nanocomposites, Kavin Manickaraj, SENSIAC (USA); Brent K. Wagner, Georgia Tech Research Institute (USA); Zhitao Kang, Georgia Tech Research Institute (USA) and Georgia Institute of Technology (USA). . . . . [8725-102]

Super-period metal nanostructures for integrated surface plasmon resonance spectrometer sensors, Junpeng Guo, Hai-Sheng Leong, The Univ. of Alabama in Huntsville (USA). . . . . [8725-103]

Solution-based photodetectors for monolithically integrated low-cost short-wave infrared focal plane arrays, Emre Heves, Huseyin Kayahan, Yasar Gurbuz, Sabanci Univ. (Turkey). . . . . [8725-104]

Large-aperture active optical carbon fiber reinforced polymer mirror, Matthew E. L. Jungwirth, Honeywell, Inc. (USA) and Sandia National Labs. (USA); Christopher C. Wilcox, U.S. Naval Research Lab. (USA); David V. Wick, Michael S Baker, Clinton G. Hobart, Jared J. Milinazzo, Sandia National Labs. (USA); Joseph L. Robichaud, L-3 Communications IOS-SSG (USA); Robert C Romeo, Robert N Martin, Composite Mirror Applications (USA); Jerome Ballesta, Imagine Optic (USA); Eustace L. Dereniak, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [8725-105]

Friday 3 May

SESSION 13
Room: Conv. Ctr. 317 . . . . . Fri 8:30 am to 9:50 am

Novel Micro/Nano Approaches to the CBRNE Detection Problem

Joint Session with Conferences 8725 and 8710

Session Chairs: **Joan A. Hoffmann, Stergios J. Papadakis,** Johns Hopkins Univ. Applied Physics Lab. (USA)

8:30 am: **Biointerfaced graphene nanosensors** *(Invited Paper)*, Michael C. McAlpine, Princeton Univ. (USA). . . . . [8725-74]

9:10 am: **Energy-transfer based nanocomposites for radiation detection** *(Invited Paper)*, Wei Chen, The Univ. of Texas at Arlington (USA) . . . . . [8725-76]

9:30 am: **SpinDx™: a rapid, sensitive, and deployable platform for diagnostics of biological and radiological threats** *(Invited Paper)*, Chung-Yan Koh, Stanley A. Langevin, Matthew E. Piccini, Anup K. Singh, Sandia National Labs., California (USA) . . . . . [8725-77]

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

SESSION 14
Room: Conv. Ctr. 317 . . . . . Fri 10:30 am to 12:00 pm

Micro- and Nanotechnologies for Standoff Detection I

Joint Session with Conferences 8725 and 8710

Session Chairs: **Michael K. Rafailov,** Univ. of Alberta (Canada); **Thomas G. Thundat,** Univ. of Alberta (Canada)

10:30 am: **Non-intrusive telemetry applications in the oilsands: from visible light and x-ray video, to acoustic imaging and spectroscopy** *(Keynote Presentation)*, John M. Shaw, Univ. of Alberta (Canada) . . . . . [8725-78]

11:00 am: **Micro- and nanostructure of asphaltene aggregates in situ characterization via monochromatic x-ray microtomography** *(Invited Paper)*, Michael K. Rafailov, Univ. of Alberta (Canada) and The Reger Group (USA); Victor E. Asadchikov, Alexei V. Buzmakov, Denis A. Zolotov, Anna S. Osadchaya, Arsen E. Muslimov, A.V. Shubnikov Institute of Crystallography (Russian Federation); Svetlana A. Rubtsova, Ctr. for Nano-Technology (Russian Federation) . . . [8725-79]

11:20 am: **Chemical sensing and imaging in microfluidic pore network structures relevant to natural carbon cycling and industrial carbon sequestration** *(Invited Paper)*, Jay W. Grate, Changyong Zhang, Michael Wilkins, Marvin G. Warner, Norman C. Anheier Jr., Jonathan D. Suter, Ryan Kelly, Mart Oostrom, Pacific Northwest National Lab. (USA) . . . . . [8725-80]

11:40 am: **Intercalation of Asphaltene nano-aggregates into natural and artificial substrates** *(Invited Paper)*, Michael K. Rafailov, Univ. of Alberta (Canada); Vladimir F. Sapega, A.P. Karpinsky Russian Geological Research Institute (Russian Federation) . . . . . [8725-81]

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

SESSION 15

Room: Conv. Ctr. 317 . . . . . Fri 1:00 pm to 2:30 pm

Micro- and Nanotechnologies for Standoff Detection II

Joint Session with Conferences 8725 and 8710

Session Chairs: **Michael K. Rafailov,** Univ. of Alberta (Canada); **Thomas G. Thundat,** Univ. of Alberta (Canada)

1:00 pm: **Micro- and nanodevices in millimetre and sub-millimetre imaging systems** *(Keynote Presentation)*, Roger Appleby, Queen's Univ. Belfast (United Kingdom) . . . . . [8725-82]

1:30 pm: **Airborne nanoparticle detection with nanomechanical string resonators** *(Invited Paper)*, Silvan Schmid, Maksymilian Kurek, Anja Boisen, Technical Univ. of Denmark (Denmark) . . . . . [8725-83]

1:50 pm: **Antenna coupled detectors for 2D staring focal plane arrays** *(Invited Paper)*, Michael A. Gritz, Leonard P. Chen, Robert Burkholder, Raytheon Co. (USA); Brian A. Lail, Florida Institute of Technology (USA); Borys P. Kolasa, Raytheon Co. (USA) . . . . . [8725-84]

2:10 pm: **Diffraction limit investigation with sub-wavelength pixels** *(Invited Paper)*, Alain Bergeron, Marc Terroux, Linda Marchese, Denis G. Dufour, Loic Le Noc, Claude Chevalier, INO (Canada) . . . . . [8725-85]

SESSION 16

Room: Conv. Ctr. 317 . . . . . Fri 2:30 pm to 3:50 pm

Micro- and Nanotechnologies for Standoff Detection III

Joint Session with Conferences 8725 and 8710

Session Chairs: **Michael K. Rafailov,** Univ. of Alberta (Canada); **Thomas G. Thundat,** Univ. of Alberta (Canada)

2:30 pm: **Raman and photothermal spectroscopies for explosive detection** *(Invited Paper)*, Eric Finot, Thibault Brulé, Padmnabh Rai, Alexandre Bouhélier, Univ. de Bourgogne (France); Thomas G. Thundat, Univ. of Alberta (Canada) . . . . . [8725-87]

2:50 pm: **Comparison of thermal and laser sources in standoff IR detection experiments** *(Invited Paper)*, Samuel P. Hernandez-Rivera, Leonardo C. Pacheco-Londoño, Univ. de Puerto Rico Mayagüez (USA); Iris Vazquez-Ayala, Naval Explosive Ordnance Disposal Technology Div. (USA); Carlos A. Ortega-Zúñiga, Nataly Y. Galán-Freyle, John R. Castro-Suarez, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8725-88]

3:10 pm: **Data analysis of multilaser standoff chem-bio detection** *(Invited Paper)*, Ali Passian, Oak Ridge National Lab. (USA) . . . . . [8725-89]

3:30 pm: **Recent advances in quantum cascade lasers for standoff detection** *(Invited Paper)*, Timothy O. Day, William B. Chapman, David B. Arnone, Allen Priest, David B. Caffey, Michael Pushkarsky, Alex Whitmore, Vivek Kamath, David Ruiz, Justin Kane, Christopher Armacost, Leigh J. Bromley, Daylight Solutions Inc. (USA) . . . . . [8725-90]

Next-Generation Spectroscopic Technologies VI

Conference Chairs: **Mark A. Druy,** Physical Sciences Inc. (USA); **Richard A. Crocombe,** Thermo Fisher Scientific Inc. (USA)

Program Committee: **Leigh J. Bromley,** Daylight Solutions (USA); **John M. Dell,** The Univ. of Western Australia (Australia); **Richard D. Driver,** Headwall Photonics Inc. (USA); **Michael B. Frish,** Physical Sciences Inc. (USA); **Fredrick G. Haibach,** Block Engineering, LLC (USA); **Martin Kraft,** Carinthian Tech Research AG (Austria); **Jouko O. Malinen,** VTT Technical Research Ctr. of Finland (Finland); **Curtis A. Marcott,** Light Light Solutions, LLC (USA); **Ellen V. Miseo,** Analytical Answers, Inc. (USA); **David W. Schiering,** Smiths Detection (USA); **John Seelenbinder,** Agilent Technologies (USA)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 327 . . . . . .Mon 8:30 am to 10:20 am

Hyperspectral Imaging Spectrometers and Applications

Session Chair: **Richard A. Crocombe,** Thermo Fisher Scientific Inc. (USA)

8:30 am: **Snapshot hyperspectral imaging systems for real-time applications** *(Invited Paper)*, Robert T. Kester, Rebellion Photonics (USA) . . . . . [8726-1]

9:00 am: **A full-spectrum VNIR and SWIR hyperspectral imager in a single instrument**, Timo Hyvärinen, Kari J. Kataja, Risto Jaskari, Jukka T. Okkonen, Ilkka Kormano, Esko Herrala, Aappo A. J. Roos, Petri Nygren, Specim Spectral Imaging Ltd. (Finland) . . . . . [8726-2]

9:20 am: **High-performance hyperspectral imaging using virtual slit optics**, Bradford B. Behr, Tornado Spectral Systems (USA); Jeffrey T. Meade, Arsen R. Hajian, Andrew T. Cenko, Tornado Spectral Systems (Canada). . . . . [8726-3]

9:40 am: **Development of a handheld widefield hyperspectral imaging (HSI) sensor for standoff detection of explosive, chemical and narcotic residues**, Matthew P. Nelson, Marko Horvat, Patrick J. Treado, ChemImage Corp. (USA) . . . . . [8726-4]

10:00 am: **MEOMS-based Fabry Perot array for SWIR-MWIR imaging spectroscopy**, Michele Hinnrichs, Pacific Advanced Technology, Inc. (USA); Neelam Gupta, U.S. Army Research Lab. (USA). . . . . [8726-6]

Coffee Break . . . . . Mon 10:20 am to 11:00 am

SESSION 2

Room: Conv. Ctr. 327 . . . . . .Mon 11:00 am to 12:00 pm

MEMS- and MOEMS-Based Spectrometers

Session Chair: **Michael B. Frish,** Physical Sciences Inc. (USA)

11:00 am: **Performance modeling of MEMS standing-wave Fourier transform microspectrometers**, Dilusha K. Silva, John M. Dell, Lorenzo Faraone, The Univ. of Western Australia (Australia) . . . . . [8726-7]

11:20 am: **Hydrocarbon gas detection with microelectromechanical Fabry-Perot interferometer**, Rami Mannila, Mikko Tuohiniemi, Jussi H. Mäkynen, Ismo Näkki, Jarkko E. Antila, VTT Technical Research Ctr. of Finland (Finland) . . [8726-8]

11:40 am: **First application close measurements applying the new hybrid integrated MEMS spectrometer**, Heinrich Grüger, Tino Puegner, Jens Knobbe, Harald Schenk, Fraunhofer-Institut für Photonische Mikrosysteme (Germany) . . . . . [8726-9]

Lunch Break . . . . . Mon 12:00 pm to 1:40 pm

SESSION 3

Room: Conv. Ctr. 327 . . . . . Mon 1:40 pm to 3:20 pm

Quantum Cascade and Tunable Diode Lasers

Session Chair: **Mark A. Druy,** Physical Sciences Inc. (USA)

1:40 pm: **Real time CRDS detection of explosives precursors using widely tunable QCLs**, Charles C. Harb, The Univ. of New South Wales (Australia); Thomas G. Spence, Loyola Univ. New Orleans (USA); David S. Moore, Los Alamos National Lab. (USA) . . . . . [8726-10]

2:00 pm: **Tunable picosecond spectroscopy for detection of nitric oxide (NO)**, Chakree Tanjaroon, Christopher J. Lue, Scott W. Reeve, Jeffrey B. Johnson, Susan D. Allen, Arkansas State Univ. (USA). . . . . [8726-11]

2:20 pm: **Low-cost lightweight airborne laser-based sensors for pipeline leak detection and reporting**, Michael B. Frish, Richard T. Wainner, Matthew C. Laderer, Mark G. Allen, Physical Sciences Inc. (USA); James Rutherford, Paul Wehnert, Heath Consultants Inc. (USA); Sean Dey, John Gilchrist, Ron Corbi, New Era Technology, Inc. (USA); Daniele Picciaia, TEA Sistemi S.p.A. (Italy); Paolo Andreussi, Univ. of Pisa (Italy); David L. Furry, Leak Surveys Inc. (USA) . . [8726-12]

2:40 pm: **Trace-gas sensing using the compliance voltage of an external cavity quantum cascade laser**, Mark C. Phillips, Matthew S. Taubman, Pacific Northwest National Lab. (USA) . . . . . [8726-13]

3:00 pm: **Mid-infrared spectroscopic imaging with a quantum cascade laser**, Kevin Yeh, Matthew V. Schulmerich, Rohit Bhargava, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [8726-14]

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

SESSION 4

Room: Conv. Ctr. 327 . . . . . Mon 3:50 pm to 4:50 pm

Data Analysis Techniques and Applications

Session Chair: **Ellen V. Miseo,** Analytical Answers, Inc. (USA)

3:50 pm: **Performance characterization of a combined material identification and screening algorithm**, Robert L. Green, Michael D. Hargreaves, Craig M. Gardner, Thermo Fisher Scientific Inc. (USA) . . . . . [8726-15]

4:10 pm: **Progress in implementing spectroscopic recognition algorithms for standoff detection on solids using quantum cascade lasers in diffuse reflectance**, Frederick G. Haibach, Richard Fauconier, Erik R. Deutsch, Block Engineering, LLC (USA). . . . . [8726-16]

4:30 pm: **Discrimination methodologies using femtosecond LIBS and correlation techniques**, Venugopal Rao Soma, Sreedhar Sunku, Nageswara Rao Epuru, Manoj Kumar Gundawar, Surya Prakash Tewari, Univ. of Hyderabad (India) . . . . . [8726-17]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 327 . . . . . Tue 8:00 am to 11:30 am

LIBS, Raman, and Terahertz

Session Chair: **Leigh J. Bromley,** Daylight Solutions Inc. (USA)

8:00 am: **Portable sub-terahertz resonance spectrometer combined with microfluidic sample cell**, Jerome P. Ferrance, J2F Engineering (USA); Aaron Moyer, Vibratess, LLC (USA); Harry Powell, Tatiana Globus, Boris L. Gelmont, Univ. of Virginia (USA); Tatyana Khromova, Vibratess, LLC (USA). . . . . [8726-18]

8:20 am: **THz-Raman: accessing molecular structure with Raman spectroscopy for identification, analysis and monitoring**, Randy A. Heyler, James T. Carriere, Frank Havermeyer, Ondax, Inc. (USA) . . . . . [8726-19]

8:40 am: **Design and industrial testing of ultrafast multi-gas Raman spectrometer**, Michael P. Buric, Steven D. Woodruff, Benjamin Chorpening, Jessica C. Mullen, National Energy Technology Lab. (USA). . . . . [8726-20]

9:00 am: **High-throughput spectrometer designs in a compact form-factor: principles and applications**, Scott M. Norton, Wasatch Photonics, Inc. (USA) . . . . . [8726-21]

9:20 am: **Spectral analysis of improvised explosives**, Amy J. R. Bauer, Applied Research Associates, Inc. (USA); Andrzej W. Miziolek, U.S. Army Research, Development and Engineering Command (USA) . . . . . [8726-22]

9:40 am: **A novel laser-based approach for cleaning contaminated metallic surfaces coupled with rapid residue analysis**, Robert V. Fox, Idaho National Lab. (USA); Frank C. De Lucia Jr., U.S. Army Research Lab. (USA); Andrzej W. Miziolek, U.S. Army Research, Development and Engineering Command (USA); Andrew I. Whitehouse, Applied Photonics, Ltd. (United Kingdom); Lauren Roberts, Idaho National Lab. (USA) . . . . . [8726-23]

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

10:30 am: **Frequency-agile, rapid scanning spectroscopy**, David A. Long, National Institute of Standards and Technology (USA); Gar-Wing Truong, National Institute of Standards and Technology (USA) and The Univ. of Western Australia (Australia); Kevin O. Douglass, Stephen Edward Maxwell, Roger D. van Zee, Joseph T. Hodges, National Institute of Standards and Technology (USA) . . . . . [8726-25]

10:50 am: **The evaluation of a new technology for gunshot residue (GSR) analysis in the field**, Danielle M. Andersen, Ellen Hondrogiannis, Towson Univ. (USA); Andrzej W. Miziolek, U.S. Army Research, Development and Engineering Command (USA) . . . . . [8726-26]

11:10 am: **Spectroscopy methods for identifying the country of origin**, Erin C. Ehrlinger, Ellen Hondrogiannis, Towson Univ. (USA); Andrzej W. Miziolek, U.S. Army Research, Development and Engineering Command (USA) . . . . . [8726-27]

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

SESSION 6
Room: Conv. Ctr. 327 . . . . . Tue 1:20 pm to 3:00 pm

Portable and Novel Designs I

Session Chair: **Ellen V. Miseo,** Analytical Answers, Inc. (USA)

1:20 pm: **Handheld spectrometers: the state of the art**, Richard A. Crocombe, Thermo Fisher Scientific Inc. (USA). . . . . [8726-28]

1:40 pm: **A low dark current a-Se detector for measurement microplasma emission in the UV for possible use on-site**, Shiva Abbaszadeh, Karim S. Karim, Vassili Karanassios, Univ. of Waterloo (Canada). . . . . [8726-29]

2:00 pm: **A handheld FTIR spectrometer with swappable modules for chemical vapor identification and surface swab analysis**, Walter J. Doherty III, Brendan Falvey, Greg Vander Rhodes, Leonid Krasnobaev, Kenneth Vachon, Thermo Fisher Scientific Inc. (USA). . . . . [8726-30]

2:20 pm: **Advanced sampling techniques for hand-held FT-IR instrumentation**, Josep Arnó, Michael Frunzi, Smiths Detection (USA). . . . . [8726-31]

2:40 pm: **Tapered air-core Bragg waveguide spectrometers for lab-on-a-chip applications**, Brian Drobot, Aaron Melnyk, Trevor Allen, Ray G. DeCorby, Univ. of Alberta (Canada) . . . . . [8726-32]

Coffee/Exhibition Break. . . . . .Tue 3:00 pm to 4:00 pm

SESSION 7
Room: Conv. Ctr. 327 . . . . . Tue 4:00 pm to 5:20 pm

Portable and Novel Designs II

Session Chair: **Frederick G. Haibach,** Block Engineering, LLC (USA)

4:00 pm: **Feasibility study of birefringent electro-optic NIR FTS imaging systems**, Valerie A. Finnemeyer, Philip J. Bos, Liquid Crystal Institute, KSU (USA) . . . . . [8726-33]

4:20 pm: **Continuous-wave near-photon counting spectral imaging detector in the mid-infrared by upconversion**, Christian Pedersen, Jeppe S. Dam, Peter Tidemand-Lichtenberg, Technical Univ. of Denmark (Denmark). . . . [8726-34]

4:40 pm: **Remote bi-photon spectroscopy using a single-photon up-conversion detector**, Oliver T. Slattery, National Institute of Standards and Technology (USA) and Univ. of Limerick (Ireland); Paulina Kuo, Young-Su Kim, Lijun Ma, Xiao Tang, National Institute of Standards and Technology (USA) . . . [8726-35]

5:00 pm: **Fourier transform infrared phase-shift cavity ring-down spectrometer**, Elizabeth C. Schundler, David J. Mansur, Robert Vaillancourt, Ryan Benedict-Gill, Scott P. Newbry, James R Engel, Julia R Dupuis, OPTRA, Inc. (USA) . . . . . [8726-36]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Broadband absorption and emission millimeter-wave spectroscopy between 220 and 325 GHz, Michael Szymkiewicz, Axel Hülsmann, Axel Tessmann, Arnulf Leuther, Michael Schlechtweg, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany); Oliver Ambacher, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) and Univ. of Freiburg (Germany); Ingmar Kallfass, Fraunhofer-Institut für Angewandte Festkörperphysik (Germany) and Karlsruher Institute of Technology (Germany); Stefan Koch, Matthias Riedel, Sony Deutschland GmbH (Germany). . . . . [8726-37]

Probing vibrational absorption of ultra-thin samples by plasmonic-enhanced infrared photoexpansion nano-spectroscopy, Feng Lu, Mikhail A. Belkin, The Univ. of Texas at Austin (USA) . . . . . [8726-38]

Wednesday - Thursday 1 - 2 May 2013 • Proceedings of SPIE Vol. 8727

Advanced Photon Counting Techniques VII

Conference Chair: **Mark A. Itzler,** Princeton Lightwave, Inc. (USA)

Conference Co-Chair: **Joe C. Campbell,** Univ. of Virginia (USA)

Program Committee: **Gerald S. Buller,** Heriot-Watt Univ. (United Kingdom); **Sergio Cova,** Politecnico di Milano (Italy); **William H. Farr,** Jet Propulsion Lab. (USA); **Robert H. Hadfield,** Heriot-Watt Univ. (United Kingdom); **Majeed Hayat,** The Univ. of New Mexico (USA); **Michael A. Krainak,** NASA Goddard Space Flight Ctr. (USA); **Robert A. Lamb,** SELEX Galileo Ltd. (United Kingdom); **K. Alex McIntosh,** MIT Lincoln Lab. (USA); **Alan L. Migdall,** National Institute of Standards and Technology (USA); **Michael Wahl,** PicoQuant GmbH (Germany); **Hugo Zbinden,** Univ. of Geneva (Switzerland)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 327 . . . . . .Wed 9:00 am to 10:00 am

Applications I: Single Photon Communications and TCSPC

Session Chair: **Mark A. Itzler,** Princeton Lightwave, Inc. (USA)

9:00 am: **Hyperentanglement and related technologies for quantum telecommunications** *(Invited Paper)*, Nicholas A. Peters, Anjali Agarwal, Applied Communication Sciences (USA); Thomas E. Chapuran, Telcordia Technologies, Inc. (USA); Paul Toliver, Ted K. Woodward, Applied Communication Sciences (USA) . . . . . [8727-1]

9:30 am: **Towards spatially dense time-domain multi-view detection in diffuse optical tomography with single-photon avalanche diodes and integrated TCSPC electronics** *(Invited Paper)*, Yves Bérubé-Lauzière, Univ. de Sherbrooke (Canada); Matteo C. Crotti, Ivan Rech, Politecnico di Milano (Italy) . . . . . [8727-3]

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

SESSION 2

Room: Conv. Ctr. 327 . . . . . .Wed 10:30 am to 11:50 am

Applications II: Single Photon Laser Radar

Session Chair: **Mark A. Itzler,** Princeton Lightwave, Inc. (USA)

10:30 am: **Ladar detection methods and an update on photon-counting detector arrays** *(Invited Paper)*, Richard M. Marino, MIT Lincoln Lab. (USA) . . . . . [8727-4]

11:00 am: **Laser ranging at few-photon level with a photon-number-resolving detector** *(Invited Paper)*, Guang Wu, Zhiyuang Wang, Weibin Kong, Min Ren, Yan A. Liang, Xiaomeng Wang, Jianhua Huang, E. Wu, Heping Zeng, East China Normal Univ. (China) . . . . . [8727-5]

11:30 am: **Laser depth ranging and imaging using low-jitter SNSPD system**, Lixing You, Sijin Chen, Dengduan Liu, Yuhao He, SIMIT, Wenxing Zhang, Shanghai Institute of Microsystem and Information Technology (China) . . . . . [8727-6]

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

SESSION 3

Room: Conv. Ctr. 327 . . . . . Wed 1:10 pm to 3:10 pm

Superconducting SPDs I

Session Chair: **William H. Farr,** Jet Propulsion Lab. (USA)

1:10 pm: **Advanced time-correlated single-photon counting applications with superconducting nanowire single-photon detectors** *(Invited Paper)*, Robert H. Hadfield, Heriot-Watt Univ. (United Kingdom) . . . . . [8727-7]

1:40 pm: **Technologies for superconducting nanowire single-photon detector array system** *(Invited Paper)*, Shigehito Miki, Taro Yamashita, Hirotaka Terai, Kazumasa Makise, Zhen Wang, National Institute of Information and Communications Technology (Japan) . . . . . [8727-8]

2:10 pm: **Membrane-integrated superconducting nanowire single-photon detectors** *(Invited Paper)*, Faraz Najafi, Massachusetts Institute of Technology (USA); Jacob Mower, Xiaolong Hu, Francesco Bellei, Prashanta Kharel, Columbia Univ. (USA); Hasan Korre, Adam McCaughan, Kristen Sunter, Massachusetts Institute of Technology (USA); Dirk R. Englund, Columbia Univ. (USA) and Massachusetts Institute of Technology (USA); Karl K. Berggren, Massachusetts Institute of Technology (USA) . . . . . [8727-9]

2:40 pm: **Superconducting nanowire single-photon detectors integrated with waveguide circuits for quantum information science** *(Invited Paper)*, Alessandro Gaggero, Istituto di Fotonica e Nanotecnologie (Italy); Döndü Sahin, Technische Univ. Eindhoven (Netherlands); Francesco Mattioli, Roberto Leoni, Istituto di Fotonica e Nanotecnologie (Italy); Giulia Frucci, Saeedeh Jahanmirinejad, Arjan Sprengers, Technische Univ. Eindhoven (Netherlands); Johannes Beetz, Matthias Lermer, Sven Höfling, Martin Kamp, Julius-Maximilians-Univ. Würzburg (Germany); Andrea Fiore, Technische Univ. Eindhoven (Netherlands) . . . . . [8727-10]

Coffee/Exhibition Break. . . . . Wed 3:10 pm to 3:50 pm

SESSION 4

Room: Conv. Ctr. 327 . . . . . Wed 3:50 pm to 5:40 pm

Superconducting SPDs II

Session Chair: **Robert H. Hadfield,** Heriot-Watt Univ. (United Kingdom)

3:50 pm: **Multiphoton detection in superconducting nanowires: nonlinear optics in the detector** *(Invited Paper)*, Andrea Fiore, Zili Zhou, Giulia Frucci, Saedeeh Jahanmirinejad, Döndü Sahin, Rosalinda Gaudio, Technische Univ. Eindhoven (Netherlands); Francesco Mattioli, Alessandro Gaggero, Roberto Leoni, Istituto di Fotonica e Nanotecnologie (Italy); Jelmer J. Renema, Michiel J. A. de Dood, Martin P. van Exter, Leiden Univ. (Netherlands). . . . . [8727-11]

4:20 pm: **93% system detection efficiency with tungsten silicide superconducting nanowire single photon detectors** *(Invited Paper)*, Francesco Marsili, Varun B. Verma, National Institute of Standards and Technology (USA); Jeffrey A. Stern, Jet Propulsion Lab. (USA); Sean Harrington, Adriana E. Lita, Thomas Gerrits, Igor Vayshenker, Burm Baek, National Institute of Standards and Technology (USA); Matthew D. Shaw, Jet Propulsion Lab. (USA); Richard P. Mirin, Sae Woo Nam, National Institute of Standards and Technology (USA) . . . [8727-12]

4:50 pm: **Tungsten silicide superconducting nanowire single-photon detector arrays for deep-space optical communication**, Matthew D. Shaw, Jeffrey A. Stern, Andrew D. Beyer, Jet Propulsion Lab. (USA); Francesco Marsili, Varun B. Verma, Richard P. Mirin, Sae Woo Nam, National Institute of Standards and Technology (USA); William H. Farr, Jet Propulsion Lab. (USA). . . . . [8727-13]

5:10 pm: **Vertically-stacked superconducting nanowire avalanche photodetectors based on amorphous tungsten silicide** *(Invited Paper)*, Varun B. Verma, Francesco Marsili, Sean Harrington, Richard P. Mirin, Sae Woo Nam, National Institute of Standards and Technology (USA) . . . [8727-14]

Thursday 2 May

SESSION 5
Room: Conv. Ctr. 327 . . . . . Thu 8:10 am to 10:20 am

SPADs I: Gated Operation

Session Chair: **K. Alex McIntosh,** MIT Lincoln Lab. (USA)

8:10 am: **GHz-gated InGaAs SPAD system with avalanche charge sensitivity approaching the fundamental limit** *(Invited Paper)*, Alessandro Restelli, Joint Quantum Institute (USA); Joshua C. Bienfang, Alan L. Migdall, National Institute of Standards and Technology (USA) . . . . . [8727-15]

8:40 am: **Advantages of silicon single-photon detectors in gated mode**, Damien Stucki, Matthieu Legré, id Quantique SA (Switzerland); Tommaso Lunghi, Hugo Zbinden, Univ. of Geneva (Switzerland) . . . . . [8727-16]

9:00 am: **Balanced detection in single-photon counting**, Zhiwen Lu, Joe C. Campbell, Univ. of Virginia (USA); Xudong Jiang, Mark A. Itzler, Princeton Lightwave, Inc. (USA) . . . . . [8727-17]

9:20 am: **Near-IR photon number resolving detector**, Jan Bogdanski, Elanor H. Huntington, The Univ. of New South Wales (Australia) . . . . . [8727-18]

9:40 am: **High-speed photon detectors operated in sinusoidally gated mode**, Yan A. Liang, Min Ren, E. Wu, Guang Wu, Heping Zeng, East China Normal Univ. (China) . . . . . [8727-19]

10:00 am: **Precise Monte Carlo simulation of single-photon detectors**, Mario Stipcevic, Rudjer Boskovic Inst. (Croatia) and Duke Univ. (USA); Daniel J. Gauthier, Duke Univ. (USA) . . . . . [8727-33]

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

SESSION 6
Room: Conv. Ctr. 327 . . . . . Thu 10:50 am to 12:20 pm

SPADs II: Arrays

Session Chair: **Joe C. Campbell,** Univ. of Virginia (USA)

10:50 am: **MiSPiA: microelectronic single-photon 3D imaging arrays for low-light high-speed safety and security applications** *(Invited Paper)*, Franco Zappa, Alberto Tosi, Politecnico di Milano (Italy) . . . . . [8727-20]

11:20 am: **New silicon technologies enable high-performance arrays of single-photon avalanche diodes** *(Invited Paper)*, Angelo Gulinatti, Ivan Rech, Politecnico di Milano (Italy); Piera Maccagnani, Istituto per la Microelettronica e Microsistemi (Italy); Sergio D. Cova, Massimo Ghioni, Politecnico di Milano (Italy) and Micro Photon Devices S.r.l. (Italy) . . . . . [8727-21]

11:50 am: **Compound semiconductor SPAD arrays** *(Invited Paper)*, Eric S. Harmon, James T. Hyland, Mikhail N. Naydenkov, LightSpin Technologies, Inc. (USA) . . . . . [8727-22]

Lunch/Exhibition Break . . . . . Thu 12:20 pm to 1:50 pm

SESSION 7
Room: Conv. Ctr. 327 . . . . . Thu 1:30 pm to 3:00 pm

SPADs III: Novel Structures

Session Chair: **Michael Krainak,** NASA Goddard Space Flight Ctr. (USA)

1:30 pm: **InP-based Geiger-mode avalanche photodiodes for photon-counting** *(Invited Paper)*, Erik K. Duerr, MIT Lincoln Lab. (USA) . . . . . [8727-23]

2:00 pm: **Integrated single-photon detectors combining the avalanche, bipolar, and field-effect transistor gain** *(Invited Paper)*, Yu-Hwa Lo, Samia Rahman, David Hall, Univ. of California, San Diego (USA) . . . . . [8727-24]

2:30 pm: **Progress towards APD imagers** *(Invited Paper)*, Daniel R. Schuette, Brian F. Aull, MIT Lincoln Lab. (USA) . . . . . [8727-25]

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

SESSION 8
Room: Conv. Ctr. 327 . . . . . Thu 3:30 pm to 4:30 pm

Quantum Structures for SPC

Session Chair: **Alan L. Migdall,**
National Institute of Standards and Technology (USA)

3:30 pm: **Single-photon detectors in the log-wavelength infrared through sub-millimeter-wave regions** *(Invited Paper)*, Susumu Komiyama, The Univ. of Tokyo (Japan) . . . . . [8727-26]

4:00 pm: **New single-nanocrystal spectroscopy approaches for investigation of emission efficiency and recombination dynamics of multi-excitons** *(Invited Paper)*, Benjamin D. Mangum, Young-Shin Park, Yagnaseni Ghosh, Jennifer A. Hollingsworth, Han Htoon, Los Alamos National Lab. (USA) . . [8727-27]

SESSION 9
Room: Conv. Ctr. 327 . . . . . Thu 4:30 pm to 5:40 pm

PMTs and Photon Counting Imagers

Session Chair: **Alan L. Migdall,**
National Institute of Standards and Technology (USA)

4:30 pm: **Performance of a compact position-sensitive photon counting detector with image charge coupling to an air-side anode** *(Invited Paper)*, Ottmar Jagutzki, Johann Wolfgang Goethe-Univ. Frankfurt am Main (Germany) and RoentDek GmbH (Germany); Sven Schössler, Achim Czasch, RoentDek GmbH (Germany) . . . . . [8727-28]

5:00 pm: **Detection of faint moving space objects with a photon counting imager**, Phan D. Dao, Air Force Research Lab. (USA) . . . . . [8727-29]

5:20 pm: **Study on the detection efficiency of gaseous photomultipliers**, Baishali Garai, Indian Institute of Science (India); V. Radhakrishna, ISRO Satellite Ctr. (India); K. Rajanna, Indian Institute of Science (India) . . . . . [8727-30]

POSTERS-THURSDAY
Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Low-noise high-speed single photon detector in gated Geiger mode, Xiuliang Chen, Yan A. Liang, E. Wu, Guang Wu, Heping Zeng, East China Normal Univ. (China) . . . . . [8727-31]

High-speed multichannel time-correlated single-photon counting electronics based on SiGe integrated time to digital converters, Michael Wahl, Tino Röhlicke, Hans-Jürgen Rahn, PicoQuant GmbH (Germany); Nick Bertone, PicoQuant Photonics North America, Inc. (Canada); Gerald Kell, Fachhochschule Brandenburg (Germany) . . . . . [8727-32]

Monday - Wednesday 29 - 1 May 2013 • Proceedings of SPIE Vol. 8728

Energy Harvesting and Storage: Materials, Devices, and Applications IV

Conference Chairs: **Nibir K. Dhar,** Defense Advanced Research Projects Agency, Microelectronics Technology Office (USA); **Palani Balaya,** National Univ. of Singapore (Singapore); **Achyut K. Dutta,** Banpil Photonics, Inc. (USA)

Program Committee: **Pulickel M. Ajayan,** Rice Univ. (USA); **Paul Boieriu,** EPISOLAR, Inc. (USA); **Deryn Chu,** U.S. Army Research Lab. (USA); **M. Saif Islam,** Univ. of California, Davis (USA); **Nobuhiko P. Kobayashi,** Univ. of California, Santa Cruz (USA); **Pooi See Lee,** Nanyang Technological Univ. (Singapore); **Pat McGrath,** Booz Allen Hamilton Inc. (USA); **Robert Olah,** Banpil Photonics, Inc. (USA); **Kimberly A. Sablon,** U.S. Army Research Lab. (USA); **A. Fred Semendy,** U.S. Army Research Lab. (USA); **Sivalingam Sivananthan,** EPIR Technologies (USA); **Ashok K. Sood,** Magnolia Optical Technologies, Inc. (USA); **Patrick J. Taylor,** U.S. Army Research Lab. (USA); **Sudhir B. Trivedi,** Brimrose Corp. of America (USA); **Rama Venkatasubramanian,** RTI International (USA); **Chunlei Wang,** Florida International Univ. (USA); **Priyalal Wijewarnasuriya,** U.S. Army Research Lab. (USA)

Monday 29 April

OPENING REMARKS

Room: Conv. Ctr. 321 . . . . . 8:00 am to 8:05 am

Session Chair: **Nibir K. Dhar,**
Defense Advanced Research Projects Agency (USA)

SESSION 1A

Room: Conv. Ctr. 321 . . . . . Mon 8:05 am to 8:40 am

Keynote

Session Chair: **Nibir K. Dhar,**
Defense Advanced Research Projects Agency (USA)

8:05 am: **Power and Energy at DARPA: enabling a paradigm shift for the Warfighter and DoD** *(Keynote Presentation)*, Brian C. Holloway, Defense Advanced Research Projects Agency (USA) . . . . . [8728-37]

SESSION 1

Room: Conv. Ctr. 321 . . . . . Mon 8:40 am to 9:55 am

Advanced Lithium Batteries I

Session Chairs: **Nibir K. Dhar,** Defense Advanced Research Projects Agency (USA); **Achyut K. Dutta,** Banpil Photonics, Inc. (USA)

8:40 am: **High-rate performing Li-ion batteries for defense applications** *(Invited Paper)*, Palani Balaya, Vishwanathan Ramar, Srirama Hariharan, Kuppan Saravanan, Chad Mason, National Univ. of Singapore (Singapore) . . . . . [8728-1]

9:05 am: **Advances in materials and electrolytes for lithium batteries** *(Invited Paper)*, Ilias Belharouak, Argonne National Lab. (USA) . . . . . [8728-2]

9:30 am: **Three-dimensional lithium-ion batteries with interdigitated electrodes** *(Invited Paper)*, Derek Johnson, Prieto Battery, Inc. (USA); Amy L. Prieto, Colorado State Univ. (USA) and Prieto Battery, Inc. (USA). . . . . [8728-4]

Coffee Break . . . . . Mon 9:55 am to 10:45 am

SESSION 2

Room: Conv. Ctr. 321 . . . . . Mon 10:45 am to 12:00 pm

Advanced Lithium Batteries II

Session Chairs: **Cynthia A. Lundgren,** U.S. Army Research Lab. (USA); **Palani Balaya,** National Univ. of Singapore (Singapore)

10:45 am: **Nanostructured vanadium pentoxides as cathodes for lithium-ion batteries** *(Invited Paper)*, Guozhong Cao, Univ. of Washington (USA). . . . . [8728-5]

11:10 am: **New directions on rechargeable nano-batteries: lessons from in-situ electron microscopy** *(Invited Paper)*, Reza Shahbazian, Anmin Nie, Michigan Technological Univ. (USA). . . . . [8728-6]

11:35 am: **Nanostructured olivine phosphate cathode material for rechargeable lithium ion batteries** *(Invited Paper)*, Sevi Murugavel, Raza Shahid, Univ. of Delhi (India). . . . . [8728-7]

Lunch Break . . . . . Mon 12:00 pm to 1:25 pm

SESSION 3

Room: Conv. Ctr. 321 . . . . . Mon 1:25 pm to 3:05 pm

Novel Batteries

Session Chairs: **Palani Balaya,** National Univ. of Singapore (Singapore); **Cynthia A. Lundgren,** U.S. Army Research Lab. (USA)

1:25 pm: **Transport properties of ordered and disordered spinel $LiMn_{1.5}Ni_{0.5}O_4$** *(Invited Paper)*, Ruhul Amin, Massachusetts Institute of Technology (USA). [8728-8]

1:50 pm: **Lithium intercalation into $Li_{1+x}V_{1-x}O_2$ a low-voltage anode for lithium batteries** *(Invited Paper)*, Pooja Panchmatia, Univ. of Huddersfield (United Kingdom) and Univ. of Bath (United Kingdom); Robert Armstrong, Univ. of St. Andrews (United Kingdom); M. Saitul Islam, Univ. of Bath (United Kingdom);

Peter G. Bruce, Univ. of St. Andrews (United Kingdom) . . . . . [8728-10]

2:15 pm: **Water-based sodium battery for energy storage** *(Invited Paper)*, Manickam Minakshi, Murdoch Univ. (Australia) . . . . . [8728-11]

2:40 pm: **From lithium to sodium: the case of olivine materials** *(Invited Paper)*, Pierre Kubiak, Montse Casas-Cabanas, Vladimir Roddatis, Damien Saurel, Teofilo Rojo, CIC Energigune (Spain) . . . . . [8728-12]

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

SESSION 4

Room: Conv. Ctr. 321 . . . . . Mon 3:35 pm to 4:50 pm

Advanced Lithium Batteries: Chemistries

Session Chairs: **Cynthia A. Lundgren,** U.S. Army Research Lab. (USA); **Palani Balaya,** National Univ. of Singapore (Singapore)

3:35 pm: **In situ studies of synthesis and lithium reaction of high-energy electrodes for lithium-ion batteries** *(Invited Paper)*, Feng Wang, Brookhaven National Lab. (USA). . . . . [8728-13]

4:00 pm: **Heat generation in Li-ion cells during charge and discharge** *(Invited Paper)*, Rengaswamy Srinivasan, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8728-14]

4:25 pm: **Lithium ion diffusion kinetics in lithium metal phosphates ($LiMPO_4$, M= Fe, Mn and Ni) in presence of 2 M Li_2SO_4 aqueous electrolyte** *(Invited Paper)*, Gurukar Shivappa Suresh, NMKRV College for Women (India). . . . . [8728-15]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . . Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 321 . . . . . Tue 8:30 am to 10:05 am

Photovoltaic Cells and Related Technologies

Session Chairs: **Nibir K. Dhar,** Defense Advanced Research Projects Agency (USA); **Achyut K. Dutta,** Banpil Photonics, Inc. (USA)

8:30 am: **The future of high-efficiency photovoltaics from materials and applications perspective** *(Invited Paper)*, Robert J. Walters, U.S. Naval Research Lab. (USA) . . . . . [8728-16]

9:10 am: **A maximum power point tracking algorithm for photovoltaic applications**, Sudarshan R. Nelatury, Penn State Erie, The Behrend College (USA); Robert Gray, Penn State Harrisburg (USA) . . . . . [8728-18]

9:25 am: **Flexible high-efficiency solar cells: approaches and advanced design concepts**, Roger E. Welser, Gopal G. Pethuraja, Magnolia Solar, Inc. (USA); Adam W. Sood, Ashok K. Sood, Magnolia Optical Technologies, Inc. (USA); Nibir K. Dhar, Defense Advanced Research Projects Agency (USA). . . . . [8728-19]

9:40 am: **Photonic and plasmonic solar energy conversion** *(Invited Paper)*, Jeremy N. Munday, Univ. of Maryland, College Park (USA) . . . . . [8728-20]

Coffee Break . . . . . .Tue 10:05 am to 10:45 am

SESSION 6
Room: Conv. Ctr. 321 . . . . . Tue 10:45 am to 11:55 am

Novel Energy Harvester

Session Chairs: **Priyalal S. Wijewarnasuriya,** U.S. Army Research Lab. (USA); **Kimberly A. Sablon,** U.S. Army Research Lab. (USA)

10:45 am: **Potential profile and electron processes in solar cells with charged quantum dots: optimization for high efficiency** *(Invited Paper)*, Vladimir V. Mitin, Univ. at Buffalo (USA); Kimberly A. Sablon, U.S. Army Research Lab. (USA); Nizami Z. Vagidov, Andrei V. Sergeev, Univ. at Buffalo (USA) . . . . . [8728-21]

11:10 am: **Flexible copper indium gallium diselenide photovoltaics for unmanned aircraft systems**, Jesse A. Frantz, Jason D. Myers, U.S. Naval Research Lab. (USA); Robel Y. Bekele, Univ. Research Foundation (USA); Vinh Q. Nguyen, U.S. Naval Research Lab. (USA); Allan J. Bruce, Sergey V. Frolov, Michael Cyrus, Sunlight Photonics (USA); Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) . . . . . [8728-22]

11:25 am: **Evaluation of the temperature dependence of thermoelectric properties of materials under steady-state isothermal conditions**, Jay R. Maddux, U.S. Army Research Lab. (USA). . . . . [8728-23]

11:40 am: **Piezoelectric-based electrical energy harvesting and storage methods and electronics for munitions**, Carlos M. Pereira, U.S. Army Armament Research, Development and Engineering Ctr. (USA); Jahangir S. Rastegar, Dake Feng, Omnitek Partners, LLC (USA) . . . . . [8728-24]

Lunch/Exhibition Break . . . . . .Tue 11:55 am to 1:30 pm

SESSION 7
Room: Conv. Ctr. 321 . . . . . Tue 1:30 pm to 4:45 pm

Advanced Harvesting Device and Applications

Session Chairs: **Kimberly A. Sablon,** U.S. Army Research Lab. (USA); **Achyut K. Dutta,** Banpil Photonics, Inc. (USA)

1:30 pm: **Controlling the interplay of photonics, electronics, and thermodynamics in solar upconversion** *(Invited Paper)*, Jennifer A. Dionne, Stanford Univ. (USA) . . . . . [8728-39]

1:55 pm: **System-level solar module optimization**, Monica Rivera, Grahm C. Roach, Joseph N. Mitchell, Jeffrey L. Boehme, Southwest Research Institute (USA) . . . . . [8728-25]

2:10 pm: **High-efficiency boost convertor for remote sensors**, Mark R. Morgenstern, David M. Mackie, U.S. Army Research Lab. (USA) . . . . . [8728-26]

2:25 pm: **Energy harvesting and energy scavenging approaches to power micro-instruments for on-site use**, Gurjit Dulai, Donghyun Lee, Vassili Karanassios, Univ. of Waterloo (Canada) . . . . . [8728-27]

2:40 pm: **Vehicle to grid: electric vehicles as an energy storage solution**, Nicole Wells, Nicholas Waite, Rodney McGee, Fouad E. Kiamilev, Willett M. Kempton, Univ. of Delaware (USA) . . . . . [8728-28]

Coffee Break . . . . . .Tue 2:55 pm to 3:30 pm

3:30 pm: **Performance of a bending mode energy harvester using Fe-Ga alloy (Galfenol)**, Robert Haynes, JinHyeong Yoo, U.S. Army Research Lab. (USA); Alison B. Flatau, Univ. of Maryland, College Park (USA) . . . . . [8728-29]

3:45 pm: **Scintillator-based beta-batteries**, Noa M. Rensing, Timothy C. Tiernan, Urmila Shirwadkar, Patrick O'Dougherty, Sara Freed, Rastgo H. Hawrami, Michael R. Squillante, Radiation Monitoring Devices, Inc. (USA) . . . . . [8728-30]

4:00 pm: **Review of the energy harvesting systems for munitions and firing platforms**, Carlos M. Pereira, U.S. Army Armament Research, Development and Engineering Ctr. (USA); Jahangir S. Rastegar, Dake Feng, Omnitek Partners, LLC (USA) . . . . . [8728-31]

4:15 pm: **Tritium power source for long-lived sensors**, Marc S. Litz, U.S. Army Research Lab. (USA); Dimosthenis C. Katsis, Athena Energy Corp. (USA); John A. Russo, David A. Burns, James J. Carroll, U.S. Army Research Lab. (USA) [8728-32]

4:30 pm: **Betavoltaic power sources for ultra-low power electronics**, Christopher Thomas, Samuel Portnoff, Widetronix, Inc. (USA); Michael G. Spencer, Cornell Univ. (USA) . . . . . [8728-38]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

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Design, modeling, and fabrication of the trapezoidal electrodes array for electrets energy harvester, Mohamad Radzi Ahmad, Mohd Haris Md Khir, Univ. Teknologi Petronas (Malaysia). . . . . [8728-33]

Pseudocapacitive and hierarchically ordered porous electrode materials supercapacitors, Bilge Saruhan-Brings, Yakup Gönüllü, Benedikt Arndt, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [8728-34]

Modeling of high-efficiency ITO/ZnO quantum wire photovoltaic, Fahad A. Althowibi, Kimberly Kaltenecker, Yevhen Rutovytskyy, Eric Donkor, Univ. of Connecticut (USA). . . . . [8728-35]

Performance study of glucose-yeast-ethanol bio-hybrid fuel cell, David M. Mackie, Sanchao Liu, Marcus S. Benyamin, U.S. Army Research Lab. (USA); Rahul Ganguli, Teledyne Scientific Co. (USA); James J. Sumner, U.S. Army Research Lab. (USA) . . . . . [8728-36]

Wednesday 1 May

SESSION 8
Room: Conv. Ctr. 317 . . . . . .Wed 8:00 am to 9:50 am

NOTE ROOM CHANGE

Nano-/Microstructured Materials for Photovoltaic and Photoelectrochemical Energy Harvesting

Joint Session with Conference 8725 and 8728

Session Chair: **Jongseung Yoon,** The Univ. of Southern California (USA)

8:00 am: **Nanostructured black silicon for photovoltaics and photoelectrochemistry** *(Keynote Presentation)*, Howard M. Branz, Todd G. Deutsch, Hao-Chih Yuan, Jihun Oh, National Renewable Energy Lab. (USA) . . . . . [8725-32]

8:30 am: **Semiconductor nanorods in energy devices** *(Invited Paper)*, Paul D. Dapkus, Ting-Wei Yeh, Yen-Ting Lin, Chun-Yung Chi, Maoqing Yao, Chongwu Zhao, The Univ. of Southern California (USA). . . . . [8725-33]

8:50 am: **Towards low-cost high-efficiency GaAs photovoltaics and photoelectrodes grown via vapor transport from a solid source** *(Invited Paper)*, Shannon W. Boettcher, Andrew Ritenour, Univ. of Oregon (USA); Jason Boucher, University of Oregon (USA) . . . . . [8725-34]

9:10 am: **Direct-bandgap nanopillar photovoltaics based on patterned catalyst-free epitaxy** *(Invited Paper)*, Diana L. Huffaker, Univ. of California, Los Angeles (USA). . . . . [8725-35]

9:30 am: **Emerging nanomaterials for photovoltaic energy harvesting** *(Invited Paper)*, Silvija Gradecak, Massachusetts Institute of Technology (USA) . . . . . [8725-36]

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

Tuesday - Wednesday 30 Arpil - 1 May 2013 • Proceedings of SPIE Vol. 8729

Scanning Microscopies 2013: Advanced Microscopy Technologies for Defense, Homeland Security, Forensic, Life, Environmental, and Industrial Sciences

Conference Chairs: **Michael T. Postek,** National Institute of Standards and Technology (USA); **Dale E. Newbury,** National Institute of Standards and Technology (USA); **S. Frank Platek,** U.S. Food and Drug Administration (USA); **Tim K. Maugel,** Univ. of Maryland, College Park (USA)

Program Committee: **Eva M. Campo,** Univ. of Pennsylvania (USA); **Ronald G. Dixson,** National Institute of Standards and Technology (USA); **Lucille A. Giannuzzi,** L.A. Giannuzzi & Associates LLC (USA); **Robert Gordon,** Hitachi High Technologies America, Inc. (USA); **Michael J. McVicar,** Ctr. of Forensic Sciences (Canada); **John P. Petrali M.D.,** U.S. Army Medical Research Institute of Chemical Defense (USA); **Mary Satterfield,** National Institute of Standards and Technology (USA); **Vladimir A. Ukraintsev,** Nanometrology International, Inc. (USA); **John S. Villarrubia,** National Institute of Standards and Technology (USA); **András E. Vladár,** National Institute of Standards and Technology (USA)

Tuesday 30 April

SESSION 1A

Room: Conv. Ctr. 317 . . . . . Tue 8:30 am to 10:40 am

NOTE ROOM CHANGE

Scanning Probe-Based Nanopatterning and Dip-Pen Nanolithography

Joint Session with Conferences 8725 and 8729

Session Chairs: **Ronald G. Dixson,** National Institute of Standards and Technology (USA); **Debjyoti Banerjee,** Texas A&M Univ. (USA)

8:30 am: **Emerging approaches for nanopatterning of soft, hard, and hybrid structures** *(Keynote Presentation)*, Vinayak P. Dravid, Northwestern Univ. (USA) . . . . . [8725-20]

9:00 am: **Dip-pen nanolithography on inorganic and biological surfaces: challenges and opportunities** *(Invited Paper)*, Albena Ivanisevic, North Carolina State Univ. (USA). . . . . [8725-21]

9:20 am: **Humidity effects in dip-pen nanolithography: multiple inks and hollow features** *(Invited Paper)*, Brandon L. Weeks, Texas Tech Univ. (USA). . . . [8725-22]

9:40 am: **Nanoelectromechanical systems fabricated using tip-based nanofabrication** *(Invited Paper)*, Huan Hu, Parsian K. Mohseni, Xiuling Li, Mark A. Shannon, William P. King, Univ. of Illinois at Urbana-Champaign (USA) . . [8725-23]

10:00 am: **Using heatable AFM probes for the nanolithography of graphene, polymers, and nanoparticles** *(Invited Paper)*, Paul E. Sheehan, Woo K. Lee, U.S. Naval Research Lab. (USA); William P. King, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [8725-24]

10:20 am: **Tip-induced nanolithography on semiconductors** *(Invited Paper)*, Thomas G. Thundat, Ravi Gaikwad, Stojan Djokic, Univ. of Alberta (Canada) . . . . . [8725-25]

Coffee Break . . . . . .Tue 10:40 am to 11:05 am

OPENING KEYNOTE SESSION INTRODUCTION AND REMARKS

Room: Conv. Ctr. 325 . . . . . 11:05 am to 11:10 am

Session Chairs: **S. Frank Platek,** U.S. Food and Drug Administration (USA); **Tim K. Maugel,** Univ. of Maryland, College Park (USA)

SESSION 1

Room: Conv. Ctr. 325 . . . . . Tue 11:10 am to 12:30 pm

Opening Keynote Session

Session Chairs: **S. Frank Platek,** U.S. Food and Drug Administration (USA); **Tim K. Maugel,** Univ. of Maryland, College Park (USA)

11:10 am: **SEM/EDS fixed-beam or overscan analysis of particles can miss the real structure: x-ray spectrum image mapping reveals the true nature** *(Keynote Presentation)*, Dale E. Newbury, Nicholas W. M. Ritchie, National Institute of Standards and Technology (USA). . . . . [8729-1]

11:40 am: **Does your SEM really tell the truth: How would you know? Part 2** *(Keynote Presentation)*, Michael T. Postek, András E. Vladár, National Institute of Standards and Technology (USA). . . . . [8729-2]

12:10 pm: **Electron microscopy and forensic practice** *(Invited Paper)*, Marek Kotrly, Ivana Turková, Institute of Criminalistics Prague (Czech Republic) . . . . . [8729-3]

Lunch/Exhibition Break . . . . . .Tue 12:30 pm to 2:00 pm

SESSION 2

Room: Conv. Ctr. 325 . . . . . Tue 2:00 pm to 4:30 pm

Advancements in Scanning Probe Microscopy

Session Chairs: **Ronald G. Dixson,** National Institute of Standards and Technology (USA); **Vladimir A. Ukraintsev,** Nanometrology International, Inc. (USA)

2:00 pm: **Traceable measurement of one-dimensional grating using a large-range metrological atomic force microscope**, Sitian Gao, National Institute of Metrology (China) . . . . . [8729-4]

2:20 pm: **Performance improvement of a large-range metrological AFM through parasitic interference feedback artifacts removing by using laser multimode modulation method**, Qi Li, Sitian Gao, National Institute of Metrology (China) . . . . . [8729-5]

2:40 pm: **Development of atomic force microscope (AFM) tip width calibration standards**, Ronald G. Dixson, National Institute of Standards and Technology (USA); Boon Ping Ng, A*STAR Singapore Institute of Manufacturing Technology (Singapore); Craig McGray, Ndubuisi Orji, Jon Geist, National Institute of Standards and Technology (USA). . . . . [8729-6]

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

3:30 pm: **Automatic tuning of pi controller for AFM based on graphics**, Daixie Chen, Institute of Electrical Engineering (China); Bohua Yin, Institute of Electrical Engineering (China); Li Han, Yunsheng Lin, Mingzhang Chu, Institute of Electrical Engineering (China) . . . . . [8729-7]

3:50 pm: **Hybrid metrology for critical dimensions data to enable 1X node production**, Johann Foucher, CEA-LETI (France) . . . . . [8729-8]

4:10 pm: **Physical-chemical measurement methods for self-assembled core-shell nanostructures**, Natalia Farkas, National Institute of Standards and Technology (USA); Puthupparampil V. Scaria, Martin C. Woodle, Aparna Biosciences (USA); John A. Dagata, National Institute of Standards and Technology (USA) . . . . . [8729-9]

PANEL DISCUSSION

Room: Conv. Ctr. 325 . . . . . .Tue 4:30 pm to 5:30 pm

AFM Discussion Session

Session Chairs: **Ronald G. Dixson,** National Institute of Standards and Technology (USA); **Vladimir A. Ukraintsev,** Nanometrology International, Inc. (USA)

Wednesday 1 May

WORKSHOP

Room: Conv. Ctr. 325 . . . . . Wed 8:55 am to 9:00 am

Introduction: STEM Workshop

Session Chairs: **Mary Satterfield,** National Institute of Standards and Technology (USA); **Michael T. Postek,** National Institute of Standards and Technology (USA)

The future of our nation hinges on our ability to prepare our next generation to be innovators in science, technology, engineering and math (STEM). Excitement for STEM begins in the earliest stages of our education process. Yet, today far too few of our students are prepared for the challenges ahead. The special session "Microscopy for STEM.

Educators" is a general interest forum with several notable invited speakers discussing their successful programs implementing microscopy in STEM education to foster student interest and excitement. A hands-on session with tabletop scanning electron microscopes will be held at the end of the presentations and the attendees are encouraged to bring samples of interest and operate the instruments. STEM educators will receive one-day reduced registration fees and will be able to visit the exposition where other microscopes may be on display.

All meeting attendees are invited to attend. Educators attending this session only may complete the Special Registration Form for STEM Educators.

Although this session does not provide formal MSDE CPD credit, we can provide a certificate of attendance for those wishing to apply for credit on their own.

SESSION 3

Room: Conv. Ctr. 325 . . . . . .Wed 9:00 am to 11:10 am

STEM Workshop

Session Chairs: **Robert Gordon,** Hitachi High Technologies America, Inc. (USA); **Mary Satterfield,** National Institute of Standards and Technology (USA)

9:00 am: **HTA educational outreach program and change the equation participation**, Robert Gordon, Hitachi High Technologies America, Inc. (USA) . . . . . [8729-10]

9:20 am: **Bringing students to the mountain: a model for developing partnerships to introduce students to cutting-edge research**, AnneLynn Gillian-Daniel, Univ. of Wisconsin-Madison (USA); Robert Gordon, Hitachi High Technologies America, Inc. (USA); Benjamin L. Taylor, Jon J. McCarthy, Univ. of Wisconsin-Madison (USA). . . . . [8729-11]

9:40 am: **Using the Hitachi TMS 3000 in a middle school classroom**, Mary Ellen Wolfinger, Takoma Park Middle School (USA) . . . . . [8729-12]

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

10:30 am: **Use of a tabletop scanning electron microscope in the classroom**, Carolyn Holcomb, Western Heights Middle School (USA) . . . . . [8729-13]

10:50 am: **Integrating research and advanced microscopy into the high school curriculum**, Craig Queenan, Alyssa Calabro, David L. Becker, Bergen County Academies (USA). . . . . [8729-14]

WORKSHOP

Room: Conv. Ctr. 325 . . . . . Wed 11:10 am to 12:10 pm

Hands On: Desktop SEM Laboratory and Instrument Use

Session Chairs: **Robert Gordon,** Hitachi High Technologies America, Inc. (USA); **Mary Satterfield,** National Institute of Standards and Technology (USA)

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

SESSION 5

Room: Conv. Ctr. 325 . . . . . Wed 1:40 pm to 2:40 pm

Advancements in Scanning Microscopies

Session Chairs: **Tim K. Maugel,** Univ. of Maryland, College Park (USA); **Dale E. Newbury,** National Institute of Standards and Technology (USA)

1:40 pm: **Metrological scanning electron microscope and imaging method**, Bohua Yin, Daixie Chen, Hong Xue, Guangrong Fang, Li Han, Institute of Electrical Engineering (China); Sitian Gao, Mingzhen Lu, National Institute of Metrology (China) . . . . . [8729-15]

2:00 pm: **Advances in photo-thermal infrared imaging microspectroscopy**, Robert Furstenberg, Christopher A. Kendziora, Michael R. Papantonakis, Viet Q. Nguyen, R. Andrew McGill, U.S. Naval Research Lab. (USA). . . . . [8729-16]

2:20 pm: **Surface optical properties for copper based on surface Kramers-Kroning analysis**, Tao Tang, Zengming Zhang, Zejun J. Ding, Univ. of Science and Technology of China (China); Karoly Tokesi, Hungarian Academy of Sciences (Hungary); K. Goto, Nagoya Institute of Technology (Japan) . . . . . [8729-17]

Coffee/Exhibition Break. . . . . Wed 2:40 pm to 3:40 pm

SESSION 6

Room: Conv. Ctr. 325 . . . . . Wed 3:40 pm to 4:40 pm

Particle Beam Interaction Modeling Workshop

Session Chairs: **John S. Villarrubia,** National Institute of Standards and Technology (USA); **András E. Vladár,** National Institute of Standards and Technology (USA)

3:40 pm: **Monte Carlo simulation for realistic beam-sample interaction in SEM: application to evaluation of sharpness measurement methods**, Zhu Ruan, S. F. Mao, Peng Zhang, Zejun J. Ding, Univ. of Science and Technology of China (China) . . . . . [8729-18]

4:00 pm: **Monte Carlo study of the influence of electron-beam focusing to SEM linewidth measurement**, Peng Zhang, Zengming Zhang, Shifeng Mao, Zejun J. Ding, Univ. of Science and Technology of China (China) . . . . . [8729-19]

4:20 pm: **Monte Carlo simulation of x-ray photoemission electron microscopic image**, Zengming Zhang, Tao Tang, Zejun J. Ding, Univ. of Science and Technology of China (China) . . . . . [8729-20]

PANEL DISCUSSION

Room: Conv. Ctr. 325 . . . . . Wed 4:40 pm to 5:20 pm

Modeling Discussion Session

Professional Development

Spend some time focusing on your career development while you're at SPIE Defense, Security, and Sensing. See the Course Materials Desk for workshop details. See the SPIE Cashier in the Pratt Lobby to register.

Flexible Electronics

Conference Chairs: **David R. Allee,** Arizona State Univ. (USA); **Eric W. Forsythe,** U.S. Army Research Lab. (USA)

Program Committee: **Nick Colaneri,** Arizona State Univ. (USA); **Khershed P. Cooper,** U.S. Naval Research Lab. (USA); **Pat Edmiston,** Raytheon Network Centric Systems (USA); **Bruce E. Gnade,** The Univ. of Texas at Dallas (USA); **Joshua A. Hagen,** Air Force Research Lab. (USA); **David C. Morton,** U.S. Army Research Lab. (USA); **Stephen M. Phillips,** Arizona State Univ. (USA); **Manuel Quevedo-Lopez,** The Univ. of Texas at Dallas (USA); **Robert H. Reuss,** Defense Advanced Research Projects Agency (USA); **Jennifer C. Ricklin,** Air Force Research Lab. (USA)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 328 . . . . . .Wed 8:20 am to 9:40 am

Flexible Electronics I

Session Chair: **Jennifer C. Ricklin,** Air Force Research Lab. (USA)

8:20 am: **Technology horizons: the U.S. Air Force Headquarters level science and technology vision for 2010-2030** *(Invited Paper)*, Werner J. A. Dahm, Arizona State Univ. (USA). . . . . [8730-1]

8:40 am: **High-performance logic circuits using solution-based, low-temperature semiconductors for flexible electronics**, Israel Mejia, Ana L. Salas-Villasenor, John W. Murphy, The Univ. of Texas at Dallas (USA); George R. Kunnen, Arizona State Univ. (USA); Kurtis D. Cantley, The Univ. of Texas at Dallas (USA); David R. Allee, Arizona State Univ. (USA); Bruce E. Gnade, Manuel A. Quevedo-Lopez, The Univ. of Texas at Dallas (USA) . . . . . [8730-2]

9:00 am: **Flexible packaging and integration of CMOS IC with elastomeric microfluidics**, Bowei Zhang, Quan Dong, Zhenyu Li, Can E. Korman, Mona Zaghloul, The George Washington Univ. (USA) . . . . . [8730-3]

9:20 am: **Nanobio manufacturing of flex devices for aerospace** *(Invited Paper)*, Richard Vaia, Michael F. Durstock, Rajesh R. Naik, Air Force Research Lab. (USA) . . . . . [8730-5]

Coffee/Exhibition Break. . . . . Wed 9:40 am to 11:00 am

SESSION 2

Room: Conv. Ctr. 328 . . . . . .Wed 11:00 am to 11:40 am

Flexible Electronics II

Session Chair: **David C. Morton,** U.S. Army Research Lab. (USA)

11:00 am: **Flexible electronics for Army applications** *(Invited Paper)*, Eric Forsythe, U.S. Army Research Lab. (USA); David R. Allee, Arizona State Univ. (USA); Jianmin Shi, David C. Morton, U.S. Army Research Lab. (USA); Nicholas Colaneri, Arizona State Univ. (USA) . . . . . [8730-6]

11:20 am: **Flexible microstrip antennas**, Camilo A. Cano, Univ. EAFIT (Colombia) . . . . . [8730-9]

Lunch/Exhibition Break . . . . . Wed 11:40 am to 1:40 pm

SESSION 3

Room: Conv. Ctr. 328 . . . . . Wed 1:40 pm to 3:00 pm

Flexible Electronics III

Session Chair: **Robert Reuss,**
Defense Advanced Research Projects Agency (USA)

1:40 pm: **FlexTech Alliance: partnering for progress in flexible, printed electronics** *(Invited Paper)*, Michael F. Ciesinski, FlexTech Alliance (USA) [8730-11]

2:00 pm: **Hybrid electrospinning casting method to produce multifunctional flexible transparent conductive films**, Miko Cakmak, The Univ. of Akron (USA) . . . . . [8730-12]

2:20 pm: **Low-temperature amorphous indium gallium zinc oxide backplane technology development for flexible sensing arrays in a manufacturing pilot line environment**, Michael Marrs, Arizona State Univ. (USA) . . . . . [8730-13]

2:40 pm: **Functional electronic and optical devices via additive driven self-sssembly and nanoimprint lithography: towards solution-based R2R fabrication** *(Invited Paper)*, James Watkins, Univ. of Massachusetts Amherst (USA) . . . . . [8730-14]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 4

Room: Conv. Ctr. 328 . . . . . Wed 3:40 pm to 5:20 pm

Flexible Electronics IV

Session Chair: **Bruce E. Gnade,** The Univ. of Texas at Dallas (USA)

3:40 pm: **Epidermal electronics** *(Invited Paper)*, John A. Rogers, Univ. of Illinois at Urbana-Champaign (USA). . . . . [8730-15]

4:00 pm: **Flexible digital x-ray technology for far-forward remote diagnostic and conformal x-ray imaging applications**, Joseph T. Smith, Michael Marrs, Mark Strnad, Arizona State Univ. (USA); Raj B. Apte, Palo Alto Research Center, Inc. (USA); David R. Allee, Nicholas Colaneri, Arizona State Univ. (USA); Eric Forsythe, David C. Morton, U.S. Army Research Lab. (USA) . . . . . [8730-16]

4:20 pm: **Sol gel ZnO films doped with Mg and Li evaluated for charged particle detectors**, John W. Murphy, Alexander Eddy, The Univ. of Texas at Dallas (USA); George R. Kunnen, Arizona State Univ. (USA); Israel Mejia, Kurtis D. Cantley, The Univ. of Texas at Dallas (USA); David R. Allee, Arizona State Univ. (USA); Manuel A. Quevedo-Lopez, Bruce E. Gnade, The Univ. of Texas at Dallas (USA) . . . . . [8730-17]

4:40 pm: **Development of a testbed for flexible sensing arrays**, Alfonso Dominguez, George R. Kunnen, Michael Vetrano, Joseph T. Smith, Michael Marrs, David R. Allee, Arizona State Univ. (USA) . . . . . [8730-18]

5:00 pm: **Towards a flexible electronic flying carpet** *(Invited Paper)*, James C. Sturm, Noah T. Jafferis, Princeton Univ. (USA). . . . . [8730-19]

Thursday 2 May

SESSION 5

Room: Conv. Ctr. 317 . . . . . Thu 12:30 pm to 3:10 pm

NOTE ROOM CHANGE

Flexible and Wearable Electronics for Defense Applications

Joint Session with Conference 8725 and 8730

Session Chairs: **Muhammad M. Hussain,**
King Abdullah Univ. of Science and Technology (Saudi Arabia);
Ali Javey, Univ. of California, Berkeley (USA)

12:30 pm: **Bio-integrated electronics and sensor systems** *(Invited Paper)*, John A. Rogers, Univ. of Illinois at Urbana-Champaign (USA) . . . . . [8725-58]

12:50 pm: **Carbon nanotube macroelectronics: toward system-on-plastic** *(Invited Paper)*, Chuan Wang, Ali Javey, Univ. of California, Berkeley (USA)[8725-59]

1:10 pm: **Heterogeneously integrated multifunctional systems via high-throughput transfer printing of micro/nano devices** *(Invited Paper)*, M. Saif Islam, Hakan Karaagac, Mark Triplett, Logeeswaran Veerayah Jayaraman, Univ. of California, Davis (USA) . . . . . [8725-60]

1:30 pm: **Skin-inspired sensor sheets for touch, chemical, and biological sensing** *(Invited Paper)*, Zhenan Bao, Stanford Univ. (USA). . . . . [8725-61]

1:50 pm: **Mechanically flexible optically transparent silicon fabric with high thermal budget devices from bulk silicon (100)** *(Invited Paper)*, Muhammad M. Hussain, Jhonathan P. Rojas, Galo Torres Sevilla, King Abdullah Univ. of Science and Technology (Saudi Arabia) . . . . . [8725-62]

2:10 pm: **Transferable single-crystalline semiconductor nanomembranes and their versatile applications** *(Invited Paper)*, Zhenqiang Ma, Univ. of Wisconsin-Madison (USA); Weidong Zhou, The Univ. of Texas at Arlington (USA) . . . [8725-63]

2:30 pm: **Biointerfaced nanopiezoelectrics** *(Invited Paper)*, Michael C. McAlpine, Princeton Univ. (USA) . . . . . [8725-64]

2:50 pm: **Ultraflexible and stretchable organic transistor integrated circuits for medical sensors** *(Invited Paper)*, Takao Someya, Tsuyoshi Sekitani, The Univ. of Tokyo (Japan) . . . . . [8725-65]

Tuesday - Thursday 30 April - 2 May 2013 • Proceedings of SPIE Vol. 8731

Laser Radar Technology and Applications XVIII

Conference Chairs: **Monte D. Turner,** Air Force Research Lab. (USA); **Gary W. Kamerman,** FastMetrix, Inc. (USA)

Program Committee: **Philip Gatt,** Lockheed Martin Coherent Technologies (USA); **Richard M. Heinrichs,** Defense Advanced Research Projects Agency (USA); **Robert T. Hintz,** Naval Air Warfare Ctr. Weapons Div. (USA); **Norman A. Lopez,** FastMetrix, Inc. (USA); **Vasyl Molebny,** National Taras Shevchenko Univ. of Kyiv (Ukraine); **Russell Philbrick,** North Carolina State Univ. (USA); **Upendra N. Singh,** NASA Langley Research Ctr. (USA); **Ove K Steinvall,** Swedish Defence Research Agency (Sweden); **Douglas G. Youmans,** SPARTA Inc./Parsons Corp. (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 347 . . . . . Tue 8:20 am to 10:00 am

3D LIDAR Processing and Exploitation I

Session Chair: **Monte D. Turner,** Air Force Research Lab. (USA)

8:20 am: **Extraction and classification of vehicles in ladar imagery**, Hans C. Palm, Trym V. Haavardsholm, Halvor R. Ajer, Cathrine V. Jensen, Forsvarets Forsknings Institute (Norway) . . . . . [8731-1]

8:40 am: **Methods for lidar point-cloud classification using local neighborhood statistics**, Angela M. Kim, Richard C. Olsen, Fred A. Kruse, Naval Postgraduate School (USA) . . . . . [8731-2]

9:00 am: **Enhancing online waveform processing by adding new point attributes**, Martin Pfennigbauer, Andreas Ullrich, RIEGL Laser Measurement Systems GmbH (Austria) . . . . . [8731-3]

9:20 am: **Classification and extraction of trees and buildings from urban scenes using discrete return lidar and aerial color imagery**, Madhurima Bandyopadhyay, Jan van Aardt, Kerry Cawse-Nicholson, Rochester Institute of Technology (USA) . . . . . [8731-4]

9:40 am: **3D scene reconstruction of mixed natural and built environments from terrestrial lidar**, David Kelbe, Paul Romanczyk, Jan van Aardt, Kerry Cawse-Nicholson, Shea Hagstrom, Rochester Institute of Technology (USA) . . . . . [8731-5]

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

SESSION 2

Room: Conv. Ctr. 347 . . . . . Tue 10:30 am to 11:50 am

3D LIDAR Processing and Exploitation II

Session Chair: **Gary W. Kamerman,** FastMetrix, Inc. (USA)

10:30 am: **Registration of multiple texel images (fused ladar/digital imagery) for 3D image creation**, Scott E. Budge, Neeraj Badamikar, Utah State Univ. (USA) . . . . . [8731-6]

10:50 am: **3D graph segmentation for target detection in FOPEN lidar data**, Nicholas S. Shorter, Judson Locke, Anthony O. Smith, Emma Keating, Philip W. Smith, Harris Corp. (USA) . . . . . [8731-7]

11:10 am: **Fusing lidar-based voxel geometry with multi-angle visible imagery**, Shea Hagstrom, David W. Messinger, Rochester Institute of Technology (USA) . . . . . [8731-8]

11:30 am: **Point spread function (PSF) noise filter strategy for Geiger-mode lidar**, Anthony O. Smith, Robert Stark, Philip W. Smith, Randall St Romain, Steven G. Blask, Harris Corp. (USA) . . . . . [8731-9]

Lunch/Exhibition Break . . . . . .Tue 11:50 am to 1:40 pm

SESSION 3

Room: Conv. Ctr. 347 . . . . . Tue 1:40 pm to 3:00 pm

3D LIDAR Processing and Exploitation III

Session Chair: **C. Russell Philbrick,** North Carolina State Univ. (USA)

1:40 pm: **Lidar data processing for scalable compression**, Ruben D. Nieves, ITT Exelis Inc. (USA) . . . . . [8731-49]

2:00 pm: **Foliage-penetration optimization for Geiger-mode avalanche photodiode lidar**, Steven E. Johnson, OG Systems (USA) . . . . . [8731-12]

2:20 pm: **3D image formation by maximum likelihood estimation of Geiger-mode lidar data**, Gary W. Kamerman, Philip E. Johnson, FastMetrix, Inc. (USA) . . . . . [8731-13]

2:40 pm: **A comparison of two embedded programming techniques for high-rep-rate coherent Doppler lidar**, Mark F. Arend, Sameh Abdelazim, Miguel Lopez, Fred Moshary, The City College of New York (USA) . . . . . [8731-14]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

SESSION 4

Room: Conv. Ctr. 347 . . . . . Tue 3:40 pm to 4:40 pm

Space Applications

Session Chair: **Monte D. Turner,** Air Force Research Lab. (USA)

3:40 pm: **Adapting a Ground-Based Laser Ranging System at NASA-GSFC for Identification and Tracking of Orbital Debris**, Donald B. Coyle, Paul Stysley, Romae Young, Kenneth Getzandanner, Jan F. McGarry, NASA Goddard Space Flight Ctr. (USA); Scott Hull, NASA Goddard Space Flight Center (USA) . . [8731-15]

4:00 pm: **Doppler lidar sensor for precision navigation in GPS-deprived environment**, Farzin Amzajerdian, NASA Langley Research Ctr. (USA); Diego F. Pierrottet, Coherent Applications, Inc. (USA); Glenn D. Hines, Larry B. Petway, Bruce W. Barnes, NASA Langley Research Ctr. (USA) . . . . . [8731-16]

4:20 pm: **Helicopter flight test of 3D imaging flash lidar technology for safe, autonomous, and precise planetary landing**, Vincent E. Roback, NASA Langley Research Ctr. (USA); Alexander Bulyshev, Analytical Mechanics Associates, Inc. (USA); Farzin Amzajerdian, Robert A. Reisse, NASA Langley Research Ctr. (USA) . . . . . [8731-17]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Three wavelength lidar data fractal dimension for Planetary Boundary Layer (PBL) detection, Liqiao Lei, Hampton Univ. (USA) and Hefei Univ. Technology (China); M. Patrick McCormick, Jia Su, Hampton Univ. (USA) . . . . . [8731-39]

Wednesday 1 May

SESSION 5
Room: Conv. Ctr. 347 . . . . . .Wed 8:40 am to 12:10 pm

Atmospheric Sensing

Session Chairs: **Ove K. Steinvall,** Swedish Defence Research Agency (Sweden); **Douglas G. Youmans,** SPARTA, Inc. (USA)

8:40 am: **Frequency locking and control technologies for remote lidar systems**, Sarah R. Bickman, Scott R. Davis, Benjamin Luey, Scott D. Rommel, Michael H. Anderson, Vescent Photonics Inc. (USA) . . . . . [8731-18]

9:00 am: **A new method to retrieve aerosol extinction coefficients from elastic-Raman lidar data**, Jia Su, Patrick McCormick, Liqiao Lei, Hampton Univ. (USA) . . . . . [8731-19]

9:20 am: **Airborne wind profiling algorithms for the pulsed 2-micron coherent Doppler lidar at NASA Langley Research Center**, Jeffrey Y. Beyon, Grady J. Koch, Michael J. Kavaya, NASA Langley Research Ctr. (USA); Taylor J. Ray, Colorado School of Mines (USA). . . . . [8731-20]

9:40 am: **Semi-empirical validation of the cross-band relative absorption technique for the measurement of molecular mixing ratios**, Denis V. Pliutau, Narasimha S. Prasad, NASA Langley Research Ctr. (USA) . . . . . [8731-21]

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

10:30 am: **Understanding lidar returns from complex dust mixtures**, D. A. Hook, Garrett E. Pangle, Hans D. Hallen, C. R. Philbrick, North Carolina State Univ. (USA) . . . . . [8731-22]

10:50 am: **Optical extinction dependence on wavelength and size distribution of airborne dust**, Garrett E. Pangle, D. A. Hook, Hans D. Hallen, C. R. Philbrick, North Carolina State Univ. (USA) . . . . . [8731-23]

11:10 am: **Using a laser aureole to study aerosols**, Brandon J. Long, D. A. Hook, Garrett E. Pangle, Hans D. Hallen, C. R. Philbrick, North Carolina State Univ. (USA) . . . . . [8731-24]

11:30 am: **Multistatic lidar measurements of nonspherical aerosols**, Hans D. Hallen, D. A. Hook, Garrett E. Pangle, C. R. Philbrick, North Carolina State Univ. (USA) . . . . . [8731-25]

11:50 am: **Optical signatures of dust**, Andrea M. Brown, Shadrian B. Strong, David M. Brown, Johns Hopkins Univ. Applied Physics Lab. (USA). . . . . [8731-26]

Lunch Break . . . . . Wed 12:10 pm to 2:00 pm

SESSION 6
Room: Conv. Ctr. 347 . . . . . Wed 2:00 pm to 3:00 pm

Topographic Mapping

Session Chair: **Monte D. Turner,** Air Force Research Lab. (USA)

2:00 pm: **Difference modeling enhancement of topographic superresolution**, Jeremy Straub, The Univ. of North Dakota (USA) . . . . . [8731-27]

2:20 pm: **Information density and 3D image quality**, Gary W. Kamerman, FastMetrix, Inc. (USA) . . . . . [8731-30]

2:40 pm: **A study on the calibration of pitch-angle deviation for airborne lidar system**, Xiangyang Hao, Lixing Jiang, Songlin Liu, Zhengzhou Institute of Surveying and Mapping (China) . . . . . [8731-28]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 7
Room: Conv. Ctr. 347 . . . . . Wed 3:40 pm to 4:40 pm

Modeling and Simulation

Session Chair: **Gary W. Kamerman,** FastMetrix, Inc. (USA)

3:40 pm: **Simulation of the performance of laser imaging and range profiling of small-surface vessels**, Ove K. Steinvall, Magnus Elmqvist, Tomas R. Chevalier, Swedish Defence Research Agency (Sweden) . . . . . [8731-31]

4:00 pm: **Scintillation effects on round-trip ladar imaging through turbulence with finite-sized objects and collecting apertures: modeling advances**, Douglas G. Youmans, SPARTA, Inc. (USA). . . . . [8731-32]

4:20 pm: **Comparison of LIDAR system performance for alternative single-mode receiver architectures: modeling and experimental validation**, Paul Toliver, Ibrahim T. Ozdur, Anjali Agarwal, Ted K. Woodward, Applied Communications Sciences (USA) . . . . . [8731-48]

Thursday 2 May

SESSION 8
Room: Conv. Ctr. 347 . . . . . Thu 9:00 am to 11:10 am

Advance Components and Systems

Session Chairs: **Gary W. Kamerman,** FastMetrix, Inc. (USA); **Monte D. Turner,** Air Force Research Lab. (USA)

9:00 am: **Large-format Geiger-mode ladar camera**, Ping Yuan, Rengarajan Sudharsanan, Xiaogang Bai, Paul McDonald, Eduardo L. Labios, Spectrolab, Inc. (USA); Bryan Morris, John P. Nicholson, Gary M. Stuart, Harrison Danny, Boeing-SVS, Inc. (USA) . . . . . [8731-33]

9:20 am: **Highly sensitive lidar with a thumb-sized sensor-head built using an optical fiber preamplifier (3)**, Daisuke Inoue, Tadashi Ichikawa, Hiroyuki Matsubara, Manabu Kagami, Toyota Central R&D Labs., Inc. (Japan). . . . [8731-34]

9:40 am: **Ice sheet surface elevation retrieval from CALIPSO lidar measurements**, Xiaomei Lu, Yongxiang Hu, NASA Langley Research Ctr. (USA) . . . . . [8731-40]

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

10:30 am: **Development of a scanning polarimetric laser detection and ranging system**, Renu Tripathi, Yuri Markushin, Nicholas P. Calvano, Gour S. Pati, Delaware State Univ. (USA). . . . . [8731-36]

10:50 am: **Handheld laser imaging for military forensic use**, Håkan Larsson, Dietmar Letalick, Swedish Defence Research Agency (Sweden) . . . . . [8731-37]

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Atmospheric Propagation X

Conference Chairs: **Linda M. Wasiczko Thomas,** U.S. Naval Research Lab. (USA); **Earl J. Spillar,** Air Force Research Lab. (USA)

Program Committee: **Ammar Al-Habash,** Raytheon Space & Airborne Systems (USA); **Gary Baker,** Lockheed Martin Space Systems Co. (USA); **Harris R. Burris Jr.,** U.S. Naval Research Lab. (USA); **Gary G. Gimmestad,** Georgia Tech Research Institute (USA); **Ken J. Grant,** Defence Science and Technology Organisation (Australia); **Juan C. Juarez,** Johns Hopkins Univ. Applied Physics Lab. (USA); **Christopher I. Moore,** U.S. Naval Research Lab. (USA); **William S. Rabinovich,** U.S. Naval Research Lab. (USA); **Jonathan M. Saint Clair,** The Boeing Co. (USA); **David H. Tofsted,** U.S. Army Research Lab. (USA); **Morio Toyoshima,** National Institute of Information and Communications Technology (Japan); **Cynthia Y. Young,** Univ. of Central Florida (USA)

Tuesday 30 April

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

USAF high energy laser (HEL) systems: multi-spectral algorithm efficiencies susceptibilities during missile staging (Case: GHADR 110 MOD 2 (SEJIL-2), Clifford A. Paiva, BSM Research Associates (USA) . . . . . [8732-20]

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 335 . . . . . .Wed 9:00 am to 10:00 am

Measurements and Systems

Session Chair: **Juan C. Juarez,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

9:00 am: **Atmospheric transmission from an instrument measuring scatter at 1550 nm**, Michael J. Vilcheck, Christopher I. Moore, Rita S. Mahon, James L. Murphy, Harris R. Burris Jr., Linda M. Thomas, William S. Rabinovich, U.S. Naval Research Lab. (USA) . . . . . [8732-7]

9:20 am: **Characterization of, and imaging through, horizontal-path turbulence**, Szymon Gladysz, Gabriele Marchi, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . . [8732-8]

9:40 am: **Multi-wavelength operation of a control algorithm for mobile FSO node alignment**, Peter G. LoPresti, The Univ. of Tulsa (USA); Dayong Zhou, Hazem Refai, The Univ. of Oklahoma - Tulsa (USA) . . . . . [8732-10]

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

SESSION 2

Room: Conv. Ctr. 335 . . . . . .Wed 10:30 am to 12:20 pm

Modeling of the Channel

Session Chair: **Harris R. Burris Jr.,** U.S. Naval Research Lab. (USA)

10:30 am: **Cloud-free line-of-sight estimation for free space optical communications** *(Invited Paper)*, Radha A. Venkat, David W. Young, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8732-1]

11:00 am: **Simulation of stochastic signals for FSO communication systems through spectral representation**, Jose Paulo G. de Oliveira, Univ. de Pernambuco (Brazil) and FITec (Brazil) . . . . . [8732-4]

11:20 am: **Strehl ratio simulation results under strong turbulence conditions for actively compensated free-space optical communication systems**, Juan C. Juarez, David M. Brown, David W. Young, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8732-5]

11:40 am: **Sparse spectrum model for the turbulent phase simulations**, Mikhail I. Charnotskii, National Oceanic and Atmospheric Administration (USA) . . . [8732-3]

12:00 pm: **Effectiveness of using gridded forecast data in hyperspectral radiative transfer analyses and high energy laser research and mission planning**, Steven T. Fiorino, Michelle F. Via, Kevin J. Keefer, Stephen Shirey, Justin T. Engel, Brannon J. Elmore, Air Force Institute of Technology (USA) . . . . . [8732-2]

Lunch Break . . . . . Wed 12:20 pm to 2:00 pm

SESSION 3

Room: Conv. Ctr. 335 . . . . . Wed 2:00 pm to 3:00 pm

Experimental Analysis

Session Chair: **Linda M. Thomas,** U.S. Naval Research Lab. (USA)

2:00 pm: **Buffer requirements of an optical communication system in atmospheric turbulence**, Troy T. Leclerc, Florida Space Institute (USA); Ronald L. Phillips, Larry C. Andrews, Robert F. Crabbs, Univ. of Central Florida (USA) . . . . . [8732-11]

2:20 pm: **Propagation statistical analysis for SMF-coupled free-space optical signal under weak to medium atmospheric turbulences**, Yoshinori Arimoto, National Institute of Information and Communications Technology (Japan) . . . . . [8732-12]

2:40 pm: **Wavelength diversity assessment of fiber bundle receiver under misalignment and turbulence**, Peter G. LoPresti, Wei Yi, Eric Rohlman, The Univ. of Tulsa (USA); Hazem Refai, The Univ. of Oklahoma - Tulsa (USA) . . . . . [8732-14]

Coffee/Exhibition Break. . . . . Wed 3:00 pm to 4:00 pm

SESSION 4

Room: Conv. Ctr. 335 . . . . . Wed 4:00 pm to 5:40 pm

High Energy and Beam Control Analysis

Session Chair: **Earl J. Spillar,** Air Force Research Lab. (USA)

4:00 pm: **Laser beam control with nonlinear phase conjugation**, Vladimir B. Markov, Anatoliy Khizhnyak, Advanced Systems & Technologies, Inc. (USA); Phillip Sprangle, Joseph Penano, Antonio Ting, U.S. Naval Research Lab. (USA); Lewis Desandre, Office of Naval Research Global (USA); Chris Davis, Univ. of Maryland, College Park (USA) . . . . . [8732-17]

4:20 pm: **Adaptive optics with extended target**, Anatoliy Khizhnyak, Vladimir B. Markov, Advanced Systems & Technologies, Inc. (USA) . . . . . [8732-19]

4:40 pm: **Analysis of combined thermal blooming and turbulence effects applying an uniquely modified scaling law model for end-to-end high energy laser propagation model based on probabilistic cimatology and numerical forecast atmospheric profiles**, Steven T. Fiorino, Kevin J. Keefer, Noah R. Van Zandt, Air Force Institute of Technology (USA) . . . . . [8732-15]

5:00 pm: **Scattering from a rough impedance surface in presence of atmospheric turbulence**, Santasri Basu, Milo W. Hyde IV, Jack E. McCrae Jr., Steven T. Fiorino, Air Force Institute of Technology (USA) . . . . . [8732-16]

5:20 pm: **PITBUL: a physics-based modeling package for imaging and tracking of airborne targets for HEL applications including active illumination and thermal effects**, Noah R. Van Zandt, Salvatore J. Cusumano, Steven T. Fiorino, Air Force Institute of Technology (USA) . . . . . [8732-18]

Laser Technology for Defense and Security IX

Conference Chairs: **Mark Dubinskii,** SPIE Advisory Board (USA); **Stephen G. Post,** Missile Defense Agency (USA)

Program Committee: **Steven R. Bowman,** U.S. Naval Research Lab. (USA); **Iyad Dajani,** Air Force Research Lab. (USA); **Fabio Di Teodoro,** The Aerospace Corp. (USA); **Anthony M. Johnson,** Univ. of Maryland, Baltimore County (USA); **Don D. Seeley,** High Energy Laser Joint Technology Office (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 346 . . . . . Tue 8:20 am to 10:00 am

Laser Diodes, Optically Pumped Semiconductor Lasers, and Practical HEL Systems

Session Chair: **Iyad Dajani,** Air Force Research Lab. (USA)

8:20 am: **Advances in AlGaInN laser diode technology for defence applications**, Stephen P Najda, TopGaN Ltd. (Poland) . . . . . [8733-1]

8:40 am: **Recent advances in power scaling of high-power optically-pumped semiconductor lasers for ultrashort pulse generation and continuous wave single frequency operation**, Alexandre Laurain, Maik Scheller, Tsuei-Lian Wang, Jorg Hader, Jerome Moloney, College of Optical Sciences, The Univ. of Arizona (USA) . . . . . [8733-3]

9:00 am: **High-energy laser activities at MBDA Germany**, Bernd Mohring, Stephan Dietrich, Leonardo Tassini, Rudolf Protz, Franz Geidek, Jürgen Zoz, MBDA Germany (Germany) . . . . . [8733-4]

9:20 am: **Beam-guidance optics for high-power fiber laser systems**, Bernd Mohring, Leonardo Tassini, Rudolf Protz, Jürgen Zoz, MBDA Germany (Germany) . . . . . [8733-5]

9:40 am: **Development of advanced seed laser modules for lidar and spectroscopy applications**, Narasimha S. Prasad, NASA Langley Research Ctr. (USA); Alex Rosiewicz, Steve Coleman, EM4, Inc. (USA) . . . . . [8733-2]

Coffee Break . . . . . .Tue 10:00 am to 10:40 am

SESSION 2

Room: Conv. Ctr. 346 . . . . . Tue 10:40 am to 11:40 am

Laser Diode Development for DPALs and Laser Weapons in the Future Battlefield

Session Chair: **Steven R. Bowman,** U.S. Naval Research Lab. (USA)

10:40 am: **Narrow-line, tunable, high-power diode laser pump for DPAL applications**, Rajiv Pandey, David D. Merchen, Dean Stapleton, David A. Irwin, Marvin C. Humble, Steve Patterson, DILAS Diode Laser, Inc. (USA); Heiko Kissel, Jens Biesenbach, DILAS Diodenlaser GmbH (Germany) . . . . . [8733-8]

11:00 am: **High-efficiency narrow linewidth diode laser pump source for Rb vapor alkali laser systems**, Zhigang Chen, Kevin Bruce, Keith W. Kennedy, Ling Bao, Kirk Price, Shuang Li, Mitch Reynolds, Charley McGowan, Aaron Brown, Manoj Kanskar, nLIGHT Corp. (USA) . . . . . [8733-9]

11:20 am: **Military applications of the laser weapons in the future battlefield**, Hasan Celik, Saban Adana, Erhan Yahsi, TAF (Turkey) . . . . . [8733-42]

Lunch Break . . . . . .Tue 11:40 am to 1:20 pm

SESSION 3

Room: Conv. Ctr. 346 . . . . . Tue 1:20 pm to 3:00 pm

Mid-IR Lasers

Session Chair: **Anthony M. Johnson,**
Univ. of Maryland, Baltimore County (USA)

1:20 pm: **Compact and efficient nanosecond pulsed tuneable OPO in the mid-IR spectral range**, Jonas Hellstrom, Peter Jänes, Gunnar Elgcrona, Håkan Karlsson, Cobolt AB (Sweden) . . . . . [8733-10]

1:40 pm: **Interband cascade lasers with high continuous-wave output powers at room temperature**, Charles D. Merritt, William W. Bewley, Chadwick L. Canedy, U.S. Naval Research Lab. (USA); Mijin Kim, Sotera Defense Solutions, Inc. (USA); Chul S. Kim, Joshua Abell, Igor Vurgaftman, Jerry R. Meyer, U.S. Naval Research Lab. (USA) . . . . . [8733-11]

2:00 pm: **Wide-band coherent supercontinuum generation**, Hongyu Hu, Wenbo Li, Niloy K. Dutta, Univ. of Connecticut (USA). . . . . [8733-13]

2:20 pm: **Tunable mid-infrared generation using a synchronized programmable fiber laser: extending to the 2nd atmospheric window**, Mathieu Giguere, Yasaman Soudagar, Alain Villeneuve, Joseph Salhany, Youngjae Kim, Alexandre Dupuis, Bryan Bourgoyne, Genia Photonics Inc. (Canada); Douglas J. Bamford, Physical Sciences Inc. (USA). . . . . [8733-14]

2:40 pm: **Performance and reliability of quantum cascade lasers**, Tanya L. Myers, Bret D. Cannon, Matthew S. Taubman, Bruce E. Bernacki, Pacific Northwest National Lab. (USA) . . . . . [8733-12]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

SESSION 4

Room: Conv. Ctr. 346 . . . . . Tue 3:40 pm to 4:40 pm

Bulk Solid State Lasers

Session Chair: **Fabio Di Teodoro,** The Aerospace Corp. (USA)

3:40 pm: **Rare-earth ions doped PTR glass DBR laser**, Aleksandr Ryasnyanskiy, OptiGrate Corp. (USA); Nikolai Vorobiev, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Vadim Smirnov, OptiGrate Corp. (USA); Julien Lumeau, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Larissa Glebova, Oleksiy Mokhun, Christine Spiegelberg, OptiGrate Corp. (USA); Michael A. Krainak, NASA Goddard Space Flight Ctr. (USA); Alexei Glebov, OptiGrate Corp. (USA); Leonid Glebov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [8733-18]

4:00 pm: **Spectroscopic analysis of efficient laser material Ho^{3+}:YVO_4**, Zackery Fleischman, Larry D. Merkle, George A. Newburgh, Mark Dubinskii, U.S. Army Research Lab. (USA) . . . . . [8733-17]

4:20 pm: **Er-doped sesquioxides for 1.5-micron lasers: spectroscopic comparisons**, Larry D. Merkle, Nikolay Ter-Gabrielyan, U.S. Army Research Lab. (USA) . . . . . [8733-19]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Ray matrix approach for the analysis of optical-axis perturbation in nonplanar ring resonators based on appropriate coordinate system, Meixiong Chen, Jie Yuan, Xingwu Long, Zhenglong Kang, Yingying Li, National Univ. of Defense Technology (China) . . . . . [8733-38]

Simulation of atmospheric turbulence compensation through piston-only phase control of a laser phased array, Jack E. McCrae Jr., Noah R. Van Zandt, Salvatore J. Cusumano, Steven T. Fiorino, Air Force Institute of Technology (USA) . . . . . [8733-39]

Experimental evaluation and performance optimization of a flash lamp pumped er: glass laser system over temperature extremes, Sachendra K. Shrivastava, Lokesh Soni, Ravindra Y. Chaudhari, Bharat Electronics Ltd. (India). . . . . [8733-40]

Compact passively mode-locked fiber laser near 1.55 µm with low timing jitter of 8 fs, Kan Wu, Perry Ping Shum, Nanyang Technological Univ. (Singapore) . . . . . [8733-35]

Wednesday 1 May

SESSION 5
Room: Conv. Ctr. 346 . . . . . .Wed 8:40 am to 10:00 am

Fiber Lasers (Continuous Wave)

Session Chair: **Iyad Dajani,** Air Force Research Lab. (USA)

8:40 am: **Stimulated Brillouin scattering in optical fibers excited by broad-band pump waves in the presence of feedback**, Mark S. Bowers, Robert Afzal, Lockheed Martin Aculight (USA) . . . . . [8733-21]

9:00 am: **High power modal instability measurements of very large mode area (VLMA) step index fibers**, Doruk Engin, Wei Lu, Horacio Verdun, Shantanu Gupta, Fibertek, Inc. (USA) . . . . . [8733-22]

9:20 am: **Analytical and numerical studies of modal instabilities in high-power fiber amplifiers**, Shadi A. Naderi, Iyad Dajani, Craig Robin, Timothy Madden, Air Force Research Lab. (USA) . . . . . [8733-23]

9:40 am: **Highly efficient resonantly pumped Er:YAG large area channel waveguide laser with diffraction limited output**, Nikolay Ter-Gabrielyan, Viktor Fromzel, Mark Dubinskii, U.S. Army Research Lab. (USA); Xiaodong Mu, Helmuth E. Meissner, Onyx Optics Inc. (USA) . . . . . [8733-20]

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

SESSION 6
Room: Conv. Ctr. 346 . . . . . .Wed 10:30 am to 12:10 pm

Advanced Laser Component Development I

Session Chair: **Christopher S. Washer,**
High Energy Laser Joint Technology Office (USA)

10:30 am: **Optimizing laser performance in Er and Yb codoped phosphate glasses**, Simi A. George, Nathan Carlie, Mark Davis, Joseph S. Hayden, Matthew Roth, Eric H. Urruti, SCHOTT North America, Inc. (USA) . . . . . [8733-26]

10:50 am: **Intrinsically-low Brillouin gain optical fibers**, Peter D. Dragic, Univ. of Illinois at Urbana-Champaign (USA); John Ballato, Stephanie Morris, Thomas Hawkins, Clemson Univ. Research Foundation (USA) . . . . . [8733-27]

11:10 am: **Recent progress in ceramic YAG cladding technology for fiber laser applications**, HeeDong Lee, Brian Sirn, Ii-Seok Park, UES, Inc. (USA) . . . [8733-28]

11:30 am: **Synthesis and spectroscopic properties of Nd^{3+} and Er^{3+}:MgO ceramics,** Tigran Sanamyan, Anthony C. Sutorik, Christopher Cooper, Gary A. Gilde, Mark. Dubinskii, U.S. Army Research Lab. (USA). . . . . [8733-29]

11:50 am: **Melt growth and equilibria of cesium germanium chloride**, Nicholas J. Condon, Steven R. Bowman, Shawn O'Connor, U.S. Naval Research Lab. (USA) . . . . . [8733-25]

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

SESSION 7
Room: Conv. Ctr. 346 . . . . . Wed 1:30 pm to 3:20 pm

Advanced Laser Component Development II

Session Chair: **Steven R. Bowman,** U.S. Naval Research Lab. (USA)

1:30 pm: **New nonlinear optical crystals for power-scalable mid-IR lasers** *(Invited Paper)*, Peter G. Schunemann, BAE Systems (USA) . . . . . [8733-34]

2:00 pm: **M2 and power in the bucket measurements of the beams diffracted by volume Bragg gratings**, Christopher Lantigua, Julien Lumeau, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Vadim Smirnov, OptiGrate Corp. (USA); Leonid Glebov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [8733-31]

2:20 pm: **Coilable single crystal fibers of doped YAG for high power laser applications**, Gisele Maxwell, Nazila Soleimani, Bennett Ponting, Shasta Crystals (USA) . . . . . [8733-32]

2:40 pm: **Advances in semiconductor core optical fibers**, John Ballato, Advanced Materials Ctr. (USA); Stephanie Morris, Thomas Hawkins, Clemson Univ. Research Foundation (USA) . . . . . [8733-50]

3:00 pm: **Recent advancements in transparent ceramics and crystal fibers for high power lasers**, Woohong R. Kim, U.S. Naval Research Lab. (USA); Catalin Florea, Sotera Defense Solutions, Inc. (USA); Colin Baker, Guillermo Villalobos, Daniel Gibson, Brandon Shaw, Steven R. Bowman, Shawn O'Connor, Shyam S. Bayya, U.S. Naval Research Lab. (USA); Bryan Sadowski, Sotera Defense Solutions, Inc. (USA); Michael Hunt, Univ. Research Foundation (USA); Ish D. Aggarwal, Sotera Defense Solutions, Inc. (USA); Jasbinder S. Sanghera, U.S. Naval Research Lab. (USA) . . . . . [8733-30]

Coffee Break . . . . . Wed 3:20 pm to 4:00 pm

SESSION 8
Room: Conv. Ctr. 346 . . . . . Wed 4:00 pm to 5:30 pm

Fiber Lasers (Mid-IR, Pulsed, and Tunable)

Session Chair: **Fabio Di Teodoro,** The Aerospace Corp. (USA)

4:00 pm: **Recent progress towards efficient and powerful fibre laser emission at 3 µm** *(Invited Paper)*, Stuart D. Jackson, Darren D. Hudson, The Univ. of Sydney (Australia). . . . . [8733-49]

4:30 pm: **Tunable fiber laser with external transverse chirped Bragg grating as an output coupler**, Aleksandr Ryasnyanskiy, OptiGrate Corp. (USA); Nikolai Vorobiev, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Vadim Smirnov, Larissa Glebova, Oleksiy Mokhun, Eugeniu Rotari, Alexei Glebov, OptiGrate Corp. (USA); Leonid Glebov, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA) . . . . . [8733-36]

4:50 pm: **High-efficiency, high-pulse energy fiber laser system**, Mark S. Bowers, Jason Henrie, Megan Garske, Dan Templeman, Robert Afzal, Lockheed Martin Aculight (USA) . . . . . [8733-37]

5:10 pm: **Enhanced power scaling potential for solid state and fiber laser systems incorporating anti-reflection microstructures**, Douglas S. Hobbs, Bruce D. MacLeod, Ernest Sabatino III, TelAztec LLC (USA) . . . . . [8733-33]

Active and Passive Signatures IV

Conference Chairs: **G. Charmaine Gilbreath,** U.S. Naval Research Lab. (USA); **Chadwick Todd Hawley,** Senior Intelligence Expert for Signatures (USA)

Program Committee: **Kelly W. Bennett,** U.S. Army Research Lab. (USA); **Carlos Omar Font,** U.S. Naval Research Lab. (USA); **Herbert J. Mitchell,** Naval Postgraduate School (USA); **Joseph E. Peak,** U.S. Naval Research Lab. (USA); **Frank Pipitone,** U.S. Naval Research Lab. (USA); **Carl Salvaggio,** Rochester Institute of Technology (USA); **Noriko Satake M.D.,** UC Davis Medical Ctr. (USA)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 322 . . . . . Wed 1:20 pm to 3:00 pm

Micro-doppler Radar I

Joint Session between Conferences 8714 and 8734

Session Chairs: **David Tahmoush,** U.S. Army Research Lab. (USA); **Ram M. Narayanan,** The Pennsylvania State Univ. (USA)

1:20 pm: **Micro-doppler and vibrometry at millimeter and submillimeter wavelengths**, Duncan A. Robertson, Scott L. Cassidy, Univ. of St. Andrews (United Kingdom) . . . . . [8714-15]

1:40 pm: **Initial measurements of the angular velocity of walking humans using an active millimeter-wave correlation interferometer**, Kojo S. Zilevu, Jeffrey A. Nanzer, Johns Hopkins Univ. Applied Physics Lab. (USA); Kelly L. Kammerman, Syracuse Univ. (USA) . . . . . [8714-17]

2:00 pm: **Simulation and signal processing of through wall UWB radar for human being's periodic motions detection**, Jing Li, Delaware State Univ. (USA) . . . . . [8734-1]

2:20 pm: **Micro-range micro-doppler for dismount classification**, David Tahmoush, U.S. Army Research Lab. (USA) . . . . . [8714-16]

2:40 pm: **Wideband radar micro-doppler applications**, David Tahmoush, U.S. Army Research Lab. (USA) . . . . . [8734-2]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 2

Room: Conv. Ctr. 322 . . . . . Wed 3:40 pm to 5:20 pm

Micro-doppler Radar II

Joint Session between Conferences 8714 and 8734

Session Chair: **Ram M. Narayanan,** The Pennsylvania State Univ. (USA)

3:40 pm: **Micro-doppler radars for human gait analysis using joint range-time-frequency representation**, Aly E. Fathy, Yazhou Wang, The Univ. of Tennessee Knoxville (USA) . . . . . [8734-3]

4:00 pm: **A measurement approach based on micro-doppler maps for signature and motion analysis**, Roberto Ricci, Alessandro Sona, Univ. degli Studi di Padova (Italy) . . . . . [8734-4]

4:20 pm: **An image-based approach for classification of human micro-doppler radar signatures**, Fok Hing Chi Tivive, Abdesselam Bouzerdoum, Son Lam Phung, Univ. of Wollongong (Australia) . . . . . [8734-5]

4:40 pm: **Radar classification of human motions under various training scenarios**, Dustin P. Fairchild, Ram M. Narayanan, The Pennsylvania State Univ. (USA) . . . . . [8734-6]

5:00 pm: **Multi-aspect angle classification of human radar signatures**, Cesur Karabacak, TOBB Univ. of Economics and Technology (Turkey); Sevgi Z. Gurbuz, TOBB Univ. of Economics and Technology (Turkey) and TÜBITAK UZAY (Turkey); Mehmet B. Guldogan, Turgut Özal Univ. (Turkey); Ali Cafer Gurbuz, TOBB Univ. of Economics and Technology (Turkey) . . . . . [8734-7]

Thursday 2 May

SESSION 3

Room: Conv. Ctr. 322 . . . . . Thu 8:20 am to 10:00 am

Spectral Signatures I

Session Chair: **Autumn Williams-Bess,** CACI International Inc. (USA)

8:20 am: **Applications of composite signatures for natural disasters 2.0**, Chadwick Todd Hawley, National Signature Program (USA) . . . . . [8734-13]

8:40 am: **Challenges in multimodal spectral tracking**, Mark A. Sartor, RDIS, LLC (USA) . . . . . [8734-32]

9:00 am: **Image and signal processing algorithm performance in the Cloud**, Kelly W. Bennett, U.S. Army Research Lab. (USA); James Robertson, Clearhaven Technologies LLC (USA) . . . . . [8734-10]

9:20 am: **Amplification of radar and lidar signatures using quantum sensors**, Marco O. Lanzagorta, U.S. Naval Research Lab. (USA) . . . . . [8734-11]

9:40 am: **A probabilistic model for simulating the effect of airborne dust on ground-based LIDAR**, Christopher Goodin, Phillip J. Durst, U.S. Army Engineer Research and Development Ctr. (USA); Zachary Prevost, Univ. of Mississippi (USA); Patrick Compton, U.S. Air Force Academy (USA). . . . . [8734-9]

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

SESSION 4

Room: Conv. Ctr. 322 . . . . . Thu 10:30 am to 12:00 pm

Spectral Signatures II

Session Chair: **Carlos O. Font,** U.S. Naval Research Lab. (USA)

10:30 am: **Multimodal contributions for volumetric object and scene recovery** *(Invited Paper)*, Charmaine Gilbreath, U.S. Naval Research Lab. (USA); Chadwick Todd Hawley, National Signature Program (USA). . . . . [8734-35]

11:00 am: **Approaches to modeling composite signatures**, Beverly Richardson, TASC, Inc. (USA) . . . . . [8734-14]

11:20 am: **Raman albedo and deep-UV resonance Raman signatures of explosives**, Balakishore Yellampalle, Brian E. Lemoff, West Virginia High Technology Consortium Foundation (USA). . . . . [8734-15]

11:40 am: **Infrared enhanced detection for laser imaging and biometrics**, Martin U Pralle, SiOnyx, Inc (USA); J Carey, SiOnyx (USA); Homayoon Haddad, SiOnyx, Inc (USA) . . . . . [8734-31]

Lunch Break . . . . . Thu 12:00 pm to 1:20 pm

SESSION 5

Room: Conv. Ctr. 322 . . . . . Thu 1:20 pm to 3:00 pm

Human Signatures I

Session Chair: **Kelly W. Bennett,** U.S. Army Research Lab. (USA)

1:20 pm: **Significance test with data dependency in speaker recognition evaluation**, Jin Chu Wu, Alvin F. Martin, Craig S. Greenberg, Raghu N. Kacker, Vincent M. Stanford, National Institute of Standards and Technology (USA) . . . . . [8734-16]

1:40 pm: **Active-SWIR signatures for long-range night/day human detection and identification**, Robert B. Martin, Mikhail Sluch, Kristopher M. Kafka, Robert V. Ice, Brian E. Lemoff, West Virginia High Technology Consortium Foundation (USA) . . . . . [8734-17]

2:00 pm: **On the use of Hough transform in an ultrasound measurement system for human signature analysis**, Roberto Ricci, Alessandro Sona, Univ. degli Studi di Padova (Italy) . . . . . [8734-18]

2:20 pm: **An inverse-kinematic appraoch using Groebner basis theory applied to gait cycle analysis**, Kimberly Kendricks, Central State Univ. (USA); Anum Barki, Ronald F. Tuttle, David J. Bunker, Christoph C. Borel, Air Force Institute of Technology (USA) . . . . . [8734-22]

2:40 pm: **Preview of the newly acquired NVESD-ARL multimodal face database**, Kenneth A. Byrd, U.S. Army Night Vision & Electronic Sensors Directorate (USA) . . . . . [8734-34]

Coffee Break . . . . . Thu 3:00 pm to 3:20 pm

SESSION 6

Room: Conv. Ctr. 322 . . . . . Thu 3:20 pm to 4:20 pm

Human Signatures II

Session Chair: **Charmaine Gilbreath,** U.S. Naval Research Lab. (USA)

3:20 pm: **Reflectance measurements of human skin from the ultraviolet to the shortwave infrared (250 nm to 2500 nm)**, David W. Allen, Catherine A. Cooksey, National Institute of Standards and Technology (USA) . . . . . [8734-20]

3:40 pm: **Unmixing hyperspectral skin data using non-negative matrix factorization**, Asif Mehmood, Jeffrey D. Clark, Air Force Institute of Technology (USA) . . . . . [8734-19]

4:00 pm: **Multimodal gait signatures and motion studies**, Christoph C. Borel, David J. Bunker, Ronald F. Tuttle, Anum Barki, Air Force Institute of Technology (USA); Charmaine Gilbreath, U.S. Naval Research Lab. (USA) . . . . . [8734-21]

SESSION 7

Room: Conv. Ctr. 322 . . . . . Thu 4:20 pm to 5:40 pm

Materials

Session Chair: **Chadwick Todd Hawley,**
National Signature Program (USA)

4:20 pm: **Influence of surface of explosive on its detection and identification using the SDA method for analysis of the reflected THz signal**, Vyacheslav A. Trofimov, Svetlana A. Varentsova, Lomonosov Moscow State Univ. (Russian Federation); Mieczyslaw Szustakowski, Norbert Palka, Military Univ. of Technology (Poland) . . . . . [8734-23]

4:40 pm: **Active-mode standoff IR sensing of explosives: angular dependence, LOD values, and substrates**, Carlos A. Ortega-Zúñiga, Nataly Y. Galán-Freyle, John R. Castro-Suarez, Leonardo C. Pacheco-Londoño, Samuel P. Hernandez-Rivera, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8734-24]

5:00 pm: **Passive RF imaging: transparent urban structures**, Thomas Carpenter, CACI International Inc. (USA) . . . . . [8734-25]

5:20 pm: **An evaluation of electric field sensors for small-arms bullet detection**, Cassandra A. Browning, Stephen J. Vinci, David M. Hull, U.S. Army Research Lab. (USA); Maciej A. Noras, The Univ. of North Carolina at Charlotte (USA) . . [8734-33]

Head- and Helmet-Mounted Displays XVIII: Design and Applications

Conference Chairs: **Peter L. Marasco,** Air Force Research Lab. (USA); **Paul R. Havig,** Air Force Research Lab. (USA); **Michael P. Browne,** SA Photonics (USA); **James E. Melzer,** Rockwell Collins Optronics (USA)

Program Committee: **Randall E. Bailey,** NASA Langley Research Ctr. (USA); **Sion Jennings,** National Research Council Canada (Canada)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 314 . . . . . .Wed 8:20 am to 10:00 am

HMD Components

Session Chair: **James E. Melzer,** Rockwell Collins Optronics (USA)

8:20 am: **Scorpion hybrid-optical-based inertial tracker (HObIT)**, Robert Atac, Eric Foxlin, Gentex Corp. (USA) . . . . . [8735-1]

8:40 am: **De-interlacing: a helmet-mounted display application perspective**, Erkan Yavuz, Ismail Ozsarac, ASELSAN Inc. (Turkey) . . . . . [8735-3]

9:00 am: **Novel method for characterization and compensation for canopy distortion over a large head-box**, Robert Atac, Mark Edel, Gentex Corp. (USA) . . . . . [8735-4]

9:20 am: **Dynamic sunlight filter (DSF) for HMD: controlling background illumination in a passive way**, Ariela Donval, Noam Gross, Eran Partouche, Ido E. Dotan, Ofir Lipman, Moshe Oron, KiloLambda Technologies, Ltd. (Israel). . [8735-6]

9:40 am: **Sampled MTF of fused fiber optic components and bonded assemblies**, Thomas E. Carter, SCHOTT Lighting and Imaging (USA) . . . [8735-18]

Coffee/Exhibition Break. . . . . Wed 10:00 am to 11:00 am

SESSION 2

Room: Conv. Ctr. 314 . . . . . .Wed 11:00 am to 12:10 pm

Human Factors for HMDs

Session Chair: **James E. Melzer,** Rockwell Collins Optronics (USA)

11:00 am: **Insight into vergence/accommodation mismatch** *(Invited Paper)*, Martin S. Banks, Univ. of California, Berkeley (USA) . . . . . [8735-7]

11:30 am: **Testing and evaluation of a wearable augmented reality system for natural outdoor environments,** David C. Roberts, Alberico Menozzi, James Cook, Todd Sherrill, Stephen Snarski, Patrick Russler, Brian Clipp, Robert Karl, Eric Wenger, Matthew Bennett, Jennifer Mauger, William Church, Herman Towles, Stephen MacCabe, Jeffrey Webb, Jasper Lupo, Applied Research Associates, Inc. (USA); Jan-Michael Frahm, The Univ. of North Carolina at Chapel Hill (USA); Enrique Dunn, The Univ. of North Carolina at Chapel Hill (USA); Christopher Leslie, Univ. of North Carolina Chapel-Hill (USA); Greg Welch, Univ. of Central Florida (USA). . . . . [8735-11]

11:50 am: **Investigation of rotary wing pilot cueing and helmet mounted display symbology for increased pilot situational awareness in a degraded visual environment.**, Bradley M. Davis, U.S. Army Research Lab. (USA); Jared J. Sapp, U.S. Army Research Lab. (USA) and US U.S. Army Armament Research, Development and Engineering Ctr. (USA); Michael S. Jessee, Anthony W. Morris, U.S. Army Research Lab. (USA); James J. Hauser, Mark A. Salverson, Product Manager Air Warrior (USA) . . . . . [8735-8]

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

SESSION 3

Room: Conv. Ctr. 314 . . . . . Wed 1:40 pm to 3:10 pm

Systems Perspectives

Session Chair: **Michael P. Browne,** SA Photonics (USA)

1:40 pm: **Advancements in HMD technology: the DARPA-sponsored SCENICC program** *(Invited Paper)*, Randall Sprague, Innovega Inc. (USA) . . . . . [8735-12]

2:10 pm: **HMD digital night vision system for fixed wing fighters**, Bobby D. Foote, Rockwell Collins, Inc. (USA). . . . . [8735-13]

2:30 pm: **Advances and trends of head-up displays systems in land vehicles**, J. Alejandro Betancur Ramírez, Alejandro Mejía, Felipe Cadavid, Univ. EAFIT (Colombia) . . . . . [8735-14]

2:50 pm: **Optical see-through head-mounted display with occlusion capability**, Chunyu Gao, Augmented Vision, Inc. (USA); Hong Hua, Yuxiang Lin, College of Optical Sciences, The Univ. of Arizona (USA). . . . . [8735-15]

Display Technologies and Applications for Defense, Security, and Avionics VII

Conference Chairs: **Daniel D. Desjardins,** Consultant (USA); **Kalluri R. Sarma,** Honeywell Technology (USA)

Program Committee: **Hari M. Atkuri,** Gamma Dynamics (USA); **James C. Byrd,** Consultant (USA); **Jerome Conway,** L-3 Display Systems (USA); **Joseph L. Cox,** Missile Defense Agency (USA); **Reginald Daniels,** Air Force Research Lab. (USA); **Steven D. Harbour,** U.S. Air Force (USA); **Gary W. Jones,** NanoQuantum Sciences, Inc. (USA); **Gail M. Nicholson,** Naval Surface Warfare Ctr. Crane Div. (USA); **Robert D. Seinfeld,** Astronautics Corp. of America (USA); **Joe Tchon,** Rockwell Collins, Inc. (USA); **Paul L. Wisely,** Aardvark Aerospace, Ltd. (United Kingdom)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 345 . . . . . Thu 8:30 am to 10:10 am

Display Ergonomics and Human Factors

Session Chair: **Daniel D. Desjardins,** Consultant (USA)

8:30 am: **A SWIR radiance model for cockpit instrumentation** *(Invited Paper)*, John Green, Tim Robinson, Esterline Control Systems (USA) . . . . . [8736-1]

9:00 am: **Task analysis modeling to improve sensor and display system design**, Gail M. Nicholson, Tanya Geiersbach, Naval Surface Warfare Ctr. Crane Div. (USA) . . . . . [8736-4]

9:20 am: **Towards a metric of antialiasing sufficiency for stereoscopic displays**, Charles J. Lloyd, Visual Performance, LLC (USA). . . . . [8736-19]

9:40 am: **Neuroergonomic methods to identify cockpit display improvements** *(Invited Paper)*, Steven D. Harbour, U.S. Air Force (USA); James C. Christensen, Air Force Research Lab. (USA). . . . . [8736-5]

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

SESSION 2

Room: Conv. Ctr. 345 . . . . . Thu 10:40 am to 12:20 pm

Display Algorithms and Information Management

Session Chair: **Joe Tchon,** Rockwell Collins, Inc. (USA)

10:40 am: **An innovative algorithm for panoramic representation in observation systems** *(Invited Paper)*, Cristian Luison, Valeria Aquilanti, Altran Italy S.p.A. (Italy); Aldo Riccobono, Claudio Liberace, SELEX Galileo S.p.A. (Italy) . . . . . [8736-6]

11:10 am: **Design of graphics display manager (GDM) software for naval combat management systems (CMS)**, Tushar K. Patra, Kranti Lal, Deepika Gupta, Bharat Electronics Ltd. (India) . . . . . [8736-7]

11:30 am: **A low-bandwidth graphical user interface for high-speed triage of potential items of interest in visual imagery**, David J. Huber, Yang Chen, Deepak Khosla, Kevin Martin, HRL Labs., LLC (USA) . . . . . [8736-8]

11:50 am: **Testing a collision avoidance display with high-precision navigation** *(Invited Paper)*, Niklas Peinecke, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Maarten Uijt de Haag, Pengfei Duan, Ohio Univ. (USA); Rene Küppers, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); Bram Beernink, Technische Univ. Delft (Netherlands) . . . . . [8736-9]

Lunch Break . . . . . Thu 12:20 pm to 1:50 pm

SESSION 3

Room: Conv. Ctr. 345 . . . . . Thu 1:50 pm to 3:20 pm

Body-Worn and Man-Portable Displays

Session Chair: **Kalluri R. Sarma,** Honeywell Technology (USA)

1:50 pm: **Advances in liquid crystal on silicon (LCOS) spatial light modulator technology** *(Invited Paper)*, William P. Bleha Jr., Lijuan A. Lei, HOLOEYE Systems Inc. (USA). . . . . [8736-10]

2:20 pm: **Precision guided firearms: man portable, networked sensor systems that track and engage point targets at extended ranges**, Jason Schauble, Bret Boyd, TrackingPoint, Inc. (USA) . . . . . [8736-11]

2:40 pm: **High brightness AMLCD overlay displays in man portable applications**, Timothy J. Edwards, Timothy Hogan, Kopin Corp. (USA) . . [8736-12]

3:00 pm: **Development of a spacesuit helmet mounted display testbed system**, Daryl J. Schuck, Honeywell International Inc. (USA). . . . . [8736-13]

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

SESSION 4

Room: Conv. Ctr. 345 . . . . . Thu 3:50 pm to 4:50 pm

Head-Up Displays

Session Chair: **Paul L. Wisely,** Aardvark Aerospace, Ltd. (United Kingdom)

3:50 pm: **The use of optical waveguides in head up display (HUD) applications**, Malcolm G. Homan, BAE Systems (United Kingdom). . . . . [8736-14]

4:10 pm: **Integration of head-up display systems in automobile industry: a generalized application approach**, J. Alejandro Betancur Ramírez, Alejandro Mejía, Univ. EAFIT (Colombia); Gilberto Osorio, Universidad EAFIT (Colombia) . . . . . [8736-15]

4:30 pm: **Head up and eyes out: advances in head-mounted displays capabilities**, Alexander A. Cameron, BAE Systems (United Kingdom) . . . [8736-22]

SESSION 5

Room: Conv. Ctr. 345 . . . . . Thu 4:50 pm to 5:10 pm

Display Innovations

Session Chair: **Gary W. Jones,** NanoQuantum Sciences, Inc. (USA)

4:50 pm: **Bio-inspired adaptive color arrays**, Richard Fu, Eric Forsythe, Steven Blomquist, Eric Wetzel, U.S. Army Research Lab. (USA) . . . . . [8736-17]

CLOSING REMARKS

Room: Conv. Ctr. 345 . . . . . Thu 5:10 pm to 5:20 pm

Degraded Visual Environments: Enhanced, Synthetic, and External Vision Solutions 2013

Conference Chairs: **Kenneth L. Bernier,** The Boeing Co. (USA); **Jeff J. Güell,** The Boeing Co. (USA)

Program Committee: **Jarvis J. Arthur III,** NASA Langley Research Ctr. (USA); **Thorsten W. Eger,** German School of Army Aviation (Germany); **Christian Pschierer,** Jeppesen GmbH (Germany); **Carlo L. Tiana,** Aireyes, Inc. (USA); **Maarten Uijt de Haag,** Ohio Univ. (USA)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 328 . . . . . Thu 8:20 am to 10:00 am

DVE Systems

Session Chair: **Carlo L. Tiana,** Aireyes, Inc. (USA)

8:20 am: **Enhancing old helicopters search and rescue capabilities through using synthetic vision system (SVS)**, Karim A. Fouad, Egyptian Air Force (Egypt) . . . . . [8737-1]

8:40 am: **Operational requirements for helicopter operations low level in degraded visual environment**, Thorsten W. Eger, German School of Army Aviation (Germany) . . . . . [8737-3]

9:00 am: **Sensor supported pilot assistance for H/C flight in DVE**, Tim Waanders, Eurocopter Deutschland GmbH (Germany); Thomas R. Muensterer, Martin J. Kress, Cassidian (Germany) . . . . . [8737-4]

9:20 am: **Vision assisted aircraft lateral navigation**, Mohamed Ibrahim Mohideen, Honeywell Technology Solutions Lab (India); Peter Seiler, Univ. of Minnesota (USA); Dinesh Ramegowda, HCL Technologies Ltd (India) . . . . . [8737-5]

9:40 am: **Helicopter synthetic-vision-based DVE processing for all phases of flight**, Patrick L. OBrien, David Baughman, Honeywell, Inc. (USA); Bruce Wallace, Defense Advanced Research Projects Agency (USA). . . . . [8737-6]

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

SESSION 2

Room: Conv. Ctr. 328 . . . . . Thu 10:30 am to 12:10 pm

DVE Displays

Session Chairs: **Jarvis J. Arthur III,** NASA Langley Research Ctr. (USA); **Jeff J. Güell,** The Boeing Co. (USA)

10:30 am: **Enhanced vision presentation in a commercial cockpit for low-visibility surface operations**, Jarvis J. Arthur III, NASA Langley Research Ctr. (USA); Robert M. Norman, The Boeing Co. (USA); Lynda J. Kramer, Lawerence J. Prinzel III, Kyle K. Ellis, NASA Langley Research Ctr. (USA); Stephanie Harrison, Virginia Polytechnic Institute and State Univ. (USA); James R. Comstock, NASA Langley Research Ctr. (USA). . . . . [8737-7]

10:50 am: **Degraded environment enhanced pilotage**, Trevor L. Bushell, Raytheon Network Centric Systems (USA) . . . . . [8737-8]

11:10 am: **Fused sensor image display for degraded visual environment**, Carlo L. Tiana, Rockwell Collins, Inc. (USA); Keith W. Alter, xVS, LLC (USA); Chris Holser, Aireyes, Inc. (USA); Joy Matsumo

oto, Monterey Technologies, Inc. (USA) . . . . . [8737-9]

11:30 am: **Sensor-based 3D conformal cueing for safe and reliable HC operation specifically for landing in DVE**, Thomas R. Muensterer, Martin J. Kress, Stephanus Klasen, Cassidian (Germany) . . . . . [8737-10]

11:50 am: **Contribution of TopOwl head mounted display system in degraded visual environments**, Olivier Lemoine, Jean-Michel François, Laurent Ducruet, Eric Gaulué, Thales Avionics S.A. (France). . . . . [8737-11]

Lunch Break . . . . . Thu 12:10 pm to 1:20 pm

SESSION 3

Room: Conv. Ctr. 328 . . . . . Thu 1:20 pm to 3:00 pm

DVE Sensing and Processing I

Session Chairs: **Maarten Uijt de Haag,** Ohio Univ. (USA); **Thorsten W. Eger,** German School of Army Aviation (Germany)

1:20 pm: **Increasing situational awareness in DVE with advanced synthetic vision**, Tobias Schafhitzel, Michael Hoyer, EADS Deutschland GmbH (Germany) . . . . . [8737-12]

1:40 pm: **Investigations on intense solar exposure and recovery of long-wave infrared sensors**, Carlo L. Tiana, Gary B. Kingsley, Daniel J. Henry, Gladys Yanez, Rockwell Collins, Inc. (USA) . . . . . [8737-13]

2:00 pm: **Characterization of the OPAL obscurant penetrating LiDAR in various degraded visual environments**, Evan Trickey, Philip M. Church, Neptec Design Group Ltd. (Canada); Gilles A. Roy, Simon Roy, Defence Research and Development Canada, Valcartier (Canada); Xiaoying Cao, Neptec Design Group Ltd. (Canada) . . . . . [8737-14]

2:20 pm: **Real-time passive millimeter-wave imaging for brownout mitigation**, Christopher A. Schuetz, Richard D. Martin, Thomas E. Dillon, Daniel Mackrides, John P. Wilson, Phase Sensitive Innovations, Inc. (USA); James Bonnett, Petersen F. Curt, EM Photonics, Inc. (USA); Charles Harrity, Alicia Zablocki, Phase Sensitive Innovations, Inc. (USA); Dennis W. Prather, Univ. of Delaware (USA). . . . . [8737-15]

2:40 pm: **MMW radar enhanced vision systems: the helicopter autonomous landing system (HALS) and radar-enhanced vision system (REVS) are rotary and fixed wing enhanced flight vision systems that enable safe flight operations in degraded visual environment.**, Jack Cross, John Schneider, Pete Cariani, Sierra Nevada Corp. (USA) . . . . . [8737-16]

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

SESSION 4

Room: Conv. Ctr. 328 . . . . . Thu 3:30 pm to 5:10 pm

DVE Sensing and Processing II

Session Chairs: **Kenneth L. Bernier,** The Boeing Co. (USA); **Thorsten W. Eger,** German Armed Forces (Germany)

3:30 pm: **Real-time imaging DUSPEN lidar for helicopter situational awareness in DVE**, James T. Murray, Jason Seely, Jeffrey J. Plath, Gregory J. Fetzer, William L. Ryder, Neil R. Van Lieu, Ronald W. Goodwin, Eric Gotfreson, Tyler J. Wagner, Nick Kridler, Chris Melancon, John R. Engel, Ken Panici, Arete Associates (USA) . . . . . [8737-17]

3:50 pm: **Diffusion and normalized cross correlation combined image registration**, Bing Li, Lockheed Martin Systems Integration-Owego (USA)[8737-18]

4:10 pm: **Improvement algorithm for the unfocused image captured by CMOS camera module**, Woonchul Ham, Chonbuk National Univ. (Korea, Republic of). . . . . [8737-19]

4:30 pm: **An adaptive approach for visibility enhancement in aerial imagery**, Numan Unaldi, Suleyman Demirci, Turkish Air Force Academy (Turkey) . . [8737-20]

4:50 pm: **ALLFlight: detection of moving objects in IR and ladar images**, Hans-Ullrich Doehler, Sven Schmerwitz, Niklas Peinecke, Thomas Lueken, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [8737-21]

Monday - Tuesday 29 - 30 April 2013 • Proceedings of SPIE Vol. 8738

Three-Dimensional Imaging, Visualization, and Display 2013

Conference Chairs: **Bahram Javidi,** Univ. of Connecticut (USA); **Jung-Young Son,** Konyang Univ. (Korea, Republic of)

Conference Co-Chairs: **Manuel Martinez-Corral,** Univ. de València (Spain); **Wolfgang Osten,** Univ. Stuttgart (Germany); **Fumio Okano,** NHK Engineering Services, Inc. (Japan)

Program Committee: **Arun Anand,** Maharaja Sayajirao Univ. of Baroda (India); **Michael T. Eismann,** Air Force Research Lab. (USA); **Pietro Ferraro,** Istituto Nazionale di Ottica (Italy); **Toshiaki Fujii,** Nagoya Univ. (Japan); **Yi-Pai Huang,** National Chiao Tung Univ. (Taiwan); **Naomi Inoue,** National Institute of Information and Communications Technology (Japan); **Jinwoong Kim,** Electronics and Telecommunications Research Institute (Korea, Republic of); **Osamu Matoba,** Kobe Univ. (Japan); **Takanori Nomura,** Wakayama Univ. (Japan); **Thomas J. Naughton,** National Univ. of Ireland, Maynooth (Ireland); **Min-Chul Park,** Korea Institute of Science and Technology (Korea, Republic of); **Adrian Stern,** Ben-Gurion Univ. of the Negev (Israel); **Chao-Hsu Tsai,** Industrial Technology Research Institute (Taiwan); **Kenji Yamamoto,** National Institute of Information and Communications Technology (Japan); **Sumio Yano,** NHK Science & Technical Research Labs. (Japan); **Zeev Zalevsky,** Bar-Ilan Univ. (Israel)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 345 . . . . . .Mon 8:30 am to 10:00 am

Devices for 3D Imaging

Session Chairs: **Jung-Young Son,** Konyang Univ. (Korea, Republic of); **Bahram Javidi,** Univ. of Connecticut (USA)

8:30 am: **Is augmented reality glass a reality?** *(Invited Paper)*, Hong Hua, College of Optical Sciences, The Univ. of Arizona (USA). . . . . [8738-1]

9:00 am: **Flickerless 3D shutter glasses for full-resolution stereoscopic display** *(Invited Paper)*, Dae-Sik Kim, SAMSUNG Electronics Co., Ltd. (Korea, Republic of); Ho-Sup Lee, Sergey Chestak, Samsung Digital City (Korea, Republic of) . . [8738-2]

9:30 am: **Liquid crystal lens for axially distributed three-dimensional sensing** *(Invited Paper)*, Yi-Pai Huang, Chih-Wei Chen, National Chiao Tung Univ. (Taiwan); Myungjin Cho, Hankyong National Univ. (Korea, Republic of); Bahram Javidi, Univ. of Connecticut (USA). . . . . [8738-3]

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

SESSION 2

Room: Conv. Ctr. 345 . . . . . .Mon 10:30 am to 11:50 am

3D Image Processing I

Session Chair: **Hong Hua,** College of Optical Sciences, The Univ. of Arizona (USA)

10:30 am: **Global view and depth (GVD) format for FTV/3DTV** *(Invited Paper)*, Masayuki Tanimoto, Kazuyoshi Suzuki, Nagoya Industrial Science Research Institute (Japan). . . . . [8738-4]

11:00 am: **Elemental images for integral-imaging display** *(Invited Paper)*, Manuel Martinez-Corral, Adrian Dorado, Anabel Llavador, Genaro Saavedra, Hector Navarro, Univ. de València (Spain); Bahram Javidi, Univ. of Connecticut (USA) . . . . . [8738-5]

11:30 am: **Projection-type 3D display system considering cross-talk between viewing zone**, Hyoung Lee, Yonsei Univ. (Korea, Republic of) and Korea Institute of Science and Technology (Korea, Republic of); Young-Sub Son, Yonsei Univ. (Korea, Republic of); Sung-Kyu Kim, Korea Institute of Science and Technology (Korea, Republic of); Kwang-Hoon Sohn, Yonsei Univ. (Korea, Republic of) . . . . . [8738-14]

Lunch Break . . . . . Mon 11:50 am to 1:30 pm

SESSION 3

Room: Conv. Ctr. 345 . . . . . Mon 1:30 pm to 2:50 pm

Digital Holography I

Session Chair: **Osamu Matoba,** Kobe Univ. (Japan)

1:30 pm: **Usage of moving nanoparticles for improved holographic recording** *(Invited Paper)*, Zeev Zalevsky, Amihai Meiri, Bar-Ilan Univ. (Israel); Eran Gur, Jerusalem College of Engineering (Israel); Javier Garcia, Vicente Micó, Univ. de València (Spain); Bahram Javidi, Univ. of Connecticut (USA). . . . . [8738-8]

2:00 pm: **Identification of malaria-infected RBC with digital holographic microscopy** *(Invited Paper)*, Arun Anand, Vani Chhaniwal, The Maharaja Sayajirao Univ. of Baroda (India); Bahram Javidi, Univ. of Connecticut (USA). . . . . [8738-9]

2:30 pm: **An alternative approach to develop digital hologram interaction system using bounding volumes for identifying object collision**, Sungjin Cho, Korea Photonics Technology Institute (Korea, Republic of) and Korea Institute of Science and Technology (Korea, Republic of); Dong-Su Lee, Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Byeong-Kwon Ju, Korea Univ. (Korea, Republic of); Jung-Young Son, Konyang Univ. (Korea, Republic of) . . . . . [8738-10]

Coffee Break . . . . . Mon 2:50 pm to 3:10 pm

SESSION 4

Room: Conv. Ctr. 345 . . . . . Mon 3:10 pm to 4:50 pm

3D Imaging Systems and Related I

Session Chair: **Yi-Pai Huang,** National Chiao Tung Univ. (Taiwan)

3:10 pm: **Generation of flat viewing zone in DFVZ autostereoscopic multiview 3D display by weighting factor** *(Invited Paper)*, Sung-Kyu Kim, Seon Kyu Yoon, Ki Hyuk Yoon, Korea Institute of Science and Technology (Korea, Republic of) . . . . . [8738-11]

3:40 pm: **Effect of viewing distance on 3D fatigue caused by viewing mobile 3D content** *(Invited Paper)*, Sungchul Mun, Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Sumio Yano, Shimane Univ. (Japan)[8738-12]

4:10 pm: **Expanding the degree of freedom of observation on depth-direction by the triple-separated slanted parallax barrier in autostereoscopic 3D display**, Kwang-Hoon Lee, Korea Photonics Technology Institute (Korea, Republic of); Yeong-Seon Choe, Korea Institute of Science and Techn

nology (Korea, Republic of); Dong-Kil Lee, Yang-Gyu Kim, Youngsik Park, Korea Photonics Technology Institute (Korea, Republic of); Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of) . . . . . [8738-13]

4:30 pm: **Light-intensity simulation in real space by viewing locations for autostereoscopic display design**, Jung Guen Jo, Korea Institute of Science and Technology (Korea, Republic of); Kwang-Hoon Lee, Korea Photonics Technology Institute (Korea, Republic of); Dong-Su Lee, Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Jung-Young Son, Konyang Univ. (Korea, Republic of). . . . . [8738-15]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 345 . . . . . Tue 8:00 am to 10:10 am

Holographic Display

Session Chair: **Manuel Martinez-Corral,** Univ. de València (Spain)

8:00 am: **Study on basic problems in real-time 3D holographic display** *(Invited Paper)*, Yongtian Wang, Jia Jia, Juan Liu, Beijing Institute of Technology (China) . . . . . [8738-16]

8:30 am: **A holographic display based on spatial multiplexing**, Jung-Young Son, Oleksii Chernyshov, Konyang Univ. (Korea, Republic of); Min-chul Park, Korea Institute of Science and Technology (Korea, Republic of); Wookho Son, Beom-Ryeol Lee, Electronics and Telecommunications Research Institute (Korea, Republic of); Jinwoong Kim, Electronics and Telecommunication Research Institute (Korea, Republic of). . . . . [8738-17]

8:50 am: **Computer-generated hologram for 3D scene from multiview images**, Eun-Young Chang, Electronics and Telecommunications Research Institute (Korea, Republic of); Yun-Suk Kang, Gwangju Institute of Science and Technology (Korea, Republic of); KyungAe Moon, Electronics and Telecommunications Research Institute (Korea, Republic of); Yo-Sung Ho, Gwangju Institute of Science and Technology (Korea, Republic of); Jinwoong Kim, Electronics and Institute (Korea, Republic of) . . . . . [8738-18]

9:10 am: **Spherically-arranged piecewise planar hologram for capturing a diffracted-object wavefield in 360 degree**, Seungtaik Oh, Electronics and Telecommunications Research Institute (Korea, Republic of); Hoyong Seo, Electronics and Telecommunication Research Institute (Korea, Republic of); Chi-Young Hwang, Beom-Ryeol Lee, Wookho Son, Electronics and Telecommunications Research Institute (Korea, Republic of) . . . . . [8738-19]

9:30 am: **Holographic 3D display with 1D spatial light modulator with a large pixel number**, Osamu Matoba, Ayaka Ueno, Kouichi Nitta, Kobe Univ. (Japan). . . . . [8738-20]

9:50 am: **A 3D visual conformity with numerical and optical holographic content reconstruction on the stereoscopic holographic display system**, Beom-Ryeol Lee, Chi-Young Hwang, Wookho Son, Electronics and Telecommunications Research Institute (Korea, Republic of); Joonku Hahn, Kyungpook National Univ. (Korea, Republic of); Jung-Young Son, Konyang Univ. (Korea, Republic of). . . . . [8738-21]

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

SESSION 6
Room: Conv. Ctr. 345 . . . . . Tue 10:40 am to 12:10 pm

Digital Holography II

Session Chair: **Adrian Stern,** Ben-Gurion Univ. of the Negev (Israel)

10:40 am: **Observation of femtosecond light pulse propagation by using digital light-in-flight recording by holography** *(Invited Paper)*, Takashi Kakue, Peng Xia, Tatsuki Tahara, Yasuhiro Awatsuji, Kenzo Nishio, Shogo Ura, Toshihiro Kubota, Kyoto Institute of Technology (Japan); Osamu Matoba, Kobe Univ. (Japan) . . . . . [8738-22]

11:10 am: **Evaluation of reconstructed quality in incoherent digital holography** *(Invited Paper)*, Osamu Matoba, Yoshiki Tone, Kouichi Nitta, Kobe Univ. (Japan); Yasuhiro Awatsuji, Kyoto Institute of Technology (Japan) . . . . . [8738-23]

11:40 am: **Synthesis and 3D display of multiwavelength digital holograms through adaptive transformation** *(Invited Paper)*, Pasquale Memmolo, Melania Paturzo, Andrea Finizio, Pietro Ferraro, Istituto Nazionale di Ottica (Italy); Bahram Javidi, Univ. of Connecticut (USA) . . . . . [8738-24]

Lunch/Exhibition . . . . . .Tue 12:10 pm to 1:50 pm

SESSION 7
Room: Conv. Ctr. 345 . . . . . Tue 1:50 pm to 4:30 pm

3D Image Processing II

Session Chair: **Hong Hua,**
College of Optical Sciences, The Univ. of Arizona (USA)

1:50 pm: **3D integral imaging using compressive sensing: an overview** *(Invited Paper)*, Abhijit Mahalanobis, Lockheed Martin Missiles and Fire Control (USA); Bahram Javidi, Univ. of Connecticut (USA). . . . . [8738-25]

2:20 pm: **Compressive sensing for improved depth discrimination in 3D holographic reconstruction** *(Invited Paper)*, Yair Rivenson, Adrian Stern, Ben-Gurion Univ. of the Negev (Israel); Bahram Javidi, Univ. of Connecticut (USA) . . . . . [8738-27]

Coffee Break . . . . . .Tue 2:50 pm to 3:30 pm

3:30 pm: **Advantage of diverging radial type for mobile stereo camera** *(Invited Paper)*, Lee Dong-Su, Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Jung-Young Son, Konyang Univ. (Korea, Republic of). . . . . [8738-28]

4:00 pm: **Information-theoretic metrics for 3D photon-counting integral imaging** *(Invited Paper)*, Majeed Hayat, Srikanth R. Narravula, Matthew P. Pepin, The Univ. of New Mexico (USA); Bahram Javidi, Univ. of Connecticut (USA) . . . . . [8738-29]

SESSION 8
Room: Conv. Ctr. 345 . . . . . Tue 4:30 pm to 5:40 pm

3D Image Processing III

Session Chair: **Seokwon Yeom,** Daegu Univ. (Korea, Republic of)

4:30 pm: **Concealed object segmentation and three-dimensional localization with passive millimeter-wave imaging** *(Invited Paper)*, Seokwon Yeom, Daegu Univ. (Korea, Republic of) . . . . . [8738-30]

5:00 pm: **Three-dimensional polarimetric imaging based on integral-imaging techniques**, Xiao Xiao, Bahram Javidi, Univ. of Connecticut (USA). . . . . [8738-31]

5:20 pm: **Real-time motion artifacts compensation of ToF sensors data on GPU**, Damien Lefloch, Thomas Hoegg, Andreas Kolb, Univ. Siegen (Germany) . . . . . [8738-32]

Best Papers and Best Student Paper Awards Ceremony
Room: Conv. Ctr. 345 . . . . . .Tue 5:40 pm to 5:50 pm

Announcing the 2013 Best Paper Awards in Three-Dimensional Imaging, Visualization, and Display!

Three papers will be selected for the Best Paper Awards among the papers accepted for this conference. One of the three awards will be a Best Student Paper Award, on which a student must be author or co-author. A panel of experts will evaluate all the papers for technical quality and merit. The criteria for evaluation will include: (1) innovation; (2) clarity and quality of the manuscript submitted for publication; and (3) the significance and impact of the work reported. In order to be considered for a Best Paper Award, authors must make their oral presentation and submit their manuscript as scheduled. Conference chairs will not participate in the evaluation process of the papers. All decisions regarding selection of the best papers will be made by an evaluation committee.

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Analysis of three-dimensional image, using Tutte polynomial for polyhedral graphs, Alejandro Gómez Montoya, Univ. EAFIT (Colombia). . . . . [8738-6]

3D profile reconstruction and analysis of liquid crystal lens using fluorescence confocal polarizing microscopy, Yi-Pai Huang, Po-Yuan Hsieh, Lin-Yao Liao, Han-Ping D. Shieh, National Chiao Tung Univ. (Taiwan). . . . . [8738-38]

Recognition of facial expression from variable quality 3D pose data, Manar D. Samad, Khan M. Iftekharuddin, Old Dominion Univ. (USA). . . . . [8738-34]

A new system parameters analysis method to improve image quality in digital microscopic hologram reconstruction, Jiansu Li, Zhao Wang, Jianmin Gao, Kun Chen, Xi'an Jiaotong Univ. (China); Yun Liu, Xi'an Jiaotong Univ. (China) and Xi'an Univ. of Technology (China) . . . . . [8738-33]

Coherent scattering stereoscopic microscopy for mask inspection of extreme ultraviolet lithography, Ki Hyuk Kim, Korea Institute of Science and Technology (Korea, Republic of); Jung Guen Jo, Korea Institute of Science and Technology (Korea, Republic of) and Korea Univ. (Korea, Republic of); Min-Chul Park, Korea Institute of Science and Technology (Korea, Republic of); Byeong-Kwon Ju, Korea Univ. (Korea, Republic of); Sungjin Cho, Korea Institute of Science and Technology (Korea, Republic of) and Korea Univ. (Korea, Republic of); Jung-Young Son, Konyang Univ. (Korea, Republic of) . . . . . [8738-37]

Automated analysis of 3D morphology of human red blood cells via off-axis digital holographic microscopy, Inkyu Moon, Chosun Univ. (Korea, Republic of) . . . . . [8738-36]

CSpace® scalable, high-resolution 3D display, Mark Willner, 3DIcon Corp. (USA) . . . . . [8738-39]

Monday - Wednesday 29 April - 1 May 2013 • Proceedings of SPIE Vol. 8739

Sensors and Systems for Space Applications VI

Conference Chairs: **Khanh D. Pham,** Air Force Research Lab. (USA); **Joseph L. Cox,** Missile Defense Agency (USA)

Program Committee: **Lisa Belodoff,** LightWorks Optics, Inc. (USA); **Thomas George,** Zyomed Corp. (USA); **Richard T. Howard,** NASA Marshall Space Flight Ctr. (USA); **Ou Ma,** New Mexico State Univ. (USA); **Tien M. Nguyen,** Raytheon Co. (USA); **Andre Samberg,** Sec-Control Finland Ltd. (Finland); **Henry Zmuda,** Univ. of Florida (USA)

Monday 29 April

OPENING REMARKS

Room: Conv. Ctr. 316 . . . . . 8:30 am to 8:40 am

Session Chairs: **Sarah T. Crites,** Univ. of Hawai'i (USA); **Richard T. Howard,** NASA Marshall Space Flight Ctr. (USA)

SESSION 1

Room: Conv. Ctr. 316 . . . . . .Mon 8:40 am to 10:20 am

Pervasive Technologies Supporting Responsive Space

Session Chairs: **Sarah T. Crites,** Univ. of Hawai'i (USA); **Richard T. Howard,** NASA Marshall Space Flight Ctr. (USA)

8:40 am: **SUCHI: the space ultra-compact hyperspectral imager for small satellites**, Sarah T. Crites, Paul G. Lucey, Robert Wright, Harold Garbeil, Keith A. Horton, Univ. of Hawai'i (USA); Mark Wood, Univ. of Hawai'i at Manoa (USA) . . . . . [8739-1]

9:00 am: **Lunar magnetic field measurements with a cubesat**, Ian Garrick-Bethell, Univ. of California, Santa Cruz (USA) and Kyung Hee Univ. (Korea, Republic of); Robert Lin, Univ. of California, Berkeley (USA); Hugo Sanchez, Belgacem S. Jaroux, NASA Ames Research Ctr. (USA); Manfred Bester, Univ. of California, Berkeley (USA); Patrick Brown, Imperial College London (United Kingdom); Daniel Cosgrove, Univ. of California, Berkeley (USA); Michele K. Dougherty, Imperial College London (United Kingdom); Jasper S. Halekas, Univ. of California, Berkeley (USA); Doug Hemingway, Univ. of California, Santa Cruz (USA); Paulo C. Lozano, Massachusetts Institute of Technology (USA); Francois Martel, Espace Inc. (USA); Caleb W. Whitlock, Massachusetts Institute of Technology (USA). . . . . [8739-2]

9:20 am: **Large diffractive/refractive apertures for space and airborne telescopes**, Howard A. MacEwen, Reviresco LLC (USA); James B. Breckinridge, Breckinridge Associates, LLC (USA); Richard L. Baron, EFOS Corp. (USA) [8739-3]

9:40 am: **An onboard computing system design for a remote sensing cubesat**, Jeremy Straub, The Univ. of North Dakota (USA) . . . . . [8739-4]

10:00 am: **Mission design and operations of a constellation of small satellites for remote sensing**, Trevor C. Sorensen, Eric J. Pilger, Mark S. Wood, Miguel A. Nunes, Lance K. Yoneshige, Univ. of Hawai'i at Manoa (USA). . . . . [8739-5]

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

SESSION 2

Room: Conv. Ctr. 316 . . . . . .Mon 10:50 am to 11:50 am

Space Payload Technologies for Dual Military-Civil Operations

Session Chairs: **Richard T. Howard,** NASA Marshall Space Flight Ctr. (USA); **Lisa Belodoff,** LightWorks Optics, Inc. (USA)

10:50 am: **Design of ground motion compensation servo system**, Tan Chan, Ding Lei, Shanghai Institute of Technical Physics (China) . . . . . [8739-6]

11:10 am: **Local-area geostationary object detection and orbital characterization utilizing image-differencing techniques**, Paul McCall, Florida International Univ. (USA); Madeleine Naudeau, Air Force Research Lab. (USA); Marlon Sorge, The Aerospace Corp. (USA); Thomas Farrell, Schafer Corp. (USA); Malek Adjouadi, Florida International Univ. (USA). . . . . [8739-7]

11:30 am: **Above the cloud computing: creating an orbital service model using cloud computing techniques**, Jeremy Straub, Atif Mohammad, The Univ. of North Dakota (USA). . . . . [8739-9]

Lunch Break . . . . . Mon 11:50 am to 1:30 pm

SESSION 3

Room: Conv. Ctr. 316 . . . . . Mon 1:30 pm to 2:30 pm

Plenary Presentation I

1:30 pm: **Plenary Presentation**, ... [8739-10]

SESSION 4

Room: Conv. Ctr. 316 . . . . . Mon 2:30 pm to 4:40 pm

Sensor Contamination Detection, Abatement, and Effects

Session Chairs: **Joseph L. Cox,** Missile Defense Agency (USA); **Sarah T. Crites,** Univ. of Hawai'i (USA)

2:30 pm: **PICARD payload thermal constrol system and general impact of the space environment on astronomical observations**, Mustapha Meftah, Lab. Atmosphères, Milieux, Observations Spatiales (France). . . . . [8739-11]

2:50 pm: **Optical analysis of a membrane photon sieve space telescope**, Olha Asmolova, Air Force Academy (USA); Geoff P. Andersen, HUA, Inc. (USA); Michael E. Dearborn, U.S. Air Force Academy (USA). . . . . [8739-12]

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

3:40 pm: **Monitoring and predicting rate of VIIRS sensitivity degradation from telescope contamination by tungsten oxide**, Slawomir Blonski, Univ. of Maryland, College Park (USA); Changyong Cao, NOAA/NESDIS/STAR (USA) . . . . . [8739-13]

4:00 pm: **Thermoelectric radiation sensors for the space mission BepiColombo to mercury**, Frank Hänschke, Ernst Kessler, Ulrich Dillner, Uwe Schinkel, Andreas Ihring, Hans-Georg Meyer, Institut für Photonische Technologien e.V. (Germany); Jörg Knollenberg, Ingo Walter, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) . . . . . [8739-14]

4:20 pm: **High-performance, water-absorption free antireflective optical coatings in the short-wave and mid-wave for earth observing optical systems**, Adam M. Phenis, Joseph E. Sauvageau, Robert D. Smith II, SAIC (USA); David C. Utley, CEB Metasystems, Inc. (USA). . . . . [8739-15]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

OPENING REMARKS

Room: Conv. Ctr. 316 . . . . . 8:30 am to 8:40 am

Session Chairs: **Erik P. Blasch,** Air Force Research Lab. (USA); **Joseph L. Cox,** Missile Defense Agency (USA)

SESSION 5

Room: Conv. Ctr. 316 . . . . . Tue 8:40 am to 9:40 am

Cognitive Optics and Advanced Technology Demonstration

Session Chairs: **Erik P. Blasch,** Air Force Research Lab. (USA); **Joseph L. Cox,** Missile Defense Agency (USA)

8:40 am: **Next-generation photonic true time delay devices as enabled by a new electro-optic architecture**, Scott R. Davis, Seth T. Johnson, Scott D. Rommel, Neil A. Rebolledo, Michael H. Anderson, Vescent Photonics Inc. (USA) . . . . . [8739-16]

9:00 am: **New electro-optic laser scanners for small-sat to ground laser communication links**, Scott R. Davis, Scott D. Rommel, Seth T. Johnson, Stephanie M. McMahon, Neil A. Rebolledo, Michael H. Anderson, Vescent Photonics Inc. (USA); Yijiang Chen, Tien-Hsin Chao, Jet Propulsion Lab. (USA) . . . . . [8739-17]

9:20 am: **Demonstration of space optical transmitter development for multiple high-frequency bands**, Hung Nguyen, NASA Glenn Research Ctr. (USA) [8739-19]

Coffee Break . . . . . Tue 9:40 am to 10:20 am

SESSION 6

Room: Conv. Ctr. 316 . . . . . Tue 10:20 am to 11:40 am

Tracking, Telemetry, and Control for Space Situational Awareness

Session Chairs: **Andre Samberg,** Sec-Control Finland Ltd. (Finland); **Khanh Pham,** Air Force Research Lab. (USA)

10:20 am: **laser ranging with the MéO telescope to improve orbital accuracy of space debris**, Laurent Hennegrave, Marine Pyanet, Hervé Haag, EADS Astrium (France); Etienne Samain, Dominique Albanese, Jocelyn Paris, Observatoire de la Côte d'AZUR (France); Guillaume Blanchet, Sophie Vial, Bruno Esmiller, EADS Astrium (France) . . . . . [8739-20]

10:40 am: **Large phase angle observations of GEO satellites**, Rita L. Cognion, Oceanit Space Surveillance (USA) . . . . . [8739-21]

11:00 am: **Conformal prediction for anomaly detection and collision alert in space surveillance**, Huimin Chen, Univ. of New Orleans (USA); Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA) . . . . . [8739-22]

11:20 am: **Analysis of orbits of hostile satellites**, Genshe Chen, Carl Looney, Intelligent Fusion Technology, Inc. (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA) . . . . . [8739-23]

Lunch/Exhibition Break . . . . . Tue 11:40 am to 1:40 pm

SESSION 7

Room: Conv. Ctr. 316 . . . . . Tue 1:40 pm to 2:40 pm

Plenary Presentation II

1:40 pm: **Blind and beacon-less TDMA scheduling for ad-hoc LEO Satellite communications**, Tien M. Nguyen, Raytheon Co. (USA) . . . . . [8739-27]

SESSION 8

Room: Conv. Ctr. 316 . . . . . Tue 2:40 pm to 4:50 pm

Connectivity and Dissemination for Cognitive Space Communications

Session Chairs: **Tien M. Nguyen,** Raytheon Co. (USA); **Gerry Tian,** National Science Foundation (USA)

2:40 pm: **An efficient QoS-aware routing algorithm for LEO polar constellations**, Xin Tian, Intelligent Fusion Technology, Inc. (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA); Zhi Tian, Michigan Technological Univ. (USA); Dan Shen, Genshe Chen, Intelligent Fusion Technology, Inc. (USA) . . . . . [8739-24]

3:00 pm: **QoS-aware dynamic spectrum access for cognitive radio networks**, Xin Tian, Intelligent Fusion Technology, Inc. (USA); Zhi Tian, Michigan Technological Univ. (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA); Genshe Chen, Intelligent Fusion Technology, Inc. (USA). . . . . [8739-25]

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

3:50 pm: **Spatial-proactive routing algorithm (SPRA) algorithms for IP-based satellite networks**, Wei Yu, Sixiao Wei, Guobin Xu, Chao Lu, Towson Univ. (USA); Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA). . . . . [8739-26]

4:10 pm: **On effectiveness of digital signal processing and image-based intrusion detection techniques for cyber security situation awareness**, Wei Yu, Xiao Wei Shi, Guobin Xu, Chao Lu, Towson Univ. (USA); Misty Blowers, Erik P. Blasch, Khanh D. Pham, Air Force Research Lab. (USA); Dan Shen, Genshe Chen, Intelligent Fusion Technology, Inc. (USA) . . . . . [8739-28]

4:30 pm: **RSD-WSN: remote source-level debugger for rapid application development in wireless sensor networks**, Mohammad Mozumdar, California State Univ., Long Beach (USA); Weiyuan Bian, Politecnico di Torino (Italy); Jose Perez, California State Univ., Long Beach (USA); Luciano Lavagno, Politecnico di Torino (Italy) . . . . . [8739-29]

Wednesday 1 May

OPENING REMARKS

Room: Conv. Ctr. 316 . . . . . 8:00 am to 8:10 am

Session Chairs: **Thomas George; Andre Samberg,** Sec-Control Finland Ltd. (Finland)

SESSION 9

Room: Conv. Ctr. 316 . . . . . Wed 8:10 am to 10:10 am

Processing, Exploitation, and Decision Support for Attributions and Tactical Planning I

Session Chairs: **Thomas George; Andre Samberg,** Sec-Control Finland Ltd. (Finland)

8:10 am: **Multiple sensor estimation using high-degree cubature information filter**, Jia Bin, Columbia Univ. (USA); Ming Xin, Mississippi State Univ. (USA); Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Khanh D. Pham, Air Force Research Lab. (USA) . . . . . [8739-30]

8:30 am: **The Doppler wind and temperature sounder: enabling next-generation weather and space weather forecasts**, Martin J. McHugh, Larry L. Gordley, David F. Fritts, GATS, Inc. (USA); Wayne F. J. Evans, NorthWest Research Associates (USA); Benjamin T. Marshall, GATS, Inc. (USA) . . . . . [8739-31]

8:50 am: **A highly sensitive multi-element HgCdTe e-APD detector for IPDA lidar applications**, Jeff Beck, DRS RSTA, Inc. (USA); Mark Skokan, Richard Scritchfield, DRS Sensors & Targeting Systems, Inc. (USA); Chris Kamilar, Terry Welch, James M. McCurdy, DRS RSTA, Inc. (USA); Pradip Mitra, DRS Technologies, Inc. (USA); Xiaoli Sun, James Abshire, NASA Goddard Space Flight Ctr. (USA); Kirk Reiff, Analog Digital Integrated Circuits (USA). . . . . [8739-32]

9:10 am: **Designing optimized lightweighted a 700mm diameter mirror and structures made of sic for spaceborne EO/IR telescope**, Haengbok Lee, Agency for Defense Development (Korea, Republic of) . . . . . [8739-33]

9:30 am: **Engineered plasma interactions for geomagnetic propulsion of ultra-small satellites**, Jeremy A. Palmer, System Planning Corp. (USA); Thomas P. Hughes, Jeremiah J. Boerner, Guy R. Bennett, Sandia National Labs. (USA) . . . . . [8739-34]

9:50 am: **Long-integration star tracker image processing for combined attitude-attitude rate estimation**, Brad Sease, Univ. of Central Florida (USA); Ryan Koglin, The Univ. of Akron (USA); Brien Flewelling, Air Foce Research Lab. (USA) . . . . . [8739-36]

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

SESSION 10

Room: Conv. Ctr. 316 . . . . . Wed 10:50 am to 12:10 pm

Processing, Exploitation, and Decision Support for Attributions and Tactical Planning II

Session Chair: **Erik P. Blasch,** Air Force Research Lab. (USA)

10:50 am: **A color component texture approach to locate a vehicle license plate**, Jianjun Gao, Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Erik P. Blasch, Khanh D. Pham, Air Force Research Lab. (USA) . . . . . [8739-35]

11:10 am: **A fuzzy-logic based approach to color segmentation**, Wei Li, Tianjin Univ. (China) and California State Univ., Bakersfield (USA); Yunyi Li, Duke Univ. (USA); Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Quoxing Zhao, Qinghao Meng, Tianjin Univ. (USA) . . . . . [8739-37]

11:30 am: **A holistic image segmentation framework for cloud detection and extraction**, Dan Shen, Intelligent Fusion Technology, Inc. (USA); Haotian Xu, Temple Univ. (USA); Erik P. Blasch, Khanh D. Pham, Gregory Horvath, Air Force Research Lab. (USA); Zhonghai Wang, Intelligent Fusion Technology, Inc. (USA); Haibin Ling, Temple Univ. (USA); Genshe Chen, Intelligent Fusion Technology, Inc. (USA) . . . . . [8739-38]

11:50 am: **Infrared target tracking using multiple instance learning with adaptive motion prediction and spatially template weighting**, Xinchu Shi, Institute of Automation (China) and Temple Univ. (USA); Weiming Hu, Institute of Automation (China); Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Haibin Ling, Temple Univ. (USA) . . . . . [8739-39]

Tuesday 30 April 2013 • Proceedings of SPIE Vol. 8740

Motion Imagery Technologies, Best Practices, and Workflows for Intelligence, Surveillance, and Reconnaissance (ISR), and Situational Awareness

Conference Chair: **Donnie Self,** National Geospatial-Intelligence Agency (USA)

Program Committee: **Gary Nadler,** Consultant, Commercial Broadcast Industry (USA); **Norman S. Stein,** TASC, Inc. (USA)

Tuesday 30 April

INTRODUCTION

Room: Conv. Ctr. 329 . . . . . 8:00 am to 8:05 am

Session Chair: **Donnie B. Self,**
National Geospatial-Intelligence Agency (USA)

SESSION 1

Room: Conv. Ctr. 329 . . . . . Tue 8:05 am to 10:05 am

Motion Imagery Technology I

Session Chair: **Donnie B. Self,**
National Geospatial-Intelligence Agency (USA)

8:05 am: **Overcoming ISR data challenges**, David Bottom, National Geospatial-Intelligence Agency (USA) . . . . . [8740-1]

8:25 am: **The convergence of GEOINT and ISR**, Michael G. Lee, Blue Canopy Group, LLC (USA) . . . . . [8740-2]

8:45 am: **Activity based intelligence**, Collin Agee, U.S. Army (USA) . . . . . [8740-3]

9:05 am: **Uses of motion imagery in activity-based intelligence**, Tom Lash, SAIC (USA) . . . . . [8740-4]

9:25 am: **Low-power multi-camera system and algorithms for automated threat detection**, David J. Huber, Deepak Khosla, Yang Chen, Darrel J. Van Buer, Kevin Martin, HRL Labs., LLC (USA). . . . . [8740-5]

9:45 am: **Delivering FMV in tactical (low bandwidth) environments**, John Snevely Jr., U.S. Dept. of Defense (USA) . . . . . [8740-6]

Coffee Break . . . . . .Tue 10:05 am to 10:35 am

SESSION 2

Room: Conv. Ctr. 329 . . . . . Tue 10:35 am to 12:15 pm

Motion Imagery Technology II

Session Chair: **Donnie B. Self,**
National Geospatial-Intelligence Agency (USA)

10:35 am: **Transporting live video over high packet loss networks**, Dave Werdin, Superior Access Solutions (USA). . . . . [8740-7]

10:55 am: **Intelligent video surveillance communication systems**, Eric P. McCulley, Christopher M. Durso, Vislink US Billerica (USA) . . . . . [8740-8]

11:15 am: **Increased efficiency for beyond line-of-sight in airborne ISR operations**, Slava Frayter, Newtec (USA); Koen Willems, Newtec (Belgium) [8740-9]

11:35 am: **A results-based process for evaluation of diverse visual analytics tools**, Gary Rubin, David H. Berger, System Planning Corp. (USA) . . . . . [8740-11]

11:55 am: **Full motion video optical navigation targeting (FMV ON-target)**, Scott D. Robbins, The MITRE Corp. (USA). . . . . [8740-12]

Lunch/Exhibition Break . . . . . .Tue 12:15 pm to 1:45 pm

INTRODUCTION

Room: Conv. Ctr. 329 . . . . . 1:45 pm to 1:50 pm

Session Chair: **Donnie B. Self,**
National Geospatial-Intelligence Agency (USA)

SESSION 3

Room: Conv. Ctr. 329 . . . . . Tue 1:50 pm to 3:30 pm

Motion Imagery Technology III

1:50 pm: **Video quality across the defense intelligence information enterprise (DI2E)**, Kevin West, U.S. Dept. of Defense (USA) . . . . . [8740-13]

2:10 pm: **Improving geolocation performance for ISR**, Michael J. Lenihan, Todd E. Johanesen, National Geospatial-Intelligence Agency (USA) . . . . . [8740-14]

2:30 pm: **Smart systems, dumb data: impact on ISR operations**, Gregory Creech, U.S. Dept. of Defense (USA) . . . . . [8740-20]

2:50 pm: **Foreground estimation in motion imagery using multiframe change detection techniques**, Andrew Lingg, Brian D. Rigling, Wright State Univ. (USA) . . . . . [8740-15]

3:10 pm: **Gaze interaction in UAS video exploitation**, Jutta E. Hild, Stefan T. Bruestle, Norbert F. Heinze, Elisabeth Peinsipp-Byma, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . . [8740-16]

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

SESSION 4

Room: Conv. Ctr. 329 . . . . . Tue 4:00 pm to 5:00 pm

Motion Imagery Technology IV

Session Chair: **Donnie B. Self,**
National Geospatial-Intelligence Agency (USA)

4:00 pm: **InnoVision's focus areas for motion imagery R&D**, Kenneth E. Rice, National Geospatial-Intelligence Agency (USA) . . . . . [8740-18]

4:20 pm: **Reel-to-real**, William Craig, WiSC Enterprises LLC (USA) . . . . . [8740-19]

4:40 pm: **Standards for efficient employment of wide-area motion imagery (WAMI) sensors**, Scott Randall, Booz Allen Hamilton Inc. (USA); Paul Maenner, Exelis Visual Information Solutions (USA) . . . . . [8740-21]

Unmanned Systems Technology XV

Conference Chairs: **Robert E. Karlsen,** U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Douglas W. Gage,** XPM Technologies (USA); **Charles M. Shoemaker,** U.S. Army Communications-Electronics Research Development and Engineering Command (USA); **Grant R. Gerhart,** U.S. Army Tank-Automotive Research, Development, and Engineering Ctr.-Retired (USA)

Program Committee: **Stephen Balakirsky,** National Institute of Standards and Technology (USA); **Johann Borenstein,** Univ. of Michigan (USA); **Jonathan A. Bornstein,** U.S. Army Research Lab. (USA); **Rajiv V. Dubey,** Univ. of South Florida (USA); **Hobart R. Everett,** Space and Naval Warfare Systems Ctr. Pacific (USA); **Jared Giesbrecht,** Defence Research and Development Canada, Suffield (Canada); **Gene A. Klager,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **James H. Lever,** U.S. Army Engineer Research and Development Ctr. (USA); **Frank L. Lewis,** The Univ. of Texas at Arlington (USA); **Larry H. Matthies,** Jet Propulsion Lab. (USA); **Paul L. Muench,** U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Hoa G. Nguyen,** Space and Naval Warfare Systems Ctr. Pacific (USA); **James L. Overholt,** U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Mike Perschbacher,** RovnoTech (USA); **Marc Raibert,** Boston Dynamics (USA); **Klaus-Juergen Schilling,** Julius-Maximilians-Univ. Würzburg (Germany); **Nahid N. Sidki,** SAIC (USA); **Harpreet Singh,** Wayne State Univ. (USA); **Anthony Stentz,** Carnegie Mellon Univ. (USA); **David L. Stone,** Mechatron Consulting (USA); **Venkataraman Sundareswaran,** Teledyne Scientific Co. (USA); **Brian H. Wilcox,** Jet Propulsion Lab. (USA); **Gary Witus,** Turing Associates, Inc. (USA); **Brian M. Yamauchi,** iRobot Corp. (USA)

Wednesday 1 May

SESSION 1
Room: Conv. Ctr. 321 . . . . . Wed 8:30 am to 10:00 am

Special Keynote Session

Open Architecture (OA)/ Open Business Model (OBM) Systems

Joint with Conferences 8741 and 8754

Session Chair: **Raja Suresh,** General Dynamics Advanced Information Systems (USA)

8:30 am: **Modular, open, scalable architectures with applications to C4ISR systems** *(Keynote Presentation)*, Bobby R. Junker, Office of Naval Research (USA) . . . . . [8754-11]

9:00 am: **The GDAIS journey in OA/OBM** *(Keynote Presentation)*, Carlo Zaffanella, General Dynamics Advanced Information Systems (USA) . [8754-12]

9:30 am: **Small business perspectives on the open business model** *(Keynote Presentation)*, Howard Reichel, In-Depth Engineering Corp. (USA). . . [8754-13]

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

PANEL DISCUSSION
Room: Conv. Ctr. 321 . . . . . 10:30 am to 11:30 am

This panel follows the Special Keynote Session between Conferences 8741 and 8754.

Open Architecture (OA)/ Open Business Model (OBM) Systems

Joint Panel with Conferences 8741 and 8754

Moderator: **Dr. Raja Suresh,** General Dynamics Advanced Information Systems

Panelists:

Bobby Junker, C4ISR Department Head, Office of Naval Research (USA)

Howard Reichel, Senior Vice President, In-Depth Engineering Corp. (USA)

Carlo Zaffanella, Vice President, General Dynamics Advanced Information Systems (USA)

Nick Guertin, Director of Transformation, U.S. Navy (USA)

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

SESSION 2
Room: Conv. Ctr. 321 . . . . . Wed 1:20 pm to 3:00 pm

Perception and Navigation I

Session Chairs: **Robert E. Karlsen,** U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); **Brian M. Yamauchi,** iRobot Corp. (USA)

1:20 pm: **Visual template tracking based MAV localization for hovering over low-textured surfaces**, Roland Brockers, Larry H. Matthies, Jet Propulsion Lab. (USA) . . . . . [8741-2]

1:40 pm: **Dynamic, cooperative multi-robot patrolling with a team of UAVs**, Charles E. Pippin, Georgia Tech Research Institute (USA); Henrik I. Christensen, Georgia Institute of Technology (USA); Lora G. Weiss, Georgia Tech Research Institute (USA) . . . . . [8741-3]

2:00 pm: **Vegetation versus man-made object detection from imagery for unmanned vehicles in off-road environments**, Josh Harguess, Jacoby Larson, Space and Naval Warfare Systems Ctr. Pacific (USA) . . . . . [8741-4]

2:20 pm: **Human activity detection for UAV emergency landings**, Pieter T. Eendebak, TNO (Netherlands); Adam W. M. van Eekeren, Richard J. den Hollander, TNO Defence, Security and Safety (Netherlands) . . . . . [8741-5]

2:40 pm: **Feature detection and SLAM on embedded processors for micro-robot navigation**, Paul Robinette, Thomas R. Collins, Georgia Tech Research Institute (USA) . . . . . [8741-45]

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

SESSION 3
Room: Conv. Ctr. 321 . . . . . Wed 3:30 pm to 5:30 pm

Perception and Navigation II

Session Chairs: **Roland Brockers,** Jet Propulsion Lab. (USA); **Paul L. Muench,** U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA)

3:30 pm: **Robot mapping in large-scale mixed indoor and outdoor environments**, John G. Rogers III, Georgia Institute of Technology (USA); Jason M. Gregory, Stuart H. Young, U.S. Army Research Lab. (USA); Henrik I. Christensen, Georgia Institute of Technology (USA) . . . . . [8741-7]

3:50 pm: **Cooperative mobile agents search using beehive partitioned structure and Tabu Random search algorithm**, Saba Ramazani, Rastko R. Selmic, Delvin Jackson, Louisiana Tech Univ. (USA) . . . . . [8741-8]

4:10 pm: **Cognitive patterns: giving autonomy some context**, Danielle A. Dumond, Webb Stacy, Alexandra Geyer, Jeffrey Rousseau, Mike Therrien, Aptima, Inc. (USA). . . . . [8741-9]

4:30 pm: **Real-time adaptive off-road vehicle navigation and terrain classification**, Urs Muller, Net-Scale Technologies, Inc. (USA); Lawrence Jackel, North-C Technologies, Inc (USA); Yann LeCun, New York Univ. (USA); Beat Flepp, Net-Scale Technologies, Inc. (USA) . . . . . [8741-11]

4:50 pm: **Multi-robot exploration strategies for tactical tasks in urban environments**, Carlos P. Nieto, John G. Rogers III, Henrik I. Christensen, Georgia Institute of Technology (USA) . . . . . [8741-12]

5:10 pm: **Semantic data association for planar features in outdoor 6D-SLAM using lidar**, Cihan Ulas, TUBITAK UME (Turkey) and Istanbul Technical Univ. (Turkey); Hakan Temeltas, Istanbul Technical Univ. (Turkey) . . . . . [8741-13]

Thursday 2 May

SESSION 4
Room: Conv. Ctr. 317 . . . . . Thu 8:00 am to 1:20 am

NOTE ROOM CHANGE

MAST: Software

Joint Session with Conferences 8725 and 8741

Session Chair: **Paul D. Samuel,** Daedalus Flight Systems, LLC (USA)

8:00 am: **Reduction and identification for hybrid dynamical models of terrestrial locomotion** *(Invited Paper)*, Sam Burden, S. Shankar Sastry, Univ. of California, Berkeley (USA) . . . . . [8725-49]

8:20 am: **Flight of the fruit fly** *(Invited Paper)*, Itai Cohen, Cornell Univ. (USA) . . . . . [8725-50]

8:40 am: **Stochastic receding horizon control: application to an octopedal robot** *(Invited Paper)*, Shridhar K. Shah, Herbert G. Tanner, Univ. of Delaware (USA) . . . . . [8725-51]

9:00 am: **Robust multi-robot mapping and exploration** *(Invited Paper)*, Henrik I. Christensen, John G. Rogers III, Carlos P. Nieto, Georgia Institute of Technology (USA) . . . . . [8725-52]

9:20 am: **Bio-inspired multimode optic flow sensors for micro air vehicles** *(Invited Paper)*, Seokjun Park, Jaehyuk Choi, Jihyun Cho, Euisik Yoon, Univ. of Michigan (USA) . . . . . [8725-53]

9:40 am: **Structure from motion in computationally constrained systems** *(Invited Paper)*, Joseph Conroy, William D. Nothwang, U.S. Army Research Lab. (USA) . . . . . [8725-54]

10:00 am: **Low power analog odometry circuit for miniature robotics** *(Invited Paper)*, Pamela A. Abshire, Michael J. Kuhlman, Tsung Hsueh Lee, Univ. of Maryland, College Park (USA) . . . . . [8725-55]

Extended Lunch/Exhibition Break . . . . . .Thu 10:20 am to 1:00 pm

SESSION 5
Room: Conv. Ctr. 321 . . . . . Thu 1:00 pm to 3:00 pm

Human-Robot Interaction and Communication

Session Chairs: **Hoa G. Nguyen,** Space and Naval Warfare Systems Ctr. Pacific (USA); **Camille Monnier,** Charles River Analytics, Inc. (USA)

1:00 pm: **Robust leader tracking from an unmanned ground vehicle**, Camille Monnier, Stan German, Andrey Ost, Charles River Analytics, Inc. (USA) . . [8741-14]

1:20 pm: **Multimodal interaction for human-robot teams**, Dustin Burke, Nathan Schurr, Jeanine Ayers, Jeffrey Rousseau, John Fertitta, Alan Carlin, Aptima, Inc. (USA). . . . . [8741-15]

1:40 pm: **An intuitive graphical user interface for small UAS**, Nicholas C. Stroumtsos, Gary Gilbreath, Scott Przybylski, Michael R. McWilliams, Space and Naval Warfare Systems Ctr. Pacific (USA) . . . . . [8741-16]

2:00 pm: **Evaluating the presentation of autonomous mapping algorithm results**, David Q. Baran, Jason M. Gregory, Arthur W. Evans, U.S. Army Research Lab. (USA) . . . . . [8741-17]

2:20 pm: **Evolution of a radio communication relay system**, Hoa G. Nguyen, Narek Pezeshkian, Abraham Hart, Joseph D. Neff, Leif Roth, Space and Naval Warfare Systems Ctr. Pacific (USA) . . . . . [8741-18]

2:40 pm: **Multilateral haptics-based immersive teleoperation for improvised explosive device disposal**, David R. Erickson, Defence Research and Development Canada, Suffield (Canada); Hervé Lacheray, John M. Daly, Quanser Inc. (Canada) . . . . . [8741-52]

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

SESSION 6
Room: Conv. Ctr. 321 . . . . . Thu 3:30 pm to 5:10 pm

Intelligent Behaviors

Session Chairs: **Frank L. Lewis,** The Univ. of Texas at Arlington (USA); **Dariusz G. Mikulski,** U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA)

3:30 pm: **MAV adaptive control algorithms in emitter localization missions using RSSI and path loss exponent metrics**, Miguel D. Gates, Rastko R. Selmic, Louisiana Tech Univ. (USA) . . . . . [8741-20]

3:50 pm: **Learning consensus in adversarial environments**, Kyriakos Vamvoudakis, Luis Rodolfo Garcia Carrillo, Joao P. Hespanha, Univ. of California, Santa Barbara (USA) . . . . . [8741-21]

4:10 pm: **Stable structures of coalitions in competitive and altruistic military teams**, Muhammad Aurangzeb, The Univ. of Texas at Arlington (USA); Dariusz G. Mikulski, Gregory R. Hudas, U.S. Army Tank Automotive Research, Development and Engineering Ctr. (USA); Frank L. Lewis, The Univ. of Texas at Arlington (USA); Edward Y. Gu, Oakland Univ. (USA) . . . . . [8741-22]

4:30 pm: **Adaptive neural network consensus-based control for mobile robot formations**, Haci Mehmet Guzey, Jagannatan Sarangapani, Missouri Univ. of Science and Technology (USA). . . . . [8741-23]

4:50 pm: **Maintaining robust connectivity in heterogeneous robotic networks**, Patricio J. Cruz, Rafael O. Fierro, The Univ. of New Mexico (USA); Wenjie Lu, Silvia Ferrari, Duke Univ. (USA); Thomas A. Wettergren, Naval Undersea Warfare Ctr. (USA) . . . . . [8741-24]

POSTERS-THURSDAY
Room: Conv. Ctr. Hall D . . . . . Thu 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

An open-source scheduler for small satellites, Donovan Torgerson, Jeremy Straub, The Univ. of North Dakota (USA) . . . . . [8741-44]

Human and tree classification based on its model using 3D ladar in GPS-denied environment, Kuk Cho, Univ. of Science & Technology (Korea, Republic of); Seung-Ho Baeg, SangDeok Park, Korea Institute of Industrial Technology (Korea, Republic of). . . . . [8741-46]

Universal framework for unmanned systems penetration testing, Philip Kobezak, Sam Abbot-McCune, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [8741-47]

The need for alternative munition integration on unmanned aircraft systems in order to bypass the identification problem, Mehmet Durkan, Ozgur Otkun, Ugur Uzunoglu, Turkish Air Force Academy (Turkey) . . . . . [8741-48]

A perspective of applications of unmanned systems in asymmetric warfare, Saban Adana, Isa Haskologlu, Ali Kemel Duzgun, Alper Alparslan Eker, Harp Akademileri Komutanligi (Turkey) . . . . . [8741-50]

Friday 3 May

SESSION 7

Room: Conv. Ctr. 321 . . . . . Fri 8:30 am to 10:10 am

Robotics CTA I

Session Chairs: **Jonathan A. Bornstein,** U.S. Army Research Lab. (USA); **Robert R. Mitchell,** General Dynamics Robotic Systems (USA)

8:30 am: **Common world model for unmanned systems**, Robert Dean, General Dynamics Robotic Systems (USA) . . . . . [8741-25]

8:50 am: **Using expectations to monitor robotic progress and recover from problems**, Unmesh Kurup, Christian Lebiere, Anthony Stentz, Martial Hebert, Carnegie Mellon Univ. (USA) . . . . . [8741-26]

9:10 am: **Terrain identification for RHex-type robots**, Camilo Ordonez, Jacob Shill, The Florida State Univ. (USA); Aaron M. Johnson, Univ. of Pennsylvania (USA); Emmanuel G. Collins Jr., Jonathan Clark, The Florida State Univ. (USA) . . . . . [8741-27]

9:30 am: **An architecture for online semantic labeling on UGVs**, Luis E. Navarro-Serment, Arne Suppe, Daniel Munoz, Drew Bagnell, Martial Hebert, Carnegie Mellon Univ. (USA). . . . . [8741-28]

9:50 am: **Features and representations for first-person human activity recognition**, Michael S. Ryoo, Larry H. Matthies, Jet Propulsion Lab. (USA) . . . . . [8741-29]

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

SESSION 8

Room: Conv. Ctr. 321 . . . . . Fri 10:40 am to 12:00 pm

Robotics CTA II

Session Chairs: **Johann Borenstein,** Univ. of Michigan (USA); **Robert R. Mitchell,** General Dynamics Robotic Systems (USA)

10:40 am: **Performance of a scanning laser line striper in outdoor lighting**, Christoph Mertz, Carnegie Mellon Univ. (USA) . . . . . [8741-30]

11:00 am: **Visual and tactile interfaces for bi-directional human robot communication**, Daniel J. Barber, Stephanie Lackey, Lauren Reinerman-Jones, Univ. of Central Florida (USA) . . . . . [8741-31]

11:20 am: **Dynamic whole-body robotic manipulation**, Michael P. Murphy, Benjamin Stephens, Yeuhi Abe, Alfred A. Rizzi, Boston Dynamics (USA) . [8741-32]

11:40 am: **Leaping experiments with a power-autonomous, compliant-spined quadruped**, Jeffrey Duperret, Univ. of Pennsylvania (USA); Jason L. Pusey, U.S. Army Research Lab. (USA); G. Clark Haynes, National Robotics Engineering Ctr. (USA); Ryan Knopf, Daniel E. Koditschek, Univ. of Pennsylvania (USA). . . [8741-33]

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

SESSION 9

Room: Conv. Ctr. 321 . . . . . Fri 1:00 pm to 3:00 pm

Special Topics I

Session Chairs: **Douglas W. Gage,** XPM Technologies (USA); **Charles M. Shoemaker,** U.S. Army Communications-Electronics Research Development and Engineering Command (USA)

1:00 pm: **Collaborative experiments of small autonomous systems at the SOURCE ATO capstone experiment**, Jason M. Gregory, David Q. Baran, U.S. Army Research Lab. (USA) . . . . . [8741-34]

1:20 pm: **Achieving integrated convoys: Cargo Unmanned Ground Vehicle development and experimentation**, Noah Zych, Oshkosh Corp. (USA); David Silver, David Stager, Carnegie Mellon Univ. (USA); Jacob Fischer, Oshkosh Corp. (USA); Colin Green, Thomas E. Pilarski, Carnegie Mellon Univ. (USA) . . . . [8741-35]

1:40 pm: **Mobile dexterous manipulator for material handling and shipping box loading and unloading**, Yi-Je Lim, John Hu, Jayson Ding, Robert Hsiung, Hstar Technologies (USA) . . . . . [8741-36]

2:00 pm: **MTRS-scale combat engineer vehicle mechanisms, behaviors and capabilities**, Gary Witus, Wayne State Univ. (USA); Douglas C. MacKenzie, Todd A. Kappauf, Mobile Intelligence Corp. (USA) . . . . . [8741-37]

2:20 pm: **Development of a spherical aerial vehicle for urban search**, Kang Hou, Hanxu Sun, Qingxuan Jia, Beijing Univ. of Posts and Telecommunications (China) . . . . . [8741-49]

2:40 pm: **Simple but novel standards for quantitatively comparing robot mapping algorithms, using SLAM and dead reckoning as controls**, Neil S. Davey, Haris Godil, National Institute of Standards and Technology (USA) [8741-39]

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

SESSION 10

Room: Conv. Ctr. 321 . . . . . Fri 3:30 pm to 4:50 pm

Special Topics II

Session Chairs: **Douglas W. Gage,** XPM Technologies (USA); **Charles M. Shoemaker,** U.S. Army Communications-Electronics Research Development and Engineering Command (USA)

3:30 pm: **Robust speech recognition and speaker identification in noisy environments**, Ranga Narayanaswami, Raman K. Mehra, Scientific Systems Co., Inc. (USA). . . . . [8741-40]

3:50 pm: **A preliminary cyber-physical security assessment of the robot operating system (ROS)**, Jarrod McClean, Harvard Univ. (USA); Christopher J. Stull, Charles R. Farrar, David L. Mascarenas, Los Alamos National Lab. (USA) . . . . . [8741-41]

4:10 pm: **UGV: security analysis of subsystem control network**, Sam Abbott-McCune, Philip Kobezak, Virginia Polytechnic Institute and State Univ. (USA) . . . . . [8741-42]

4:30 pm: **The characteristics of future UAVs against asymmetric threats**, Ugur Uzunoglu, Mehmet Durkan, Turkish Air Force Academy (Turkey) . . . . . [8741-43]

Ground/Air Multisensor Interoperability, Integration, and Networking for Persistent ISR IV

Conference Chair: **Tien Pham** (USA)

Conference Co-Chairs: **Michael A. Kolodny,** U.S. Army Research Lab. (USA); **Kevin L. Priddy,** Air Force Research Lab. (USA)

Program Committee: **Jacques Bédard,** Defence Research and Development Canada, Valcartier (Canada); **Robert Heathcock,** U.S. Defense Intelligence Agency (USA); **Gavin Pearson,** Defence Science and Technology Lab. (United Kingdom); **Stephen G. Perry,** MTC Services Corp. (USA); **Andre Samberg,** Sec-Control Finland Ltd. (Finland); **King K. Siu,** U.S. Army Armament Research, Development and Engineering Ctr. (USA); **Raja Suresh,** General Dynamics Advanced Information Systems (USA); **Graeme P. van Voorthuijsen,** TNO Defence, Security and Safety (Netherlands); **Robert Williams,** Air Force Research Lab. (USA)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 323 . . . . . Mon 1:30 pm to 2:50 pm

Data-to-Decisions

Joint Session with Conferences 8742 and 8758

Session Chairs: **David L. Hall,** The Pennsylvania State Univ. (USA); **James Llinas,** Univ. at Buffalo (USA); **Tien Pham** (USA)

Opening remarks by **James Llinas**, Univ. at Buffalo (USA)

1:30 pm: **Data-to-decisions** *(Keynote Presentation)*, John S. Eicke, Michael A. Kolodny, U.S. Army Research Lab. (USA) . . . . . [8758-7]

2:10 pm: **Context-rich semantic framework for effective data-to-decisions in coalition networks**, Keith Grueneberg, Geeth de Mel, IBM Thomas J. Watson Research Ctr. (USA); David Braines, IBM United Kingdom Ltd. (United Kingdom); Seraphin Calo, Xiping Wang, IBM Thomas J. Watson Research Ctr. (USA); Tien Pham (USA) . . . . . [8742-2]

2:30 pm: **A system architecture for decision-making support on ISR missions with stochastic needs and profit**, Nan Hu, Thomas F. LaPorta, The Pennsylvania State Univ. (USA); Diego Pizzocaro, Alun D. Preece, Cardiff Univ. (United Kingdom) . . . . . [8742-3]

Coffee Break . . . . . Mon 2:50 pm to 3:40 pm

PANEL DISCUSSION

Room: Conv. Ctr. 323 . . . . . Mon 3:40 pm to 4:40 pm

NOTE ROOM CHANGE

Decision-Driven Analysts

Joint Panel with Conferences 8742 and 8758

David L. Hall, The Pennsylvania State Univ. (USA); **James Llinas**, Univ. at Buffalo (USA); **Bhopinder Madahar**, Defence Science and Technology Laboratory (United Kingdom); **Tien Pham** (USA)

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 2

Room: Conv. Ctr. 323 . . . . . Tue 8:20 am to 10:00 am

ISR Interoperability: UGS SWG and Terra Harvest I

Session Chair: **Michael A. Kolodny,** U.S. Army Research Lab. (USA)

8:20 am: **UGS SWG and terra harvest overview** *(Invited Paper)*, ... [8742-42]

8:40 am: **Using advanced manufacturing to produce unmanned aerial vehicles**, Michael A. Balazs, Jonathan Rotner, The MITRE Corp. (USA); Steven Easter, Jonathan Turman, Dave Sheffler, Univ. of Virginia (USA) . . . . . [8742-41]

9:00 am: **The terra harvest open software environment: remote interface**, Kevin Klawon, Kristen M. Bachman, Joshua Gold, Univ. of Dayton Research Institute (USA) . . . . . [8742-5]

9:20 am: **How to use the terra harvest open software environment (THOSE): GUI**, Kevin Klawon, Nicholas Marcucci, David Humeniuk, Univ. of Dayton Research Institute (USA) . . . . . [8742-6]

9:40 am: **Development of terra harvest compliant plug-ins for McQ unattended ground sensors (UGS)**, Brent W. Roeder, Robert C. Fish, McQ, Inc. (USA) . .[8742-7]

Coffee/Exhibition Break. . . . . .Tue 10:00 am to 10:30 am

SESSION 3

Room: Conv. Ctr. 323 . . . . . Tue 10:30 am to 11:50 am

ISR Interoperability: UGS SWG and Terra Harvest II

Session Chair: **Tien Pham (**USA)

10:30 am: **Slew to cue of persistent imagers using ground sensors**, Thomas W. Walker, Nino Srour, U.S. Army Research Lab. (USA) . . . . . [8742-8]

10:50 am: **ISR information: new paradigms, priorities and interoperability: everything your mother was afraid to tell you** *(Invited Paper)*, Michael A. Kolodny, U.S. Army Research Lab. (USA). . . . . [8742-9]

11:30 am: **Demonstration of the terra harvest controller architecture**, Gary H. Stolovy, U.S. Army Research Lab. (USA) . . . . . [8742-11]

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

SESSION 4

Room: Conv. Ctr. 323 . . . . . Tue 1:20 pm to 3:00 pm

Coalition Interoperability

Session Chair: **Tien Pham (**USA)

1:20 pm: **U.K. MoD land open system architecture and coalition interoperability with the U.S.**, Gavin Pearson, Defence Science and Technology Lab. (United Kingdom); Michael A. Kolodny, U.S. Army Research Lab. (USA); Tien Pham (USA) . . . . . [8742-12]

1:40 pm: **Practical experience in deploying and controlling the data sharing interoperability layer at the UK land open systems architecture (LOSA) field trials in October 2012**, Flavio Bergamaschi, Dave Conway-Jones, IBM United Kingdom Ltd. (United Kingdom); Gavin Pearson, Defence Science and Technology Lab. (United Kingdom). . . . . [8742-13]

2:00 pm: **Future interoperability of camp protection systems (FICAPS)**, Sylvie Caron, Direction Générale de l'Armement (France); Rainer Gündisch, Wehrtechnische Dienststelle für Schutz- und Sondertechnik (Germany); Karl-Hermann Stahl, Rheinmetall Defence Electronics GmbH (Germany); Alain Marchand, TDA Armements S.A.S. (France) . . . . . [8742-14]

2:20 pm: **Coalition warfare program (CWP) project on policy controlled information query and dissemination**, Andrew Toth, U.S. Army Research Lab. (USA); Todd Karr, NATO Intelligence Fusion Ctr. (United Kingdom); Graham A. Bent, Dominic Harries, IBM United Kingdom Ltd. (United Kingdom) . . . . . [8742-15]

2:40 pm: **Flexible procedural interoperability across security and coalition boundaries using rapidly re-configurable boundary protection definitions**, Nicholas Peach, 2IC Limited (United Kingdom) . . . . . [8742-16]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

SESSION 5
Room: Conv. Ctr. 323 . . . . . Tue 3:40 pm to 4:00 pm

Science of Autonomy

Session Chair: **Tien Pham (**USA)

3:40 pm: **The science of autonomy: integrating autonomous systems with the ISR enterprise**, Gregory Creech, U.S. Dept. of Defense (USA) . . . . . [8742-17]

PANEL DISCUSSION
Room: Conv. Ctr. 323 . . . . . .Tue 4:00 pm to 5:20 pm

Science of Autonomy

Panel discussion on the science of autonomy: integrating autonomous systems with the ISR enterprise.

Moderator: **Gregory S. Creech,** Special Assistant for GEOINT, OUSD(I), Intelligence Systems and Architectures (IS&A)

Panelists: **Dr. Robert Kohout,** Vice President for Research, iRobot; **CAPT Rich Davis,** Chief, Airborne ISR, OUSD(I), Intelligence Systems and Architectures (IS&A); **Mark Chapin** (Col USAF ret), Director Air Warfare and ISR, The Charles Stark Draper Lab.; **Dr. Kristina Czuchlewski**, Project Scientist, Sandia National Labs.

Wednesday 1 May

SESSION 6
Room: Conv. Ctr. 323 . . . . . .Wed 8:20 am to 9:40 am

NATO SET-189 Battlefield Acoustics

Session Chair: **Gavin Pearson,** Defence Science and Technology Lab. (United Kingdom)

8:20 am: **NATO SET battlefield acoustics sensing activities** *(Invited Paper)*, Michael V. Scanlon, U.S. Army Research Lab. (USA) . . . . . [8742-18]

9:00 am: **Hostile fire indicator threat data collection for helicopter-mounted applications**, Pierre Naz, Sebastien De Mezzo, Sébastien Hengy, Institut Franco-Allemand de Recherches de Saint-Louis (France) . . . . . [8742-19]

9:20 am: **River as a part of ground battlefield**, Miodrag S. Vracar, Ivan P. Pokrajac, Predrag Okiljevic, Military Technical Institute (Serbia) . . . . . [8742-21]

Coffee Break . . . . . Wed 9:40 am to 10:30 am

SESSION 7
Room: Conv. Ctr. 323 . . . . . .Wed 10:30 am to 11:50 am

Persistent ISR

Session Chair: **Tien Pham (**USA)

10:30 am: **Air route selection for improved air-to-ground situation assessment**, Marc Oispuu, Massimo Sciotti, Alexander Charlish, Fraunhofer FKIE (Germany) . . . . . [8742-22]

10:50 am: **Integrating UAV and UGS for persistent ISR**, James Morrison, McQ, Inc. (USA) . . . . . [8742-23]

11:10 am: **Clustering of estimated spatial locations in networked sensors**, Miodrag S. Vracar, Ivan P. Pokrajac, Predrag Okiljevic, Military Technical Institute (Serbia) . . . . . [8742-24]

11:30 am: **Application of inexpensive, low-cost, low-bandwidth silhouette profiling UGS systems to current remote sensing operations**, Feng Jin, Brimrose Corp. of America (USA); Emir Y. Haskovic, Sterling Walsh III, Brimrose Technology Corp. (USA); Glenn Cloud, Brimrose Corp. of America (USA). [8742-25]

Lunch/Exhibition Break . . . . . Wed 11:50 am to 2:00 pm

SESSION 8
Room: Conv. Ctr. 323 . . . . . Wed 2:00 pm to 2:40 pm

Networking for Netcentric Warfare

Joint Session with Conferences 8742 and 8754

Session Chairs: **Raja Suresh,** General Dynamics Advanced Information Systems (USA); **Tien Pham (**USA)

2:00 pm: **A key management scheme for tiered wireless sensor network with self-healing capability**, Maoyu Wang, Communications Research Ctr. Canada (Canada); Helen Y. Tang, Defence Research and Development Canada, Ottawa (Canada); F. Richard Yu, Carleton Univ. (Canada) . . . . . [8742-26]

2:20 pm: **A data collection decision-making framework for a multi-tier collaboration of heterogeneous orbital, aerial and ground craft**, Jeremy Straub, The Univ. of North Dakota (USA). . . . . [8742-27]

Coffee Break . . . . . Wed 2:40 pm to 3:40 pm

SESSION 9
Room: Conv. Ctr. 323 . . . . . Wed 3:40 pm to 4:40 pm

Distributed/Decentralized Sensor Networks and Data Fusion

Session Chair: **Tien Pham (**USA)

3:40 pm: **On-line data validation in distributed data fusion**, Jurgo Preden, Tallinn Univ. of Technology (Estonia); James Llinas, Univ. at Buffalo (USA); Galina L. Rogova, Encompass Consulting (USA); Raido Pahtma, Leo Motus, Tallinn Univ. of Technology (Estonia) . . . . . [8742-28]

4:00 pm: **Dynamically allocated virtual clustering management system**, Kelvin M. Marcus, U.S. Army Research Lab. (USA); Jess A. Cannata, Dynamics Research Corp. (USA) . . . . . [8742-29]

4:20 pm: **Low Frame Rate Video Target Localization and Tracking Testbed**, Pu Pang, Temple Univ. (USA); Dan Shen, Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Pengpeng Liang, Temple University (USA); Khanh D. Pham, Erik P. Blasch, Air Force Research Lab. (USA); Zhonghai Wang, Intelligent Fusion Technology, Inc. (USA); Haibin Ling, Temple Univ. (USA) . . . . . [8742-31]

Thursday 2 May

SESSION 10
Room: Conv. Ctr. 323 . . . . . Thu 8:20 am to 10:00 am

Collaborative Information Processing/Sharing

Session Chair: **Gavin Pearson,** Defence Science and Technology Lab. (United Kingdom)

8:20 am: **Acoustic network event classification using swarm optimization**, Jerry A. Burman, Intelligent Recognition Systems (USA) . . . . . [8742-32]

8:40 am: **Virtual GEOINT Center: C2ISR through an avatar's eyes**, Sanjay Kumar Boddhu, MetaCarta, a Div. of Qbase (USA); Robert L. Williams, Air Force Research Lab. (USA); Mark Seibert, Wright State Univ. (USA) . . . . . [8742-33]

9:00 am: **Characterization and definition of a software stack for a reference experimental framework**, Andrew Toth, U.S. Army Research Lab. (USA); Flavio Bergamaschi, IBM United Kingdom Ltd. (United Kingdom) . . . . . [8742-34]

9:20 am: **Managing ISR sharing policies at the network edge using Controlled English**, Christos Parizas, Diego Pizzocaro, Alun D. Preece, Cardiff Univ. (United Kingdom); Petros Zerfos, IBM Thomas J. Watson Research Ctr. (USA). . . [8742-35]

9:40 am: **Diagnosing Degradation of Services in Hybrid Wireless Tactical Networks**, Srikar Tati, The Pennsylvania State Univ. (USA); Petr Novotny, Imperial College London (United Kingdom); Bong Jun Ko, IBM Thomas J. Watson Research Ctr. (USA); Alexander L. Wolf, Imperial College London (United Kingdom); Thomas F. LaPorta, The Pennsylvania State Univ. (USA) . . . . . [8742-36]

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

SESSION 11
Room: Conv. Ctr. 323 . . . . . Thu 10:30 am to 11:50 am

Collaborative Information Processing/Sharing via Mobile Devices

Session Chair: **Gavin Pearson,** Defence Science and Technology Lab. (United Kingdom)

10:30 am: **A collaborative smartphone sensing platform for detecting and tracking hostile drones**, Sanjay Kumar Boddhu, MetaCarta, a Div. of Qbase (USA); Robert L. Williams, Air Force Research Lab. (USA); Matt Macarthny, Wright State University (USA) . . . . . [8742-37]

10:50 am: **Smartphones for distributed multimode sensing: biological and environmental sensing and analysis**, Sanjay Kumar Boddhu, MetaCarta, a Div. of Qbase (USA); Robert L. Williams, Air Force Research Lab. (USA); Tyler Feitshans, Ohio Northern Univ. (USA). . . . . [8742-38]

11:10 am: **Context-aware event detection smartphone application for first responders**, Sanjay Kumar Boddhu, MetaCarta, a Div. of Qbase (USA); Robert L. Williams, Air Force Research Lab. (USA) . . . . . [8742-39]

11:30 am: **Smartphone citizen sensors for urban ground tracking**, Sanjay Kumar Boddhu, MetaCarta, a Div. of Qbase (USA); Robert L. Williams, Air Force Research Lab (USA); Michael Fox, Wright State Univ. (USA) . . . . . [8742-40]

Monday - Thursday 29 Arpil - 2 May 2013 • Proceedings of SPIE Vol. 8743

Algorithms and Technologies for Multispectral, Hyperspectral, and Ultraspectral Imagery XIX

Conference Chairs: **Sylvia S. Shen,** The Aerospace Corp. (USA); **Paul E. Lewis,** National Geospatial-Intelligence Agency (USA)

Program Committee: **Gail P. Anderson,** Air Force Research Lab. (USA); **Chein-I Chang,** Univ. of Maryland, Baltimore County (USA); **Eustace L. Dereniak,** College of Optical Sciences, The Univ. of Arizona (USA); **Michael T. Eismann,** Air Force Research Lab. (USA); **Glenn E. Healey,** Univ. of California, Irvine (USA); **Fred A. Kruse,** Naval Postgraduate School (USA); **Jacqueline J. Le Moigne,** NASA Goddard Space Flight Ctr. (USA); **David W. Messinger,** Rochester Institute of Technology (USA); **Alan P. Schaum,** U.S. Naval Research Lab. (USA); **James Theiler,** Los Alamos National Lab. (USA); **Grady Tuell,** Georgia Tech Research Institute (USA); **Miguel Velez-Reyes,** The Univ. of Texas at El Paso (USA)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 326 . . . . . .Mon 8:30 am to 10:30 am

Detection, Identification, and Quantification I

Session Chair: **Sylvia S. Shen,** The Aerospace Corp. (USA)

8:30 am: **The remarkable success of adaptive cosine estimator in hyperspectral target detection** *(Invited Paper)*, Dimitris G. Manolakis, MIT Lincoln Lab. (USA); Eric Truslow, Northeastern Univ. (USA); Michael L. Pieper, MIT Lincoln Lab. (USA); Thomas Cooley, Michael Brueggman, Steven J. Lipson, Air Force Research Lab. (USA) . . . . . [8743-1]

9:10 am: **Extending continuum fusion to create unbeatable detectors**, Alan P. Schaum, U.S. Naval Research Lab. (USA) . . . . . [8743-2]

9:30 am: **A hyperspectral anomaly detector based on partitioning pixel into adjacent components**, Edisanter Lo, Susquehanna Univ. (USA) . . . . . [8743-3]

9:50 am: **False alarm mitigation techniques for hyperspectral target detection**, Michael L. Pieper, Eric Truslow, Dimitris G. Manolakis, MIT Lincoln Lab. (USA) . . . . . [8743-4]

10:10 am: **Image change detection via ensemble learning**, Benjamin W. Martin, The Univ. of Tennessee Knoxville (USA); Ranga R. Vatsavai, Oak Ridge National Lab. (USA) . . . . . [8743-5]

Coffee Break . . . . . Mon 10:30 am to 11:00 am

SESSION 2

Room: Conv. Ctr. 326 . . . . . .Mon 11:00 am to 12:20 pm

Spectral Methodologies and Applications I

Session Chair: **Paul E. Lewis,**
National Geospatial-Intelligence Agency (USA)

11:00 am: **Material classification for unmanned ground vehicles using multispectral cameras**, David Chambers, Marc Alban, William C. Flannigan, Southwest Research Institute (USA) . . . . . [8743-6]

11:20 am: **Hyperspectral imaging for detection and identification of blood stains at the crime scene**, Gerda Edelman, Academic Medical Center (Netherlands); Ton G van Leeuwen, Univ. van Amsterdam (Netherlands) and Academic Medical Center (Netherlands); Maurice C.G. Aalders, Academic Medical Center (Netherlands) . . . . . [8743-85]

11:40 am: **Spectral unmixing applied to desert soils for the detection of sub-pixel disturbances**, Jessica L. Stuart, U. S. Dept. of Defense (USA); Fred A. Kruse, Naval Postgraduate School (USA). . . . . [8743-8]

12:00 pm: **An advanced algorithm suite for wide-field of view multispectral threat warning systems**, Joel B. Montgomery, Marjorie Montgomery, M&M Aviation (USA) . . . . . [8743-9]

Lunch Break . . . . . Mon 12:20 pm to 1:40 pm

SESSION 3

Room: Conv. Ctr. 326 . . . . . Mon 1:40 pm to 3:00 pm

Spectral Methodologies and Applications II

Session Chair: **Scott D. Brown,** Rochester Institute of Technology (USA)

1:40 pm: **Undercomplete learned dictionaries for land cover classification in multispectral imagery of Arctic landscapes using CoSA: clustering of sparse approximations**, Daniela I. Moody, Steven P. Brumby, Joel C. Rowland, Chandana Gangodagamage, Los Alamos National Lab. (USA) . . . . . [8743-11]

2:00 pm: **Security inspection through anomaly detection using hyperspectral imaging technology**, Javier Rivera, Fernando L. Valverde, Manuel Saldana, Vidya B. Manian, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8743-12]

2:20 pm: **A multistage framework for dismount spectral verification in the VNIR**, Dalton S. Rosario, U.S. Army Research Lab. (USA) . . . . . [8743-13]

2:40 pm: **LWIR hyperspectral change detection for target acquisition and situation awareness in urban areas**, Rob J. Dekker, Piet B. W. Schwering, Koen W. Benoist, TNO Defence, Security and Safety (Netherlands); Stefano Pignatti, Federico Santini, CNR IMAA (Italy); Ola Friman, FOI (Sweden) . . . . . [8743-14]

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

SESSION 4

Room: Conv. Ctr. 326 . . . . . Mon 3:30 pm to 4:50 pm

Spectral Data Collections and Experiments

Session Chair: **David W. Messinger,**
Rochester Institute of Technology (USA)

3:30 pm: **The SHARE 2012 data collection campaign**, AnneMarie Giannandrea, Nina Raqueno, David W. Messinger, Jason Faulring, John P. Kerekes, Jan van Aardt, Kelly Canham, Shea Hagstrom, Erin Ontiveros, Aaron Gerace, Rochester Institute of Technology (USA); Jason Kaufman, Karmon M. Vongsy, Air Force Research Lab. (USA); Heather Griffith, UTC Aerospace Systems (USA); Brent D. Bartlett, The MITRE Corp. (USA). . . . . [8743-15]

3:50 pm: **SHARE 2012: large edge targets for hyperspectral imaging applications**, Kelly Canham, Daniel S. Goldberg, John P. Kerekes, Nina Raqueno, David W. Messinger, Rochester Institute of Technology (USA) . . . . . [8743-16]

4:10 pm: **SHARE 2012: subpixel detection and unmixing experiments**, John P. Kerekes, Kyle Ludgate, AnneMarie Giannandrea, Nina Raqueno, Rochester Institute of Technology (USA) . . . . . [8743-17]

4:30 pm: **SHARE 2012: analysis of illumination differences on targets in hyperspectral imagery**, Emmett Ientilucci, Rochester Institute of Technology (USA) . . . . . [8743-18]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 326 . . . . . Tue 8:00 am to 9:40 am

Spectral Data Analysis Methodologies I

Session Chair: **Scott D. Brown,** Rochester Institute of Technology (USA)

8:00 am: **Detection and tracking of gas plumes in LWIR hyperspectral video sequence data**, Torin Gerhart, Justin Sunu, California State Univ., Long Beach (USA); Lauren Lieu, Harvey Mudd College (USA); Ekaterina Merkurjev, Univ. of California, Los Angeles (USA); Jen-Mei Chang, California State Univ., Long Beach (USA); Jerome Gilles, Andrea L. Bertozzi, Univ. of California, Los Angeles (USA) . . . . . [8743-19]

8:20 am: **Geometrical interpretation of the adaptive coherence estimator for hyperspectral target detection**, Shahar Bar, Ori Bass, Alon Volfman, Tomer Dallal, Stanley R. Rotman, Ben-Gurion Univ. of the Negev (Israel) . . . . . [8743-20]

8:40 am: **Target detection using the background model from the topological anomaly detection algorithm**, Leidy P. Dorado Munoz, David W. Messinger, Amanda K. Ziemann, Rochester Institute of Technology (USA) . . . . . [8743-22]

9:00 am: **Low-rank decomposition-based anomaly detection**, Shih-Yu Chen, Shiming Yang, Konstantinos Kalpakis, Chein-I Chang, Univ. of Maryland, Baltimore County (USA). . . . . [8743-23]

9:20 am: **Improved target recognition using live atmospheric cancellation**, Cynthia I. Archer, Jim Morgenstern, Vision4ce LLC (USA) . . . . . [8743-24]

Coffee/Exhibition Break. . . . . .Tue 9:40 am to 10:30 am

SESSION 6
Room: Conv. Ctr. 326 . . . . . Tue 10:30 am to 12:10 pm

Multisensor Data Fusion

Session Chair: **Grady Tuell,** Georgia Tech Research Institute (USA)

10:30 am: **Multimodal detection of man-made objects**, Richard L. Tutwiler, Matthew S. Baran, Donald J. Natale, The Pennsylvania State Univ. (USA) [8743-25]

10:50 am: **A method to generate sub-pixel classification maps for use in DIRSIG three-dimensional models**, Ryan Givens, Karl C. Walli, Air Force Institute of Technology (USA); Michael T. Eismann, Air Force Research Lab. (USA) [8743-26]

11:10 am: **Snapshot spectral and polarimetric collection: video tracking and target identification**, Brent D. Bartlett, Mikel D. Rodriguez, The MITRE Corp. (USA) . . . . . [8743-27]

11:30 am: **Detecting occluded and obscured targets in airborne hyperspectral imagery with co-registered lidar**, Taylor Glenn, Paul D. Gader, Univ. of Florida (USA) . . . . . [8743-28]

11:50 am: **Blind analysis of multispectral and polarimetric data via canonical correlation analysis**, Ozgur Polat, ASELSAN Inc. (Turkey); Yakup Özkazanç, Hacettepe Univ. (Turkey). . . . . [8743-29]

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

SESSION 7
Room: Conv. Ctr. 326 . . . . . Tue 1:10 pm to 3:10 pm

Spectral Data Analysis Methodologies II

Session Chair: **Miguel Velez-Reyes,** The Univ. of Texas at El Paso (USA)

1:10 pm: **Lossless to lossy compression for hyperspectral imagery based on wavelet and integer KLT transforms with 3D binary EZW**, Kai-jen Cheng, Jeffrey C. Dill, Ohio Univ. (USA) . . . . . [8743-30]

1:30 pm: **Analytical and comparative analysis of lossy ultraspectral image compression**, Rolando Herrero, Vinay K. Ingle, Northeastern Univ. (USA) [8743-31]

1:50 pm: **Supervised method for optimum hyperspectral band selection**, Robert K. McConnell, Way 2C (USA) . . . . . [8743-32]

2:10 pm: **Second order statistics target-specified virtual dimensionality**, Drew Paylor, Chein-I Chang, Univ. of Maryland, Baltimore County (USA). . . . . [8743-33]

2:30 pm: **Hyperspectral image unmixing via bi-linear generalized approximate message passing**, Jeremy Vila, Philip Schniter, The Ohio State Univ. (USA); Joseph Meola, U.S. Air Force (USA) . . . . . [8743-34]

2:50 pm: **Comparing quadtree region partitioning metrics for hyperspectral unmixing**, Miguel A. Goenaga-Jimenez, Univ. de Puerto Rico Mayagüez (USA); Miguel Velez-Reyes, The Univ. of Texas at El Paso (USA) . . . . . [8743-35]

Coffee Break . . . . . .Tue 3:10 pm to 3:50 pm

SESSION 8
Room: Conv. Ctr. 326 . . . . . Tue 3:50 pm to 5:30 pm

Spectral Methodologies and Applications III

Session Chair: **Fred A. Kruse,** Naval Postgraduate School (USA)

3:50 pm: **Impact of specular reflection on bottom type retrieved from WorldView-2 images**, Karen W. Patterson, Gia M. Lamela, U.S. Naval Research Lab. (USA) . . . . . [8743-36]

4:10 pm: **Using multi-angle WorldView-2 imagery to determine bathymetry near Oahu, Hawaii**, Krista R. Lee, Richard C. Olsen, Fred A. Kruse, Angela M. Kim, Naval Postgraduate School (USA) and Remote Sensing Ctr. (USA). . . . . [8743-37]

4:30 pm: **Automatic ship detection from commercial multispectral satellite imagery**, Brian J. Daniel, Alan P. Schaum, Eric C. Allman, Robert A. Leathers, Trijntje Downes, U.S. Naval Research Lab. (USA) . . . . . [8743-38]

4:50 pm: **A decade of measured greenhouse forcings from AIRS hyperspectral outgoing longwave spectra**, Milton Halem, David Chapman, Phuong Nguyen, Univ. of Maryland, Baltimore County (USA) . . . . . [8743-39]

5:10 pm: **Initial validation of atmospheric compensation for a Landsat land surface temperature product**, Monica J. Cook, John R. Schott, Rochester Institute of Technology (USA) . . . . . [8743-40]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Progressive constrained energy minimization for subpixel detection, Yulei Wang, Harbin Engineering Univ. (China); Robert C. Schultz, U.S. Naval Academy (USA); Shih-Yu Chen, Univ. of Maryland, Baltimore County (USA); Chunhong Liu, South China Agricultural Univ. (China); Chein-I Chang, Univ. of Maryland, Baltimore County (USA). . . . . [8743-75]

GPUs for parallel on-board hyperspectral image radiometric normalization, Yuanfeng Wu, Bing Zhang, Ctr. for Earth Observation and Digital Earth (China); Haina Zhao, Jianwei Gao, Li Ni, Wei Yang, Graduate Univ. of the Chinese Academy of Sciences (China) and Ctr. for Earth Observation and Digital Earth (China) . . . . . [8743-76]

Impact of spatial complexity preprocessing on hyperspectral data unmixing, Stefan A. Robila, Montclair State Univ. (USA). . . . . [8743-77]

Code aperture design and performance comparison based on coded aperture spectral snapshot imager (CASSI) system, Qunbo Lv, Bin Xiangli, Xiaoru Zeng, Yangyang Liu, Mingxiang Huang, The Academy of Opto-Electronics (China) . . . . . [8743-78]

Concealed target detection using hyperspectral imagers based on intersection kernel of SVM, Min-Sheob Shim, Sungho Kim, Yeungnam Univ. (Korea, Republic of). . . . . [8743-79]

Fusion and quality analysis for satellite images using contourlet transform, Yoonsuk Choi, Ershad Sharifahmadian, Shahram Latifi, Univ. of Nevada, Las Vegas (USA) . . . . . [8743-80]

Improving performance of hyperspectral image classification via adaptive principle subspace detection, Xiaoxia Sun, Johns Hopkins Univ. (USA); Nasser M. Nasrabadi, U.S. Army Research Lab. (USA); Trac D. Tran, Johns Hopkins Univ. (USA) . . . . . [8743-81]

High Etedue interferometric imaging spectrometer, Jianxin Li, Xin Meng, Rihong Zhu, Nanjing Univ. of Science and Technology (China) . . . . . [8743-84]

Water mapping through universal pattern decomposition method in comparison to modified normalized difference water index (MNDWI), Muhammad Hasan Ali Baig, Lifu Zhang, Liu Kai, Tong Shuai, Institute of Remote Sensing and Digital Earth (China); Ji Lei, U.S. Geological Survey (USA) . . [8743-86]

Wednesday 1 May

SESSION 9

Room: Conv. Ctr. 326 . . . . . .Wed 8:00 am to 10:00 am

Detection, Identification, and Quantification II

Session Chair: **Miguel Velez-Reyes,** The Univ. of Texas at El Paso (USA)

8:00 am: **Detection of unknown gas-phase chemical plumes in hyperspectral imagery**, James Theiler, Brendt E. Wohlberg, Los Alamos National Lab. (USA) . . . . . [8743-41]

8:20 am: **Hyperspectral chemical plume quantification via background radiance estimation**, Sidi Niu, Northeastern Univ. (USA); Steven Golowich, Dimitris G. Manolakis, MIT Lincoln Lab. (USA). . . . . [8743-42]

8:40 am: **Detection and tracking of gas clouds in an urban area by imaging infrared spectroscopy**, Samer Sabbah, Peter Rusch, Joern-Hinnrich Gerhard, Roland Harig, Bruker Optik GmbH (Germany) . . . . . [8743-43]

9:00 am: **Spectral target detection using a physical model and a manifold learning technique**, James A. Albano, David W. Messinger, Rochester Institute of Technology (USA) . . . . . [8743-44]

9:20 am: **Target detection performed on manifold approximations recovered from hyperspectral data**, Amanda K. Ziemann, David W. Messinger, James A. Albano, Rochester Institute of Technology (USA). . . . . [8743-45]

9:40 am: **Hyperspectral target detection by Gaussian/non-Gaussian subspace division and nonparametric density estimation**, Gil A. Tidhar, Stanley R. Rotman, Ben-Gurion Univ. of the Negev (Israel) . . . . . [8743-46]

Coffee/Exhibition Break. . . . . Wed 10:00 am to 10:50 am

SESSION 10

Room: Conv. Ctr. 326 . . . . . .Wed 10:50 am to 12:10 pm

Spectral Sensor Development and Characterization

Session Chair: **Eustace L. Dereniak,**
College of Optical Sciences, The Univ. of Arizona (USA)

10:50 am: **On super-resolved coded aperture spectral imaging**, Hoover F. Rueda, Univ. of Delaware (USA); Henry Arguello, Univ. of Delaware (USA) and Univ. Industrial de Santander (Colombia); Gonzalo R. Arce, Univ. of Delaware (USA) . . . . . [8743-48]

11:10 am: **A prototype panoramic compact shortwave infrared hyperspectral sensor for maritime sensing: performance and applications**, K. Peter Judd, Jonathan M. Nichols, James R. Waterman, U.S. Naval Research Lab. (USA); Colin C. Olson, Sotera Defense Solutions, Inc. (USA); Dan Guerin, Brandywine Photonics LLC (USA); Gordon Scriven, Opto Knowledge Systems, Inc. (USA). . . . . [8743-49]

11:30 am: **Modeling, development, and testing of a shortwave infrared supercontinuum laser source for use in active hyperspectral imaging**, Joseph Meola, Air Force Research Lab. (USA) . . . . . [8743-50]

11:50 am: **Low-complexity image processing for a high-throughput, low-latency snapshot multispectral imager with integrated tiled filters**, Bert Geelen, Klaas Tack, Andy Lambrechts, Carolina Blanch, IMEC (Belgium) . . . . . [8743-51]

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

SESSION 11

Room: Conv. Ctr. 326 . . . . . Wed 1:10 pm to 3:10 pm

Spectral Data Analysis Methodologies III

Session Chair: **David W. Messinger,**
Rochester Institute of Technology (USA)

1:10 pm: **Interactive mapping and quantification tools for remote sensing imagery**, Reid B. Porter, Los Alamos National Lab. (USA). . . . . [8743-52]

1:30 pm: **Enhancement of hyperspectral imagery using spectrally weighted tensor anisotropic nonlinear diffusion for classification**, Maider J. Marin-Mcgee, Univ. de Puerto Rico Mayagüez (USA); Miguel Velez-Reyes, The Univ. of Texas at El Paso (USA) . . . . . [8743-53]

1:50 pm: **Pan-sharpening of spectral image with anisotropic diffusion for fine feature extraction using GPU**, Weihua Sun, Bin Chen, David W. Messinger, Rochester Institute of Technology (USA) . . . . . [8743-54]

2:10 pm: **An analysis of the probability distribution of spectral angle and Euclidean distance in hyperspectral remote sensing using microspectroscopy**, Ronald G. Resmini, Christopher J. Deloye, The MITRE Corp. (USA); David W. Allen, National Institute of Standards and Technology (USA). . . . . [8743-55]

2:30 pm: **Advanced spectral signature discrimination algorithm**, Sumit Chakravarty, New York Institute of Technology (USA) . . . . . [8743-56]

2:50 pm: **Blind source separation of the HyMap hyperspectral data via canonical correlation analysis**, Ozgur Polat, ASELSAN Inc. (Turkey); Yakup Özkazanç, Hacettepe Univ. (Turkey) . . . . . [8743-57]

Coffee Break . . . . . Wed 3:10 pm to 3:50 pm

SESSION 12

Room: Conv. Ctr. 326 . . . . . Wed 3:50 pm to 5:30 pm

Spectral Signature Measurements and Applications

Session Chair: **Fred A. Kruse,** Naval Postgraduate School (USA)

3:50 pm: **Intensity offset and correction of solid samples measured behind quartz cover glass**, Bruce E. Bernacki, Rebecca L. Redding, Yin-Fong Su, Timothy J. Johnson, Pacific Northwest National Lab. (USA) . . . . . [8743-58]

4:10 pm: **Estimation of measurement uncertainties for a hyperspectral imager operating at the sub-millimeter spatial scale**, David W. Allen, National Institute of Standards and Technology (USA); Christopher J. Deloye, Ronald G. Resmini, The MITRE Corp. (USA) . . . . . [8743-59]

4:30 pm: **An automated method for locating spectral features for signature analysis and library optimization**, William Basener, Rochester Institute of Technology (USA) and Exelis Visual Information Solutions (USA); Robert McEwen, National Ground Intelligence Ctr. (USA) . . . . . [8743-60]

4:50 pm: **Spectral variability constraints on multispectral and hyperspectral mapping performance**, Fred A. Kruse, Kenneth G. Fairbarn Jr., Naval Postgraduate School (USA). . . . . [8743-61]

5:10 pm: **Multispectral and hyperspectral advanced characterization of soldier's camouflage equipment**, Philippe Lagueux, Telops (Canada); Mariusz Kastek, Tadeusz Piatkowski, Rafal Dulski, Military Univ. of Technology (Poland); Vincent Farley, Martin Chamberland, Telops (Canada). . . . . [8743-62]

Thursday 2 May

SESSION 13

Room: Conv. Ctr. 326 . . . . . Thu 8:00 am to 10:20 am

Spectral Data Enhancement Technologies and Techniques

Session Chair: **Paul E. Lewis,**
National Geospatial-Intelligence Agency (USA)

8:00 am: **Spectral image destriping using a low-dimensional model**, Steven M. Adler-Golden, Spectral Sciences, Inc. (USA); Steven C. Richtsmeier, Spectral Sciences Inc (USA); Patrick F. Conforti, Lawrence S. Bernstein, Spectral Sciences, Inc. (USA). . . . . [8743-63]

8:20 am: **New algorithms for destriping and registration correction for Hyperion imagery**, Shawn D. Hunt, John Lunzer, Univ. de Puerto Rico Mayagüez (USA) . . . . . [8743-64]

8:40 am: **Accurate accommodation of scan-mirror distortion in the registration of hyperspectral data cubes**, Damon M. Conover, The George Washington Univ. (USA); John K. Delaney, National Gallery of Art (USA) and The George Washington Univ. (USA); Murray H. Loew, The George Washington Univ. (USA) . . . . . [8743-65]

9:00 am: **Automated geo/ortho registered aerial imagery product generation using the mapping system interface card (MSIC)**, Paul E. Lewis, National Geospatial-Intelligence Agency (USA) . . . . . [8743-66]

9:20 am: **An uncertainty estimate for the georeference of high resolution hyperspectral images of an urban scenario**, Thomas O. Opsahl, Trym V. Haavardsholm, Norwegian Defence Research Establishment (Norway). . . [8743-67]

9:40 am: **Evaluation of the CASSI-DD hyperspectral compressive sensing imaging system**, Maria Busuioceanu, David W. Messinger, Rochester Institute of Technology (USA); John B. Greer, Justin C. Flake, National Geospatial-Intelligence Agency (USA) . . . . . [8743-68]

10:00 am: **Modeling satellite imaging sensors over optically complex bodies of water**, Robert Nevins, St. Olaf College (USA); Aaron Gerace, Rochester Institute of Technology (USA) . . . . . [8743-69]

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

SESSION 14

Room: Conv. Ctr. 326 . . . . . Thu 10:50 am to 12:10 pm

Clustering and Classification

Session Chair: **Sylvia S. Shen,** The Aerospace Corp. (USA)

10:50 am: **Spectral dependence of texture features integrated with hyperspectral data for area target classification improvement**, Corey Bangs, Marine Corps Intelligence Activity (USA); Richard C. Olsen, Fred A. Kruse, Naval Postgraduate School (USA). . . . . [8743-70]

11:10 am: **A semi-supervised classification algorithm using the TAD-derived background as training data**, Lei Fan, David W. Messinger, Brittany Ambeau, Rochester Institute of Technology (USA) . . . . . [8743-72]

11:30 am: **Scale profile as feature for quick satellite image object-based classification**, David Dubois, Richard Lepage, Ecole de Technologie Supérieure (Canada) . . . . . [8743-73]

11:50 am: **Multiscale vector tunnel classification algorithm for hyperspectral images**, Suleyman Demirci, Turkish Air Force Academy (Turkey); Isin Erer, Istanbul Technical Univ. (Turkey); Numan Unaldi, Turkish Air Force Academy (Turkey) . . . . . [8743-74]

Automatic Target Recognition XXIII

Conference Chairs: **Firooz A. Sadjadi,** Lockheed Martin Advanced Technology Labs. (USA); **Abhijit Mahalanobis,** Lockheed Martin Missiles and Fire Control (USA)

Program Committee: **Mohammad S. Alam,** Univ. of South Alabama (USA); **Farid Amoozegar,** Jet Propulsion Lab. (USA); **Mahmood R. Azimi-Sadjadi,** Colorado State Univ. (USA); **David Casasent,** Carnegie Mellon Univ. (USA); **Leon Cohen,** Hunter College (USA); **Frederick D. Garber,** Wright State Univ. (USA); **Guillermo C. Gaunaurd,** Consultant (USA); **Izidor Gertner,** The City College of New York (USA); **Patti S. Gillespie,** U.S. Army Research Lab. (USA); **Riad I. Hammoud,** BAE Systems (USA); **Bahram Javidi,** Univ. of Connecticut (USA); **Ismail I. Jouny,** Lafayette College (USA); **Behzad Kamgar-Parsi,** U.S. Naval Research Lab. (USA); **Timothy J. Klausutis,** Air Force Research Lab. (USA); **Wolfgang Kober,** Data Fusion Corp. (USA); **Aaron D. Lanterman,** Georgia Institute of Technology (USA); **Randolph L. Moses,** The Ohio State Univ. (USA); **Robert R. Muise,** Lockheed Martin Missiles and Fire Control (USA); **Nasser M. Nasrabadi,** U.S. Army Research Lab. (USA); **Les Novak,** Scientific Systems Co., Inc. (USA); **Joseph A. O'Sullivan,** Washington Univ. in St. Louis (USA); **Mubarak Ali Shah,** Univ. of Central Florida (USA); **Andre U. Sokolnikov,** Visual Solutions and Applications (USA); **Bradley C. Wallet,** Automated Decisions LLC (USA); **Edmund Zelnio,** Air Force Research Lab. (USA)

Monday 29 April

SESSION 1
Room: Conv. Ctr. 341 . . . . . .Mon 8:30 am to 10:10 am

New Methodologies I

Session Chair: **Alan J. Van Nevel,**
Naval Air Warfare Ctr. Aircraft Div. (USA)

8:30 am: **Generalized linear correlation filters**, Andres F. Rodriguez, Air Force Research Lab. (USA) and Carnegie Mellon Univ. (USA); B. V. K. Vijaya Kumar, Carnegie Mellon Univ. (USA) . . . . . [8744-1]

8:50 am: **An ATR architecture for algorithm development and testing**, Gøril M. Breivik, Kristin H. Løkken, Alvin Brattli, Hans C. Palm, Trym V. Haavardsholm, Norwegian Defence Research Establishment (Norway) . . . . . [8744-2]

9:10 am: **Implementation of a cascaded HOG-based pedestrian detector**, Christopher Reale, Prudhvi Gurram, Shuowen Hu, Alex L. Chan, U.S. Army Research Lab. (USA) . . . . . [8744-3]

9:30 am: **No-reference image quality measurement for low-resolution images**, Josh Sanderson, Wright State Univ. (USA); Yu Liang, Shane Fernandes, Michael Henderson, Central State Univ. (USA); Darrell Barker, Air Force Research Lab. (USA) . . . . . [8744-4]

9:50 am: **Unsupervised pedestrian detection using support vector data description**, Prudhvi Gurram, Shuowen Hu, Christopher Reale, Alex L. Chan, U.S. Army Research Lab. (USA) . . . . . [8744-5]

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

SESSION 2
Room: Conv. Ctr. 341 . . . . . .Mon 10:40 am to 11:40 am

Image and Signal Processing for Target Tracking Applications I

Session Chair: **Andre U. Sokolnikov,**
Visual Solutions and Applications (USA)

10:40 am: **Improved real-time photogrammetric stitching**, Jason P. de Villiers, Jaco Cronje, Council for Scientific and Industrial Research (South Africa) . [8744-7]

11:00 am: **Multi-camera rigid body pose estimation using higher-order dynamic models**, Alec E. Forsman, David A. Schug, Naval Air Warfare Ctr. Aircraft Div. (USA); Anton Haug, Johns Hopkins Univ. Applied Physics Lab. (USA) . [8744-8]

11:20 am: **Score-based gating control method in the presence of stop-move maneuvering motorboat's wake**, Fatih Pektas, ASELSAN Inc. (Turkey) . . [8744-9]

Lunch Break . . . . . Mon 11:40 am to 1:00 pm

SESSION 3
Room: Conv. Ctr. 341 . . . . . Mon 1:00 pm to 2:00 pm

Image and Signal Processing for Target Tracking Applications II

Session Chair: **Andre U. Sokolnikov,**
Visual Solutions and Applications (USA)

1:00 pm: **An empirical evaluation of infrared clutter for point target detection algorithms**, Mark McKenzie, Sebastien Wong, DSTO (Australia); Danny Gibbins, The Univ. of Adelaide (Australia) . . . . . [8744-10]

1:20 pm: **Hyperspectral remote sensing and illegal oil bunkering in the Niger Delta of Nigeria**, Henry O. Odunsi, Earth Info Services (Nigeria). . . . . [8744-11]

1:40 pm: **Position-independent ATR using hierarchical Hidden Markov Model as the identification algorithm** *(Invited Paper)*, Andre U. Sokolnikov, Visual Solutions and Applications (USA) . . . . . [8744-12]

SESSION 4
Room: Conv. Ctr. 341 . . . . . Mon 2:00 pm to 4:30 pm

IR-Based ATR I

Session Chair: **Riad I. Hammoud,** BAE Systems (USA)

2:00 pm: **Noise cancellation in IR video based on empirical mode decomposition**, José P. Ave, Manuel Blanco-Velasco, Fernando Cruz Roldán, Univ. de Alcalá (Spain); Antonio Artés Rodríguez, Univ. Carlos III de Madrid (Spain) . . . . . [8744-13]

2:20 pm: **Robust coastal region detection method using image segmentation and sensor LOS information for infrared search and track**, Sungho Kim, Yeungnam Univ. (Korea, Republic of) . . . . . [8744-14]

2:40 pm: **Person detection in LWIR imagery using image retrieval**, Thomas Müller, Daniel Manger, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . . [8744-15]

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

3:30 pm: **Hot spot detection and classification in LWIR videos for person recognition**, Michael Teutsch, Thomas Müller, Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany) . . . . . [8744-16]

3:50 pm: **Image restoration and superresolution for on-demand satellite imagery**, Riad I. Hammoud, Luis Galup, Diane G. Mills, BAE Systems (USA) . . . . . [8744-17]

4:10 pm: **Multilayer robust and adaptive dismounts detection approach for WAPS**, Riad I. Hammoud, BAE Systems (USA); Matthew Antone, Massachusetts Institute of Technology (USA) . . . . . [8744-18]

Symposium-wide Plenary Session
Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5
Room: Conv. Ctr. 341 . . . . . Tue 8:00 am to 9:00 am

IR Based ATR II

Session Chair: **Riad I. Hammoud,** BAE Systems (USA)

8:00 am: **Boosting target tracking using particle filter with flow control**, Nima Moshtagh, Moses W. Chan, Lockheed Martin Space Systems Co. (USA). [8744-19]

8:20 am: **Dynamic data driven applications systems (DDDAS) modeling for ATR**, Erik P. Blasch, Gunasekaran Seetharaman, Air Force Research Lab. (USA); Jianbo Gao, Wright State Univ. (USA); Frederica Darema, Kitt C. Reinhardt, Air Force Office of Scientific Research (USA). . . . . [8744-20]

8:40 am: **The rigid non-cooperative target recognition in practice based on the sparse representation**, Bo Sun, Xuewen Wu, Jun He, Xiaoming Zhu, Beijing Normal Univ. (China) . . . . . [8744-21]

SESSION 6
Room: Conv. Ctr. 341 . . . . . Tue 9:00 am to 11:30 am

New Methodologies II

Session Chair: **Andres F. Rodriguez,** Air Force Research Lab. (USA)

9:00 am: **Pre- and post- processing correlation filter data**, Andres F. Rodriguez, Air Force Research Lab. (USA) and Carnegie Mellon Univ. (USA); B. V. K. Vijaya Kumar, Carnegie Mellon Univ. (USA) . . . . . [8744-22]

9:20 am: **Dealing with circular correlation effects**, Andres F. Rodriguez, Air Force Research Lab. (USA) and Carnegie Mellon Univ. (USA); B. V. K. Vijaya Kumar, Carnegie Mellon Univ. (USA) . . . . . [8744-24]

Coffee/Exhibition Break. . . . . .Tue 9:40 am to 10:30 am

10:30 am: **Multi-kernel aggregation of local and global features in long-wave infrared for detection of SWAT teams in challenging environments**, Ankit Arya, Derek T. Anderson, Cindy Bethel, Daniel Carruth, Mississippi State Univ. (USA) . . . . . [8744-25]

10:50 am: **From shape to threat: exploiting the convergence between visual and conceptual organization for weapon identification and threat assessment** *(Invited Paper)*, Abdullah N. Arslan, Christian F. Hempelmann, Carlo Di Ferrante, Salvatore Attardo, Nikolay M. Sirakov, Texas A&M Univ.-Commerce (USA)[8744-26]

11:10 am: **Improved sample covariance matrix estimation for real-time target detection in hyperspectral imagery**, Wei Yang, Ctr. for Earth Observation and Digital Earth (China) and Chinese Academy of Sciences (China); Bing Zhang, Lianru Gao, Yuanfeng Wu, Ctr. for Earth Observation and Digital Earth (China); Li Ni, Ctr. for Earth Observation and Digital Earth (China) and Chinese Academy of Sciences (China) . . . . . [8744-27]

BEST PAPER AWARD PRESENTATION
Room: Conv. Ctr. 341 . . . . . 11:30 am to 12:00 pm

2013 ATR Best Paper Awards

Session Chair: **Firooz A. Sadjadi,** Lockheed Martin Corp. (USA)

Lockheed Martin Corporation had generously offered to sponsor the Best Paper Awards for the Automatic Target Recognition (ATR) conference. Two awards are planned: the first is the overall Best Paper Award, and the second is a Best Student Paper Award.

Award Sponsored by

LOCKHEED MARTIN

SESSION 7
Room: Conv. Ctr. 341 . . . . . Tue 1:00 pm to 3:00 pm

New Methodologies III

Session Chair: **Izidor Gertner,** The City College of New York (USA)

1:00 pm: **Chipping and segmentation of target of interest from low-resolution electro-optical data**, Shane Fernandes, Yu Liang, Michael Henderson, Central State Univ. (USA); Josh Sanderson, Wright State Univ. (USA); Darrell Barker, Air Force Research Lab. (USA). . . . . [8744-28]

1:20 pm: **Robust static and moving object detection via multi-scale attentional mechanisms**, Alexander L. Honda, Yang Chen, Deepak Khosla, HRL Labs., LLC (USA) . . . . . [8744-29]

1:40 pm: **Application of a knowledge interface to algorithmic selection**, Allison Mathis, Paul Barros, Kevin Newman, Steve M. Wilder, Lockheed Martin Corp. (USA) . . . . . [8744-30]

2:00 pm: **Automatic laser beam alignment using blob detection for an environment monitoring spectroscopy**, Jarjees A. Khidir, Youhua Chen, Gary T. Anderson, Univ. of Arkansas at Little Rock (USA) . . . . . [8744-31]

2:20 pm: **Target localization and function estimation in sparse sensor networks** *(Invited Paper)*, Natalia A. Schmid, West Virginia Univ. (USA) . . [8744-32]

2:40 pm: **A method for constructing orthonormal basis functions with good time-frequency localization**, Izidor Gertner, The City College of New York (USA) . . . . . [8744-41]

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

SESSION 8
Room: Conv. Ctr. 341 . . . . . Tue 3:30 pm to 5:30 pm

Active Sensors, Radar/Laser/Sonar Processing

Session Chair: **Leon Cohen,** Hunter College (USA)

3:30 pm: **SAR imaging in the presence of spectrum notches via fast missing data IAA** *(Invited Paper)*, William T. Rowe, Johan Karlsson, Univ. of Florida (USA); Luzhou Xu, Integrated Adaptive Applications, Inc. (USA) and Univ. of Florida (USA); George-Othon Glentis, Univ. of Peloponnese (Greece); Juan Li, Univ. of Florida (USA) . . . . . [8744-33]

3:50 pm: **HALOS: compact, high-speed adaptive optics**, Geoff P. Andersen, HUA Inc. (USA) . . . . . [8744-34]

4:10 pm: **A simulation study of target detection using hyperspectral data analysis**, Ershad Sharifahmadian, Yoonsuk Choi, Shahram Latifi, Univ. of Nevada, Las Vegas (USA) . . . . . [8744-36]

4:30 pm: **Sonar signal feature extraction for target recognition in range-dependent environments**, Patrick J. Loughlin, Vikram T. Gomatam, Univ. of Pittsburgh (USA) . . . . . [8744-37]

4:50 pm: **New electro-optic laser scanner desing for continuous coverage over a 120 x 120 degree field of regard**, Scott R. Davis, Scott D. Rommel, Seth T. Johnson, Neil A. Rebolledo, Stephanie M. McMahon, Michael H. Anderson, Vescent Photonics Inc. (USA); Jason M. Auxier, U.S. Naval Research Lab. (USA) . . . . . [8744-38]

5:10 pm: **Propagation effects in channels**, Leon Cohen, Hunter College (USA) . . . . . [8744-40]

Monday - Thursday 29 - 2 May 2013 • Proceedings of SPIE Vol. 8745

Signal Processing, Sensor Fusion, and Target Recognition XXII

Conference Chair: **Ivan Kadar,** Interlink Systems Sciences, Inc. (USA)

Conference Co-Chairs: **Erik P. Blasch,** Air Force Research Lab. (Canada); **Kenneth Hintz,** George Mason Univ. (USA); **Thia Kirubarajan,** McMaster Univ. (Canada); **Ronald P. S. Mahler,** Lockheed Martin Corp. (USA)

Program Committee: **Mark G. Alford,** Air Force Research Lab. (USA); **William D. Blair,** Georgia Tech Research Institute (USA); **Mark J. Carlotto,** General Dynamics Advanced Information Systems (USA); **Kuo-Chu Chang,** George Mason Univ. (USA); **Chee-Yee Chong,** BAE Systems (USA); **Marvin N. Cohen,** Georgia Tech Research Institute (USA); **Frederick E. Daum,** Raytheon Co. (USA); **Mohammad Farooq,** AA Scientific Consultants Inc (Canada); **Charles W. Glover,** Oak Ridge National Lab. (USA); **I. R. Goodman,** Consultant (USA); **Lynne L. Grewe,** California State Univ., East Bay (USA); **David L. Hall,** The Pennsylvania State Univ. (USA); **Michael L. Hinman,** Air Force Research Lab. (USA); **Jon S. Jones,** Air Force Research Lab. (USA); **Martin E. Liggins II,** The MITRE Corp. (USA); **James Llinas,** Univ. at Buffalo (USA); **Raj P. Malhotra,** Air Force Research Lab. (USA); **Alastair D. McAulay,** Lehigh Univ. (USA); **Raman K. Mehra,** Scientific Systems Co., Inc. (USA); **Harley R. Myler,** Lamar Univ. (USA); **David Nicholson,** BAE Systems (United Kingdom); **Les Novak,** Scientific Systems Co., Inc. (USA); **John J. Salerno Jr.,** Air Force Research Lab. (USA); **Andrew G. Tescher,** AGT Associates (USA); **Stelios C. A. Thomopoulos,** National Ctr. for Scientific Research Demokritos (Greece); **Wiley E. Thompson,** New Mexico State Univ. (USA); **Pierre Valin,** Defence Research and Development Canada, Valcartier (Canada)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 342 . . . . . .Mon 8:30 am to 10:10 am

Multisensor Fusion, Multitarget Tracking, and Resource Management I

Session Chairs: **Ivan Kadar,** Interlink Systems Sciences, Inc. (USA); **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **Kenneth Hintz,** George Mason Univ. (USA)

8:30 am: **Estimability of thrusting trajectories in 3D from a single passive sensor**, Ting Yuan, Yaakov Bar-Shalom, Peter Willett, Univ. of Connecticut (USA) . . . . . [8745-1]

8:50 am: **Comparing truth-to-track assignment methods for situation correctness**, John R. Maskasky, Mark E. Silbert, Naval Air Warfare Ctr. Aircraft Div. (USA) . . . . . [8745-2]

9:10 am: **Advances in displaying uncertain estimates of multiple targets**, David F. Crouse, U.S. Naval Research Lab. (USA) . . . . . [8745-3]

9:30 am: **Tracklets classification for target signature detection**, Sowmya Ramakrishnan, Riad I. Hammoud, Nathan Shnidman, BAE Systems (USA). [8745-4]

9:50 am: **Overview of Dempster-Shafer methods in target tracking**, Erik P. Blasch, Air Force Research Lab. (USA); Jean C. Dezert, Benjamin Pannetier, ONERA (France) . . . . . [8745-5]

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

SESSION 2

Room: Conv. Ctr. 342 . . . . . .Mon 10:30 am to 11:50 am

Multisensor Fusion, Multitarget Tracking, and Resource Management II

Session Chairs: **Thiagalingam Kirubarajan,** McMaster Univ. (Canada); **Kenneth Hintz,** George Mason Univ. (USA); **Ivan Kadar,** Interlink Systems Sciences, Inc. (USA)

10:30 am: **Decentralized closed-loop collaborative surveillance and tracking performance sensitivity to communications connectivity**, Jonathan T. DeSena, Sean R. Martin, Jesse C. Clarke, Daniel A. Dutrow, Brian C. Kohan, Andrew J. Newman, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8745-6]

10:50 am: **GMTI radar resource management and partially observed Markov decision processes**, Bhashyam Balaji, Defence Research and Development Canada, Ottawa (Canada) . . . . . [8745-7]

11:10 am: **Sensor selection for target localization in a network of proximity sensors and bearing sensors**, Qiang Le, Hampton Univ. (USA); Lance Kaplan, U.S. Army Research Lab. (USA) . . . . . [8745-8]

11:30 am: **Evaluating detection and estimation capabilities of magnetometer based vehicle sensors**, David Slater, Garry M. Jacyna, The MITRE Corp. (USA) . . . . . [8745-9]

Lunch Break . . . . . Mon 11:50 am to 1:30 pm

INVITED PANEL DISCUSSION

Room: Conv. Ctr. 342 . . . . . Mon 1:30 pm to 4:45 pm

Real World Issues and Challenges in Big Data Processing with Applications to Information Fusion

Panel Organizers: **Ivan Kadar**, Interlink Systems Sciences, Inc., **Chee-Yee Chong**, BAE Systems, **Srikanta Kumar**, Technology Consultant

Panel Moderators: **Srikanta Kumar**, Technology Consultant; **Chee-Yee Chong**, BAE Systems; **Ivan Kadar**, Interlink Systems Sciences, Inc.

Panelists: **Christopher White**, DARPA; **Raman Mehra**, Scientific Systems Co.; **Subrata Das**, Machine Analytics; **Kathleen Lossau**, Sotera Defense Solutions; **Erik Blasch**, Air Force Research Lab.; **Premkumar Natarajan**, Raytheon BBN Technologies; **Chee-Yee Chong**, BAE Systems; **Ivan Kadar**, Interlink Systems Sciences, Inc.

The panel will address real-world issues and challenges highlighting the problem of handling/processing and using big data sources. A number of invited experts will discuss current challenges of using big data sources in the fusion process and research to address these challenges. The proliferation of data sources has created an urgent need to manage, collect/retrieve and make sense of “big data”. The big data problem is present in diverse areas such as: cybersecurity, financial and health analytics, social media networks, digital video, text data, sensor networks, etc. Methods are needed to handle big data feeds from sensors, perform data and information fusion, and provide real-time and near real time information delivery.

Processing challenges include machine learning techniques, robust predictive and explanatory analysis of high dimensional structured or unstructured data (e.g., data varying in format and dimensionality such as fusing text and video when video is not annotated and audio if needed), distributed and parallel processing paradigms, distributed fusion techniques to handle distributed data sources/bases, cloud computing, database query processing and model-based techniques. Additional necessary paradigms include structural learning, grouping data/clustering, dimensionality reduction, data mining, feature extraction and selection, statistical inference, regression, predictive modeling, signal processing, association and fusion. For example, in the unstructured data fusion problem mentioned above, if the video is not annotated a human interpreter would not know what parts are of the video and the text is related, thus requiring sophisticated visualization methods.

The panelists shall illustrate parts of the above mentioned area in many applications, and will specifically address applications to all levels of information fusion. The objective of this panel is to bring to the attention of the fusion community the importance of dealing with, processing and using big data sources, the challenges and potential benefits. Conceptual and real-world related examples associated with the overall complex problem will be used by the panel to highlight issues and challenges. Audience participation is welcomed to provide a forum for exchange of ideas.

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 3

Room: Conv. Ctr. 342 . . . . . Tue 8:00 am to 11:50 am

Multisensor Fusion Methodologies and Applications I

Session Chair: **Ronald P. S. Mahler,** Lockheed Martin Corp. (USA)

8:00 am: **Urban multitarget tracking via gas-kinetic dynamics models**, Ronald P. S. Mahler, Lockheed Martin Corp. (USA) . . . . . [8745-11]

8:20 am: **Background agnostic CPHD tracking of dim targets in heavy clutter**, Adel I. El-Fallah, Aleksandar Zatezalo, Scientific Systems Co., Inc. (USA); Ronald P. S. Mahler, Lockheed Martin Corp. (USA); Raman K. Mehra, Scientific Systems Co., Inc. (USA); Wellesley E. Pereira, Air Force Research Lab. (USA) . . . . . [8745-12]

8:40 am: **Tracking, identification and classification with random finite sets**, Ba Tuong Vo, Ba-Ngu B. Vo, Curtin Univ. (Australia) . . . . . [8745-13]

9:00 am: **PHD filtering with localised target number variance**, Emmanuel D. Delande, Jeremie Houssineau, Daniel E. Clark, Heriot-Watt Univ. (United Kingdom). . . . . [8745-15]

9:20 am: **Divergence detectors for multitarget tracking algorithms**, Ronald P. S. Mahler, Lockheed Martin Corp. (USA) . . . . . [8745-16]

9:40 am: **A Gaussian mixture ensemble transform filter for vector observations**, Santosh Nannuru, Mark Coates, McGill Univ. (Canada); Arnaud Doucet, Univ. of Oxford (United Kingdom) . . . . . [8745-17]

Coffee/Exhibition Break. . . . . .Tue 10:00 am to 10:50 am

10:50 am: **Fusion of imaging data and auxiliary signal for target classification**, Aleksandar Zatezalo, Ssu-Hsin Yu, Scientific Systems Co., Inc. (USA) . . . [8745-18]

11:10 am: **Missile tracking using a multiple model particle filter**, Aleksandar Zatezalo, Adel I. El-Fallah, Scientific Systems Co., Inc. (USA); Ronald P. S. Mahler, Lockheed Martin Corp. (USA); Raman K. Mehra, Scientific Systems Co., Inc. (USA); Charles E. Lewis, Missile Defense Agency (USA) . . . . . [8745-19]

11:30 am: **Tracking multiple missiles using a network of sensors**, Adel I. El-Fallah, Aleksandar Zatezalo, Scientific Systems Co., Inc. (USA); Ronald P. S. Mahler, Lockheed Martin Corp. (USA); Raman K. Mehra, Scientific Systems Co., Inc. (USA); Rene Silva-Viego, Missile Defense Agency (USA). . . . . [8745-20]

SESSION 4

Room: Conv. Ctr. 342 . . . . . Tue 11:50 am to 12:30 pm

Multisensor Fusion Methodologies and Applications II

Session Chairs: **Michael L. Hinman,** Air Force Research Lab. (USA);
Chee-Yee Chong, BAE Systems (USA);
Ivan Kadar, Interlink Systems Sciences, Inc. (USA)

11:50 am: **Accelerating the OODA loop with multisensor systems**, Greg Gottschalk, Kevin Andryc, Timothy Eagleson, Pete Kuzdeba, Michael Rose, Jesse D. Chamberlain, Daniel LaValley, Brent Kowal, Nick Beluzo, Brian Rusiecki, L-3 KEO (USA) . . . . . [8745-21]

12:10 pm: **High level information fusion (HLIF) with nested fusion loops**, Robert Woodley, Michael Gosnell, 21st Century Systems, Inc. (USA); Amber D. Fischer, 21st Century Systems Inc. (USA) . . . . . [8745-22]

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

SESSION 5

Room: Conv. Ctr. 342 . . . . . Tue 1:30 pm to 3:30 pm

Multisensor Fusion Methodologies and Applications III

Session Chairs: **Chee-Yee Chong,** BAE Systems (USA);
Michael L. Hinman, Air Force Research Lab. (USA);
Kenneth Hintz, George Mason Univ. (USA);
Ivan Kadar, Interlink Systems Sciences, Inc. (USA)

1:30 pm: **A robust technique for semanic annotation of group activities based on recognition of extracted features in video streams**, Amir Shirkhodaie, Vinayak Elangovan, Tennessee State Univ. (USA) . . . . . [8745-23]

1:50 pm: **Feynman path integral discretization and its applications to nonlinear filtering**, Bhashyam Balaji, Defence Research and Development Canada, Ottawa (Canada) . . . . . [8745-24]

2:10 pm: **Particle flow inspired by Knothe-Rosenblatt transport for nonlinear filters**, Frederick E. Daum, Jim Huang, Raytheon Co. (USA) . . . . . [8745-25]

2:30 pm: **Particle flow with non-zero diffusion For nonlinear filters**, Frederick E. Daum, Raytheon Co. (USA); Jim Huang, Raytheon (USA) and Raytheon Co (USA) . . . . . [8745-26]

2:50 pm: **Zero curvature particle flow for nonlinear filters**, Frederick E. Daum, Jim Huang, Raytheon Co. (USA) . . . . . [8745-27]

3:10 pm: **Fourier transform particle flow for nonlinear filters**, Frederick E. Daum, Jim Huang, Raytheon Co. (USA) . . . . . [8745-28]

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

SESSION 6

Room: Conv. Ctr. 342 . . . . . Tue 4:00 pm to 4:50 pm

Multisensor Fusion Methodologies and Applications V

Session Chairs: **Kenneth Hintz,** George Mason Univ. (USA);
Michael L. Hinman, Air Force Research Lab. (USA);
Chee-Yee Chong, BAE Systems (USA);
Erik P. Blasch, Air Force Research Lab. (USA)

4:00 pm: **Sequential testing over multiple stages and performance analysis of data fusion**, Gaurav S. Thakur, The MITRE Corp. (USA) . . . . . [8745-30]

4:20 pm: **Dempster-Shafer theory and connections to information theory** *(Invited Paper)*, Joseph S. Peri, Johns Hopkins Univ. Applied Physics Lab. (USA) . . . . . [8745-33]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Infrared small target detection technology based on OpenCV, Lei Liu, Jilu Chen, Nanjing Univ. of Science and Technology (China) . . . . . [8745-66]

Simultaneous optimization by simulation of iterative deconvolution and noise removal for non-negative data, Abolfazl M. Amini, Southern Univ. and A&M College (USA); George E. Ioup, Juliette W. Ioup, Univ. of New Orleans (USA) . . . . . [8745-67]

Simultaneous optimization by simulation of iterative deconvolution and noise removal to improve the resolution of impulsive inputs, Abolfazl M. Amini, Southern Univ. and A&M College (USA); George E. Ioup, Juliette W. Ioup, Univ. of New Orleans (USA) . . . . . [8745-68]

Self-adaptive characteristics segmentation optimized algorithm of weld defects based on flooding, Changying Dang, Jianmin Gao, Wang Zhao, Fumin Chen, Xi'an Jiaotong Univ. (China) . . . . . [8745-69]

Intrusion detection on oil pipeline right of way (ROW) using monogenic signal representation, Binu M. Nair, Vijayan K. Asari, Varun Santhaseelan, Univ. of Dayton (USA) . . . . . [8745-71]

Optimising the use of hyperspectral and multispectral data for regional crop classification, Li Ni, Ctr. for Earth Observation and Digital Earth (China) and Chinese Academy of Sciences (China); Bing Zhang, Lianru Gao, Sha nshan Li, Yuanfeng Wu, Wei Yang, Ctr. for Earth Observation and Digital Earth (China) . . . . . [8745-72]

Close-loop fusion system structure: information fusion and resource management, Dongliang Peng, Hangzhou Dianzi Univ. (China); Zonggui Zhao, Institute of Electronic Engineering of Nanjing (China); Anke Xue, Hangzhou Dianzi Univ. (China); Kuochu C. Chang, George Mason Univ. (USA) . . . . . [8745-73]

Breast tumor classification via single-frequency microwave imaging, Cuong M. Do, Rajeev Bansal, Univ. of Connecticut (USA) . . . . . [8745-74]

Safety threat object detection by fusion of RGD-D data and hyperspectral imaging, Jangwoo Lee, Soon Kwon, Daegu Gyeongbuk Institute of Science & Technology (Korea, Republic of); Sungho Kim, Yeungnam Univ. (Korea, Republic of) . . . . . [8745-75]

Stabilizing bidirectional associative memory with principles in independent component analysis and null space, Yuriy Luzanov, Air Force Research Lab. (USA); James P. LaRue, Jadco Signals (USA) . . . . . [8745-76]

Option pricing formulas and nonlinear filtering: a Feynman oath integral perspective, Bhashyam Balaji, Defence Research and Development Canada, Ottawa (Canada) . . . . . [8745-77]

Bayesian approach to Cole-Cole model parameter estimation, Sreeraman Rajan, Bhashyam Balaji, Defence Research and Development Canada, Ottawa (Canada); Milodrag Bolic, Univ. of Ottawa (Canada). . . . . [8745-78]

Consistent estimates for oscillometric blood pressure signal model using Kalman filters, Bhashyam Balaji, Sreeraman Rajan, Defence Research and Development Canada, Ottawa (Canada); Milodrag Bolic, Univ. of Ottawa (Canada) . . . . . [8745-79]

Wednesday 1 May

SESSION 7

Room: Conv. Ctr. 342 . . . . . .Wed 8:20 am to 9:40 am

Signal and Image Processing, and Information Fusion Applications I

Session Chairs: **Lynne L. Grewe,** California State Univ., East Bay (USA);
Mark J. Carlotto, General Dynamics Advanced Information Systems (USA);
Alastair D. McAulay, Lehigh Univ. (USA);
Mark G. Alford, Air Force Research Lab. (USA)

8:20 am: **Object classification using image moment functions applied to video and imagery analysis.**, Olegs Mise, GE Intelligent Platforms (USA) . . . . . [8745-34]

8:40 am: **Multiparametric data fusion for enhanced target identification and discrimination**, Vladimir B. Markov, Stephen A. Kupiec, Advanced Systems & Technologies, Inc. (USA); Joseph R. Chavez, Air Force Research Lab. (USA) . . . . . [8745-35]

9:00 am: **A neuromorphic system for multiobject detection and classification**, Deepak Khosla, Yang Chen, Kyungnam Kim, Shinko Y. Cheng, Alexander L. Honda, Lei Zhang, HRL Labs., LLC (USA) . . . . . [8745-36]

9:20 am: **Machine vision tracking of carrier-deck assets for improved launch safety**, Brynmor J. Davis, Richard W. Kaszeta, Robert D. Chambers, Bruce R. Pilvelait, Patrick J. Magari, Creare Inc. (USA); Michael Withers, David Rossi, Naval Air Warfare Ctr. Aircraft Div. (USA) . . . . . [8745-37]

Coffee/Exhibition Break. . . . . Wed 9:40 am to 10:30 am

SESSION 8

Room: Conv. Ctr. 342 . . . . . .Wed 10:30 am to 12:30 pm

Signal and Image Processing, and Information Fusion Applications II

Session Chairs: **Mark J. Carlotto,** General Dynamics Advanced Information Systems (USA);
Alastair D. McAulay, Lehigh Univ. (USA);
Lynne L. Grewe, California State Univ., East Bay (USA);
Mark G. Alford, Air Force Research Lab. (USA)

10:30 am: **Qualitative evaluations and comparisons of six night-vision colorization methods**, Yufeng Zheng, Alcorn State Univ. (USA); Kristopher Reese, Univ. of Louisville (USA); Erik P. Blasch, Air Force Research Lab. (USA); Paul McManamon, Exciting Technology, LLC (USA) . . . . . [8745-40]

10:50 am: **Real-time classification of ground from lidar data for helicopter navigation**, Ferdinand Eisenkeil, Univ. Konstanz (Germany); Tobias Schafhitzel, Uwe Kühne, EADS Deutschland GmbH (Germany); Oliver Deussen, Univ. Konstanz (Germany) . . . . . [8745-41]

11:10 am: **High-resolution land cover classification using low resolution global data**, Mark J. Carlotto, General Dynamics Advanced Information Systems (USA). . . . . [8745-42]

11:30 am: **Fusion of multispectral and stereo information for unsupervised target detection in very high resolution airborne data**, Dirk C. Borghys, Mahamadou Idrissa, Michal Shimoni, Royal Belgian Military Academy (Belgium); Ola Friman, Maria Axelsson, Mikael Lundberg, Swedish Defence Research Agency (Sweden); Christiaan Perneel, Royal Belgian Military Academy (Belgium) . [8745-43]

11:50 am: **Combining structured light and ladar for pose tracking in THz sensor management**, Philip Engström, Maria Axelsson, Mikael Karlsson, Swedish Defence Research Agency (Sweden) . . . . . [8745-44]

12:10 pm: **Application of artificial intelligence methods for feature extraction optimization**, Jack E. Fulton Jr., Naval Surface Warfare Ctr. Crane Div. (USA) . . . . . [8745-45]

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

SESSION 9

Room: Conv. Ctr. 342 . . . . . Wed 1:20 pm to 3:00 pm

Signal and Image Processing, and Information Fusion Applications III

Session Chairs: **Alastair D. McAulay,** Lehigh Univ. (USA);
Mark G. Alford, Air Force Research Lab. (USA);
Lynne L. Grewe, California State Univ., East Bay (USA);
Mark J. Carlotto, General Dynamics Advanced Information Systems (USA)

1:20 pm: **Human activity recognition based on human shape dynamics**, Zhiqing Cheng, Infoscitex Corp. (USA); Timothy Webb, Huaining Cheng, Air Force Research Lab. (USA); Stephen Mosher, Infoscitex Corp. (USA). . . . . [8745-46]

1:40 pm: **Seismic signature analysis for discrimination of people from animals**, Thyagaraju Damarla, U.S. Army Research Lab. (USA); James M. Sabatier, Univ. of Mississippi (USA); Asif Mehmood, U.S. Army Research Lab. (USA). . . . . [8745-47]

2:00 pm: **Anomalous human behavior detection: an adaptive approach**, Coen van Leeuwen, TNO Defence, Security and Safety (Netherlands); Arvid Halma, TNO Defence, Security and Safety (Netherlands) and Research Kitchen (Netherlands); Klamer Schutte, TNO Defence, Security and Safety (Netherlands) . . . . . [8745-48]

2:20 pm: **Behavioral profiling in CCTV cameras by combining multiple subtle suspicious observations of different surveillance operators**, Henri Bouma, Jack Vogels, Olav Aarts, Chris Kruszynski, Remco Wijn, Gertjan Burghouts, TNO Defence, Security and Safety (Netherlands) . . . . . [8745-49]

2:40 pm: **Invariant unsupervised segmentation of dismounts in depth images**, Richard L. Tutwiler, Nathan S. Butler, Ryan J. Poore, The Pennsylvania State Univ. (USA) . . . . . [8745-50]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 10

Room: Conv. Ctr. 342 . . . . . Wed 3:40 pm to 5:20 pm

Signal and Image Processing, and Information Fusion Applications III

Session Chairs: **Mark G. Alford,** Air Force Research Lab. (USA);
Alastair D. McAulay, Lehigh Univ. (USA);
Mark J. Carlotto, General Dynamics Advanced Information Systems (USA);
Lynne L. Grewe, California State Univ., East Bay (USA)

3:40 pm: **Acoustic recognition of human-object interactions in persistent surveillance systems**, Amir Shirkhodaie, Amjad H. Alkilani, Tennessee State Univ. (USA) . . . . . [8745-51]

4:00 pm: **Time series prediction of nonlinear and nonstationary process modeling for ATR**, Andre U. Sokolnikov, Visual Solutions and Applications (USA) . . . . . [8745-52]

4:20 pm: **A multiattribute based methodology for vehicle detection and identification**, Amir Shirkhodaie, Vinayak Elangovan, Bashir Alsaidi, Tennessee State Univ. (USA). . . . . [8745-53]

4:40 pm: **Advancement and results in hostile fire indication using potassium-line spectral discrimination**, Joel B. Montgomery, Marjorie Montgomery, M&M Aviation (USA) . . . . . [8745-54]

5:00 pm: **A cross-spectral variation of the cross-ambiguity function**, Douglas J. Nelson, National Security Agency (USA). . . . . [8745-55]

Thursday 2 May

SESSION 11

Room: Conv. Ctr. 342 . . . . . .Thu 8:00 am to 12:20 pm

Invited Special Session: Social/Cultural Modeling with Application to Information Fusion

Objective of Invited Special Session:
Accurate situation assessment cannot be accomplished without bringing the human into the picture. For a long time the fusion community modeled physical systems and attempted to use this evidence to understand the current situation and the impact and project this situation to forecast potential impacts or threats. The human cannot be left out of this understanding since it is the human performing the actions.

An invited panel discussion, entitled, "Real-World Issues and Challenges in Social/Cultural Modeling with Application to Information Fusion" was held last year (2012) at the same conference, (SPIE Conference Vol. 8392), whose purpose was to bring to the attention of the fusion community, the role of social/cultural modeling, the challenges and its potential benefits. This invited special session will leverage-off the invited panel and dive into more detail many of the topics introduced.

Note: The session is divided into two parts: (1) Activity-Based Modeling, and (2) Achieving Higher Levels of Fusion - Understanding the Human Element.

SESSION 12

Room: Conv. Ctr. 342 . . . . . Thu 8:00 am to 10:00 am

Part 1: Activity-Based Modeling

Session Chairs: **Shanchieh Jay Yang,** Rochester Institute of Technology (USA);
Laurie H. Fenstermacher, Air Force Research Lab. (USA);
Ivan Kadar, Interlink Systems Sciences, Inc. (USA);
John J. Salerno Jr., Air Force Research Lab. (USA)

8:00 am: **Summary of applications of human, social, cultural, and behavioral modeling to information fusion** *(Invited Paper)*, Erik P. Blasch, John J. Salerno Jr., Air Force Research Lab. (USA); Ivan Kadar, Interlink Systems Sciences, Inc. (USA); Shanchieh J. Yang, Rochester Institute of Technology (USA); Mica Endsley, SA Technologies (USA); Laurie H. Fenstermacher, Air Force Research Lab. (USA); Lynne L. Grewe, California State Univ., East Bay (USA) . . . . . [8745-58]

8:30 am: **An approach to behavioral sensor fusion: Past success and future requirements** *(Invited Paper)*, Laurie H. Fenstermacher, Air Force Research Lab. (USA); Alex J. Barelka, U.S. Air Force (USA). . . . . [8745-59]

9:00 am: **Pattern of life from WAMI objects tracking based on visual context-awareness tracking and infusion network models** *(Invited Paper)*, Jianjun Gao, Intelligent Fusion Technology, Inc. (USA); Haibin Ling, Temple Univ. (USA); Erik P. Blasch, Khanh Pham, Air Force Research Lab. (USA); Genshe Chen, Intelligent Fusion Technology, Inc. (USA) . . . . . [8745-60]

9:30 am: **Learning and detecting coordinated multi-entity activities from persistent surveillance** *(Invited Paper)*, Georgiy M. Levchuk, Matthew Jacobsen, Caitlin Furjanic, Aptima, Inc. (USA); Aaron F. Bobick, Georgia Institute of Technology (USA) . . . . . [8745-61]

Coffee Break . . . . . .Thu 10:00 am to 10:20 am

SESSION 13

Room: Conv. Ctr. 342 . . . . . Thu 10:20 am to 12:20 pm

Part 2: Achieving Higher Levels of Fusion, Understanding the Human Element

Session Chairs: **Lynne L. Grewe,** California State Univ., East Bay (USA);
Erik P. Blasch, Air Force Research Lab. (USA);
Ivan Kadar, Interlink Systems Sciences, Inc. (USA);
John J. Salerno Jr., Air Force Research Lab. (USA)

10:20 am: **Consumer-oriented social data fusion: controlled learning in social environments, social advertising and more** *(Invited Paper)*, Lynne L. Grewe, California State Univ., East Bay (USA) . . . . . [8745-62]

10:50 am: **Examining social dynamics and malware secrets to mitigate net-centric attacks** *(Invited Paper)*, Ziming Zhao, Univ. of Information Engineering (China); Gail J. Ahn, The Univ. of North Carolina at Charlotte (USA) . . . . . [8745-63]

11:20 am: **Influence versus intent: a comparative study for information fusion** *(Invited Paper)*, Biru Cui, Rochester Institite of Technology (USA); Shanchieh Jay Yang, Rochester Institute of Technology (USA); Ivan Kadar, Interlink Systems Sciences, Inc. (USA) . . . . . [8745-64]

11:50 am: **Cyber insider mission detection for situation awareness** *(Invited Paper)*, Haitao Du, Neil Wong, Hon Chan, Shanchieh Jay Yang, Rochester Institute of Technology (USA); Changzhou Wang, Jai Choi, The Boeing Co. (USA); Tao Zhang, Peng Liu, The Pennsylvania State Univ. (USA) . . . . . [8745-65]

Algorithms for Synthetic Aperture Radar Imagery XX

Conference Chairs: **Edmund Zelnio,** Air Force Research Lab. (USA); **Frederick D. Garber,** Wright State Univ. (USA)

Program Committee: **David Blacknell,** Defence Science and Technology Lab. (United Kingdom); **Mujdat Cetin,** Sabanci Univ. (Turkey); **Gil J. Ettinger,** Systems & Technology Research (USA); **Charles V. Jakowatz Jr.,** Sandia National Labs. (USA); **Eric R. Keydel,** SAIC (USA); **Juan Li,** Univ. of Central Florida (USA); **Michael J. Minardi,** Air Force Research Lab. (USA); **Randolph L. Moses,** The Ohio State Univ. (USA); **Les Novak,** Scientific Systems Co., Inc. (USA); **Lee C. Potter,** The Ohio State Univ. (USA); **Brian Rigling,** Wright State Univ. (USA); **Timothy D. Ross,** Jacobs Technology (USA); **Michael A. Saville,** Air Force Research Lab. (USA); **Gerard W. Titi,** BAE Systems (USA)

Wednesday 1 May

CONFERENCE WELCOME

Room: Conv. Ctr. 341 . . . . . .Wed 9:00 am to 9:10 am

Session Chair: **Edmund Zelnio,** Air Force Research Lab. (USA)

SESSION 1

Room: Conv. Ctr. 341 . . . . . .Wed 9:10 am to 11:10 am

Image Formation

Session Chair: **Charles V. Jakowatz Jr.,** Sandia National Labs. (USA)

9:10 am: **Frequency-dependent reflectivity image reconstruction**, Paul Sotirelis, U.S. Air Force Research Lab. (USA); Margaret Cheney, Colorado State Univ. (USA); Jason Parker, Xueyu Hu, Air Force Research Lab. (USA); Matthew A. Ferrara, Matrix Research Inc. (USA) . . . . . [8746-1]

9:20 am: **Iteratively compensating for multiple scattering in SAR imaging**, Alejandro F. Martinez, Zhijun G. Qiao, The Univ. of Texas-Pan American (USA) . . . . . [8746-2]

9:30 am: **Notched spectrum: from probing waveforms to receive filters**, Yi Jiang, Luzhou Xu, Christopher D. Gianelli, Integrated Adaptive Applications, Inc. (USA) . . . . . [8746-3]

9:40 am: **Point source localization from de-ramped phase history bound on interferometric synthetic aperture radar (IFSAR) accuracy**, Matthew P. Pepin, Majeed Hayat, The Univ. of New Mexico (USA) . . . . . [8746-4]

9:50 am: **SAR focusing using multiple trihedrals**, Kerry E. Dungan, John W. Nehrbass, Dynamics Research Corp. (USA) . . . . . [8746-5]

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

10:30 am: **An algorithm for upsampling spotlight SAR imagery: a Radarsat-2 SLC perspective**, Khalid El-Darymli, C-CORE (Canada) and Memorial Univ. of Newfoundland (Canada); Peter McGuire, Desmond Power, C-CORE (Canada); Cecilia R. Moloney, Memorial Univ. of Newfoundland (Canada) . . . . . [8746-6]

10:40 am: **An autofocus technique for video SAR**, Robert Linnehan, John Miller, Edward Bishop, Volker Horndt, Thomas E. Medl, General Atomics Aeronautical Systems, Inc. (USA) . . . . . [8746-7]

10:50 am: **An application of backprojection for video SAR image formation exploiting a subaperature circular shift register**, John Miller, Edward Bishop, General Atomics Aeronautical Systems, Inc. (USA); Armin W. Doerry, Sandia National Labs. (USA) . . . . . [8746-8]

11:00 am: **SAR digital spotlight implementation in MATLAB**, Kerry E. Dungan, High Performance Technologies, Inc. (USA); Linda J. Moore, LeRoy Gorham, Air Force Research Lab. (USA) . . . . . [8746-9]

SESSION 2

Room: Conv. Ctr. 341 . . . . . .Wed 11:10 am to 12:20 pm

Exploitation of Motion

Session Chair: **Michael J. Minardi,** Air Force Research Lab. (USA)

11:10 am: **Range migration phenomenology of moving targets in spotlight SAR**, David A. Garren, James W. Scrofani, Murali Tummala, John C. McEachen II, Naval Postgraduate School (USA) . . . . . [8746-33]

11:20 am: **Imaging of moving targets using bi-static synthetic aperture radar**, Kaan Duman, Rensselaer Polytechnic Institute (USA) and Bilkent Univ. (Turkey); Birsen Yazici, Rensselaer Polytechnic Institute (USA) . . . . . [8746-10]

11:30 am: **Augmenting synthetic aperture radar with space time adaptive processing**, Michael R. Riedl, Lee C. Potter, Emre Ertin, The Ohio State Univ. (USA) . . . . . [8746-11]

11:40 am: **Phase wrapping ambiguity in along-track interferometry**, Ross W. Deming, U.S. Air Force (USA); Roman Ilin, Air Force Research Lab. (USA); Matthew Best, US Air Force (USA) . . . . . [8746-12]

11:50 am: **Using posterior distributions on target states and clutter statistics for performance prediction and efficient resource management**, Gregory E. Newstadt, Univ. of Michigan (USA); Edmund Zelnio, Air Force Research Lab. (USA); Alfred O. Hero III, Univ. of Michigan (USA) . . . . . [8746-13]

12:00 pm: **Multiple-object shape and motion reconstruction with missing radar data**, Gregory Arnold, Matthew A. Ferrara, Matrix Research Inc. (USA); Jason Parker, Air Force Research Lab. (USA) . . . . . [8746-14]

12:10 pm: **SAR based classification of ground moving targets to assist tracker performance**, George S. Goley, Etegent Technologies, Ltd. (USA); Brian D. Rigling, Wright State Univ. (USA); Adam R. Nolan, Etegent Technologies, Ltd. (USA) . . . . . [8746-15]

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

POSTER SESSION. . . . . .Wed 1:20 pm to 2:50 pm

Coffee Break . . . . . Wed 2:50 pm to 3:20 pm

DISCUSSION/WORKSHOP. . . . . .Wed 3:20 pm to 4:20 pm

Thursday 2 May

SESSION R4

Room: Conv. Ctr. 341 . . . . . Thu 8:30 am to 8:40 am

Conference Welcome

Session Chair: **Edmund Zelnio,** Air Force Research Lab. (USA)

SESSION 3

Room: Conv. Ctr. 341 . . . . . Thu 8:40 am to 9:50 am

Automatic Target Detection and Recognition

Session Chair: **David Blacknell,**
Defence Science and Technology Lab. (United Kingdom)

8:40 am: **Change detection experiments using gotcha public release SAR data** *(Invited Paper)*, Ivana Stojanovic, Les Novak, Scientific Systems Co., Inc. (USA) . . . . . [8746-16]

9:00 am: **Joint imaging and change detection for robust exploitation in interrupted SAR environments**, Joshua N. Ash, The Ohio State Univ. (USA) . . . . . [8746-17]

9:10 am: **Spatially variant incoherence trimming for improved SAR CCD**, Daniel B. Andre, David Blacknell, Defence Science and Technology Lab. (United Kingdom); Keith Morrison, Cranfield Univ. (United Kingdom) . . . . . [8746-18]

9:20 am: **Reconstruction of interrupted SAR imagery for persistent surveillance change detection**, Ivana Stojanovic, Scientific Systems Co., Inc. (USA); William C. Karl, Boston Univ. (USA); Les Novak, Scientific Systems Co., Inc. (USA) . . . . . [8746-19]

9:30 am: **SAR ATR challenge problem**, Adam R. Nolan, Etegent Technologies, Ltd. (USA); Lee C. Potter, The Ohio State Univ. (USA); Dan Kubacki, Michael Bakich, Air Force Research Lab. (USA) . . . . . [8746-20]

9:40 am: **Focusing and ATR for the Gotcha 2008 wide angle SAR collection**, Luzhou Xu, Christopher D. Gianelli, Integrated Adaptive Applications, Inc. (USA) . . . . . [8746-21]

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

SESSION 4

Room: Conv. Ctr. 341 . . . . . Thu 10:20 am to 12:10 pm

Sensor Management

Session Chair: **Alfred O. Hero III,** Univ. of Michigan (USA)

10:20 am: **Adaptive sensing and estimation of sparse signals**, Dennis Wei, Alfred O. Hero III, Univ. of Michigan (USA) . . . . . [8746-22]

10:30 am: **Value-of-information aware active task assignment**, Beipeng Mu, Girish Chowdhary, Jonathan P. How, Massachusetts Institute of Technology (USA) . . . . . [8746-23]

10:40 am: **Change-point detection for high-dimensional time series with missing date**, Rebecca M. Willett, Yao Xie, Jiaji Huang, Duke Univ. (USA) . . . . . [8746-24]

10:50 am: **Low-rank covariance estimation with missing data**, Laura Bolzano, Univ. of Michigan (USA) . . . . . [8746-25]

11:00 am: **Information theoretic bounds on localization and telemetry via differential radar cross-section signaling**, Itay Cnaan-On, Jeffrey Krolik, Matthew Reynolds, Duke Univ. (USA) . . . . . [8746-26]

11:10 am: **Geometic image formation for target identification in multi-energy computed tomography**, Brian H. Tracey, Eric L. Miller, Tufts Univ. (USA) [8746-27]

11:20 am: **Spatiotemporal Gaussian feature detection in sparsely sample data with application to InSAR**, Scott T. Acton, Univ. of Virginia (USA). . . . . [8746-28]

11:30 am: **Detection in networked radar**, Kaitlyn Beaudet, Lauren Crider, Douglas Cochran, Arizona State Univ. (USA) . . . . . [8746-29]

11:40 am: **The importance of informative subspaces in matched subspace detectors**, Nick Asendorf, Raj Nadakuditi, Univ. of Michigan (USA) . . . . . [8746-30]

11:50 am: **The geometry of radar targets**, Emre Ertin, The Ohio State Univ. (USA) . . . . . [8746-31]

12:00 pm: **Information-theoretic assessment of system parameter uncertainty on inverse reconstruction problems**, Joel W. LeBlanc, Michigan Tech Research Institute (USA); Brian J. Thelen, Michican Tech Research Institute (USA) . [8746-32]

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

POSTER SESSION. . . . . .Thu 1:40 pm to 3:50 pm

Coffee Break . . . . . 2:20 to 3:50 pm

DISCUSSION/WORKSHOP . . . . . .Thu 3:50 pm to 4:50 pm

Geospatial InfoFusion III

Conference Chairs: **Matthew F. Pellechia,** ITT Exelis (USA); **Richard J. Sorensen,** U.S. Air Force (USA); **Kannappan Palaniappan,** Univ. of Missouri-Columbia (USA)

Conference Co-Chairs: **Shiloh L. Dockstader,** ITT Exelis (USA); **Xuan Liu,** IBM Thomas J. Watson Research Ctr. (USA); **Peter Doucette,** National Geospatial-Intelligence Agency (USA); **Paul B. Deignan,** L-3 Communications Integrated Systems (USA)

Program Committee: **Selim Aksoy,** Bilkent Univ. (Turkey); **Erik P. Blasch,** Air Force Research Lab. (Canada); **Bernard V. Brower,** ITT Exelis (USA); **Filiz Bunyak,** Univ. of Missouri-Columbia (USA); **Rama Chellappa,** Univ. of Maryland, College Park (USA); **Hui Cheng,** SRI International Sarnoff (USA); **Brian J. Daniel,** U.S. Naval Research Lab. (USA); **Larry S. Davis,** Univ. of Maryland, College Park (USA); **Emmanuel Duflos,** École Centrale de Lille (France); **Dan L. Edwards,** National Geospatial-Intelligence Agency (USA); **Paul Fieguth,** Univ. of Waterloo (Canada); **Robert D. Fiete,** ITT Exelis (USA); **Michael E. Gangl,** MacAulay-Brown, Inc. (USA); **Robert J. Gillen,** Univ. of Dayton Research Institute (USA); **Adel Hafiane,** Ecole Nationale Supérieure d'Ingénieurs (France); **Anthony J. Hoogs,** Kitware, Inc. (USA); **Yan Huang,** Univ. of North Texas (USA); **Holger E. Jones,** Lawrence Livermore National Lab. (USA); **Simon J. Julier,** Univ. College London (United Kingdom); **Frederick W. Koehler IV,** National Geospatial-Intelligence Agency (USA); **Boris Kovalerchuk,** Central Washington Univ. (USA); **Mohamed F. Mokbel,** Univ. of Minnesota, Twin Cities (USA); **Dennis Motsko,** National Geospatial-Intelligence Agency (USA); **Raghuveer M. Rao,** U.S. Army Research Lab. (USA); **John A. Richards,** Sandia National Labs. (USA); **Carlo Regazzoni,** Univ. degli Studi di Genova (Italy); **Larry A. Scarff,** UTC Aerospace Systems (USA); **Gunasekaran Seetharaman,** Air Force Research Lab. (USA); **Philippe M. Vanheeghe,** École Centrale de Lille (France); **Pramod Kumar Varshney,** Syracuse Univ. (USA); **Darrell L. Young,** Raytheon Intelligence & Information Systems (USA); **Ranga R. Vatsavai,** Oak Ridge National Lab. (USA); **Karmon M. Vongsy,** Air Force Research Lab. (USA); **Lexing Xie,** The Australian National Univ. (Australia); **Chengyang Zhang,**Terradata Corp. (USA)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 346 . . . . . Thu 8:00 am to 11:10 am

Geo-registration and Uncertainty Handling in Geospatial Data

Session Chair: **Peter Doucette,**
National Geospatial-Intelligence Agency (USA)

8:00 am: **The full multi-state vector error covariance matrix: why needed and its practical representation**, John Dolloff, Integrity Applications, Inc. (USA) . . . . . [8747-1]

8:20 am: **Evaluating conflation methods using uncertainty modeling**, Peter Doucette, National Geospatial-Intelligence Agency (USA) and Integrity Applications, Inc. (USA); John Dolloff, Robert Canavosio-Zuzelski, Michael J. Lenihan, Dennis J. Motsko, National Geospatial-Intelligence Agency (USA) . . . . . [8747-2]

8:40 am: **A standards framework for geo-registration methods**, Peter Doucette, Jim Antonisse, Aaron Braun, Michael J. Lenihan, Michelle Brennan, National Geospatial-Intelligence Agency (USA) . . . . . [8747-3]

9:00 am: **Uncertainty quantification techniques for population density estimates derived from sparse open source data**, Robert N. Stewart, Devin A. White, Marie L. Urban, Oak Ridge National Lab. (USA); April M. Morton, Oak Ridge National Lab. (USA) and California State Polytechnic Univ. (USA); Eddie A. Bright, Budhendra L. Bhaduri, Oak Ridge National Lab. (USA) . . . . . [8747-4]

9:20 am: **Geo-accurate 3-dimensional reconstruction via image-based geometry**, Derek J. Walvoord, Adam Rossi, Bradley D. Paul, Bernard V. Brower, Matthew F. Pellechia, ITT Exelis (USA) . . . . . [8747-5]

9:40 am: **Guidance in feature extraction to resolve uncertainty**, Boris Kovalerchuk, Central Washington Univ. (USA) and BKF Systems (USA); Michael Kovalerchuk, BKF Systems (USA). . . . . [8747-6]

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

10:30 am: **A fast, accurate, cross-modality image geo-registration and target/object detection algorithm**, Troy R. Mckay, CACI International Inc. (USA); Herb Hirsch, HEC, Inc., CACI Consultant (USA) . . . . . [8747-7]

10:50 am: **Improved evaluation of geo-registration algorithms for airborne EO/IR imagery**, Clark N. Taylor, Air Force Research Lab. (USA) . . . . . [8747-8]

SESSION 2

Room: Conv. Ctr. 346 . . . . . Thu 11:10 am to 12:10 pm

Geospatial Information Application Needs and Challenges

Session Chair: **Paul B. Deignan Jr.,**
L-3 Communications Integrated Systems (USA)

11:10 am: **Geodata fusion study by the Open Geospatial Consortium**, George Percivall III, Open Geospatial Consortium, Inc. (USA) . . . . . [8747-9]

11:30 am: **Overview of contextual tracking approaches in information fusion**, Erik P. Blasch, Air Force Research Lab. (USA); Jesus Garcia Herrero, Univ. Carlos III de Madrid (Spain); Lauro Snidaro, Univ. degli Studi di Udine (Italy); James Llinas, Univ. at Buffalo (USA); Gunasekaran Seetharaman, Air Force Research Lab. (USA); Kannappan Palaniappan, Univ. of Missouri-Columbia (USA) . . . . . [8747-10]

11:50 am: **Geometric exploration of virtual planes in a fusion-based 3D data registration framework**, Hadi AliAkbarpour, Univ. de Coimbra (Portugal); Kannappan Palaniappan, Univ. of Missouri-Columbia (USA); Jorge M. Dias, Univ. de Coimbra (Portugal) . . . . . [8747-11]

Lunch/Exhibition Break . . . . . Thu 12:10 pm to 1:20 pm

PANEL DISCUSSION

Room: Conv. Ctr. 346 . . . . . .Thu 1:20 pm to 2:50 pm

Synergistic Data Fusion through Multi-Sensing Enablement

Session Chair: **Shiloh L. Dockstader,** ITT Exelis (USA)

Coffee Break . . . . . Wed 2:50 pm to 3:20 pm

SESSION 3

Room: Conv. Ctr. 346 . . . . . Thu 3:20 pm to 5:20 pm

Geospatial Data Processing Exploitation and Visualization

Session Chair: **Paul B. Deignan Jr.,**
L-3 Communications Integrated Systems (USA)

3:20 pm: **Impact of feature descriptors on low pixel-count persistent surveillance tracking system performance**, Jason A. Edelberg, Christopher Miller, U.S. Naval Research Lab. (USA); Kyle Novak, Tekla Research Inc. (USA); Michael Wilson, U.S. Naval Research Lab. (USA). . . . . [8747-12]

3:40 pm: **Processing of aerial H.264 data for ground object tracking**, Paul B. Deignan Jr., L-3 Communications Integrated Systems (USA); R. Daniel Creider, Texas A&M Univ.-Commerce (USA) . . . . . [8747-13]

4:00 pm: **A position-independent image complexity seLector (PICSEL) for enhanced visualization and intuitive object detection in images**, Troy R. McKay, CACI International Inc. (USA); Herb Hirsch, HEC, Inc., CACI Consultant (USA) . . . . . [8747-14]

4:20 pm: **Feature selection for appearance-based vehicle tracking in geospatial video**, Mahdieh Poostchi, Kannappan Palaniappan, Filiz Bunyak, Univ. of Missouri-Columbia (USA); Gunasekaran Seetharaman, Air Force Research Lab. (USA) . . . . . [8747-16]

4:40 pm: **Particle filter-based vehicle tracking by fusing spatial features with a nonlinear motion model**, Raphael Viguier, Kannappan Palaniappan, Univ. of Missouri-Columbia (USA); Emmanuel Duflos, Philippe M. Vanheeghe, École Centrale de Lille (France). . . . . [8747-17]

5:00 pm: **Vehicle detection and orientation estimation using the radon transform**, Rengarajan V. Pelapur, Kannappan Palaniappan, Filiz Bunyak, Univ. of Missouri-Columbia (USA); Gunasekaran Seetharaman, Air Force Research Lab. (USA) . . . . . [8747-18]

Friday 3 May

SESSION 4

Room: Conv. Ctr. 346 . . . . . Fri 8:00 am to 10:20 am

Geospatial Processing Exploitation and Visualization

8:00 am: **Evaluation fusion techniques for multisensor satellite image data**, Benjamin W. Martin, The Univ. of Tennessee Knoxville (USA); Ranga R. Vatsavai, Christopher T. Symons, Oak Ridge National Lab. (USA); Itamar Arel, The Univ. of Tennessee Knoxville (USA) . . . . . [8747-19]

8:20 am: **Usage of data-encoded web maps with client side color rendering for combined data access, visualization, and modeling purposes**, Denis V. Pliutau, Narasimha S. Prasad, NASA Langley Research Ctr. (USA) . . . . . [8747-20]

8:40 am: **Correlation of partial frames for fusion, change detection, and video compression**, Boris Kovalerchuk, Central Washington Univ. (USA) and BKF Systems (USA); Sergei Kovalerchuk, BKF Systems (USA) . . . . . [8747-21]

9:00 am: **Subdimensional geo-localization from finite set statistics**, Frank A. Boyle, Paul B. Deignan Jr., L-3 Communications Integrated Systems (USA) . . . . . [8747-22]

9:20 am: **KOLAM: a cross-platform architecture for scalable visualization and tracking in wide-area imagery**, Kannappan Palaniappan, Fraser Joshua, Anoop Haridas, Univ. of Missouri-Columbia (USA); Gunasekaran Seetharaman, Air Force Research Lab. (USA); Raghuveer M. Rao, U.S. Army Research Lab. (USA)[8747-23]

9:40 am: **A semi-automated building outline tool (SABOT)**, Scott Simmons, Mike Thompson, Deborah Lamb, Troy R. McKay, CACI International Inc. (USA); Herb Hirsch, HEC, Inc., CACI Consultant (USA) . . . . . [8747-24]

10:00 am: **Mining pattern in a persistent surveillance system with smart query and visual analytics**, Mohammad S. Habibi, Tennessee State Univ. (USA) . . . . . [8747-26]

Optical Pattern Recognition XXIV

Conference Chairs: **David Casasent,** Carnegie Mellon Univ. (USA); **Tien-Hsin Chao,** Jet Propulsion Lab. (USA)

Program Committee: **Mohammad S. Alam,** Univ. of South Alabama (USA); **Don A. Gregory,** The Univ. of Alabama in Huntsville (USA); **Bahram Javidi,** Univ. of Connecticut (USA); **B. V. K. Vijaya Kumar,** Carnegie Mellon Univ. (USA); **Yunlong Sheng,** Univ. Laval (Canada); **Robert C. Stirbl,** Jet Propulsion Lab. (USA); **Ashit Talukder,** National Institute of Standards and Technology (USA); **Rupert C. Young,** Univ. of Sussex (United Kingdom)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 333 . . . . . .Mon 8:30 am to 10:30 am

Invited Optical Pattern Recognition Papers

Session Chair: **David Casasent,** Carnegie Mellon Univ. (USA)

8:30 am: **Tree-based adaptive measurement design for compressive imaging under device constraints** *(Invited Paper)*, David Bottisti, Robert R. Muise, Lockheed Martin Missiles and Fire Control (USA). . . . . [8748-1]

9:00 am: **High-speed optical correlator with custom electronics interface design** *(Invited Paper)*, Tien-Hsin Chao, Thomas T. Lu, Jet Propulsion Lab. (USA) . . . . . [8748-2]

9:30 am: **Light-driven robotics for nanoscopy** *(Invited Paper)*, Jesper Glückstad, Darwin Palima, Technical Univ. of Denmark (Denmark) . . . . . [8748-3]

10:00 am: **Big data research and use: cases** *(Invited Paper)*, Ashit Talukder, National Institute of Standards and Technology (USA). . . . . [8748-4]

Coffee Break . . . . . Mon 10:30 am to 11:00 am

SESSION 2

Room: Conv. Ctr. 333 . . . . . .Mon 11:00 am to 12:00 pm

Quantum and Numeric FFT and Correlator Hardware and Architectures

Session Chair: **Tien-Hsin Chao,** Jet Propulsion Lab. (USA)

11:00 am: **Coherent optical implementations of the fast Fourier transform and their comparison to the optical implementation of the quantum Fourier transform**, Rupert C. Young, Philip M. Birch, Christopher R. Chatwin, Univ. of Sussex (United Kingdom) . . . . . [8748-5]

11:20 am: **Adapted all-numerical correlator for face recognition applications**, Marwa Elbouz, ISEN Brest (France); Fatma Bouzidi, ISEN Brest (France) and Univ. de Sfax (Tunisia); Ayman Alfalou, ISEN Brest (France); Christian Brosseau, Univ. de Bretagne Occidentale (France); Isabelle Leonatd, ISEN Brest (France); Badr-Eddine Benkelfat, TELECOM & Management SudParis (France) . . . . . [8748-6]

11:40 am: **Robust 3D reconstruction using LiDAR and N - visual image**, Prakash Duraisamy, Stephen Jackson, Kamesh Namuduri, Univ. of North Texas (USA); Mohammed S. Alam, Univ.

of South Alabama (USA); Bill Buckles, Univ. of North Texas (USA). . . . . [8748-22]

Lunch Break . . . . . Mon 12:00 pm to 2:00 pm

SESSION 3

Room: Conv. Ctr. 333 . . . . . Mon 2:00 pm to 2:50 pm

Distortion Invariant Correlation Filters

Session Chairs: **Rupert C. Young,** Univ. of Sussex (United Kingdom); **Mohammad S. Alam,** Univ. of South Alabama (USA)

2:00 pm: **Smart pattern recognition** *(Invited Paper)*, Ayman Alfalou, ISEN Brest (France); Christian Brosseau, Univ. de Bretagne Occidentale (France); Mohammad S. Alam, Univ. of South Alabama (USA) . . . . . [8748-9]

2:30 pm: **Optimized fusion method based on adaptation of the RMS time-frequency criterion for simultaneous compression and encryption of multiple images**, Mohammed Aldossari, Ayman Alfalou, ISEN Brest (France); Christian Brosseau, Univ. de Bretagne Occidentale (France) . . . . . [8748-11]

Coffee Break . . . . . Mon 2:50 pm to 3:30 pm

SESSION 4

Room: Conv. Ctr. 333 . . . . . Mon 3:30 pm to 4:30 pm

Novel Image Processing Techniques

Session Chair: **Mohammad S. Alam,** Univ. of South Alabama (USA)

3:30 pm: **A new morphology algorithm for shoreline extraction from DEM data**, Amr H. Yousef, Khan M. Iftekharuddin, Mohammad A. Karim, Old Dominion Univ. (USA) . . . . . [8748-13]

3:50 pm: **Superresolution technique using neighborhood estimation and filtering**, Mohammed N. Islam, Farmingdale State College (USA) . . . . . [8748-14]

4:10 pm: **Image registration under poor illumination using calibrated cameras**, Prakash Duraisamy, Stephen Craig Jackson, Univ. of North Texas (USA); Mohammad S. Alam, Univ. of South Alabama (USA); Bill Buckles, Univ. of North Texas (USA). . . . . [8748-15]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 5

Room: Conv. Ctr. 333 . . . . . Tue 8:50 am to 10:10 am

Pattern Recognition Applications I

Session Chairs: **Rupert C. Young,** Univ. of Sussex (United Kingdom); **Mohammad S. Alam,** Univ. of South Alabama (USA)

8:50 am: **Defining properties of speech spectrogram images to allow effective pre-processing prior to pattern recognition**, Mohammed H. Al-Darkazali, Rupert C. Young, Christopher R. Chatwin, Philip M. Birch, Univ. of Sussex (United Kingdom). . . . . [8748-16]

9:10 am: **An image hiding method based on cascaded iterative Fourier transform and public-key encryption algorithm**, Bing Zhang, Jun Sang, Chongqing Univ. (China); Mohammad S. Alam, Univ. of South Alabama (USA) . . . . . [8748-17]

9:30 am: **Joint Transform Correlation for face tracking: elderly fall detection application**, P. Katz, M. Aron, Ayman Alfalou, ISEN Brest (France). . . . . [8748-18]

9:50 am: **Enhanced information security employing orthogonal code, steganography, and joint transform correlation**, Mohammed N. Islam, Farmingdale State College (USA); Mohammad F. Islam, George Washington Univ. (USA); Kamal Shahrabi, Farmingdale State College (USA) . . . . . [8748-20]

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

SESSION 6
Room: Conv. Ctr. 333 . . . . . Tue 10:50 am to 11:50 am

Pattern Recognition Applications II

Session Chairs: **Tien-Hsin Chao,** Jet Propulsion Lab. (USA);
Rupert C. Young, Univ. of Sussex (United Kingdom)

10:50 am: **Human gait recognition by pyramid of HOG feature on silhouette images**, Guang Yang, Yafeng Yin, Jeanrok Park, Hong Man, Stevens Institute of Technology (USA) . . . . . [8748-19]

11:10 am: **Optical image processing and pattern recognition algorithms for optimal optical data retrieval**, Brian P. Walker, Thomas T. Lu, Sean Stuart, George F. Reyes, Tien-Hsin Chao, Jet Propulsion Lab. (USA) . . . . . [8748-21]

11:30 am: **Small feature recognition of moving targets**, Andre U. Sokolnikov, Visual Solutions and Applications (USA) . . . . . [8748-23]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

Distortion Invariant Correlation Filters

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Comparison of correlation peaks characteristics for scaled images recognition using MACE, GMACE and MINACE filters, Petr A. Ivanov, Yaroslavl State Technical Univ. (Russian Federation). . . . . [8748-25]

MINACE filter realization as computer generated hologram for 4-f correlator, Nikolay N. Evtikhiev, Dmitriy V. Shaulskiy, Evgeny Y. Zlokazov, Rostislav S. Starikov, National Research Nuclear Univ. MEPhI (Russian Federation) . . [8748-26]

Distortion invariant correlation filters application for quality inspection of master-matrix for security holograms, Evgeny Y. Zlokazov, Dmitriy V. Shaulskiy, Rostislav S. Starikov, National Research Nuclear Univ. MEPhI (Russian Federation); Sergey B. Odinokov, Alexander Y. Zherdev, Vasiliy V. Koluchkin, Ivan A. Shvetsov, Bauman Moscow State Technical Univ. (Russian Federation); Andrey V. Smirnov, Krypten (Russian Federation) . . . . . [8748-27]

Efficient mine detection using wavelet PCA and morphological top hat filtering, Nizam U. Chowdhury, Mohammad S. Alam, Univ. of South Alabama (USA) . . . . . [8748-28]

JTC based concealed object detection in terahertz imaging, Md. Habib U. Habib, Mohammad S. Alam, Waleed K. Al-Assadi, Univ. of South Alabama (USA) . . . . . [8748-29]

Dim small target detection based on stochastic resonance, Nong Sang, Huazhong Univ. of Science and Technology (China); Ruoling Wang, Wuhan Univ. (China); Haitao Gan, Jian Du, Huazhong Univ. of Science and Technology (China); Qiling Tang, South-Central Univ. for Nationalities (China) . . . . . [8748-30]

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

Novel Image Processing Techniques

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

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Spectral fringe-adjusted joint transform correlation based efficient object classification in hyperspectral imagery, Paheding Sidike, Mohammad S. Alam, Univ. of South Alabama (USA) . . . . . [8748-31]

Thursday - Friday 2 - 3 May 2013 • Proceedings of SPIE Vol. 8749

Quantum Information and Computation XI

Conference Chairs: **Eric Donkor,** Univ. of Connecticut (USA); **Andrew R. Pirich,** ACP Consulting (USA); **Howard E. Brandt,** Independent Researcher (USA)

Program Committee: **Paul M. Alsing,** Air Force Research Lab. (USA); **Chip Brig Elliott,** Raytheon BBN Technologies (USA); **Reinhard K. Erdmann,** Air Force Research Lab. (USA); **Michael L. Fanto,** Air Force Research Lab. (USA); **Michael R. Frey,** Bucknell Univ. (USA); **Michael J. Hayduk,** Air Force Research Lab. (USA); **Louis H. Kauffman,** Univ. of Illinois at Chicago (USA); **Vladimir E. Korepin,** Stony Brook Univ. (USA); **Samuel J. Lomonaco Jr.,** Univ. of Maryland, Baltimore County (USA); **John M. Myers,** Harvard Univ. (USA); **Alexander V. Sergienko,** Boston Univ. (USA); **Tai Tsun Wu,** Harvard Univ. (USA)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 331 . . . . . Thu 8:20 am to 10:00 am

Quantum Entanglement

Session Chairs: **Howard E. Brandt,** Independent Researcher (USA); **Eric Donkor,** Univ. of Connecticut (USA)

8:20 am: **Quantum energy teleportation enabled by thermal discord**, Michael R. Frey, Bucknell Univ. (USA); Masahiro Hotta, Tohoku University (Japan) . . . [8749-1]

8:40 am: **Theory for entanglement of electron dressed with circularly polarized light on graphene and three-dimensional topological insulators**, Andrii Iurov, Godfrey A. Gumbs, Hunter College (USA) . . . . . [8749-3]

9:00 am: **The correlation conversion property of quantum channels**, Laszlo Gyongyosi, Budapest Univ. of Technology and Economics (Hungary) and Hungarian Academy of Sciences (Hungary); Sandor Imre, Budapest Univ. of Technology and Economics (Hungary) . . . . . [8749-4]

9:20 am: **Handy elementary algebraic properties of the geometry of entanglement**, Howard A. Blair, Syracuse Univ. (USA); Paul M. Alsing, Air Force Research Lab. (USA) . . . . . [8749-5]

9:40 am: **Entangled photons in remote information exchange**, Reinhard K. Erdmann, Advanced Automation Corp. (USA); Richard J. Michalak, David H. Hughes, Air Force Research Lab. (USA) . . . . . [8749-6]

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

SESSION 2

Room: Conv. Ctr. 331 . . . . . Thu 10:30 am to 11:50 am

QKD, Cryptography, and Quantum Networks

Session Chairs: **Samuel J. Lomonaco Jr.,** Univ. of Maryland, Baltimore County (USA); **John M. Myers,** Harvard Univ. (USA)

10:30 am: **Dynamic high-dimensional quantum key distribution**, Jacob Mower, Massachusetts Institute of Technology (USA) and Columbia Univ. (USA); Zheshen Zhang, Massachusetts Institute of Technology (USA); Pierre Desjardins, Columbia Univ. (USA); Catherine Lee, Massachusetts Institute of Technology (USA) and Columbia Univ. (USA); Jeffrey H. Shapiro, Massachusetts Institute of Technology (USA); Dirk R. Englund, Massachusetts Institute of Technology (USA) and Columbia Univ. (USA) . . . . . [8749-7]

10:50 am: **Practical error correction strategies for QKD key production**, Alan Mink, Anastase Nakassis, National Institute of Standards and Technology (USA) . . . . . [8749-8]

11:10 am: **Verification of light shift imbalance induced blockade in an atomic ensemble via collective state Rabi oscillations**, May E. Kim, Yanfei Tu, Shih Tseng, Resham Sarkar, Mohamed Fouda, Selim M. Shahriar, Northwestern Univ. (USA) . . . . . [8749-9]

11:30 am: **Gaming quantum neuronal networks**, Faisal S. Khan, Khalifa Univ. of Science, Technology and Research (United Arab Emirates); Ahmed El Hady, Max-Planck-Institut für Dynamik und Selbstorganisation (Germany) . . . . . [8749-10]

Lunch Break . . . . . .Thu 11:50 am to 1:20 pm

SESSION 3

Room: Conv. Ctr. 331 . . . . . Thu 1:20 pm to 3:00 pm

Quantum Information Theory

Session Chair: **Eric Donkor,** Univ. of Connecticut (USA)

1:20 pm: **A quantum algorithm for Floer homology based on quantum knots**, Samuel J. Lomonaco Jr., Univ. of Maryland, Baltimore County (USA) and Princeton Univ. (USA); Louis H. Kauffman, Univ. of Illinois at Chicago (USA). . . . . [8749-11]

1:40 pm: **Topological quantum computation and the fractional quantum hall effect**, Louis H. Kauffman, Univ. of Illinois at Chicago (USA); Samuel J. Lomonaco Jr., Univ. of Maryland, Baltimore County (USA) . . . . . [8749-12]

2:00 pm: **The quantum-classical boundary**, Howard E. Brandt, Independent researcher (USA) . . . . . [8749-35]

2:20 pm: **Effects of gauge theory based number scaling on geometry**, Paul Benioff, Argonne National Lab. (USA) . . . . . [8749-14]

2:40 pm: **A phase-unlocked Hong-Ou-Mandel interferometer**, Timothy M. Yarnall, MIT Lincoln Lab. (USA); Ayman F. Abouraddy, CREOL, The College of Optics and Photonics, Univ. of Central Florida (USA); Giovanni Di Guiseppe, Univ. degli Studi di Camerino (Italy) . . . . . [8749-15]

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

SESSION 4

Room: Conv. Ctr. 331 . . . . . Thu 3:30 pm to 5:30 pm

Quantum Algorithms

Session Chairs: **Eric Donkor,** Univ. of Connecticut (USA); **Reinhard K. Erdmann,** Air Force Research Lab. (USA)

3:30 pm: **Progress in analytical investigations of the achievement of fault tolerance in quantum computing**, Gerald N. Gilbert, Yaakov S. Weinstein, The MITRE Corp. (USA) . . . . . [8749-16]

3:50 pm: **Implementation of quantum game theory simulations using python**, Alejandro Madrid Sánchez, Univ. EAFIT (Colombia) . . . . . [8749-17]

4:10 pm: **Quantum Fourier transform (QFT) over Galois fields**, Sergio Rodriguez, Univ. EAFIT (Colombia) . . . . . [8749-18]

4:30 pm: **Possible quantum algorithm for the LIpshitz-Sarkar-Steenrod square for Khovanov homology**, Juan F. Ospina, Univ. EAFIT (Colombia) . . . . . [8749-19]

4:50 pm: **Dependence of quantum error correction criteria on concentration of qubits in an ion-trap quantum computer**, Naoki Fukuda, Shota Sakaguchi, Koji Nakamae, Osaka Univ. (Japan) . . . . . [8749-20]

5:10 pm: **A quantum way to searching software engineering**, Nan Wu, Haixing Hu, FangMin Song, Nanjing Univ. (China); Xiangdong Li, New York City College of Technology (USA) . . . . . [8749-21]

Friday 3 May

SESSION 5

Room: Conv. Ctr. 331 . . . . . Fri 8:20 am to 10:00 am

Quantum Gates, Circuits, and Memories

Session Chairs: **Michael R. Frey,** Bucknell Univ. (USA);
Louis H. Kauffman, Univ. of Illinois at Chicago (USA)

8:20 am: **Effective Jaynes-Cummings model from on-chip filter in a dc SQUID phase qubit**, Benjamin K. Cooper, Rangga P. Budoyo, Univ. of Maryland, College Park (USA); Vitaley Zaretskey, Univ. of Maryland, College Park (USA) and Lab. for Physical Sciences (USA); Cody J. Ballard, J. R. Anderson, Chris J. Lobb, Fred C. Wellstood, Univ. of Maryland, College Park (USA) . . . . . [8749-22]

8:40 am: **Optimal scheme for generating photonic cluster states**, Dmitry Uskov, Brescia Univ. (USA); Michael L. Fanto, Air Force Research Lab. (USA); A. Matthew Smith, Paul M. Alsing, U.S. Air Force (USA) . . . . . [8749-23]

9:00 am: **Beyond qubits with spatial modes of light**, Enrique J. Galvez, Michael A. Senatore, Xinru Cheng, Brett Rojec, Colgate Univ. (USA) . . . . [8749-24]

9:20 am: **Wave functions as theoretical entities taking part in classical computations**, John M. Myers, Harvard Univ. (USA). . . . . [8749-25]

9:40 am: **Multi-photon interactions in travelling wave resonators**, Stefan F. Preble, Edwin Hach, Rochester Institute of Technology (USA); Ali Elshaari, Benghazi Univ. (Libyan Arab Jamahiriya) . . . . . [8749-26]

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

SESSION 6

Room: Conv. Ctr. 331 . . . . . Fri 10:30 am to 12:30 pm

Quantum Imaging and Measurement

Session Chairs: **Eric Donkor,** Univ. of Connecticut (USA);
Howard E. Brandt, Independent Researcher (USA)

10:30 am: **Three dimensional computational ghost imaging with a signal-pixel detector**, Zhipeng Chen, Hu Li, Jianhong Shi, Guihua Zeng, Shanghai Jiao Tong Univ. (China) . . . . . [8749-28]

10:50 am: **Demonstration of multiple nonorthogonal state discrimination below the standard quantum limit**, Francisco E. Becerra, Jingyun Fan, National Institute of Standards and Technology (USA); Julius Goldhar, Univ. of Maryland, College Park (USA); Gerald B. Baumgartner, Jon Kosloski, Lab. for Telecommunications Sciences (USA); Alan L. Migdall, National Institute of Standards and Technology (USA) . . . . . [8749-29]

11:10 am: **Increasing the accuracy of measurements, based on the solution of Pauli's quantum equation**, Sergey Ermishin, Alexandra Korol, Althaven Technology (Belarus). . . . . [8749-31]

11:30 am: **The photonic nanowire: an emerging platform for highly efficient single-photon sources for quantum information applications**, Niels Gregersen, Jesper Mørk, Technical Univ. of Denmark (Denmark); Julien Claudon, Commissariat à l'Énergie Atomique (France); Mathieu Munsch, Commissariat à l'Énergie Atomique (Switzerland); Nitin Singh Malik, Joël Bleuse, Emmanuel Dupuy, Adrien Delga, Jean-Michel Gerard, Commissariat à l'Énergie Atomique (France). [8749-34]

11:50 am: **Quantum image processing using Gaussian-Hermite filters**, Esteban Soto Tirado, Univ. EAFIT (Colombia). . . . . [8749-32]

12:10 pm: **Hyper-entanglement based system with enhanced resolution, signal to noise ratio, and measurement time**, James F. Smith III, U.S. Naval Research Lab. (USA) . . . . . [8749-30]

Wednesday - Friday 1 - 3 May 2013 • Proceedings of SPIE Vol. 8750

Independent Component Analyses, Compressive Sampling, Wavelets, Neural Net, Biosystems, and Nanoengineering XI

Conference Chair: **Harold H. Szu,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

Conference Co-Chair: **Liyi Dai,** U.S. Army Research Office (USA)

Program Committee: **Shun-ichi Amari,** RIKEN (Japan); **Richard G. Baraniuk,** Rice Univ. (USA); **John J. Benedetto,** Univ. of Maryland, College Park (USA); **Henry Chu,** Univ. of Louisiana at Lafayette (USA); **Ronald R. Coifman,** Yale Univ. (USA); **John Daugman,** Univ. of Cambridge (United Kingdom); **David Donohoe,** Stanford Univ. (USA); **Ronald G. Driggers,** U.S. Naval Research Lab. (USA); **Jide Familoni,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Fredric M. Ham,** Florida Institute of Technology (USA); **Yutaka Hata,** Univ. of Hyogo (Japan); **Charles C. Hsu,** Trident Systems Inc. (USA); **Tzyy-Ping Jung,** Univ. of California, San Diego (USA); **Marc W. Kirschner,** Harvard Medical School (USA); **Keith A. Krapels,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Horacio Lamela,** Univ. Carlos III de Madrid (Spain); **Joseph S. Landa,** BriarTek, Inc. (USA); **Douglas A. Lauffenburger,** Massachusetts Institute of Technology (USA); **Soo-Young Lee,** KAIST (Korea, Republic of); **Kevin W. Lyons,** National Institute of Standards and Technology (USA); **Anke D. Meyer-Baese,** The Florida State Univ. (USA); **Uwe Meyer-Baese,** The Florida State Univ. (USA); **Francesco Carlo Morabito,** Univ. Mediterranea di Reggio Calabria (Italy); **Hiroshi Nakajima,** OMRON Corp. (Japan); **Hyung-Min Park,** Sogang Univ. (Korea, Republic of); **Kitt C. Reinhardt,** Air Force Office of Scientific Research (USA); **Zuowei Shen,** National Univ. of Singapore (Singapore); **Metin Sitti,** Carnegie Mellon Univ. (USA); **Jan-Olov Stromberg,** Royal Institute of Technology (Sweden); **John Tangney,** Office of Naval Research (USA); **Emmanuel Vincent,** IRISA / INRIA Rennes (France); **Nadarajen A. Vydelingum,** National Institutes of Health (USA); **Lipo Wang,** Nanyang Technological Univ. (Singapore); **Olaf Wolkenhauer,** Univ. Rostock (Germany); **Donald C. Wunsch II,** Missouri Univ. of Science and Technology (USA); **Ning Xi,** Michigan State Univ. (USA); **Takeshi Yamakawa,** Fuzzy Logic Systems Institute (Japan); **Yiping Zhao,** The Univ. of Georgia (USA); **Yufeng Zheng,** Alcorn State Univ. (USA); **Xiaowei Zhuang,** Harvard Univ. (USA)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 333 . . . . . .Wed 8:00 am to 8:40 am

Wavelet Pioneer Award

Session Chairs: **John J. Benedetto,** Univ. of Maryland, College Park (USA); **Zuowei Shen,** National Univ. of Singapore (Singapore)

2013 Recipient of the Wavelet Pioneer Award

Presented to **Prof. Hans G. Feichtinger,** Univ. Vienna (Austria)

8:00 am: **Group theoretical methods and wavelet theory (coorbit theory and applications)** *(Invited Paper)*, Hans G. Feichtinger, Univ. Wien (Austria) . . . . . [8750-1]

PANEL DISCUSSION

Room: Conv. Ctr. 333 . . . . . 8:40 am to 8:50 am

Panel Discussion on Robustness of Orthogonal Versus Non-Orthoganal Wavelets Concentration of Signal Energy

Moderators: **Zuowei Shen**, National Univ. of Singapore (Singapore); **Soo-Young Lee,** KAIST (Korea, Republic of); **Harold Szu,** U. S. Army Night Vision & Electronic Sensors Directorate (USA)

SESSION 2

Room: Conv. Ctr. 333 . . . . . .Wed 8:50 am to 10:10 am

Robustness Wavelet Applications

8:50 am: **Composite wavelet representations for reconstruction of missing data** *(Invited Paper)*, Wojtek Czaja, Julia Dobrosotskaya, Benjamin Manning, Univ. of Maryland, College Park (USA). . . . . [8750-2]

9:30 am: **Multiscale and multidirectional tight frames for image analysis** *(Invited Paper)*, Edward H. Bosch, Alexey Castrodad, National Geospatial-Intelligence Agency (USA); Wojtek Czaja, Julia Dobrosotskaya, Univ. of Maryland, College Park (USA); John S. Cooper, National Geospatial-Intelligence Agency (USA) . . . . . [8750-3]

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

SESSION 3

Room: Conv. Ctr. 333 . . . . . .Wed 10:40 am to 12:00 pm

Multiresolution Applications

10:40 am: **Multi-frequency resolution method for distortion-free signal extraction from convolutive mixtures** *(Invited Paper)*, Soo-Young Lee, KAIST (Korea, Republic of). . . . . [8750-4]

11:20 am: **Emotional state and its impact on voice authentication accuracy** *(Invited Paper)*, Miroslav Voznak, Pavol Partila, Marek Penhaker, Tomas Peterek, Karel Tomala, Filip Rezac, Jakub Safarik, Technical Univ. of Ostrava (Czech Republic) . . . . . [8750-5]

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

SESSION 4

Room: Conv. Ctr. 333 . . . . . Wed 1:30 pm to 2:10 pm

Unsupervised Learning ICA Pioneer Award

Session Chairs: **Emmanuel Vincent,** IRISA / INRIA Rennes (France); **Soo-Young Lee,** KAIST (Korea, Republic of); **Tzyy-Ping Jung,** Univ. of California, San Diego (USA)

2013 Recipient of the ICA Unsupervised Learning and ICA Award for the Blind Source Separation in the Frequency Domain

Presented to **Dr. Hiroshi Sawada,** NTT Communication Science Lab. (Japan)

1:30 pm: **Audio source separation with multiple microphones on time-frequency representations** *(Invited Paper)*, Hiroshi Sawada, Nippon Telegraph and Telephone Corp. (Japan) . . . . . [8750-6]

PANEL DISCUSSION

Room: Conv. Ctr. 333 . . . . . 2:10 pm to 2:30 pm

Why are pre-processing and post-processing necessary for unsupervised learning?

Panel Moderators: **Hiroshi Sawada,** NTT Communications Science Lab. (Japan; and **Soo-Young Lee,** KAIST (Korea, Republic of)

Panelists: **Emmanuel Vincent,** IRISA / INRIA Rennes(France); **Tzyy-Ping Jung,** Univ. of California, San Diego (USA); **Harold Szu,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

SESSION 5
Room: Conv. Ctr. 333 . . . . . Wed 2:30 pm to 3:10 pm

Neural Network Learning Application

Session Chairs: **Hiroshi Sawada,** Nippon Telegraph and Telephone Corp. (Japan); **Harold Szu,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

2:30 pm: **Optimization of object region and boundary extraction by energy minimization of a recurrent neural network for activity recognition**, Fatema A. Albalooshi, Vijayan K. Asari, Univ. of Dayton (USA) . . . . . [8750-7]

2:50 pm: **Automated analysis of texture features for non-masses**, Anke Meyer-Baese, The Florida State Univ. (USA) . . . . . [8750-8]

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

SESSION 6
Room: Conv. Ctr. 333 . . . . . Wed 3:40 pm to 5:40 pm

Unsupervised Learning Neural Nets and ICA

Session Chairs: **Hiroshi Sawada,** Nippon Telegraph and Telephone Corp. (Japan); **Harold Szu,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

3:40 pm: **Wavelet neural networks for stock trading and prediction** *(Invited Paper)*, Lipo Wang, Nanyang Technological Univ. (Singapore) . . . . [8750-9]

4:10 pm: **Comparative analysis of filtered back-projection algorithms in optoacoustic endoscopy using ultrasonic optic sensors for Intravascular Imaging** *(Invited Paper)*, Horacio Lamela Rivera, Pablo González, Pedro F. Escudero, Antonio Rincon, Omar de Varona, Daniel C. Gallego, Univ. Carlos III de Madrid (Spain) . . . . . [8750-10]

4:40 pm: **Artificial neural networks (AANs) as compared to partial least squares (PLS) for spectral interference correction** *(Invited Paper)*, Z. Li, Vassili Karanassios, Univ. of Waterloo (Canada) . . . . . [8750-11]

5:20 pm: **Analysis and removing noise from the speech signal using wavelet transforms**, Karel Tomala, Miroslav Voznak, Pavol Partila, Filip Rezac, Jakub Safarik, Technical Univ. of Ostrava (Czech Republic) . . . . . [8750-12]

Thursday 2 May

SESSION 7
Room: Conv. Ctr. 333 . . . . . Thu 8:00 am to 8:40 am

Compressive Sampling Pioneer Award

Session Chairs: **Liyi Dai,** U.S. Army Research Office (USA); **John J. Benedetto,** Univ. of Maryland, College Park (USA)

2013 Recipient of the Compressive Sampling: "For the pioneer contribution to compressive sensing"

Presented to Prof. Justin Romberg, Georgia Institute of Technology (USA)

8:00 am: **Blind deconvolution using convex programming** *(Invited Paper)*, Justin K. Romberg, Georgia Institute of Technology (USA) . . . . . [8750-13]

PANEL DISCUSSION
Room: Conv. Ctr. 333 . . . . . 8:40 am to 9:00 am

Difference of Pre-Processing versus Post-Processing, i.e. JPEG2000 Compression versus CRTD Compressive Sensing

Panel Moderators: **Justin Romberg,** Georgia Institute of Technology (USA); and **Liyi Dai,** U.S. Army Research Office (USA)

Panelists: **John Benedetto,** Univ. of Maryland, College Park (USA); **Hans G. Feichtinger**, Univ. Wien (Austria); **Lee-Soo Young,** KAIST (Republic of Korea); **Carlo Morabito**, Univ. Mediterranea di Reggio Calabria (Italy); **Harold Szu,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

SESSION 8
Room: Conv. Ctr. 333 . . . . . Thu 9:00 am to 10:00 am

Compressive Sampling Applications I

Session Chairs: **Justin K. Romberg,** Georgia Institute of Technology (USA); **Liyi Dai,** U.S. Army Research Office (USA)

9:00 am: **Compressive sensing effects on human visual system-based passive ranging**, Jae H. Cha, U.S. Army Night Vision & Electronic Sensors Directorate (USA) . . . . . [8750-14]

9:20 am: **Feature-organized sparseness for efficient face recognition from multiple poses**, Tomo Iwamura, Japan Ministry of Defense (Japan) . . . . . [8750-15]

9:40 am: **Adaptive sparse signal processing of on-orbit lightning data using learned dictionaries**, Daniela I. Moody, David A. Smith, Los Alamos National Lab. (USA) . . . . . [8750-16]

Coffe Break . . . . . Thu 10:00 am to 10:30 am

SESSION 9
Room: Conv. Ctr. 333 . . . . . Thu 10:30 am to 12:30 pm

Compressive Sampling Applications II

Session Chairs: **Justin K. Romberg,** Georgia Institute of Technology (USA); **Liyi Dai,** U.S. Army Research Office (USA)

10:30 am: **Compressive feedback for real-time control: compressive sensing beyond sensing**, Ning Xi, Michigan State Univ. (USA) . . . . . [8750-43]

10:50 am: **Hyperspectral waveband group optimization for time-resolved human sensing**, Balvinder Kaur, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Jill K. Nelson, George Mason Univ. (USA); Andrew J. Hutchinson, Van A. Hodgkin, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Vasiliki N. Ikonomidou, George Mason Univ. (USA) . . . [8750-18]

11:10 am: **Decoupling sparse coding of SIFT descriptors for large-scale visual recognition**, Zhengping Ji, James Theiler, Rick Chartrand, Los Alamos National Lab. (USA); Garrett Kenyon, Los Alamos National Laboratory (USA); Steven P. Brumby, Los Alamos National Lab. (USA) . . . . . [8750-19]

11:30 am: **A study of the coherence parameter of the progressive compressive imager based on Radon transform**, Adrian Stern, Vladimir Farber, Yair Rivenson, Ben-Gurion Univ. of the Negev (Israel) . . . . . [8750-20]

11:50 am: **Mammogram superresolution reconstruction based on compressive sampling**, Yan Shen, Houjin Chen, Chang Yao, Jupeng Li, Beijing Jiaotong Univ. (China); Zhijun G. Qiao, The Univ. of Texas-Pan American (USA) . . . . . [8750-21]

12:10 pm: **Noise SAR imagery compressing and reconstruction based on compressed sensing**, Huihuang Zhao, Hengyang Normal Univ. (China); Juan Lopez, Yufeng Cao, Zhijun G. Qiao, The Univ. of Texas-Pan American (USA) . . . . . [8750-22]

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

SESSION 10
Room: Conv. Ctr. 333 . . . . . Thu 1:30 pm to 2:10 pm

Nanoengineering and Implementation Award

Session Chairs: **Yiping Zhao,** The Univ. of Georgia (USA); **Uwe Meyer-Baese,** The Florida State Univ. (USA)

Recipient 2013 of the Nanoengineering "For the contribution to self-assembly of three dimensional nanostructures"

Presented to **Prof. David H. Gracias,** Johns Hopkins Univ. (USA)

1:30 pm: **Three dimensional self-assemply at the nanoscale** *(Invited Paper)*, David H. Gracias, Johns Hopkins Univ. (USA) . . . . . [8750-23]

PANEL DISCUSSION
Room: Conv. Ctr. 333 . . . . . 2:10 pm to 2:30 pm

Nano-enhancement of Moore's Law

Panel Moderator: **David Gracias,** Johns Hopkins Univ. (USA); **Yiping Zhao,** The Univ. of Georgia (USA); **Ning Xi,** Michigan State Univ. (USA)

Panelists: **J. Wu,** George Washington Univ. (USA); **Harold Szu,** U. S. Army Night Vision & Electronic Sensors Directorate (USA)

SESSION 11
Room: Conv. Ctr. 333 . . . . . Thu 2:30 pm to 5:00 pm

Implementation

Session Chairs: **Henry Chu,** Univ. of Louisiana at Lafayette (USA); **Uwe Meyer-Baese,** The Florida State Univ. (USA)

2:30 pm: **Gadolinium nanoparticles studies by using coded optoacoustic signals with two lasers for dual-mode biomedical imaging**, Pedro F. Escudero Sr., Daniel C. Gallego, Horacio Lamela Rivera, Fernando Herranz, Univ. Carlos III de Madrid (Spain); Hugo Amary Groult, Jesús Maria Ruiz-Cabello, Nacional de Investigaciones Cardiovasculares (Spain). . . . . [8750-24]

2:50 pm: **Optimization of block-matching algorithms using custom instruction-based paradigm on NIOS II microprocessors**, Diego González, Univ. Complutense de Madrid (Spain); Guillermo Botella, Uwe Meyer-Baese, Anke Meyer-Baese, The Florida State Univ. (USA) . . . . . [8750-25]

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

3:40 pm: **Segmentation and kinetic analysis of non-mass-enhancing lesions in dynamic contrast enhanced magnetic resonance Imaging**, Anke Meyer-Baese, The Florida State Univ. (USA); Sebastian M. Goebl, Ludwig-Maximilians-Univ. München (Germany) . . . . . [8750-26]

4:00 pm: **A modified PSO based particle filter algorithm for object tracking**, Yufei Tang, The Univ. of Rhode Island (USA); Siyao Fu, Central Univ. of Nationalities (China); Bo Tang, Haibo He, The Univ. of Rhode Island (USA)[8750-27]

4:20 pm: **Visual saliency approach to anomaly detection in an image ensemble**, Anurag Singh, Univ of Louisiana at Lafayette (USA); Michael Pratt, Henry Chu, Univ. of Louisiana at Lafayette (USA). . . . . [8750-28]

4:40 pm: **Fast algorithm for entropy estimation**, Evgeniy Timofeev, Yaroslavl State Univ. (Russian Federation); Alexei Kaltchenko, Wilfrid Laurier Univ. (Canada) . . . . . [8750-29]

Friday 3 May

SESSION 12
Room: Conv. Ctr. 333 . . . . . Fri 8:00 am to 8:40 am

Biomedical Wellness Applications I Award

Session Chairs: **Lipo Wang,** Nanyang Technological Univ. (Singapore); **Anke Meyer-Baese,** The Florida State Univ. (USA); **Jide Familoni,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

2013 Recipient of the Biomedical Wellness Pioneer Award

Presented to **Prof. Weichuan Yu,** Hong Kong Univ. of Technology (Hong Kong)

8:00 am: **Low-rank modeling and its applications in medical image analysis** *(Invited Paper)*, Xiaowei Zhou, Weichuan Yu, Hong Kong Univ. of Science and Technology (Hong Kong, China) . . . . . [8750-30]

PANEL DISCUSSION
Room: Conv. Ctr. 333 . . . . . 8:40 am to 9:20 am

Why don't insurance companies support homecare technology for an aging society?

Panel Moderators: **Lipo Wang,** Nanyang Technological Univ. (Singapore); **Weichuan Yu**, Hong Kong Univ. of Technology (Hong Kong)

Panelists: **Yutaka Hata,** Univ. of Hyogo (Japan); **Hiroshi Nakajima,** OMRON Corp. (Japan); **Soo-Young Lee,** KAIST (Republic of Korea)

SESSION 13
Room: Conv. Ctr. 333 . . . . . Fri 9:20 am to 10:00 am

Biomedical Wellness Applications II

Session Chairs: **Jide Familoni,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Hiroshi Nakajima,** OMRON Corp. (Japan)

9:20 am: **Robust compressive sensing of noisy images**, Charles C. Hsu, Harold Szu, Charles C. Nguyen, The Catholic Univ. of America (USA) . . . . . [8750-17]

9:40 am: **Visual analysis of large graphs in phosphoproteomic data analysis**, Anke Meyer-Baese, The Florida State Univ. (USA) . . . . . [8750-32]

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

SESSION 14
Room: Conv. Ctr. 333 . . . . . Fri 10:30 am to 11:50 am

Biomedical Wellness Applications III

Session Chairs: **Jide Familoni,** U.S. Army Night Vision & Electronic Sensors Directorate (USA); **Yutaka Hata,** Univ. of Hyogo (Japan)

10:30 am: **Monitoring and diagnosis of Alzheimer disease using noninvasive compressive sensing EEG** *(Invited Paper)*, Francesco Carlo Morabito, Univ. Mediterranea di Reggio Calabria (Italy); Giuseppe Morabito, Univ. degli Studi di Pavia (Italy); Harold Szu, U.S. Army Night Vision & Electronic Sensors Directorate (USA) . . . . . [8750-35]

11:10 am: **Health sensor for human body by using infrared, acoustic energy and magnetic signature**, Jerry Wu, The George Washington Univ. (USA); Harold Szu, The Catholic Univ. of America (USA). . . . . [8750-34]

11:30 am: **Principles of biomedical wellness homecare system**, Harold Szu, The Catholic Univ. of America (USA) . . . . . [8750-36]

Lunch Break . . . . . Fri 11:50 am to 1:30 pm

SESSION 15
Room: Conv. Ctr. 333 . . . . . Fri 1:30 pm to 2:10 pm

Systems of Biology Award

Session Chairs: **Nadarajen A. Vydelingum,** National Institutes of Health (USA); **Anke Meyer-Baese,** The Florida State Univ. (USA); **Shun-ichi Amari,** RIKEN (Japan); **Fredric M. Ham,** Florida Institute of Technology (USA)

Recipient of the 2013 System of Biology: Self-organization of 3D Neural and Retinal Structures in vitro

Presented to **Dr. Yoshihiki Sasai,** a stem-cell biologist at RIKEN Center of Developmental biology in Jube, Japan

1:30 pm: **Embryonic stem cells self-assembly model** *(Invited Paper)*, Yoshiki Sasai, RIKEN (Japan). . . . . [8750-37]

PANEL DISCUSSION
Room: Conv. Ctr. 333 . . . . . 2:10 pm to 2:50 pm

'Laissez faire stem cells' (leave us be, let us do): medicine from the organ self repairmen perspective

Panel Moderators: **Nadarajen Vydelingum,** National Institutes of Healty (USA); **Anke Meyer-Baese,** Florida State Univ. (USA)

Panelists: **Gianfranco Basti**, Pontificia Univ. Lateranense (Italy); **Francesco Carlos Morabito,** Univ. Mediterranea di Reggio Calabria (Italy); **Frederic Ham,** Florida Institute of Technology (USA); **Harold Szu,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

Coffee Break . . . . . Wed 2:50 pm to 3:20 pm

SESSION 16
Room: Conv. Ctr. 333 . . . . . Fri 3:20 pm to 5:00 pm

Systems Applications

Session Chairs: **Nadarajen A. Vydelingum,** National Institutes of Health (USA); **Anke Meyer-Baese,** The Florida State Univ. (USA); **Fredric M. Ham,** Florida Institute of Technology (USA)

3:20 pm: **Understanding 3D Human Torso Shape via Manifold Clustering**, Sheng Li, Northeastern Univ. (USA); Peng Li, U.S. Army Natick Soldier Research, Development and Engineering Ctr. (USA); Yun Fu, Northeastern Univ. (USA) . . . . . [8750-38]

3:40 pm: **Principle of probabilistic comparison for statistical inference and learning**, Xinjia Chen, Southern Univ. and A&M College (USA) . . . . . [8750-39]

4:00 pm: **Simultaneous inference of population proportions and its applications in machine learning**, Xinjia Chen, Southern Univ. and A&M College (USA) . . . . . [8750-40]

4:20 pm: **Entropy estimation and Fibonacci numbers**, Evgeniy Timofeev, Yaroslavl State Univ. (Russian Federation); Alexei Kaltchenko, Wilfrid Laurier Univ. (Canada) . . . . . [8750-41]

4:40 pm: **User friendly practices of biomedical wellness homecares**, Jeffrey C. Jenkins, U.S. Army Night Vision & Electronic Sensors Directorate (USA); Harold Szu, The Catholic Univ. of America (USA). . . . . [8750-42]

Machine Intelligence and Bio-inspired Computation: Theory and Applications VII

Conference Chairs: **Misty Blowers,** Air Force Research Lab. (USA); **Olga Mendoza-Schrock,** Air Force Research Lab. (USA)

Program Committee: **Dale E. Courte,** Univ. of Dayton (USA); **Peter M. LaMonica,** Air Force Research Lab. (USA); **Leonid Perlovsky,** Air Force Research Lab. (USA); **Michael R. Peterson,** Univ. of Hawai'i (USA); **Robinson Pino,** Army Research Lab. (USA); **Mateen M. Rizki,** Wright State Univ. (USA); **Andres F. Rodriguez,** Carnegie Melon Univ. (USA); **Todd V. Rovito,** Air Force Research Lab. (USA); **John Spina,** Air Force Research Lab. (USA); **Clare Thiem,** Air Force Research Lab. (USA); **Juan R. Vasquez,** Air Force Research Lab. (USA); **Bryant T. Wysocki,** Air Force Research Lab. (USA)

Thursday 2 May

SESSION 1

Room: Conv. Ctr. 335 . . . . . Thu 9:00 am to 10:00 am

Advanced Approaches for Image Processing

Session Chair: **Andres F. Rodriguez,** Carnegie Melon Univ. (USA)

9:00 am: **Optimization of background subtraction for image enhancement**, Larry Venetsky, Ross Boczar, Robert Lee-Own, Naval Air Warfare Ctr. Aircraft Div. (USA) . . . . . [8751-1]

9:20 am: **Statistical recognition of 3D objects using integral imaging**, Cuong M. Do, Univ. of Connecticut (USA) . . . . . [8751-2]

9:40 am: **Temporal context for moving vehicle detection in wide area motion imagery**, Pengpeng Liang, Temple Univ. (USA); Erik P. Blasch, Khanh Pham, Air Force Research Lab. (USA); Zhonghai Wang, Genshe Chen, Intelligent Fusion Technology, Inc. (USA); Haibin Ling, Temple Univ. (USA) . . . . . [8751-4]

Coffee/Exhibition Break. . . . . .Thu 10:00 am to 10:50 am

SESSION 2

Room: Conv. Ctr. 335 . . . . . Thu 10:50 am to 11:50 am

Information Fusion

Session Chair: **Jonathan Williams,** Air Force Research Lab. (USA)

10:50 am: **Hybrid optimized genetic algorithm for bayesian network structure learning**, Feng Lin, Zhejiang Univ. (China); Chunyan Zhou, Shaoxing Vocational & Technical College (China); Wei Sun, K. C. Chang, George Mason Univ. (USA) . . . . . [8751-5]

11:10 am: **Fusing video and text data by integrating appearance and relational similarity**, Georgiy M. Levchuk, Aptima, Inc. (USA); Aaron F. Bobick, Georgia Institute of Technology (USA); Mathew Jacobsen, Aptima, Inc. (USA). . . . . [8751-6]

11:30 am: **Applications of the Self Organizing Map (SOM) in Unattended Ground Sensor (UGS) systems**, Brent W. Roeder, McQ, Inc. (USA) . . . . . [8751-9]

Lunch Break . . . . . .Thu 11:50 am to 1:20 pm

SESSION 3

Room: Conv. Ctr. 335 . . . . . Thu 1:20 pm to 2:40 pm

Cyber Operations I

Session Chair: **Misty Blowers,** Air Force Research Lab. (USA)

1:20 pm: **Trusted computation through biologically inspired processes**, Gustave Anderson, Luna Innovations Inc. (USA) . . . . . [8751-10]

1:40 pm: **A developmental approach to learning causal models for cyber security**, Jonathan Mugan, 21CT (USA) . . . . . [8751-11]

2:00 pm: **Computational intelligence and neuromorphic computing potential for cybersecurity applications**, Robinson Pino, Michael Shevenell, ICF International (USA); Hasan Cam, U.S. Army Research Lab. (USA); Mark R. McLean, Ctr. for Exceptional Computing (USA). . . . . [8751-12]

2:20 pm: **Human guided machine learning for Real-Time identification and characterization of cyber attacks**, Misty Blowers, Air Force Research Lab. (USA) . . . . . [8751-13]

SESSION 4

Room: Conv. Ctr. 335 . . . . . Thu 2:40 pm to 3:20 pm

Cyber Operations II

Session Chair: **Robinson Pino,** ICF International (USA)

2:40 pm: **A pipelined FPGA implementation of an encryption algorithm based on genetic algorithm.**, Nonel S. Thirer, Holon Institute of Technology (Israel) . . . . . [8751-14]

3:00 pm: **A spider-web approach to the recovery of ad hoc cognitive radio networks of heterogeneous sensor nodes in energy-limited environments**, William S. Hortos Jr., Associates in Communication Engineering Research and Technology (USA) . . . . . [8751-16]

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

SESSION 5

Room: Conv. Ctr. 335 . . . . . Thu 3:50 pm to 4:50 pm

Remote Sensing

Session Chair: **Misty Blowers,** Air Force Research Lab. (USA)

3:50 pm: **Vehicle tracking and analysis within a city**, Yu Liang, Michael Henderson, Shane Fernandes, Central State Univ. (USA); Josh Sanderson, Wright State Univ. (USA); Darrell Barker, Air Force Research Lab. (USA) . . . . . [8751-17]

4:10 pm: **Exploring manifold learning using laser vibrometry data**, Andrew M. Freeman, Air Force Research Lab. (USA); Scott J. Kangas, Jacobs Engineering Group Inc. (USA); Olga Mendoza-Schrock, Air Force Research Lab. (USA)[8751-18]

4:30 pm: **The effects of clothing on gender classification using LIDAR Data**, Ryan R. McCoppin, Nathan Koester, Howard N. Rude, Louis A. Tamburino, Wright State Univ. (USA); Andrew M. Freeman, Air Force Research Lab. (USA); Mateen M. Rizki, Wright State Univ. (USA); Olga Mendoza-Schrock, Air Force Research Lab. (USA) . . . . . [8751-19]

Modeling and Simulation for Defense Systems and Applications VIII

Conference Chair: **Eric J. Kelmelis,** EM Photonics, Inc. (USA)

Program Committee: **James P. Durbano,** Northrop Grumman (USA); **James N. Elele,** Naval Air Systems Command (USA); **Susan Harkrider,** U.S. Army Night Vision & Electronic Sensors Directorate (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 328 . . . . . Tue 8:00 am to 9:00 am

Electromagnetic and Signal Modeling

Session Chair: **Eric J. Kelmelis,** EM Photonics, Inc. (USA)

8:00 am: **High-fidelity modeling and simulation for wideband receiver development**, Chen Wu, Anne Young, Defence Research and Development Canada, Ottawa (Canada) . . . . . [8752-1]

8:20 am: **Integration of radio-frequency transmission and radar in general software for multimodal battlefield signal modeling**, Kenneth K. Yamamoto, Nathan J. Reznicek, D. Keith Wilson, U.S. Army Engineer Research and Development Ctr. (USA) . . . . . [8752-2]

8:40 am: **Model-driven requirements engineering (MDRE) for real-time ultra-wide instantaneous bandwidth signal simulation**, Daniel Y. Chang, Naval Air Warfare Ctr. Weapons Div. (USA) . . . . . [8752-3]

SESSION 2

Room: Conv. Ctr. 328 . . . . . Tue 9:00 am to 10:00 am

Operations

Session Chair: **D. Keith Wilson,** U.S. Army Engineer Research and Development Ctr. (USA)

9:00 am: **NASA Operational Simulator (NOS) for V&V of complex systems**, Scott Zemerick, TMC Technologies (USA); Justin Morris, NASA IV&V (USA) . . . . [8752-4]

9:20 am: **Validating an artificial intelligence human proximity operations system with test cases**, Justin R. Huber, Jeremy Straub, The Univ. of North Dakota (USA) . . . . . [8752-5]

9:40 am: **A five states survivability model for missions with ground-to-air threats**, Tina Erlandsson, Saab AB (Sweden); Lars Niklasson, Univ. of Skövde (Sweden) . . . . . [8752-6]

Coffee/Exhibition Break. . . . . .Tue 10:00 am to 10:50 am

SESSION 3

Room: Conv. Ctr. 328 . . . . . Tue 10:50 am to 11:10 am

Networks

Session Chair: **Daniel Y. Chang,** Naval Air Warfare Ctr. Weapons Div. (USA)

10:50 am: **Method for simulating free space optical data links for personnel applications**, Kiron Mateti, Naval Surface Warfare Ctr. Crane Div. (USA); Brandon R Clarke, Ean J Seals, Gregory J Petty, Hoang Q Tran, Courtney L Boykin, Gail M Nicholson, Joshua D Borneman, Naval Surface Warfare Center Crane Electro Optic Technology Division (USA) . . . . . [8752-8]

SESSION 4

Room: Conv. Ctr. 328 . . . . . Tue 11:10 am to 12:10 pm

Applications

Session Chair: **Chen Wu,** Defence Research and Development Canada, Ottawa (Canada)

11:10 am: **Super-resolution mosaics from airborne video using robust gradient regularization and optimization algorithm**, Aldo Camargo, Ingenia Technology Ltd. (Peru); Kannappan Palaniappan, Univ. of Missouri-Columbia (USA); Qiang He, Mississippi Valley State Univ. (USA) . . . . . [8752-9]

11:30 am: **Review scalable high performing solutions using GPUs**, Thomas Reed, NVIDIA Corp. (USA) . . . . . [8752-10]

11:50 am: **Advances in computational fluid dynamics solvers for modern computing environments**, Daniel L. Hertenstein, John R. Humphrey Jr., Eric J. Kelmelis, EM Photonics, Inc. (USA). . . . . [8752-11]

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

SESSION 5

Room: Conv. Ctr. 328 . . . . . Tue 1:40 pm to 3:00 pm

HPC Tools

Session Chair: **Jonathan Rogers,** Texas A&M Univ. (USA)

1:40 pm: **Productive high-performance software for OpenCL devices**, James Malcolm, John M. Melonakos, AccelerEyes LLC (USA) . . . . . [8752-12]

2:00 pm: **Scalable models for programming modern HPC systems**, Kyle E Spagnoli, John R. Humphrey Jr., Paul A. Fox, Eric J. Kelmelis, EM Photonics, Inc. (USA) . . . . . [8752-13]

2:20 pm: **Performance gains of data-dependent clustering algorithms using CUDA's dynamic parallelism**, Jeffrey T. DiMarco, EM Photonics, Inc. (USA); Michela Taufer, Univ. of Delaware (USA) . . . . . [8752-14]

2:40 pm: **Applying big data techniques to heterogeneous military data**, John R. Humphrey Jr., Kyle E. Spagnoli, Eric J. Kelmelis, EM Photonics, Inc. (USA) . . . . . [8752-15]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

SESSION 6

Room: Conv. Ctr. 328 . . . . . Tue 3:40 pm to 5:10 pm

Battlespace

Session Chair: **Daniel Mackrides,** Phase Sensitive Innovations, Inc. (USA)

3:40 pm: **Digital command and control (C2) in electromagnetic bttlespace**, Ekrem Kurt, Turkish Air Force Academy (Turkey) . . . . . [8752-16]

4:00 pm: **Determining the flare dispensing program effectiveness against conical-scan and spin-scan reticle systems via Gaussian mixture models**, Mehmet C. Sahingil, Murat S. Aslan, TÜBITAK UEKAE (Turkey) . . . . . [8752-17]

4:20 pm: **GPU-enabled projectile guidance for impact area constraints**, Jonathan Rogers, Texas A&M Univ. (USA) . . . . . [8752-19]

4:40 pm: **Characterization of infrared imaging performance within a general statistical framework for environmental impacts on battlefield signals and sensing**, D. Keith Wilson, U.S. Army Engineer Research and Development Ctr. (USA); Christopher T. Borden, Elizabeth S. Bettencourt, Atmospheric and Environmental Research, Inc. (USA); Kenneth K. Yamamoto, U.S. Army Engineer Research and Development Ctr. (USA). . . . . [8752-20]

5:00 pm: **An extended analytical Bayesian framework for comparison of disparate test articles,** Holger M. Jaenisch, James W. Handley, Licht Strahl Engineering, Inc. (USA) . . . . . [8752-18]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Design and implementation of dynamic virtual network, Peili Qiao, Harbin Univ. of Science and Technology (China). . . . . [8752-21]

Wireless Sensing, Localization, and Processing VIII

Conference Chairs: **Sohail A. Dianat,** Rochester Institute of Technology (USA); **Michael David Zoltowski,** Purdue Univ. (USA)

Program Committee: **John W. Nieto,** Harris Corp. (USA); **Raghuveer M. Rao,** U.S. Army Research Lab. (USA); **Yimin D. Zhang,** Villanova Univ. (USA)

Wednesday 1 May

SESSION 1

Room: Conv. Ctr. 334 . . . . . .Wed 8:20 am to 10:00 am

Sensor Networks

Session Chair: **John W. Nieto,** Harris Corp. (USA)

8:20 am: **Multi-platform RF emitter localization using extremum seeking control**, Huthaifa A. Al Issa, Raul Ordonez, Univ. of Dayton (USA) . . . . . [8753-1]

8:40 am: **Quality-of-service comparison of a protocol for an active RFID network with sensing and a cross-layer protocol for a wireless sensor network**, William S. Hortos Jr., Associates in Communication Engineering Research and Technology (USA) . . . . . [8753-2]

9:00 am: **Optical communication line-of-sight analysis for dismounted warfighters**, Jiayi Geng, Gail Nicholson, Naval Surface Warfare Ctr. Crane Div. (USA) . . . . . [8753-3]

9:20 am: **Performance evaluation of CCI on the forward CDMA channel**, Salim Alsharif, Mohammad Alam, Univ. of South Alabama (USA) . . . . . [8753-4]

9:40 am: **Pulse based sensor networking using mechanical waves through metal substrates**, Stephan Lorenz, Michigan State Univ. (USA) and College of Electrical and Computer Engineering (USA); Bo Dong, Qiong Huo, William J. Tomlinson Jr., Subir Biswas, Michigan State Univ. (USA) . . . . . [8753-5]

Coffee/Exhibition Break. . . . . Wed 10:00 am to 10:50 am

SESSION 2

Room: Conv. Ctr. 334 . . . . . .Wed 10:50 am to 11:50 am

Diversity and Multicarrier Techniques

Session Chair: **Michael David Zoltowski,** Purdue Univ. (USA)

10:50 am: **An investigation of Crest factor and power amplifier back-off requirements For non-OFDM multicarrier modulations**, John W. Nieto, Harris Corp. (USA) . . . . . [8753-6]

11:10 am: **Turbo MMSE equalizer for spread OFDM signal detection**, Ali A. Elghariani, Michael D. Zoltowski, Purdue Univ. (USA) . . . . . [8753-8]

11:30 am: **Noncoherent unitary space-time codes for wireless MIMO communications**, Xinjia Chen, Ernest L. Walker, Southern Univ. and A&M College (USA) . . . . . [8753-9]

Lunch/Exhibition Break . . . . . Wed 11:50 am to 1:40 pm

SESSION 3

Room: Conv. Ctr. 334 . . . . . Wed 1:40 pm to 3:00 pm

Modulation and Channel Estimation

Session Chair: **Raghuveer M. Rao,** U.S. Army Research Lab. (USA)

1:40 pm: **Quasi-coherent performance of convolutional-coded continuous phase modulation**, James A. Norris, John W. Nieto, Harris Corp. (USA) . [8753-11]

2:00 pm: **PSK31 implementation in an FPGA**, William M. Batts Jr., Carlos O. Alva, Harris Corp. (USA) . . . . . [8753-12]

2:20 pm: **Power and spectrally efficient communications: a comparison of linear and nonlinear modulation schemes**, Colin Brown, Phil Vigneron, Communications Research Ctr. Canada (Canada) . . . . . [8753-13]

2:40 pm: **Estimating channel capacity and power transfer efficiency of a multilayer acoustic-electric channel**, Soumya Chakraborty, Kyle R. Wilt, Gary J. Saulnier, Henry A. Scarton, Rensselaer Polytechnic Institute (USA); Pankaj K. Das, Univ. of California, San Diego (USA) . . . . . [8753-14]

Coffee Break . . . . . Wed 3:00 pm to 3:40 pm

SESSION 4

Room: Conv. Ctr. 334 . . . . . Wed 3:40 pm to 5:20 pm

Detection and Localization

Session Chair: **John W. Nieto,** Harris Corp. (USA)

3:40 pm: **Low-complexity algorithms for RF source localization and spatio-temporal directional spectrum sensing with applications in cognitive radio**, Arjuna Madanayake, Chamith Wijenayake, Judith Abeysekara, Uma Potluri, D ale Mugler, The Univ. of Akron (USA) . . . . . [8753-15]

4:00 pm: **Precise RFID localization in impaired environment through sparse signal recovery**, Yimin D. Zhang, Saurav Subedi, Moeness G. Amin, Villanova Univ. (USA) . . . . . [8753-16]

4:20 pm: **Target Position Localization in a Passive Radar System Through Convex Optimization**, Batu Chalise, Yimin D. Zhang, Moeness G. Amin, Villanova Univ. (USA); Braham Himed, Air Force Research Laboratory (USA). . . . . [8753-17]

4:40 pm: **Collaborative beamfocusing radio (COBRA)**, Jeremy P. Rode, Mark Hsu, David Smith, Anis Husain, Ziva Corp. (USA) . . . . . [8753-18]

5:00 pm: **Rapid estimation of the seismic disaster-stricken area based on wireless communication data**, Xiaoyong Zhang, National Earthquake Response Support Service (China) . . . . . [8753-19]

Thursday 2 May

SESSION 5

Room: Conv. Ctr. 334 . . . . . Thu 8:20 am to 10:00 am

Implementation and Applications

Session Chair: **James A. Norris,** Harris Corp. (USA)

8:20 am: **A novel self-organized distributed pulse switching architecture for binary sensing and actuation applications**, Qiong Huo, Bo Dong, Subir Biswas, Michigan State Univ. (USA) . . . . . [8753-20]

8:40 am: **Fast Fourier sampling for ultra-wide digital receiver application**, Chen Wu, Sreeraman Rajan, Defence Research and Development Canada, Ottawa (Canada) . . . . . [8753-21]

9:00 am: **Combination of spatial diversity and parallel decision feedback equalizer in a single-input multiple-output underwater acoustic communication system operating at very high frequencies**, Violeta Skoro Kaskarovska, Pierre-Philippe Beaujean, Florida Atlantic Univ. (USA). . . . . [8753-22]

9:20 am: **Regularization in radio tomographic imaging**, Ramakrishnan Sundaram, Gannon Univ. (USA); Richard Martin, Air Force Institute of Technology (USA); Christopher Anderson, U.S. Naval Academy (USA). . . . . [8753-24]

9:40 am: **Ubiquitous data modeling and analysis for ambulance services enhancement**, Jalel Akaichi, ISG (Tunisia). . . . . [8753-25]

Open Architecture/Open Business Model Net-Centric Systems and Defense Transformation 2013

Conference Chair: **Raja Suresh,** General Dynamics Advanced Information Systems (USA)

Program Committee: **Vasu D. Chakravarthy,** Air Force Research Lab. (USA); **Megan Cramer,** U.S. Navy PEO LCS (USA); **John S. Eicke,** U.S. Army Research Lab. (USA); **Bassam S. Farroha,** U.S. Dept. of Defense (USA); **Deborah Farroha,** U.S. Dept. of Defense (USA); **Gayle D. Grant,** U.S. Army Communications-Electronics Command (USA); **Thomas Green,** SAIC (USA); **Michael A. Kolodny,** U.S. Army Research Lab. (USA); **Andrew Morrison; Leo J. Rose,** U.S. Air Force (USA); **Jason R. Stack,** Office of Naval Research (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 334 . . . . . Tue 9:00 am to 12:30 pm

Perspectives on Open Architecture/ Open Business Model (OA/OBM) Systems

Session Chairs: **Megan Cramer,** U.S. Navy (USA); **Jason R. Stack,** Office of Naval Research (USA)

9:00 am: **Naval open systems architecture** *(Invited Paper)*, Nick Guertin, U.S. Navy (USA) . . . . . [8754-1]

9:30 am: **Networked sensors: insights into ISR and force protection** *(Invited Paper)*, Thomas Conway, PM/NV-RSTA (USA) . . . . . [8754-3]

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

10:30 am: **The UAS control segment architecture: an overview** *(Invited Paper)*, Richard Ernst, Office of the Secretary of Defense (USA); Parag Batavia, Neya Systems LLC (USA) . . . . . [8754-4]

11:00 am: **RF-FPGA and its impact on open architecture arrays** *(Invited Paper)*, William Chappell, Defense Advanced Research Projects Agency (USA) . . . [8754-5]

11:30 am: **A model for open architecture mission control systems** *(Invited Paper)*, Tim Pavlick, IBM Corp. (USA) . . . . . [8754-6]

12:00 pm: **Program executive office littoral combat ships (PEO LCS) science and technology overview** *(Invited Paper)*, Megan Cramer, U.S. Navy (USA) . . . . . [8754-7]

Lunch/Exhibition Break . . . . . .Tue 12:30 pm to 2:20 pm

SESSION 2

Room: Conv. Ctr. 334 . . . . . Tue 2:20 pm to 3:00 pm

Net-centric Architectures and Information Assurance

Session Chairs: **Andrew Morrison,** Metron, Inc. (USA); **Bassam S. Farroha,** U.S. Dept. of Defense (USA)

2:20 pm: **Architecting a dynamic cyber defense through hardening privilege, identity, and access management**, Bassam S. Farroha, U.S. Dept. of Defense (USA) . . . . . [8754-9]

2:40 pm: **Evaluating encrypted Boolean functions on encrypted bits: Secure decision-making on the black side**, Rajesh Krishnan, Cosocket LLC (USA); Ravi Sundaram, Northeastern Univ. (USA) . . . . . [8754-10]

Coffee/Exhibition Break. . . . . .Tue 3:00 pm to 4:00 pm

SPECIAL WORKSHOP AND DISCUSSION

Room: Conv. Ctr. 334 . . . . . .Tue 4:00 pm to 5:30 pm

Modular Open System Architecture (MOSA) Back End for RF Systems (MBE-RF)

Keynote Speaker : **Gregory Rubertus**, Air Force Research Lab. (USA)

Technical Presentation: **Dr. Gregory Twaites**, Chief Engineer, General Dynamics Advanced Information Systems

Workshop Moderator: **Edwin Culpepper**, Air Force Research Lab. (USA)

Radio Frequency (RF) systems including radars, signals intelligence (SIGINT), electronic warfare (EW) and communications systems have traditionally been designed as monolithic systems with tightly coupled RF front ends and processing back ends. Suppliers have traditionally designed these systems as integrated front and back ends, often with proprietary standards and interfaces. The result is that the government is locked into that supplier for the life of the system, thus excluding potential competition to manage costs.

The Air Force Research Laboratory (AFRL) has launched a program to address this issue. The goal of the Modular Open System Architecture (MOSA) Back End for RF (MBE-RF) program is to develop a hardware-independent, open reference architecture for the back end processing of RF systems, thereby allowing a variety of suppliers to offer solutions. The objective is to drive down the life cycle cost of these systems while at the same time making it easier to upgrade systems as new technology becomes available.

This workshop is offered by AFRL. A detailed overview of the MBE-RF reference architecture for back end RF systems will be provided. The topics to be covered include the following:

1. **Introduction to Problem**
   - Technical perspective
   - Procurement perspective
2. **Overview of MBE Architecture**
   - Scope of MBE
   - Architecture development process
   - Reference architecture description
3. **Using the MBE Architecture**
   - Designing MBE systems and components
   - Integrating MBE components and systems
   - Upgrading an existing system to MBE compliance
4. **Handout Materials**
   - MBE Overview Brochure/Whitepaper
   - Technical Data Package items available upon request to DoD contractors

Wednesday 1 May

SESSION 3
Room: Conv. Ctr. 321 . . . . . Wed 8:30 am to 10:00 am

NOTE ROOM CHANGE

Special Keynote Session

Open Architecture (OA)/
Open Business Model (OBM) Systems

Joint with Conferences 8741 and 8754

Session Chair: **Raja Suresh,**
General Dynamics Advanced Information Systems (USA)

8:30 am: **Modular, open, scalable architectures with applications to C4ISR systems** *(Keynote Presentation)*, Bobby R. Junker, Office of Naval Research (USA) . . . . . [8754-11]

9:00 am: **The GDAIS journey in OA/OBM** *(Keynote Presentation)*, Carlo Zaffanella, General Dynamics Advanced Information Systems (USA) . [8754-12]

9:30 am: **Small business perspectives on the open business model** *(Keynote Presentation)*, Howard Reichel, In-Depth Engineering Corp. (USA). . . [8754-13]

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

PANEL DISCUSSION
Room: Conv. Ctr. 321 . . . . . 10:30 am to 11:30 am

NOTE ROOM CHANGE

This panel follows the Special Keynote Session between Conferences 8741 and 8754.

Open Architecture (OA)/
Open Business Model (OBM) Systems

Joint Panel with Conferences 8741 and 8754

Moderator: **Dr. Raja Suresh,**
General Dynamics Advanced Information Systems

Panelists:

Bobby Junker,
C4ISR Department Head, Office of Naval Research (USA)

Howard Reichel,
Senior Vice President, In-Depth Engineering Corp. (USA)

Carlo Zaffanella,
Vice President, General Dynamics Advanced Information Systems (USA)

Nick Guertin,
Director of Transformation, U.S. Navy (USA)

SESSION 4
Room: Conv. Ctr. 323 . . . . . Wed 2:00 pm to 2:40 pm

NOTE ROOM CHANGE

Networking for Netcentric Warfare

Joint Session with Conferences 8742 and 8754

Session Chairs: **Raja Suresh,**
General Dynamics Advanced Information Systems (USA);
Tien Pham (USA)

2:00 pm: **A key management scheme for tiered wireless sensor network with self-healing capability**, Maoyu Wang, Communications Research Ctr. Canada (Canada); Helen Y. Tang, Defence Research and Development Canada, Ottawa (Canada); F. Richard Yu, Carleton Univ. (Canada) . . . . . [8742-26]

2:20 pm: **A data collection decision-making framework for a multi-tier collaboration of heterogeneous orbital, aerial and ground craft**, Jeremy Straub, The Univ. of North Dakota (USA). . . . . [8742-27]

Mobile Multimedia/Image Processing, Security, and Applications 2013

Conference Chairs: **Sos S. Agaian,** The Univ. of Texas at San Antonio (USA); **Sabah A. Jassim,** The Univ. of Buckingham (United Kingdom); **Eliza Yingzi Du,** Indiana Univ.-Purdue Univ. Indianapolis (USA)

Program Committee: **Farid Ahmed,** Johns Hopkins Univ. Applied Physics Lab. (USA); **David Akopian,** The Univ. of Texas at San Antonio (USA); **Salim Alsharif,** Univ. of South Alabama (USA); **Cesar Bandera,** BanDeMar Networks (USA); **Chang Wen Chen,** Univ. at Buffalo (USA); **Reiner Creutzburg,** Fachhochschule Brandenburg (Germany); **Stephen P. DelMarco,** BAE Systems (USA); **Martin A. Dietze,** Freiheit.Com Technologies GmbH (Germany); **Frederic Dufaux,** Telecom ParisTech (France); **Touradj Ebrahimi,** Ecole Polytechnique Fédérale de Lausanne (Switzerland); **Erlan H. Feria,** College of Staten Island (USA); **Phalguni Gupta,** Indian Institute of Technology Kanpur (India); **Yo-Ping Huang,** National Taipei Univ. of Technology (Taiwan); **Jacques Koreman,** Norwegian Univ. of Science and Technology (Norway); **Maryline Maknavicius,** TELECOM & Management SudParis (France); **Alessandro Neri,** Univ. degli Studi di Roma Tre (Italy); **Salil Prabhakar,** DigitalPersona, Inc. (USA); **Cheryl L. Resch,** Johns Hopkins Univ. Applied Physics Lab. (USA); **Sonia Garcia-Salicetti,** Telecom ParisTech (France); **Harin Sellahewa,** The Univ. of Buckingham (United Kingdom); **Xiyu Shi,** Univ. of Surrey (United Kingdom); **Yuri Shukuryan,** National Academy of Sciences of Armenia (Armenia); **Yue Wu,** Tufts Univ. (USA); **Yicong Zhou,** Univ. of Macau (Macao, China)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 335 . . . . . Mon 1:30 pm to 4:40 pm

Best Paper Award candidates will present in this special session in Mobile Multimedia/Image Processing, Security, and Applications 2013!

Session Chairs: **Eliza Yingzi Du,** Indiana Univ.-Purdue Univ. Indianapolis (USA); **Stephen P. DelMarco,** BAE Systems (USA)

Eight papers are selected as the candidates for the Best Paper Award among the papers accepted for this conference, and one of the eight papers will be selected to receive the Best Paper Award. A panel of experts will evaluate all the papers for technical quality and merit. The criteria for evaluation will include: (1) innovation, (2) clarity and quality of the manuscript submitted for publication, and (3) the significance and impact of the work reported. In order to be considered for a Best Paper Award, authors must make their oral presentation and submit their manuscript as scheduled. Conference Chairs will not participate in the evaluation process of the papers. All decisions regarding selection of the best paper will be made by an evaluation committee, and the winner will be announced at the end of the conference on Tuesday afternoon.

Evaluation Committee*:*
Sumit Chakravarty, New York Institute of Technology (USA);
Reiner Creutzburg, Fachhochschule Brandenburg (Germany);
Stephen DelMarco, BAE Systems (USA);

1:30 pm: **Image encryption in the wavelet domain,** Long Bao, Yicong Zhou, C. L. Philip Chen, Univ. of Macau (Macao, China) . . . . . [8755-1]

1:50 pm: **Biometric feature embedding using robust steganography technique**, Rasber D. Rashid, Sabah A. Jassim, Harin Sellahewa, The Univ. of Buckingham (United Kingdom) . . . . . [8755-2]

2:10 pm: **Performance assessments of Android-powered military applications operating on tactical handheld devices**, Brian A. Weiss, Lisa Fronczek, Emile Morse, National Institute of Standards and Technology (USA); Zeid Kootbally, Univ. of Maryland, College Park (USA); Brian Antonishek, Craig I. Schlenoff, National Institute of Standards and Technology (USA) [8755-3]

2:30 pm: **No-reference quality assessment of H.264/AVC encoded video based on natural scene features**, Kongfeng Zhu, Univ. Konstanz (Germany) and Univ. of Dayton (USA); Vijayan K. Asari, Univ. of Dayton (USA); Dietmar Saupe, Univ. Konstanz (Germany) . . . . . [8755-4]

2:50 pm: **Adjunctive numerical relations in multimedia signal covers**, James C. Collins, Sos S. Agaian, The Univ. of Texas at San Antonio (USA). . . . . [8755-5]

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

3:40 pm: **A novel method of testing image randomness with applications to image shuffling and encryption**, Yue Wu, Tufts Univ. (USA); Sos S. Agaian, The Univ. of Texas at San Antonio (USA); Joseph P. Noonan, Tufts Univ. (USA) . . . . . [8755-8]

4:00 pm: **Efficient high-capacity steganography techniques**, Alan A. Abdulla, Harin Sellahewa, Sabah A. Jassim, The Univ. of Buckingham (United Kingdom) . . . . . [8755-7]

4:20 pm: **Mean field game theoretic approach for security in mobile ad-hoc networks**, Yanwei Wang, Carleton Univ. (Canada); Helen Y. Tang, Defence Research and Development Canada, Ottawa (Canada); Fei R. Yu, Minyi Huang, Carleton Univ. (Canada) . . . . . [8755-6]

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

SESSION 2
Room: Conv. Ctr. 335 . . . . . Tue 8:20 am to 10:20 am

Mobile Information Security

Session Chairs: **Ayman Alfalou,** ISEN Brest (France); **Erlan H. Feria,** College of Staten Island (USA)

8:20 am: **Smartphone identification using digital images** *(Invited Paper)*, Harin Sellahewa, The Univ. of Buckingham (United Kingdom) . . . . . [8755-9]

8:50 am: **Location-assured, multifactor authentication on smartphones via LTE communication**, Torben Kuseler, Ihsan A. Lami, The Univ. of Buckingham (United Kingdom) . . . . . [8755-10]

9:10 am: **Security enhancement for MANETs routing with OLSRv2**, Zhexiong Wei, Carleton Univ. (Canada); Helen Y. Tang, Defence Research and Development Canada, Ottawa (Canada); Fei R. Yu, Carleton Univ. (Canada); Maoyu Wang, Communications Research Ctr. Canada (Canada); Peter Mason, Defence Research and Development Canada, Ottawa (Canada) . . . . . [8755-11]

9:30 am: **Multiple-image encryption based on optical coherence multiplexing technique**, Badr-Eddine Benkelfat, TELECOM & Management SudParis (France); Sonia Elwardi, Mourad Zghal, Univ. of Carthage (Tunisia); Ayman Alfalou, ISEN Brest (France) . . . . . [8755-13]

9:50 am: **Robust image coding** *(Invited Paper)*, Erlan H. Feria, College of Staten Island (USA) . . . . . [8755-45]

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

SESSION 3
Room: Conv. Ctr. 335 . . . . . Tue 10:50 am to 12:10 pm

Mobile Biometric Authentication

Session Chairs: **Sabah A. Jassim,** The Univ. of Buckingham (United Kingdom); **Seokwon Yeom,** Daegu Univ. (Korea, Republic of)

10:50 am: **A new feature selection method for OCT retinal data analysis**, Sumit Chakravarty, New York Institute of Technology (USA) . . . . . [8755-26]

11:10 am: **Progress in multi-channel image fusion for face image matching**, Stephen P. DelMarco, BAE Systems (USA) . . . . . [8755-16]

11:30 am: **Face detection at a distance with AdaBoost filtering and color-shape information**, Seokwon Yeom, Dongsu Lee, Daegu Univ. (Korea, Republic of) . . . . . [8755-17]

11:50 am: **Feature quality-based multimodal unconstrained eye recognition**, Zhi Zhou, Eliza Y. Du, Indiana Univ.-Purdue Univ. Indianapolis (USA); Edward J. Delp III, Purdue Univ. (USA) . . . . . [8755-18]

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

SESSION 4
Room: Conv. Ctr. 335 . . . . . Tue 1:40 pm to 3:20 pm

Multimedia Algorithms and Systems

Session Chairs: **Eliza Yingzi Du,** Indiana Univ.-Purdue Univ. Indianapolis (USA); **Jinshan Tang,** Michigan Technological Univ. (USA)

1:40 pm: **Image enhancement technology for stereo videos**, Yimin Qiu, School of Computer Science and Technology (China); Jinshan Tang, Michigan Technological Univ. (USA) . . . . . [8755-20]

2:00 pm: **High-capacity embedding with indexed data recovery using adjunctive numerical relations in multimedia signal covers**, Sos S. Agaian, The Univ. of Texas at San Antonio (USA); James C. Collins, Air Force Information Operations Ctr. (USA) . . . . . [8755-21]

2:20 pm: **Sub-word-based Arabic handwriting analysis for writer identification**, Makki Maliki, Naseer Al-Jawad, Sabah A. Jassim, The Univ. of Buckingham (United Kingdom) . . . . . [8755-22]

2:40 pm: **ZEA-TDMA: design and system level implementation of a TDMA protocol for anonymous wireless networks**, Debasmit Banerjee, Bo Dong, Subir Biswas, Michigan State Univ. (USA) . . . . . [8755-23]

3:00 pm: **Edge-preserving image restoration**, Bo Jiang, National Institute of Aerospace (USA) . . . . . [8755-19]

Coffee Break . . . . . Tue 3:20 pm to 4:00 pm

SESSION 5
Room: Conv. Ctr. 335 . . . . . Tue 4:00 pm to 5:30 pm

Security, Trust, and Innovative Solutions

Session Chairs: **Sos S. Agaian,** The Univ. of Texas at San Antonio (USA); **Sabah A. Jassim,** The Univ. of Buckingham (United Kingdom)

4:00 pm: **Superresolution-based face recognition: Do we need training image set?** *(Invited Paper)*, Nadia Al-Hassan, Harin Sellahewa, Sabah A. Jassim, The Univ. of Buckingham (United Kingdom) . . . . . [8755-46]

4:30 pm: **Social network forensics: using commercial software in a university forensics lab environment**, Pavel Halkin, Knut Kroeger, Reiner Creutzburg, Fachhochschule Brandenburg (Germany) . . . . . [8755-24]

4:50 pm: **Gait recognition using spatio-temporal silhouette-base features**, Azhin Sabir, Naseer Al-Jawad, Sabah A. Jassim, The Univ. of Buckingham (United Kingdom) . . . . . [8755-25]

5:10 pm: **Adaptive error-correction codes for distortion face identification**, Wafaa R. Hussein, Sabah A. Jassim, The Univ. of Buckingham (United Kingdom) . . . . . [8755-27]

AWARD CEREMONY
Room: Conv. Ctr. 335 . . . . . Tue 5:30 pm to 5:40 pm

Presented by the Best Paper Award Evaluation Committee.

POSTERS-TUESDAY
Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Linger thermo theory, Part I: on the novel dynamics dual of the stationary ectropy/entropy latency information theory, Erlan H. Feria, College of Staten Island (USA) . . . . . [8755-14]

Linger thermo theory, Part II: on the application of linger thermo theory to determining life insurance premiums, Erlan H. Feria, College of Staten Island (USA) . . . . . [8755-30]

Linger thermo theory, Part III: on the application of the nascent linger thermo theory to cosmology, Erlan H. Feria, College of Staten Island (USA) . . . . [8755-38]

Comparison of LSB steganography in Encrypted YCbCr and RGB image planes, Muhammad U. Ghani, The Univ. of Oklahoma (USA) . . . . . [8755-28]

Security solution against denial of service attacks in BESIP system, Filip Rezac, Miroslav Voznak, Jakub Safarik, Pavol Partila, Karel Tomala, Technical Univ. of Ostrava (Czech Republic) . . . . . [8755-29]

IP telephony-based danger alert communication system and its implementation, Filip Rezac, Jakub Safarik, Miroslav Voznak, Karel Tomala, Pavol Partila, Technical Univ. of Ostrava (Czech Republic) . . . . . [8755-31]

Breaking down the barriers of using strong authentication and encryption in resource constrained embedded systems, Ron Knobler, Peter Scheffel, Scott Jackson, McQ, Inc. (USA); Kris Gaj, Jens-Peter Kaps, George Mason Univ. (USA) . . . . . [8755-32]

Solving data-at-rest for the storage and retrieval of files in ad hoc networks, Ron Knobler, Peter Scheffel, Jonathan Williams, McQ, Inc. (USA); Kris Gaj, Jens-Peter Kaps, George Mason Univ. (USA) . . . . . [8755-33]

Automatic analysis of attack data from distributed honeypot network, Jakub Safarik, Filip Rezac, Miroslav Voznak, Karel Tomala, Pavol Partila, Technical Univ. of Ostrava (Czech Republic) . . . . . [8755-34]

Passive radiation detection using optically active CMOS sensors, Patrick Schalk, Luke Dosiek, Assured Information Security (USA) . . . . . [8755-35]

Three-dimensional alpha weighted quadratic filter-based image color contrast enhancement, Chen Gao, Karen Panetta, Tufts Univ. (USA); Sos S. Agaian, The Univ. of Texas at San Antonio (USA) . . . . . [8755-36]

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Tuesday - Wednesday 30 April - 1 May 2013 • Proceedings of SPIE Vol. 8756

Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications 2013

Conference Chair: **Jerome J. Braun,** MIT Lincoln Lab. (USA)

Program Committee: **Sheela V. Belur,** The Van Dyke Technology Group, Inc. (USA); **David P. Benjamin,** Pace Univ. (USA); **Belur V. Dasarathy,** Information Fusion Technologies (USA); **Michael Heizmann,** Fraunhofer-Institut für Optronik, Systemtechnik und Bildauswertung (Germany); **Charles F. Hester,** U.S. Army Research, Development and Engineering Command (USA); **Mieczyslaw M. Kokar,** Northeastern Univ. (USA); **Damian M. Lyons,** Fordham Univ. (USA); **Mirela Popa,** Chemring Detection Systems, Inc. (USA); **Firooz A. Sadjadi,** Lockheed Martin Maritime Systems & Sensors (USA); **Pierre Valin,** Defence Research and Development Canada, Valcartier (Canada); **Pramod Kumar Varshney,** Syracuse Univ. (USA); **Shanchieh Jay Yang,** Rochester Institute of Technology (USA)

Tuesday 30 April

SESSION 1

Room: Conv. Ctr. 332 . . . . . Tue 11:00 am to 12:00 pm

Information Fusion Approaches and Algorithms I

Session Chairs: **Jerome J. Braun,** MIT Lincoln Lab. (USA); **Damian M. Lyons,** Fordham Univ. (USA)

11:00 am: **Affordable non-traditional sources context exploitation to improve distributed fusion system robustness**, Christopher L. Bowman, Data Fusion & Neural Networks, LLC (USA); Alan N. Steinberg, Georgia Tech Research Institute (USA); Charles Morefield, Michael Morefield, Arctan Group LLC (USA) . . . . [8756-3]

11:20 am: **Considerations for multiple hypothesis correlation on tactical platforms**, Alan M. Thomas, Georgia Tech Research Institute (USA) . . . . . [8756-4]

11:40 am: **Scalable sensor management for automated fusion and tactical reconnaissance**, Thomas J. Walls, Michael L. Wilson, U.S. Naval Research Lab. (USA); Darin Partridge, Jonathan R. Haws, Mark Jensen, Troy Johnson, Brad Petersen, Scott A. Anderson, Space Dynamics Lab. (USA) . . . . . [8756-2]

Lunch/Exhibition Break . . . . . .Tue 12:00 pm to 2:00 pm

SESSION 2

Room: Conv. Ctr. 332 . . . . . Tue 2:00 pm to 3:00 pm

Information Fusion Approaches and Algorithms II

Session Chairs: **Mirela Popa,** Chemring Detection Systems, Inc. (USA); **David P. Benjamin,** Pace Univ. (USA)

2:00 pm: **Efficiently applying uncertain implication rules to the transferable belief model**, William J. Farrell III, Andrew M. Knapp, Lakota Technical Solutions, Inc. (USA). . . . . [8756-5]

2:20 pm: **A methodology for hard/soft information fusion in the condition monitoring of aircraft**, Joseph T. Bernardo, Penn State (USA). . . . . [8756-6]

2:40 pm: **Using classifier fusion to improve the performance of multiclass classification problems**, Robert S. Lynch, Naval Undersea Warfare Ctr. (USA); Peter Willett, Univ. of Connecticut (USA) . . . . . [8756-7]

Coffee Break . . . . . .Tue 3:00 pm to 3:40 pm

SESSION 3

Room: Conv. Ctr. 332 . . . . . Tue 3:40 pm to 5:00 pm

Information Fusion Approaches and Algorithms III

Session Chair: **David P. Benjamin,** Pace Univ. (USA)

3:40 pm: **Generalized information fusion and visualization using spatial voting and data modeling,** Holger M. Jaenisch, James W. Handley, Licht Strahl Engineering, Inc. (USA) . . . . . [8756-10]

4:00 pm: **Real-time tracking and fast retrieval of persons in multiple surveillance cameras of a shopping mall**, Henri Bouma, TNO Defence, Security and Safety (Netherlands); Jan Baan, Technisch Physische Dienst-TNO (Netherlands); Sander Landsmeer, Chris Kruszynski, TNO Defence, Security and Safety (Netherlands); Gert Van Antwerpen, Technisch Physische Dienst-TNO (Netherlands); Judith Dijk, TNO Defence, Security and Safety (Netherlands) . . . . . [8756-11]

4:20 pm: **Spatial voting for automatic feature selection, fusion, and visualization,** Holger M. Jaenisch, James W. Handley, Licht Strahl Engineering, Inc. (USA). . . . . [8756-12]

4:40 pm: **Adaptive fusion algorithm for VIS and IR images driven by neural network**, Bohumil Stoklasa, Jaroslav Rehacek, Zdenek Hradil, Palack? Univ. Olomouc (Czech Republic) . . . . . [8756-29]

Wednesday 1 May

SESSION 4

Room: Conv. Ctr. 332 . . . . . .Wed 8:20 am to 10:00 am

Image Fusion

Session Chair: **Mirela Popa,** Chemring Detection Systems, Inc. (USA)

8:20 am: **Multi-classifier decision level fusion for face classification in the harsh environments**, Seokwon Yeom, Daegu Univ. (Korea, Republic of). [8756-13]

8:40 am: **Intelligent decision making system using cloud models for monitoring farming operations**, Abdulqadir I. Khoshnaw, Univ. of Kurdistan (Iraq) . . [8756-14]

9:00 am: **Fusion of data from multiple sensors with model-based data analysis**, Jeremy Straub, The Univ. of North Dakota (USA) . . . . . [8756-15]

9:20 am: **Performance analysis of image fusion methods in transform domain**, Yoonsuk Choi, Ershad Sharifahmadian, Shahram Latifi, Univ. of Nevada, Las Vegas (USA) . . . . . [8756-16]

9:40 am: **An approach to DSM refinement with fusion of airborne lidar point cloud data and optical imagery**, Xiangyang Hao, Lixing Jiang, Songlin Liu, Zhengzhou Institute of Surveying and Mapping (China) . . . . . [8756-17]

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

SESSION 5

Room: Conv. Ctr. 332 . . . . . .Wed 10:30 am to 11:50 am

Information Fusion and Robotics I

Session Chairs: **Damian M. Lyons,** Fordham Univ. (USA); **Jerome J. Braun,** MIT Lincoln Lab. (USA)

10:30 am: **A cognitive approach to vision for a mobile robot**, David P. Benjamin, Pace Univ. (USA); Damian M. Lyons, Fordham Univ. (USA); Christopher Funk, Pace Univ. (USA) . . . . . [8756-18]

10:50 am: **Persistent unmanned airborne network support for cooperative sensors**, Ajay Verma, Ronald Fernandes, Knowledge Based Systems, Inc. (USA) . . . . . [8756-19]

11:10 am: **Fusion of ranging data from robot teams operating in confined areas**, Damian M. Lyons, Tsung-Ming Liu, Karma Shrestha, Fordham Univ. (USA) .

11:30 am: **Combining metric episodes with semantic event concepts within the symbolic and sub-symbolic robotics intelligence control system (SS-RICS)**, Troy D. Kelley, U.S. Army Research Lab. (USA) . . . . . [8756-21]

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

SESSION 6

Room: Conv. Ctr. 332 . . . . . Wed 1:20 pm to 2:40 pm

Information Fusion and Robotics II

Session Chairs: **Damian M. Lyons,** Fordham Univ. (USA); **David P. Benjamin,** Pace Univ. (USA)

1:20 pm: **Primate-inspired vehicle navigation using optic flow and mental rotations**, Ronald C. Arkin, Frank Dellaert, Natesh Suresh, Ryan Kerwin, Georgia Institute of Technology (USA) . . . . . [8756-22]

1:40 pm: **Multi-brain fusion and applications to intelligence analysis**, Adrian Stoica, Yumi Iwashita, Curtis W. Padgett, Jet Propulsion Lab. (USA); Kyrre Glette, Univ. of Oslo (Norway); Riccardo Poli, Univ. of Essex (United Kingdom) . . [8756-23]

2:00 pm: **Spatial cognition: robot localization in open arenas based on rat studies**, Alfredo Weitzenfeld, Univ. of South Florida Polytechnic (USA) . . [8756-24]

2:20 pm: **Development of standard test methods for unmanned and manned industrial vehicles used near humans**, Roger V. Bostelman, Richard J. Norcross, Joseph A. Falco, Jeremy A. Marvel, National Institute of Standards and Technology (USA) . . . . . [8756-25]

PANEL DISCUSSION

Room: Conv. Ctr. 332 . . . . . Wed 2:40 pm to 3:20 pm

Information Fusion and Robotics II: Panel Discussion

Panel Moderator: **Jerome J. Braun,** MIT Lincoln Lab. (USA)

Coffee Break . . . . . Wed 3:20 pm to 4:00 pm

SESSION 7

Room: Conv. Ctr. 332 . . . . . Wed 4:00 pm to 5:00 pm

Information Fusion Systems and Evaluation Measures

Session Chair: **Damian M. Lyons,** Fordham Univ. (USA)

4:00 pm: **Information measures for multisensor systems**, Christian P. Minor, Nova Research, Inc. (USA); Brian Stout, U.S. Navy (USA); Kevin R. Johnson, U.S. Naval Research Lab. (USA) . . . . . [8756-26]

4:20 pm: **Measuring knowledge: investigative research into the quantification of performance within a contextual multi-source PED fusion process**, Larry A. Scarff, UTC Aerospace Systems (USA); Cullen Jackson, Dustin Burke, Eric Jones, Aptima, Inc. (USA); Stephanie Pratt, Aptima Inc. (USA); Shawn Weil, Aptima, Inc. (USA); Lynne G. Gilfillan, Rhumbline Consultants (USA); Stephen Fiore, Univ. of Central Florida (USA) . . . . . [8756-27]

4:40 pm: **Enhancing situational awareness by means of visualization and information integration of sensor networks**, Jussi Timonen, Jouko Vankka, Finnish Defence Forces (Finland) . . . . . [8756-28]

Cyber Sensing 2013

Conference Chairs: **Igor V. Ternovskiy,** Air Force Research Lab. (USA); **Peter Chin,** Johns Hopkins Univ. Applied Physics Lab. (USA)

Tuesday 30 April

SESSION 1
Room: Conv. Ctr. 318 . . . . . Tue 10:30 am to 11:30 am

Analysis of Cyber Attacks

Session Chair: **Peter Chin,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

10:30 am: **On localization attacks against cloud infrastructure**, Wei Yu, Linqiang Ge, Mohammad Ali Sistani, Towson Univ. (USA); Rommie Hardy, Robert Reschly, U.S. Army Research Lab. (USA) . . . . . [8757-2]

10:50 am: **Quantitative analysis of intrusion detection systems: snort and suricata**, Joshua S. White, Thomas Fitzsimmons, Jeanna Matthews, Clarkson Univ. (USA) . . . . . [8757-20]

11:10 am: **ICS logging solution for network-based attacks using Gumistix technology**, Jeremy Otis, Air Force Institute of Technology (USA) . . . . . [8757-3]

SESSION 2
Room: Conv. Ctr. 318 . . . . . Tue 11:30 am to 12:10 pm

Cyber Security of Infrastructures

Session Chair: **Peter Chin,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

11:30 am: **Industrial controls intrusion detection sensor**, Robert M. Jaromin, Air Force Institute of Technology (USA); Barry E. Mullins, Jonathan W. Butts, Air Force Institute of Technology (USA). . . . . [8757-7]

11:50 am: **Tools, tactics, and techniques advanced threat actors use to steal your technology, and new innovative sensing techniques you can use to identify them**, Stephen Windsor, Ronald Shaffer, Maddrix, LLC (USA). . . [8757-30]

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

SESSION 3
Room: Conv. Ctr. 318 . . . . . Tue 1:40 pm to 2:40 pm

Security of Internet and Clouds

Session Chair: **Peter Chin,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

1:40 pm: **Framework for network-wide semantic event correlation**, Robert Hall, Joshua Taylor, Assured Information Security (USA) . . . . . [8757-8]

2:00 pm: **Efficient identity management and access control in cloud environment**, Jonathan A. Gloster, The Van Dyke Technology Group, Inc. (USA) . . . . . [8757-9]

2:20 pm: **Software analysis in the semantic web**, Joshua Taylor, Robert Hall, Assured Information Security (USA) . . . . . [8757-10]

SESSION 4
Room: Conv. Ctr. 318 . . . . . Tue 2:40 pm to 3:20 pm

Novel Cyber Sensors

Session Chair: **Peter Chin,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

2:40 pm: **A keystroke dynamics sensor for authentication, continuous verification, and identification**, Patrick Schalk, Scott Young, Robert Dora, John McCarthy, Assured Information Security (USA) . . . . . [8757-12]

3:00 pm: **Dynamic malware analysis using IntroVirt: a modified hypervisor-based system**, Joshua S. White, Richard Gloo, Stephen Pape, Adam Meily, Assured Information Security (USA) . . . . . [8757-14]

Wednesday 1 May

SESSION 5
Room: Conv. Ctr. 318 . . . . . .Wed 9:00 am to 10:00 am

Novel Algorithms for Cyber Sensing

Session Chair: **Peter Chin,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

9:00 am: **The two stages hierarchical unsupervised learning system for complex dynamic ISR**, Igor V. Ternovskiy, Air Force Research Lab. (USA); James Graham, U.S. Army Research Lab. (USA); Alan O'Connor, Air Force Research Lab. (USA) . . . . . [8757-15]

9:20 am: **Performance comparison of the prophecy algorithm in FFT form for unseen feature prediction,** Holger M. Jaenisch, Licht Strahl Engineering, Inc. (USA) . . . . . [8757-16]

9:40 am: **A multiresolution fractal additive scheme for blind watermarking of 3D point data**, Mark D. Rahmes, Kathy Wilder, Kevin L. Fox, Harris Corp. (USA) . . . . . [8757-17]

Coffee/Exhibition Break. . . . . Wed 10:00 am to 11:00 am

SESSION 6
Room: Conv. Ctr. 318 . . . . . .Wed 11:00 am to 12:00 pm

Algorithms for Attack Detection

Session Chair: **Peter Chin,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

11:00 am: **On detection of android malware**, Wei Yu, Hanlin Zhang, Towson Univ. (USA); Rommie Hardy, Robert Reschly, Carol Ellis, U.S. Army Research Lab. (USA) . . . . . [8757-21]

11:20 am: **Complex scenes and situations visualization using hierarchical learning and recognition algorithm with dynamic 3D NeoAxis engine**, Igor V. Ternovskiy, Air Force Research Lab. (USA); James Graham, U.S. Army Research Lab. (USA) . . . . . [8757-23]

11:40 am: **Cognitive algorithms for cyber sensing and security**, Leonid Perlovsky, Air Force Research Lab. (USA) . . . . . [8757-24]

SESSION 7
Room: Conv. Ctr. 318 . . . . . Wed 12:00 pm to 12:40 pm

Lessons Learned and Future Ideas

Session Chair: **Peter Chin,**
Johns Hopkins Univ. Applied Physics Lab. (USA)

12:00 pm: **Long-range costs of cyber-security research**, Mohammed M. Olama, James Nutaro, Oak Ridge National Lab. (USA). . . . . [8757-25]

12:20 pm: **Why cyber-forensic tools fail**, Gary Hamilton, Assured Information Security (USA) . . . . . [8757-27]

Next-Generation Analyst

Conference Chairs: **Barbara D. Broome,** U.S. Army Research Lab. (USA); **David L. Hall,** The Pennsylvania State Univ. (USA); **James Llinas,** Univ. at Buffalo (USA)

Program Committee: **Nina M. Berry,** Sandia National Labs., California (USA); **John S. Eicke,** U.S. Army Research Lab. (USA); **James Fink,** U. S. Army Intelligence Ctr. of Excellence (USA); **Timothy P. Hanratty,** U.S. Army Research Lab. (USA); **James Hendler,** Rensselaer Polytechnic Institute (USA); **John E. Lavery,** U.S. Army Research Lab. (USA); **Bob Madahar,** Defence Science and Technology Lab. (United Kingdom); **Paul Sajda,** Columbia Univ. (USA); **Alan Steinberg,** Georgia Tech Research Institute (USA); **Edward L. Waltz,** BAE Systems (USA)

Monday 29 April

SESSION 1

Room: Conv. Ctr. 323 . . . . . Mon 1:30 pm to 2:50 pm

NOTE ROOM CHANGE

Data-to-Decisions

Joint Session with Conferences 8742 and 8758

Session Chairs: **David L. Hall,** The Pennsylvania State Univ. (USA); **James Llinas,** Univ. at Buffalo (USA); **Tien Pham** (USA)

Opening remarks by **James Llinas**, Univ. at Buffalo (USA)

1:30 pm: **Data-to-decisions** *(Keynote Presentation)*, John S. Eicke, Michael A. Kolodny, U.S. Army Research Lab. (USA) . . . . . [8758-7]

2:10 pm: **Context-rich semantic framework for effective data-to-decisions in coalition networks**, Keith Grueneberg, Geeth de Mel, IBM Thomas J. Watson Research Ctr. (USA); David Braines, IBM United Kingdom Ltd. (United Kingdom); Seraphin Calo, Xiping Wang, IBM Thomas J. Watson Research Ctr. (USA); Tien Pham (USA) . . . . . [8742-2]

2:30 pm: **A system architecture for decision-making support on ISR missions with stochastic needs and profit**, Nan Hu, Thomas F. LaPorta, The Pennsylvania State Univ. (USA); Diego Pizzocaro, Alun D. Preece, Cardiff Univ. (United Kingdom) . . . . . [8742-3]

Coffee Break . . . . . Mon 2:50 pm to 3:40 pm

PANEL DISCUSSION

Room: Conv. Ctr. 323 . . . . . Mon 3:40 pm to 4:40 pm

NOTE ROOM CHANGE

Decision-Driven Analysts

Joint Panel with Conferences 8742 and 8758

David L. Hall, The Pennsylvania State Univ. (USA); **James Llinas**, Univ. at Buffalo (USA); **Bhopinder Madahar**, Defence Science and Technology Laboratory (United Kingdom); **Tien Pham** (USA)

Symposium-wide Plenary Session

Room: Conv. Ctr. Ballroom 1 - 2 . . .Mon. 5:00 pm to 6:00 pm

DARPA: Driving Technological Surprise

Arati Prabhakar,
Director, Defense Advanced Research Projects Agency (DARPA)

Tuesday 30 April

OPENING REMARKS

Room: Conv. Ctr. 348 . . . . . 8:40 am to 8:50 am

David L. Hall, The Pennsylvania State Univ. (USA)

SESSION 2

Room: Conv. Ctr. 348 . . . . . Tue 8:50 am to 11:30 am

Big Data

Session Chair: **James Llinas,** Univ. at Buffalo (USA)

8:50 am: **Some alternative strategies for dealing with big data** *(Keynote Presentation)*, Moises Sudit, CUBRC Corp. (USA). . . . . [8758-26]

9:35 am: **Adaptive context exploitation**, Alan N Steinberg, Georgia Tech Research Institute (USA); Christopher L. Bowman, Data Fusion Corp. (USA) . . . . . [8758-9]

Coffee Break . . . . . Tue 9:55 am to 10:30 am

10:30 am: **Concept of operations for collaboration and discovery from big data across enterprise data warehouses**, Sreenivas R. Sukumar, Mohammed M. Olama, James Nutaro, Oak Ridge National Lab. (USA) . . . . . [8758-10]

10:50 am: **GOOSE: Semantic search on internet connected sensors**, Klamer Schutte, TNO Defence, Security and Safety (Netherlands); Freek Bomhof, TNO (Netherlands); Gertjan Burghouts, TNO Defence, Security and Safety (Netherlands); Jurriaan van Diggelen, TNO (Netherlands); Peter Hiemstra, TNO Defence, Security and Safety (Netherlands); Jaap van 't Hof, TNO Science and Industry (Netherlands); Wessel Kraaij, TNO (Netherlands); Huib Pasman, Arthur Smith, TNO Defence, Security and Safety (Netherlands); Corne Versloot, Joost de Wit, TNO (Netherlands) . . . . . [8758-11]

11:10 am: **A big data use perspective: CiteSeerX and friends**, C. Lee Giles, The Pennsylvania State Univ. (USA). . . . . [8758-12]

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

SESSION 3

Room: Conv. Ctr. 348 . . . . . Tue 1:20 pm to 3:00 pm

Soft Data Processing, Value, and Trust

Session Chair: **David L. Hall,** The Pennsylvania State Univ. (USA)

1:20 pm: **Controlled English to facilitate human/machine analytical processing**, David Braines, David Mott, Simon Laws, IBM United Kingdom Ltd. (United Kingdom); Geeth de Mel, IBM Thomas J. Watson Research Ctr. (USA) and U. S. Army Research Lab. (USA); Tien Pham, U.S. Army Research Lab. (USA) . [8758-13]

1:40 pm: **MIPS: A service-based aid for intelligence analysis**, David Braines, John B. Ibbotson, Graham White, IBM United Kingdom Ltd. (United Kingdom) . . . . . [8758-14]

2:00 pm: **A decision support system for fusion of soft- and hard-sensor information based on latent semantic analysis technique**, Amir Shirkhodaie, Vinayak Elangovan, Mohammad S. Habibi, Amjad H. Alkilani, Tennessee State Univ. (USA) . . . . . [8758-24]

2:20 pm: **Reusing information for high-level fusion: characterizing bias and uncertainty in human-generated intelligence**, Dustin Burke, Aptima, Inc. (USA) . . . . . [8758-16]

2:40 pm: **Reasoning with uncertain information and trust**, Murat Sensoy, Univ. of Aberdeen (United Kingdom); Achille Fokoue, IBM Thomas J. Watson Research Ctr. (USA); Timothy J. Norman, Jeff Z. Pan, Univ. of Aberdeen (United Kingdom); Yuqing Tang, Carnegie Mellon Univ. (USA); Nir Oren, Univ. of Aberdeen (United Kingdom); Geeth de Mel, IBM Thomas J. Watson Research Ctr. (USA); Katia Sycara, Carnegie Mellon Univ. (USA); Lance Kaplan, U.S. Army Research Lab. (USA) . . . . . [8758-17]

Coffee Break . . . . . Tue 3:00 pm to 3:40 pm

Conference 8758

SESSION 4

Room: Conv. Ctr. 348 . . . . . Tue 3:40 pm to 5:40 pm

Analyst Tools and Interfaces

Session Chair: **Michael D. McNeese,** The Pennsylvania State Univ. (USA)

3:40 pm: **Crowded: a crowd-sourced perspective of events as they happen**, Richard Brantingham, Aleem Hossain, Defence Science and Technology Lab. (United Kingdom). . . . . [8758-1]

4:00 pm: **Supporting tactical intelligence using collaborative environments and social networking**, Arthur Wollocko, Michael Farry, Robert Stark, Charles River Analytics, Inc. (USA) . . . . . [8758-2]

4:20 pm: **Using the living laboratory framework as a basis for understanding next-generation analyst work**, Michael D. McNeese, Vincent F. Mancuso, Nathaniel J. McNeese, Tristan C. Endsley, Peter K. Forster, The Pennsylvania State Univ. (USA) . . . . . [8758-3]

4:40 pm: **Exploiting client logs towards characterizing the user behavior on Web applications**, Leandro G. Vasconcelos, National Institute for Space Research (Brazil); Rafael D. Coelho dos Santos, Instituto Nacional de Pesquisas Espaciais (Brazil); Laercio A. Baldochi Jr., Federal Univ. of Itajuba (Brazil) . . . . . [8758-4]

5:00 pm: **Exploring the dynamics of collective cognition using a computational model of cognitive dissonance**, Paul R. Smart, Univ. of Southampton (United Kingdom); Katia Sycara, Carnegie Mellon Univ. (USA); Darren Richardson, Univ. of Southampton (United Kingdom) . . . . . [8758-5]

5:20 pm: **CE-SAM: a conversational interface for ISR mission support**, Diego Pizzocaro, Christos Parizas, Alun Preece, Cardiff Univ. (United Kingdom); Dave Braines, David Mott, IBM United Kingdom Ltd. (United Kingdom); Jonathan Bakdash, Cheryl A. Giammanco, U.S. Army Research Lab. (USA). . . . . [8758-6]

POSTERS-TUESDAY

Room: Conv. Ctr. Hall D . . . . . Tue 6:00 pm to 7:30 pm

All symposium attendees are invited to attend the poster sessions. Come view the high-quality papers that are presented in this alternative format and interact with the poster author, who will be available for discussion. Enjoy light refreshments while networking with colleagues in your field. Attendees are required to wear their conference registration badges to the poster sessions.

Authors may set-up their posters between 10:00 am and 5:00 pm the day of their poster session. Posters that are not set-up by the 5:00 pm cut-off time will be considered no-shows, and their manuscripts may not be published. Poster authors should be at their papers from 6:00 to 7:30 pm to answer questions from attendees. All posters and other materials must be removed no later than 8:00 pm. Any papers left on the boards at the close of the poster session will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of each poster session.

Gain-aware multicast content routing in delay tolerant networks, Faezeh Hajiaghajani Memar, Subir Biswas, Michigan State Univ. (USA) . . . . . [8758-23]

Beyond visualization of big data: a multistage data exploration approach using visualization, sonification, and storification, Jeffrey C. Rimland, Mark Ballora, Nicklaus A. Giacobe, Wade Shumaker, The Pennsylvania State Univ. (USA) . . . . . [8758-22]

Visualization and characterization of users in a citizen science project, Alessandra M. Marli, Instituto Nacional de Pesquisas Espaciais (Brazil); Jordan Raddick, Johns Hopkins Univ. (USA); Rafael D. Coelho dos Santos, Instituto Nacional de Pesquisas Espaciais (Brazil) . . . . . [8758-21]

Representation of potential information gain to measure the price of anarchy on ISR activities, Hector J. Ortiz-Pena, CUBRC (USA); Michael J. Hirsch, Raytheon Co. (USA); Mark Karwan, Rakesh Nagi, Univ. at Buffalo (USA); Moises Sudit, CUBRC (USA) and Univ. at Buffalo (USA) . . . . . [8758-20]

Conserving analyst attention units: use of multi-agent software and CEP methods to assist information analysis, Jeffrey C. Rimland, Michael McNeese, David Hall, The Pennsylvania State Univ. (USA) . . . . . [8758-19]

Participatory telerobotics, Alexander D. Wissner-Gross, Harvard Univ. (USA) and Massachusetts Institute of Technology (USA) and Gemedy, Inc. (USA); Timothy M. Sullivan, Gemedy, Inc. (USA). . . . . [8758-18]

Multimodal scenario analysis and visualization tool, Erin Ontiveros, Dave Messinger, Rolando Raqueno, Chris DeAngelis, Andrew Scott, Rochester Institute of Technology (USA) . . . . . [8758-25]

General Information

Registration

Onsite Registration and Badge Pick-Up Hours
Pratt St. Lobby (Level 300)

Sunday, 28 April . . . . . 4:00 pm to 7:00 pm
Monday, 29 April . . . . . 7:00 am to 5:00 pm
Tuesday, 30 April. . . . . 7:30 am to 5:00 pm
Wednesday, 1 May . . . . . 7:30 am to 5:00 pm
Thursday, 2 May . . . . . 7:30 am to 5:00 pm
Friday, 3 May. . . . . 7:30 am to 12:00 pm

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Includes admission to all conference sessions, plenaries, panels, and poster sessions, admission to the Exhibition, Welcome Reception, coffee breaks, and a choice of proceedings. Student pricing does not include proceedings.

Course and Workshop Registration

Courses and workshops are priced separately. Course-only registration includes your selected course(s), course notes, coffee breaks, and admittance to the exhibition. Course prices include applicable taxes. Onsite, please go to Course Materials Pickup after you pick up your badge.

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Author / Presenter Information

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Monday through Friday . . . . . 7:30 am to 5:00 pm

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Hall D (Level 100) · Tuesday 30 April and Thursday 2 May

Poster presenters must set up their posters between 10:00 am and 5:00 pm on the day of their poster session.

- Paper numbers will be posted in the poster boards in numerical order; please find your poster number and set up your poster in the designated space.
- Presenters who have not set up their poster by 5:00 pm on the day of their presentation will be considered a "no show' and their manuscript will not be published.
- A poster author or coauthor is required to stand by the poster during the scheduled poster session to answer questions from attendees
- It is your responsibility to remove your poster at the end of the session
- Posters not removed will be considered unwanted and will be discarded.

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Coffee Breaks

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Monday, Thursday afternoon, and Friday

Hall D and Hall G (Level 100)
Tuesday through Thursday morning

Complimentary coffee will be served twice daily, at 10:00 am and 3:00 pm. Check individual conference listings for exact times and locations.

Food and Refreshments for Purchase

Market Fresh Café – Main Terrace (Level 300)

Starbucks – Pratt St Lobby (Level 300)

Coffee Stand – Camden Lobby (Level 300)

Monday through Friday - hours posted

Exhibition Halls (Level 100)
Tuesday through Thursday during exhibition hours

Hot and cold snacks, hot entrees, deli sandwiches, salads, and pastries are available for purchase including espresso & beverages. Cash and credit cards accepted.

Lunch Voucher

Exhibition Hall Food Outlets
11:00 am through 1:00 pm

Vouchers are redeemable on Tuesday through Thursday at any of the food outlets in the exhibition hall. No change returned if purchase is less. No cash value

Desserts

Complimentary tickets for dessert snacks are included in course and conference attendee registration packets.

Free Popcorn

Exhibition Hall

A Popcorn cart will be open Tuesday and Wednesday from 11:00 am to 3:00 pm; Thursday from 11:00 am to 2:00 pm.

Sponsored by GENERAL DYNAMICS Global Imaging Technologies

Travel/Transportation

Train service from Reagan Washington National Airport (DCA) to Baltimore Washington International Thurgood Marshall Airport (BWI)

- From DCA, take SuperShuttle to Washington Union Station (WAS). SuperShuttle offers a discount for roundtrip reservations, normally $14 one way. From WAS (Union Station), take the Amtrak train to Baltimore Washington Airport (BWI) Amtrak Station. Then catch the Light Rail to the Balitimore Convention Center Station and further stops servicing the downtown hotels. BWI is located approximately 45 miles north of Washington, D.C.
- From DCA, an alternate method of transportation to Washington Union Station (WAS) is the Metrorail. At DCA, locate the Metrorail station connected to the concourse level of Terminals B and C. Take the YELLOW line (towards Mt. Vernon) to Gallery Place Chinatown Metro Station. Change lines there to the the RED line (towards Silver Spring) to Union Station (WAS). The fare is approximately $4 one way on the Metrorail (subject to change). From Union Station, take the Amtrak train to Baltimore WA Airport (BWI) Amtrak Station. Then catch the Light Rail to the Baltimore Convention Center Station and further stops servicing the downtown hotels.
- AMTRAK - Amtrak FARES range from $15 - $37 depending on the route and trip time you choose from Union Station to BWI. The 2110 Acela Express $37 is a faster trip (21 minutes), with fewer stops, and reserved seats from Union Station to/from BWI. 84 Northeast Regional is $15 (25 minutes). 176 Northeast Regional and 94 Northeast Regional are both $21 (27 minutes). Fares depend on fastest routes and departure times. See Amtrak Schedules for all routes.
- From BWI, take the Light Rail to the Convention Center stop by Baltimore Convention Center or further stops servicing the downtown hotels.
- MARC (Maryland Area Regional Commuter) operates Monday through Friday ONLY. MARC runs on the Penn Line from Baltimore/Camden Station to Washington Union Station ($7 one way subject to change) and takes just over 1 hour each way. The Baltimore Convention Center is on the Camden Line. The Penn Line and the Camden Line never meet. Therefore from BWI, take the Light Rail along the Camden Line to the Baltimore Convention Center Stop.
- METRO SUBWAY - The Metro Subway System travels to/from Baltimore suburbs and John Hopkins Hospital. It does NOT travel to/from Baltimore Washington International Airport. Metro Subway Map

Transportation from Baltimore Washington International Airport (BWI)

- SUPERSHUTTLE has offered a discount rate (code 2N83B) for all attending SPIE Defense, Security & Sensing 2013. Discount rate applies ONLY when booked in advance. Super Shuttle runs 24/7. Book SuperShuttle Online with Discount Code 2N83B - Discount applies for roundtrip reservations.
- TAXI rates from BWI to the Baltimore Convention Center and downtwon Baltimore hotels ranges from $25 - $35 one way based on traffic and time of day. Locate the taxi stand just outside baggage claim area of the lower level of the BWI terminal.
- View SuperShuttle Flyer
- Light Rail from BWI to downtown Baltimore, Convention Center and Hotels
- Charm City Circulator (free transportation) around downtown Baltimore

Car Rental

Hertz

Hertz Car Rental has been selected as the official car rental agency for this Symposium. To reserve a car, identify yourself as a Defense, Security & Sensing Symposium attendee using the Hertz Meeting Code CV# 029B0018. Discount rates apply for rentals up to one week prior through one week after the conference dates. Note: When booking from International Hertz locations, the CV # must be quoted with the letters CV before the number, i.e. CV029B0018. To book online below, please note that the CV# is already incorporated into the link. Book Hertz Online

- In the United States call 1-800-654-2240.

See EDT at SPIE DSS – Booth 1135

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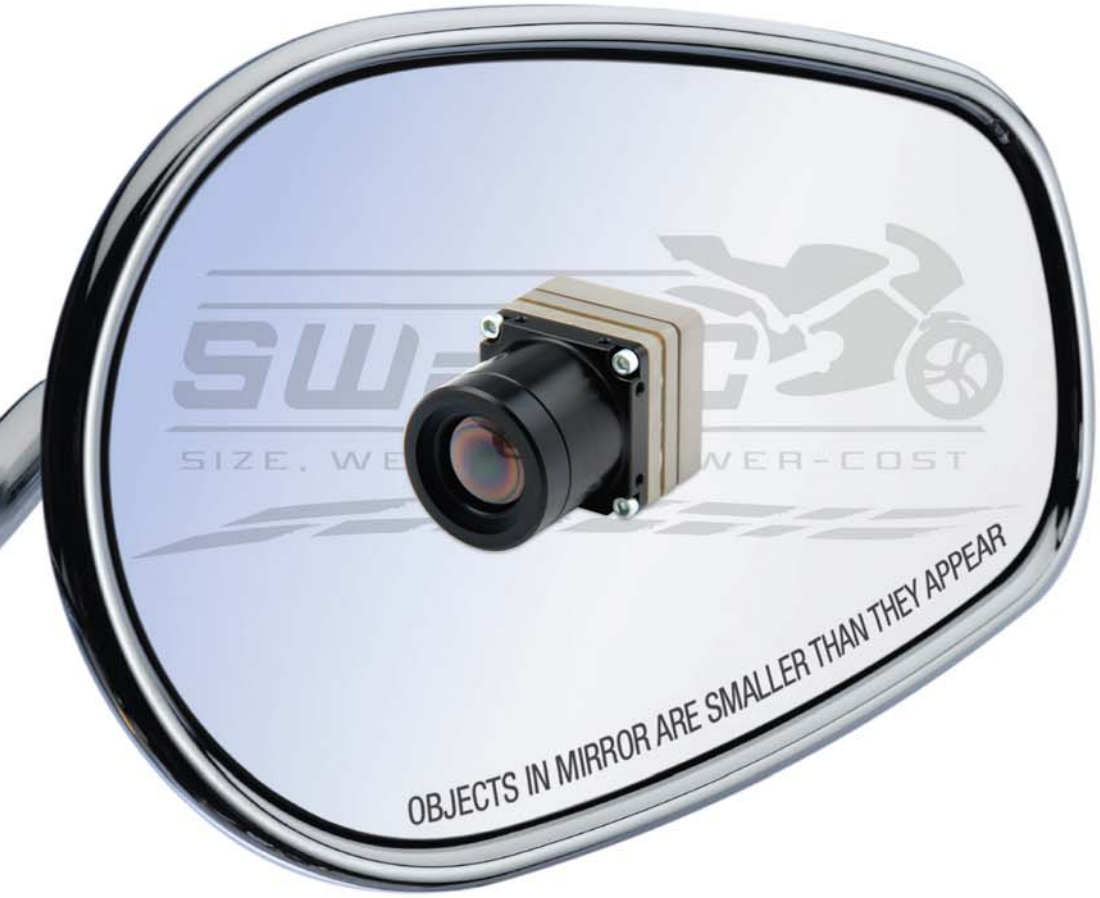

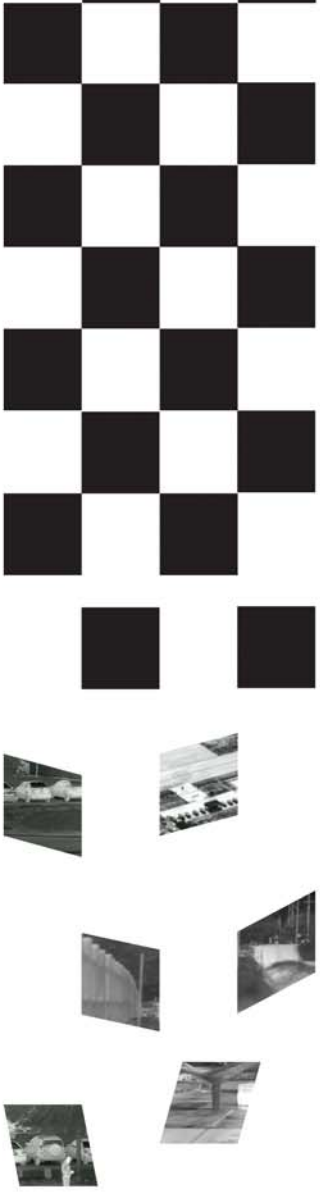

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